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THE REGULATION OF FINANCIAL INSTITUTIONS

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CONTENTS

Consumers' Perceptions of Discriminatory Treatment and Credit Availability, and Access to Consumer Credit Markets

William K. Brandt and Robert P. Shay*

I. Introduction

The Equal Credit Opportunity Act (hereafter labelled ECOA) is both a consumer protection statute and a civil rights statute, sharing a heritage with the Equal Employment Opportunity Act[1] as well as the Consumer Credit Protection Act of 1968,[2] to which it is attached as Title VII. As others have noted, the ECOA is partly a consumer protection measure but mostly an antidiscrimination statute.[3] Its emphasis on disclosing the reasons for adverse action on a credit application make it consistent with the disclosure requirements of truth-in-lending; however, inclusion of the "effects test" as a criterion for determining whether a procedure used to screen applicants is discriminatory is drawn directly from the Supreme Court decision on employment discrimination.

ECOA defines credit discrimination as occurring when a creditor treats one applicant less favorably than other applicants on any of the bases prohibited by the statute: sex, marital status, race, color, religion, national origin, age, receipt of income from public assistance programs, and good faith exercise of rights under the Consumer Credit Protection Act of 1968 (which includes among other titles, Truth in Lending, Fair Credit Billing, Fair Credit Reporting, and Consumer Leasing Acts). The specific constraints of the ECOA enacted in 1974,[4] amended in 1976[5] and governed by Regulation B prevent discrimination based on any of the following characteristics:[6]

[1] P.L. 88-352, Title VII, Sections 703, 705, 78 Statute 255, 258, 42 U.S.C., Sec. 2000-e-2, e-4 (1975).

[2] 15 U.S.C. sec. 1601 *et seq.*

[3] "Equal Credit Opportunity," *Federal Reserve Bulletin,* Feb. 1977, p. 101.

[4] P.L. 93-495, 1975, effective in October, 1975.

[5] P.L. 94-239, 1976; the amendments became effective in March, 1977.

[6] The recent Bakke decision of the U.S. Supreme Court (1978) raises the question whether favored characteristics will be protected by ECOA, along with groups thought to be subjected to discriminatory treatment.

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Characteristics	Favored	Discriminated Against
Sex	Male	Female
Marital Status	Married	Single, Divorced, Widowed, Separated
Race and Color	White Caucasian	Minorities
National Origin	U.S.	Other
Age	Middle, Young	Old (62 and older)
Public Assistance Income	None	Some
Good faith exercise of CCPA rights	None	One or more

Both judgmental systems and empirically derived credit-scoring systems used by creditors to evaluate applicants cannot use these attributes, excepting age, even if past experience indicated that they were the best predictors of creditworthiness. In the case of age, if a credit-scoring system has met the regulation's test of being demonstrably sound and empirically derived, Section 701 (b) (3) of the amended act permits age to be considered, but forbids the assignment of a lesser point value for age whenever the applicant is 62 years or older. Because of the preference granted the 62 and older group in empirically derived scoring systems, the young and middle ages are grouped together as not requiring the law's full protection.

More specifically, this study attempts to determine whether consumer perceptions of discrimination are, indeed, borne out by data showing a greater incidence of credit denial or reduction in the amount of credit granted; or whether consumer perceptions of discrimination underestimate actual market discrimination. Market discrimination requires that there are demonstrable market differences in the treatment of applicants on the bases prohibited, forming the eight protected classes cited above. That is, were there significant market differences in denials of credit applications or other forms of adverse action taken on the bases prohibited by law? Our research efforts focus on two lines of inquiry:

(a) Did consumers reporting discriminatory treatment in 1977 perceive that credit was more difficult to obtain than for other respondents, were they denied credit more often than others, or did they obtain less nonmortgage debt than others after differences in socioeconomic characteristics related to creditworthiness were taken into account?

(b) Did consumers in classes protected by ECOA perceive that credit was more difficult to obtain than other respondents, were they denied credit more frequently than others, or did they obtain less nonmortgage debt than others after socioeconomic characteristics related to creditworthiness were taken into account?

Consumer Surveys, 1977 and 1970

The findings of this paper are based on two consumer surveys, one conducted in October 1977 and the other in October 1970. Although the metho-

dology and some questions were similar for both surveys, the question used to measure discrimination as defined by ECOA was not included in the 1970 survey. Accordingly, the results which follow are drawn primarily from the 1977 survey, with the 1970 survey used as a benchmark for comparative purposes.

The 1977 survey is based on three probability samples of 967 households across the continental United States. The telephone survey included only households in which a major durable good costing $200 or more had been purchased within 12 months prior to the interview.

The first sample of 813 households was drawn from 83 central cities and urban fringe areas within standard metropolitan statistical areas (SMSAs) across the country in proportion to the population in each area. Rural areas were excluded from the survey to eliminate the possible mixing of personal and business credit common to rural life. Because the sample includes only nonrural residents and families making a major purchase, the respondents' characteristics differ somewhat from those of the general population: the average levels of income and education being slightly above the averages for the U.S. population.

The second sample of 54 households was drawn from the same sampling base as the national survey but included only unmarried women who were heads of household and who had made a major durable goods purchase. This sample was obtained to enlarge our sample of this segment of the protected classes under ECOA who might otherwise have been either underrepresented or not sufficiently numerous to permit separate analyses.

Because fewer minorities, elderly, unmarried less affluent residents of central cities qualified for the survey on a representative basis, 100 additional interviews were conducted in disadvantaged areas of four major cities.[7] Before each interview, each respondent was screened to ensure that the head of household had made a qualifying purchase and fell within at least one of the following categories:

- 62 years of age or older
- non-Caucasian
- household income under $10,000
- unmarried if female

The 1970 survey was based on two probability samples of 793 California households which had purchased a major durable good costing $100 or more in the 12 months preceding a personal interview. The first was a statewide sample of 641 families and the second a sample of 152 black households chosen from areas throughout the state with high concentrations of blacks. For both surveys, previous research indicates that combining the sub-samples (three for 1977 and two for 1970) does not seriously bias the results where the focus is on between-group differences.[8]

[7]Detroit, Michigan; Los Angeles, California; New York, New York; and Washington, D.C.

[8]Richard F. Kosobud and James N. Morgan (editors), *Consumer Behavior of Individual Families over Two and Three Years.* (Ann Arbor: University of Michigan Press, 1964), p. 2.

Both surveys gathered extensive data about the respondents' knowledge, attitudes and experience with consumer credit and credit sources in addition to a broad range of demographic, financial and other socioeconomic measures. For purchases of a car or major household durable goods, sequential questions were asked to help researchers retrace the decision-making process, including specific details about credit aspects of the transaction when the respondent financed the purchase.[9]

This paper limits its attention to respondents who financed their durable goods purchase.

In the 1977 survey, consumer perceptions of discriminatory treatment covered the two years prior to the date of the survey. For the sex and marital status criteria, these years were post-ECOA, since the law was passed in 1975. The other criteria were added to ECOA's coverage in 1977, only six months before the survey was taken. For these criteria – listed above – discrimination on bases later prohibited by ECOA was legal for 18 months of the two-year retrospective period.

II. Perceptions of Credit Discrimination

To gain some measure of consumer perceptions of credit discrimination, each respondent to the Shay-Brandt survey was asked:

> Whenever you tried to get credit in the past two years or so, do you think you were treated less favorably than others in getting the credit because of your age, sex, marital status, race or nationality?

About 12 percent of the respondents in the national sample said they believed they had been treated less favorably than others, and another ½ percent said that they might have been (Table 1).[10] Since a respondent's perception of discriminatory treatment cannot be regarded as proof of discriminatory practices, the responses indicate that about one out of every eight purchasers perceived that he or she had not received treatment as favorable as others were thought to receive when applying for credit in at least one instance during the past two years.

Respondents who perceived discrimination were asked "What do you think affected the way you were treated?" and, if an answer was given, "Anything else?" was asked. Open-end responses were grouped and tallied.

The major reasons given for the perceived discriminatory treatment were age, sex and marital status while race and nationality were reported by relatively few (Table 2). Reasons other than the six cited in the question (see note to table

[9] See questionnaire in Arnold Heggestad, principal investigator, *The Costs and Benefits of Public Regulation of Consumer Financial Services, Final Report* (Cambridge, Mass.: Abt Associates, 1979) pp. 250-266.

[10] In the analysis which follows reference to the national sample indicates that only the national probability sample was used; inner-city sample refers to the 100 interviews with inner-city respondents and combined sample includes the entire group of 967 households.

TABLE 1

Perceptions of Credit Discrimination,
National and Combined Sample, 1977

Perceived Discrimination	National Sample #	National Sample %	Combined Sample #	Combined Sample %
Yes	87	11.8	109	12.6
Might have been	3	0.4	5	0.6
Sub-Total	90	12.2	114	13.2
No	646	87.8	754	86.8
Total[a]	736	100.0	868	100.0

[a]The total excludes 71 respondents in the national sample who claimed that they did not seek credit during the prescribed period.

TABLE 2

Reason for Perceived Credit Discrimination
National and Combined Sample, 1977

Reason Reported	National Sample #	National Sample %	Combined Sample #	Combined Sample %
Age[a]	20	25.3	25	23.8
Sex	19	24.1	25	23.8
Marital Status	11	13.9	21	20.0
Race	3	3.8	4	3.8
Nationality	1	1.3	1	1.0
Other	25	31.6	29	27.6
Total[b]	79	100.0	105	100.0

[a]In this table and those which follow, 23 respondents who were less than 62 years of age and who reported age as the only kind of discrimination encountered were eliminated from the combined sample (21 from the national sample). Respondents under 62 years of age who reported age and some other form of discrimination remain in the sample. The reason is that, although respondents of all ages are covered by the law, the regulations protect persons 62 years of age or older, when credit decisions are based on acceptable credit-scoring systems.

[b]Due to multiple responses, total frequency is in excess of the number of purchasers perceiving discrimination.

2) accounted for about 32 percent of the responses, suggesting that respondents view discrimination more broadly than the law's coverage.

Another breakdown reported in Table 3 considers the differences in perceived discrimination between respondents protected by the ECOA and those who were not protected. A "protected" household is defined as one which is headed by a single female or single male, a minority group member, a person 62 years or older, an immigrant or a person receiving public welfare payments. Of the protected-class respondents 14 percent perceived discrimination in obtaining credit compared with 7 percent for nonprotected households. Except for marital status, which showed a much higher level of perceived discrimination among protected-class households, we find no important differences between the two groups in terms of the type of discrimination reported. In short, discriminatory treatment was reported by respondents in the "favored" groups as well as those classed as "protected."

ECOA proponents can cite the law's effectiveness in achieving the moderate levels of perceived discrimination reported, at least for the sex and marital status criteria.[11] A nagging question remains whether or not reported levels would have been substantially higher prior to passage of the ECOA. The fact that reported instances of credit discrimination were *higher* for sex and marital status than for the other bases despite two years of regulation, suggests that the real pre-regulation problems lay with sex and marital status, rather than with those covered by the 1977 amendment to ECOA.

Credit Source

Respondents reporting less favorable treatment were also asked: "What type of creditor was this [that treated you less favorably]?" Considered on a simple frequency count basis, we find that banks and retail outlets accounted for three-fourths of the reported discrimination cases (Table 4). Measured on a more meaningful basis which takes into account the incidence of patronage at each type of credit source, the results indicate the banks, finance companies and retailers had similar proportions of customers who perceived discriminatory treatment in at least one instance. The proportion for credit unions, on the other hand, was markedly lower than for the other institutions.

In sum, the analysis to this point indicates that consumer perceptions of discriminatory treatment over a two-year period were not widely held at the time of the survey. Although a 12 percent figure cannot be viewed as negligible, the responses indicate that consumers did not perceive high levels of discrimination based on any one characteristic. Age was mentioned most frequently as the rationale for perceived discrimination, but most of these perceptions were held by respondents under 30 years of age. Thus age, sex and marital status represent the predominant reasons for discrimination reported among classes now covered by ECOA.

[11] Although age was cited frequently by respondents giving more than one reason for perceived discrimination, only 4 of the 25 respondents who cited age were 62 or over.

TABLE 3

Perceptions of and Reasons for Credit Discrimination for Households Protected and Not Protected by ECOA, Combined Samples, 1977

	Protected Classes[a]		Nonprotected Classes	
	#	%	#	%
Perceived Discrimination, "Yes" or "Might have been"	60	14.4	31	7.2
Reason Reported				
Age	15	20.5	10	31.3
Sex	16	21.9	9	28.1
Marital Status	20	27.4	1	3.1
Race	3	4.1	1	3.1
Nationality	1	1.4	0	0
Other	18	24.7	11	34.4
Total[b]	73	100.0	32	100.0

[a]"Protected-class" household is defined as one which is headed by a single female or single male, a minority group member, a person 62 years or older, an immigrant or a person receiving public-welfare payments.

[b]Total includes more than one kind of discrimination reported by some respondents.

TABLE 4

Perceptions of Credit Discrimination by Types of Credit Source Adjusted for Incidence of Patronage at Credit Outlet

Type of Credit Institution	National Sample		Combined Sample		Weighted Average Frequency of Perceived Discrimination[b]	
	#	%	#	%	National Sample #	Combined Sample %
Bank	41	42.3	50	41.7	10.4	11.3
Credit Union	4	4.1	4	3.3	2.2	1.9
Finance Company	15	15.5	17	14.2	11.5	11.6
Retailer	32	33.0	43	35.8	11.7	12.9
Other	5	5.1	6	5.0	n.a.	n.a.
Total[a]	97	100.0	120	100.0		

[a]Due to multiple responses, total frequency is in excess of the number of purchasers perceiving discrimination.

[b]Number of respondents reporting discriminatory treatment divided by number of respondents reporting use of credit source in the past three years.

n.a. = not available

Credit Denials

Because a credit denial is a likely reason for respondents to report discriminatory treatment, a review of credit denials in relation to perceptions of discriminatory treatment is in order. To assess the incidence of credit denials each respondent in the Shay-Brandt survey was asked: "In the past two years or so, have you ever been turned down for credit by a particular lender or creditor?" If an affirmative response was given, a question was asked to identify the type of lender who denied the credit and the reason given for the refusal.

The results in Table 5 indicate that 12.3 percent of respondents in the national sample and 14 percent of the combined sample reported being denied credit within the past two years. Among the reasons given for being refused credit, only 6.4 percent were attributable to marital status, 3.2 percent to sex and 8.5 percent to age (most of them young). The predominant reasons given for credit denials in the combined sample were no credit rating, income, new job and age. Only a relatively small proportion of the reasons given for credit denials could be attributed to perceptions of discriminatory treatment covered by ECOA.

TABLE 5

Reported Credit Denials and Reason for Refusal, National and Combined Sample, 1977

	National Sample		Combined Sample	
	#	%	#	%
Credit Denied, "Yes"	100	12.3	135	14.0
Reason Given for Refusal				
No Credit Rating	19	20.2	26	21.3
Income	15	16.0	25	20.5
New Job	14	14.9	18	14.8
Age	8	8.5	10	8.2
No Collateral	6	6.4	7	5.7
Over-indebted	6	6.4	6	4.9
Slow Payer	5	5.3	5	4.1
Marital Status	6	6.4	6	4.9
Mixup	3	3.2	4	3.3
Bad Credit Risk	3	3.2	4	3.3
Moved Recently	3	3.2	3	2.5
Sex	3	3.2	4	3.3
No Co-signer	2	2.1	3	2.5
Other	1	1.0	1	.7
Total[a]	94	100.0	122	100.0
Number of Respondents	813		967	

[a]Total includes more than one reason reported by some respondents and no reason for other respondents.

When respondents reporting credit denials are cross-tabulated with perceptions of discriminatory treatment, the results in Table 6 suggest that one-third of those who were refused credit believed that discriminatory treatment might have been involved. Among those who were not denied credit less than 5 percent perceived discrimination in some form. Whether the perceived discriminatory treatment was in fact linked with the reported credit denial cannot be determined, but the evidence strongly suggests that some perceptions about discrimination were associated with credit denials. Marital status was the only ECOA-protected criterion that appeared to be more strongly associated with credit denials than when credit was not denied. All other reported reasons for discrimination were more common among the group that was not denied credit than among those who were.

III. Multivariate Analysis of Perceptions of Discrimination in Consumer Credit Markets

Introduction

The legal definition of discrimination requires that the consumer be treated less favorably than others of similar economic circumstances. To investigate this issue more rigorously we need to move beyond simple cross-tabulation which considers one variable at a time. Multiple regression analysis allows us to address the question of discriminatory perceptions in a way which takes into account

TABLE 6

Reported Credit Denials and Perceptions of and Reasons Given for Credit Discrimination, Combined Survey, 1977

	Credit Denied		Credit Not Denied	
	#	%	#	%
Perceived Discrimination, "Yes or "Might have been"	47	34.8	39	4.7
Reason Reported				
Age	10	17.2	15	31.9
Sex	12	20.7	13	27.7
Marital Status	16	27.6	5	10.6
Race	1	1.7	3	6.4
Nationality	1	1.7	0	0
Other	18	31.1	11	23.4
Total[a]	58	100.0	47	100.0
Number of Respondents	135		829	

[a]Total includes more than one kind of discrimination reported by respondents.

differences in socioeconomic and demographic characteristics other than those prohibited by law.

In the analysis which follows we approach the discrimination issue from three perspectives:

- Are consumer perceptions of credit discrimination related to perceptions of *less* credit availability after differences in socioeconomic characteristics are taken into account;
- Are perceptions of credit discrimination related to *less* use of nonmortgage debt after the same differences are considered; and
- Are these perceptions related to a *greater incidence* of credit denials when other factors are taken into account?

A subsequent question in each instance is whether the characteristics protected by ECOA are more strongly associated with each dependent variable, i.e., perceptions of credit availability, use of nonmortgage debt and credit denials, than is the perception of credit discrimination. If so, there may have been unperceived and/or unreported discrimination, suggesting that respondents in groups protected by ECOA did not recognize and/or report discriminatory treatment. If the opposite were true, respondents may have perceived discrimination which did not breed these outcomes (credit denials or lesser amounts of debt).

Perceptions of Credit Availability

To measure the respondent's level of confidence about his or her ability to obtain credit each respondent was asked:

> Now, let's suppose you wanted to make a large dollar purchase, like a color T.V. How difficult do you think it would be for you to borrow from a bank for an instalment loan?

The answers ranged on a four-point scale from "extremely difficult" to "not at all difficult." The question was repeated for finance companies, credit unions, installment plans from a retail store and a credit card from a department store.[1 2]

Before the analysis was conducted, the following relationships were hypothesized for the independent variables and perceived credit availability:

- income and education – positive
- level of nonmortgage debt, family size and age less than 30 – negative

The regression equation shown in column 1 of Table 7 indicates that perceptions of credit availability were consistent with the hypotheses, except for education level. By including these variables first by themselves, and then in successive regression equations (columns 2 and 3) we are able to determine (1) whether perceptions of credit discrimination were related to perceptions of less credit availability after differences in socioeconomic characteristics of re-

[1 2] This question became the dependent variable used in the analysis for Table 7. It was calculated as an average of the perceived degrees of difficulty respondents reported they would have in obtaining credit from banks, credit unions, finance companies and installment plans from retailers. See note 1, Table 7.

TABLE 7

Socioeconomic and Protected Class Characteristics and Perceptions of Discrimination Regressed on Perceptions of Credit Availability, 1977 Survey, Combined Samples[1]

	Regression and Coefficient and t-values		
Independent Variables	Column 1	Column 2	Column 3
Family Income ($000)	.025[a] (5.85)	.023[a] (5.66)	.025[a] (5.53)
Education of Head (Number of years of schooling)	–[2]	–	–
Age – Under 30 (= 1, all others 0)	–.416[a] (5.00)	–.380[a] (4.84)	–.344[a] (3.97)
Family Size (Number of persons)	–.049[b] (2.03)	–.057[a] (2.48)	–.059[b] (2.09)
Total Nonmortgage Debt ($000)	–.030[b] (2.06)	–.032[b] (2.28)	–.023[c] (1.54)
Perceived Discrimination (= 1, all others 0)		–.783[a] (7.77)	
Single Male Head (= 1, all others 0)			–.283[b] (2.28)
Female Family Head (= 1, all others 0)			–
Race – minorities (= 1, all others 0)			–.296[a] (3.28)
Age – 62 and over (= 1, all others 0)			.166[c] (1.51)
Welfare Recipient (= 1, all others 0)			–
Immigrant (= 1, all others 0)			–
Constant	3.24	3.37	3.31
Adj. R^2	.15	.24	.18
F-value	13.20[a]	27.05[a]	11.04[a]

[1]The dependent variable, perceptions of credit availability, is scaled from 1 to 4 according to the degree of ease perceived in obtaining nonrevolving credit from banks, credit unions, finance companies and retail stores.

[2]A dash indicates that the t-value for the variable was less than 1.0, and a = $p < .01$, b = $p < .05$, and c = $p < .10$.

spondents are accounted for, and (2) whether perceptions of less credit availability were held more strongly by the groups protected by ECOA.[13]

Column 2 of Table 7 establishes that perceptions of discrimination were significantly related to perceptions of less credit availability even after differences in income, education, family size, age under 30, and level of nonmortgage debt are held constant. Column 3 indicates that among groups fully covered by ECOA in 1977, only single males and minorities held perceptions of less credit availability that were significantly different from consumers without these attributes. Female heads of household, senior citizens, welfare recipients, and immigrants did not show significant differences after variations in other socioeconomic characteristics were taken into account. It should be noted that the statistical test of discriminatory perceptions and ECOA-protected groups is a stiff one since it asks whether after differences in creditworthiness (e.g., income, debt level, etc.) are considered, did respondents protected by ECOA or those reporting discriminatory behavior perceive that credit was less available. The statistical answer is "yes" for the group which reported perceptions of discriminatory treatment. Among respondents fully protected by ECOA, only single males and minorities passed the statistical test.

Using the same statistical technique, it is possible to evaluate whether respondents reporting perceptions of discriminatory treatment or those covered by ECOA, held higher or lower nonmortgage debt levels. The hypothesis in this instance is that those respondents who reported discriminatory treatment were unable to obtain as much debt as others, after differences in income, education, family size and age under 30 are taken into account.

Considering only socioeconomic characteristics of respondents, column 1 of Table 8 indicates that of the three variables positively associated with the level of nonmortgage debt, family income and family size showed the strongest associations followed by the under 30 age group.

Column 2 establishes that respondents who perceived discriminatory treatment did not have significantly lower levels of nonmortgage debt relative to other respondents. This finding is critical for when we compare it with column 2 of table 7, showing a strong negative effect of perceived discrimination on perceived credit availability, it becomes apparent that perceptions about discrimination, whether based in fact or not, did not preclude those respondents from obtaining debt levels comparable to others.

When respondents with the ECOA-protected characteristics were compared to others (Table 8, column 3), we find that the debt level was influenced only by senior age (and income). Respondents 62 years or older had significantly lower debt levels. Because this group did not perceive that credit was more difficult to obtain (Table 7), it seems probable that the lower level of debt owed by senior citizens resulted from reduced demands for durable goods rather than

[13]The inclusion of the perceptions variable in an equation where all other variables are more clearly exogenous might be questioned, but since the dummy variable affects only the intercept and not the slope of the equation, it does not affect the other regression coefficients.

TABLE 8

Socioeconomic and Protected Class Characteristics and Perceptions of Discrimination Regressed on Total Nonmortgage Debt Levels, 1977 Survey, Combined Sample[1]

	Regression Coefficient and t-values		
Independent Variables	Column 1	Column 2	Column 3
Family Income ($000)	38.2[a] (3.56)	38.0[a] 3.52)	26.2[b] (2.27)
Education of Head (Number of years of schooling)	–[2]	–	–
Age – Under 30 (= 1, all others 0)	364.0[b] (1.73)	368.1[b] (1.75)	–
Family Size (Number of Persons)	201.5[a] (3.33)	200.6[a] (3.30)	80.1 (1.11)
Perceived Discrimination (= 1, all others 0)		–	
Single Male Head (= 1, all others 0)			–
Female Family Head (= 1, all others 0)			–
Race – minorities (= 1, all others 0)			–
Age – 62 and over (= 1, all others 0)			–1269.7[a] (4.59)
Welfare Recipients (= 1, all others 0)			433.7 (1.04)
Immigrant (= 1, all others 0)			–
Constant	247.41	262.68	1183.87
Adj. R^2	.04	.04	.07
F-value	8.88[a]	7.12[a]	6.12[a]

[1] The dependent variable, total nonmortgage debt level, scaled in dollars.

[2] A dash indicates that the t-value for the variable was less than 1.0, and a = $p < .01$, b = $p < .05$, and c = $p < .10$.

from discriminatory constraints upon the supply of credit. The fact that other ECOA-protected classes did not have lower debt levels implies that these groups were able to obtain debt at a level consistent with their economic circumstances.

These findings do not support a judgment that credit discrimination was nonexistent at the time of the survey. Rather it supports the inference that where credit discrimination was perceived or where respondents in classes protected by ECOA were concerned, there were no statistically significant differences in debt levels observed, holding certain socioeconomic characteristics constant. In short, after allowance for differences in these socioeconomic factors, the evidence suggests that credit discrimination after ECOA has not resulted in

lower nonmortgage debt levels either for respondents perceiving discriminatory treatment or for those protected by ECOA. Whether these consumers were forced to borrow from higher cost sources or on less favorable contract terms, however, cannot be determined directly from these results. By assessing the incidence of credit denials among the same groups, other inferences about the discrimination process can be drawn.

Credit Denials

The third test for discrimination was conducted using the credit denial question described earlier as the dependent measure. When socioeconomic characteristics alone are regressed on the credit denial variable, family income shows a negative association while nonmortgage debt levels and young families exhibit a positive association: that is, more denials are experienced when family incomes are lower, total debt is higher and when the head of the family is under 30 (Table 9, column 1).

Respondents who perceived discriminatory treatment in the financing of their durable goods purchases reported more instances of credit denials during the past two years than those who did not, after consideration of the socioeconomic characteristics (column 2). This finding supports the thesis that for respondents perceiving discriminatory treatment, credit denials occurred beyond levels attributable to income, debt level and other measures of creditworthiness.

When this result is compared with column 2 of Table 8, indicating that debt levels of respondents reporting credit discrimination were no different from others, the two findings are consistent only if respondents perceiving discriminatory treatment were able to obtain the needed credit elsewhere. For some, this may have meant obtaining credit from higher cost outlets.

Two of the six classes protected by ECOA experienced a significantly higher incidence of credit denials than was indicated by the socioeconomic variables alone. These were minorities and female heads of families. It will be recalled that despite the fact of the significantly higher incidence of credit denials, both minorities and female heads of families were able to obtain nonmortgage debt levels consistent with the socioeconomic characteristics considered. That minorities perceived, however, that credit was more difficult for them to obtain than for others, further suggests that these consumers might well have been denied credit because of race alone. Out of this experience could have evolved a perceptual set, based on reality, that credit was more difficult for them to obtain and that to borrow money they were best advised to start their search with higher cost sources, a finding supported in previous research by Day and Brandt.[14] As we noted elsewhere, these respondents did not shop more or less widely than white respondents when other characteristics are taken into account.[15]

[14] George F. Day and William K. Brandt, "A Study of Consumer Credit Decisions; Implications for Present and Prospective Legislation," National Commission on Consumer Finance, *Technical Studies,* Vol. I, (Washington, D.C.:, U.S. Government Printing Office, 1973) Ch. 6, p. 91.

[15] Heggestad, "The Costs and Benefits," pp. 245, 247.

TABLE 9

Socioeconomic and Protected Class Characteristics and Perceptions of Discrimination Regressed on Credit Denials during the Past Two Years, 1977 Survey, Combined Samples[1]

	Regression Coefficient and t-values		
Independent Variables	Column 1	Column 2	Column 3
Socioeconomic Characteristics			
Family Income	−.004[a] (2.47)	−.003[b] (1.92)	−.004[b] (2.14)
Education of Head (Number years of schooling)	–[2]	–	–
Age – under 30 (= 1, all others 0)	.149[a] (4.69)	.130[a] (4.42)	.132[a] (3.93)
Family Size (Number of persons)	–	–	–
Total Nonmortgage Debt ($000)	.018[a] (3.20)	.019[a] (3.60)	.016[a] (2.79)
Perceptions			
Perceived Discrimination (= 1, all others 0)		.417[a] (11.08)	
Protected Classes			
Single Male Head (= 1, all others 0)			–
Female Family Head (= 1, all others 0)			.069[b] (1.85)
Race – minorities (= 1, all others 0)			.103[a] (2.96)
Age – 62 and over (= 1, all others 0)			−.064[c] (1.50)
Welfare Recipient (= 1, all others 0)			–
Immigrant (=1, all others 0)			–
Constant	.17	.10	1.6
Adj. R^2	.06	.19	.07
F-values	9.59[a]	29.80[a]	6.11[a]

[1] The dependent variable, credit denials, is a dummy variable where a respondent reporting denial = 1, and all others = 0.

[2] A dash indicates that the t-value for the variable was less than 1.0, and a = $p < .01$, b = $p < .05$, and c = $p < .10$.

IV. Perceptions of Credit Availability in 1970

In the 1970 Sample of California Consumers conducted by Day and Brandt for the National Commission on Consumer Finance, responses to questions similar to those asked in the 1977 Survey were available for comparative analysis.[16] Questions relating to perceptions of discriminatory treatment in financing purchases were not asked, but comparable questions concerning perceptions of credit availability and nonmortgage debt levels were asked.[17]

The socioeconomic characteristics held constant in Table 10 were: income, age – under 30, credit attitude (scaled 1-7, higher digits denote more favorable attitude toward using credit), education, family size, and awareness of the annual percentage rate (APR). These include many of the same variables as considered in 1977 with some additions (credit attitude and APR awareness) and one omission (nonmortgage debt level). These additions and omissions did not appear to affect the comparability of the results.

The results in Table 10 indicate that income, credit attitude, heads of families under 30, and APR awareness were all related to perceptions of credit availability. Credit attitude and income were also associated with the level of nonmortgage debt in a manner that was consistent with perceptions – that is, higher incomes and more favorable attitudes toward credit were held by families with higher debt levels. Young respondents, however, had perceptions of more limited credit availability accompanied by higher nonmortgage debt levels than their other socioeconomic characteristics would have predicted. Education, family size and APR awareness showed no consistent coefficients at acceptable confidence levels.

When these socioeconomic characteristics were taken into account, each of the classes later covered by ECOA, except for senior citizens (65 and over), held strong perceptions that credit was more difficult to obtain than for the nonprotected (future) groups. Given that a strong relation between perceptions of

[16] Day and Brandt, "A Study of Consumer Decisions," Ch. II.

[17] The question to obtain perception of credit availability was:

> Now, let's suppose you wanted to make a large dollar purchase, like a color T.V. How difficult do you think it would be for you to borrow from a bank for an instalment loan? Do you think it would be extremely difficult, somewhat difficult, not too difficult, or not at all difficult to obtain this type of loan for this color T.V.?

The question was repeated using different wording where appropriate for a finance company, retail store, credit union or credit card. The question to ascertain nonmortgage debt level was:

> Now, let's talk about another aspect of credit for a moment. I'd like to get an idea of *all* the money you *owe except* for your mortgage. Consider *all* the money you owe different places and people, such as loans to pay off furniture or cars, doctor bills, charge accounts, and everything else you owe. About how much money do you think it would take to pay off the entire amount? Would it be over or under $1,500? If under, would that be under $500 or over $500 but less than $1,500? If over $1,500, would that be $1,500 but less than $8,000; $3,000 but less than $5,000, or $5,000 or over?

TABLE 10

Perceptions of Difficulty in Obtaining Installment Credit Compared to Actual Amount of Installment Debt Obtained, 1970

Independent Variables	Arithmetic Mean	Regression Coefficient and t-value: Perceptions[1]	Regression Coefficient and t-value: Total Debt
Socioeconomic Characteristics			
Income ($000)	$11,309	.03[a] (3.00)	41.91[a] (2.99)
Credit Attitude (1 to 7, higher number denotes more favorable attitude)	3.24	.04[b] (1.96)	218.39[a] (4.14)
Education of Head of Household (number of years of schooling)	12.57	–[2]	–
Age under 30 (= 1, all others 0)	.22	–.45[a] (5.50)	542.55[a] (2.70)
Family Size (Number of persons)	3.62	–	54.38 (1.11)
Rate Awareness (= 1, unaware 0)	.58	.15[b] (2.19)	–
Protected Classes			
Female Family Head (= 1, all others 0)	.16	–.51[a] (5.30)	303.94 (1.30)
Single Male Head (= 1, all others 0)	.05	–.75[a] (4.80)	–
Race – minorities (= 1, all others 0)	.30	–.31[b] (2.26)	671.21[a] (3.58)
Age – 65 and over (= 1, all others 0)	.12	–	861.61[a] (3.12)
Constant		–2.27	–138.32
Adj. R^2		.26	.13
F-value		13.17[a]	5.45

[1] Perceptions variable scaled 1 to 5 according to the degree of difficulty the respondent believed he (she) would experience in obtaining credit at four institutional sources.

[2] A dash indicates that the t-value for the variable was less than 1.0, and a = $p < .01$, b = $p < .05$, c = $p < .10$.

credit discrimination and credit availability was noted in the 1977 sample, the finding suggests that perceptions of credit discrimination may have been higher in 1970 as well, but this cannot be verified.

When we look at the level of nonmortgage debt among the protected classes, we find that only senior citizens and single female family heads had significantly lower debt levels, but even here the coefficient for female family heads is only marginally significant at the 90 percent confidence level. Minorities, on the other hand, had significantly *higher* debt levels than would have been predicted by their socioeconomic circumstances. As was the case in 1977, the lower debt level for senior citizens was not accompanied by perceptions of less credit availability and is attributed to less credit demand as a result of the stage of the life cycle. In short, only female family heads had perceptions at all consistent with differences in debt level.

Although the evidence from 1970 is fragmentary, it indicates that perceptions of restricted credit availability were more widely held among groups now protected by ECOA than was the case in 1977. It also suggests that female family heads (in California) were the only ECOA coverage group that might have been constrained to lower debt levels than others not now covered by that legislation.

V. Conclusions

From our two lines of inquiry, we conclude

(a) that consumers reporting discriminatory treatment in 1977 did have more limited perceptions of credit availability than other respondents, they were denied credit more often than other respondents, but they were able to obtain nonmortgage debt levels similar to respondents, and

(b) that among consumers in classes protected by ECOA, minorities and single male respondents perceived more limited availability of credit than was perceived by other respondents, minorities and female family heads were denied credit more often than other respondents, but all of the protected class groups (other than senior citizens) were able to obtain debt levels consistent with those attained by other respondents after differences in socioeconomic circumstances were taken into account.

More generally, perceptions of credit discrimination over the two years preceding October 1977 were moderate, held by only 12 percent of the sample representing residents in metropolitan areas of the United States – the predominant reasons given for these perceptions were marital status and sex, while race, nationality and age (over 62) were reported rarely.

It has been possible to narrow the scope of discriminatory outcomes from these perceptions to credit denials and possible patronage of more costly credit sources, since our results do not support a hypothesis that respondents perceiving discriminatory treatment were unable to obtain debt levels consistent with their socioeconómic circumstances.

Looking back to the pre-ECOA period in the 1970 Day-Brandt California survey, we note that the perceptions of more limited credit availability held by protected class groups were not accompanied by significantly lower nonmortgage debt levels, a possible exception being female heads of families. With this one exception we suggest that it is not likely that credit discrimination greatly limited access to consumer credit markets, either before or after ECOA, although it may have caused considerable inconvenience and/or higher cost to those subjected to it.

Discussion

Carol S. Greenwald*

Professor Brandt's and Professor Shay's paper raises an interesting teleological question very similar to one of the classic questions discussed in philosophy classes, "If a tree falls in the forest, does it make a noise if there is no one to hear the crash?" Similarly, Professors Brandt and Shay challenge us, "Can women and minorities receive discriminatory treatment in credit markets without knowing it?" While I will leave to philosophers the first question about the bases of knowledge, I will venture to answer the second by saying, "Most assuredly."

One of the most pernicious effects of discrimination is for the group being discriminated against to internalize the prejudices of the dominant culture. When turned down for credit, women and minorities believe that they were not creditworthy. They do not automatically think that white males with similar income and length of employment would have received credit. When a woman receives a credit card in the mail with a line of credit for $500, she is likely to be genuinely pleased. She is less likely to wonder if that line of credit is lower than a similarly situated white male would have received. She is usually in no position to find out even in the unlikely event the idea crossed her mind. Nor is a woman likely to perceive discrimination when a bank loan officer reviews her loan application and very politely asks her to have her husband sign it with her. In a study I've conducted using actual testers, mortgage applicants have called a bank and asked for a mortgage application to buy a home located in a predominantly minority neighborhood. The bank officer has politely explained to the "applicant" that the bank lends only in contiguous communities which do not include this particular one. If handled politely enough, the prospective applicant will not feel discriminated against and in fact, the bank will not have to record the incident in its rejected application file for ECOA purposes. If this had not been a test, the applicant would never know that a white applicant also applying for a mortgage on a home in a noncontiguous town was given an application. Just as Brandt and Shay conclude that "a respondent's perception of discriminatory treatment cannot be regarded as proof of discriminatory practices," neither can nonperception be taken as proof that discrimination was not practiced.

Other studies have also concluded that consumers have an inaccurate perception of the credit-granting process. A study published in 1976 in the *Journal*

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of Consumer Affairs[1] concluded that consumers overestimated the difficulty of obtaining bank loans. "Consumers clearly misperceive the credit standards of both banks and finance companies."[2] Thus, consumers when rejected for a bank loan are likely to accept a vaguely worded rejection that they were uncreditworthy because consumers tend to believe that banks have higher credit standards than they in fact do.

By focusing on purchases of durable goods costing $200 or more Brandt and Shay have both trivialized the issue and biased their results. Even women can usually borrow $200. A major problem with the paper as a useful analysis of discriminatory treatment in credit markets is that it excludes from the analysis the major credit area in which women and minorities and the elderly have charged discrimination: in the mortgage market. By discussing only nonmortgage debt, they have almost begged the whole issue. Furthermore, they have biased their results by limiting attention to respondents who financed a durable goods purchase, thus excluding those who did not qualify for credit, possibly on a discriminatory basis.

I also disagree with the Brandt-Shay exclusion of married women or young people from the protected class. The protection of the law is not limited to female heads of household or to the elderly. ECOA is designed to allow women to obtain credit on their own whether married or not, and to allow all people regardless of their age, given that they are old enough to sign a legally binding contract, to have nondiscriminatory access to credit. So when Brandt and Shay report that discriminatory treatment was reported in the "favored" groups as well as those classed as "protected," I believe they have mixed their groups. An unknown proportion of married women and younger respondents are in their "favored" group. It would also be interesting to know how many women or young persons gave as the reason for credit denial "no credit rating" or "new job," both factors having age- and sex-linked characteristics. Before ECOA, married women had no credit histories and, therefore, no credit rating. Similarly, given that women leave and reenter the paid labor force more often than men, a credit denial based on the classification "new job" has the effect, if not the intent, of having a heavier impact on women and, obviously, on young persons. Again, it would be interesting to know what proportion of the combined sample who gave these "nondiscriminatory" reasons for credit rejections were women and the young.

Brandt's and Shay's finding that groups afforded ECOA protection had as much nonmortgage debt does not indicate, as they imply, that these groups did not experience discrimination in obtaining credit. Questions about terms and conditions are largely ignored. Were married women asked for a spouse co-signor on the installment loan contract? Were minorities more likely to obtain credit from high cost finance companies rather than banks? Did single women need a father as a co-signor?

[1] Dale A. Dauten and Joel J. Dauten, "Consumer Perceptions of the Consumer Credit Process," *Journal of Consumer Affairs,* Summer, 1976. Vol. 10, No. 1.

[2] *Ibid.*, p. 62.

I am also amused by Brandt's and Shay's surprise that "reported instances of credit discrimination were *higher* for sex and marital status than for the other bases despite *two years of regulation*- - - -." What regulation are they referring to? No federal regulatory agency had a meaningful enforcement effort for ECOA compliance in the 1975-1977 period. Only in 1978 did the federal bank regulatory agencies even write an examination procedure. If discrimination was lower in 1977 than in 1970 and I believe it was, it is because society's perceptions of women have changed and the change in those perceptions has been helped by the passage of the ECOA.

What I object to in this paper is its tone, which creates the feeling that ECOA was unnecessary legislation. This inference is most clearly stated in the paper's concluding sentence: "With this one exception [female heads of households] we suggest that it is not likely that credit discrimination greatly limited access to consumer markets, either before or after ECOA, although it may have caused considerable inconvenience and/or higher cost to those subjected to it." The paper dismisses all the anecdotal evidence repeated in numerous hearings by women and minorities alleging credit discrimination. If we grant Brandt and Shay the assumption that these people simply did not understand that they were uncreditworthy on empirically justifiable grounds, how do we handle bankers' admissions that before 1975 they regularly did discount a woman's income because they knew she was only working temporarily until she got pregnant? Or the admitted widespread use of credit-scoring systems which give negative weights to income from part-time or nonearned income, which more heavily impacted women who were more likely than men to have part-time jobs or alimony or welfare income? Sears has recently petitioned the Federal Reserve to amend Reg B to make such credit discrimination legal. Or department stores which would not issue a charge card to a woman in her own name even if she were working? Or credit-scoring systems which assign a negative weight to zip codes with heavy minority populations? Just this past summer, Montgomery Ward settled with the FTC a case in which the disputed practice was that Montgomery Ward gave false reasons for credit rejections. Montgomery Ward told credit applicants that they had insufficient income when in fact the basis of the rejection was the negative weight attached to the zip code in the credit-scoring system. Rejected black applicants were quite likely to believe it was their income and not their neighborhood or race which was the determining factor.

To say in the face of these widespread industry practices by the major credit sources that affected groups were not disadvantaged is to place a great deal of faith in a very simple regression equation's results. Especially one whose adjusted R^2's are in the phenomenally low range of .26 to .04! By their own admission, these variables explain virtually none of the variance in nonmortgage debt holdings. The equations are simply misspecified and when better specified the rejected discriminatory variables may well enter the equations. On the basis of these regression results, one can conclude virtually nothing. For my part, I'll take the reality of testimony from women and minorities and the admitted discriminatory practices of the industry as better evidence that ECOA was and is needed to give everyone equal access to credit.

Rebuttal

William K. Brandt and Robert P. Shay

Carol Greenwald's allegation of bias in our results by the exclusion of respondents who did not finance their credit purchase is wrong. We did not limit our attention only to those respondents who financed a durable goods purchase. In fairness to Ms. Greenwald, a careless sentence in our text may have led her to this conclusion, but the point was made quite clearly on the following page that the question which measured perceptions of discrimination was asked of all respondents whether or not they financed their durable goods purchase. Those 12 percent of respondents in the national sample who perceived at least one instance of credit discrimination in the past two years included all such purchasers, including the young, married wives, single persons, and others. Thus, the possible source of bias could have been the exclusion of those respondents who did not purchase a durable good costing $200 or more in the past 12 months.

Further, while we may have erred in classifying married women with married men in the "favored" rather than "protected" ECOA groups, we had little choice since we were unable to separate married women from married men when the family unit was the basis of our data. If we classify the young (under 30 years of age) as a protected class, we supplement our overall conclusion since a review of Tables 7 through 9 indicates that young families reported perceptions that credit was less available to them, that they were denied credit more frequently, but they were not prevented from obtaining as much nonmortgage debt as the middle-aged, after income, family size, and other socioeconomic differences were considered.

Effects of Creditor Remedies and Rate Restrictions[1]

Richard L. Peterson*

I. Background

A. *The Nature of the Study*

This study attempts to assess the impact that restrictions on legal rate ceilings and restrictions on creditors' abilities to collect on delinquent or defaulted debts (i.e., "creditors' remedies") have on the consumer credit markets. The methodology employed is to study intensively the behavior of creditors in selected local consumer credit markets. The consumer credit markets studied were located in states with widely differing restrictions on rate ceilings and creditors' remedies. By comparing consumer and creditor behavior under markedly different regulatory environments, we felt we could most readily determine where that behavior was altered by differences in the regulatory environment. The individual local credit markets selected were chosen so that they (i) were well defined, (ii) contained a fairly large proportion of individuals (particularly blue collar workers) that were likely to use consumer credit, and (iii) were, especially in the case of the Northern "paired" cities, highly similar with respect to the socio-economic characteristics of their population.

The states selected for intensive study were chosen so that their regulatory schemes would fit one of the categories: (illustrated in Figure I).

Category I: Consumer credit rate ceilings are restrictive and, in addition, substantial restrictions exist on creditors' remedies in the event debts are defaulted.

[1] The footnotes on this paper were added after it was presented at the conference. The main reason they were added was to improve the paper by taking into account pertinent afterthoughts and some of the constructive comments made by conference participants and colleagues after the paper was written. The footnotes generally develop topics that may have been treated too lightly in the initial draft.

In addition, a unified conclusion section was added after the conference. This paper and the companion Dunkelberg paper were initially planned to be one paper. However, it was not possible to incorporate findings of the Dunkelberg paper before the conference. The new section takes those findings into account in reaching its conclusions.

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Category II: Rate ceilings are restrictive, but restrictions on creditors' remedies are not unusually severe.

Category III: Rate ceilings are not restrictive, but creditors' remedies are severely restricted.

Category IV: Neither rate ceilings nor creditors' remedies are highly restricted.

Figure I

	Creditors' Remedies Restrictive	Creditors' Remedies Not Highly Restrictive
Rate Ceilings Highly Restrictive	Category I Wisconsin	Category II Arkansas
Rate Ceilings Not Restrictive	Category III Louisiana	Category IV Illinois

The states selected to represent each category were the following:

Wisconsin was selected for Category I because the Wisconsin Consumer Act (WCA) restricts both rates that can be charged on consumer loans and remedies that can be used to collect on defaulted debts. National finance company executives indicated that, because of the WCA, Wisconsin was one of the harder states in which to collect on bad debts. Also, allowable rate ceilings in Wisconsin were among the lower rate ceilings applicable to personal loans. Finally, the industrial area of Wisconsin along Lake Michigan matched up well on a socio-economic basis with the industrial area of Illinois, just south of the Wisconsin border.

Illinois was selected to represent category IV because its rate ceilings were not highly restrictive. In addition, consumer finance company executives indicated that its creditors' remedies were among the least restrictive in the nation and a review of creditor remedy laws indicated that they were less restrictive in Illinois than in most other states. Also, the northern industrial area of Illinois was very similar in socio-economic terms to the lower Wisconsin industrial area, so a ready comparison could be made of similar individuals located in states with substantial differences in consumer credit laws.

Arkansas was selected to represent Category II because its creditors' remedies are not highly restrictive while its comprehensive 10 percent usury law is the most restrictive consumer loan rate regulation in the nation.

Louisiana was selected to represent Category III because it has very high loan rate ceilings (particularly on personal loans). In fact, its rate ceilings are sufficiently high that it is one of only a handful of states where a major finance company reported that it did not feel it necessary to charge legal ceiling rates on personal loans. In addition, Louisiana has some of the most restrictive creditors' remedies in the nation. It is the only state in the nation that has not adopted

the Uniform Commercial Code. Instead, Louisiana law is derived from the Napoleonic Code and requires legal intervention to aid in collecting on defaulted debts. Thus, finance company executives reported that it is one of the more difficult states in which to collect on delinquent and defaulted debts.

Table 1 presents information on the legal rate ceiling and creditor remedy environment applicable to each of the four consumer credit markets selected for intensive study.

B. *Theoretical Background*

Rate Ceilings. Theoretically, rate ceilings, if effective, will reduce the price of credit and affect credit supply and demand. Demand will be increased at lower rates. However, creditors will be less willing to supply as much credit if rates are reduced. Creditors may adjust credit supplied, risk, and expected returns by adjusting credit terms, nonrate credit charges, or their willingness to accept credit risk.

Considerable theoretical and empirical work has been conducted on the impact of rate ceilings on consumer credit availability. See for instance, Avio (1973), (1974), Blades and Lynch (1976), Dunkelberg (1973), Durkin (1974), Eisenbeis and Murphy (1974), Goudzwaard (1968), Greer (1973), (1974), Jadlow (1975), Lynch (1968), National Commission on Consumer Finance (1973), Peterson (1977-e), and Ying (1977). However, many important issues remain unresolved. In particular, it is not fully understood how, and to what extent, credit markets adjust to the imposition of rate ceilings. Possible adjustments include: (i) adjusting credit availability to riskier customers, (ii) altering credit collection policies, (iii) cross-selling credit-related items such as credit insurance or credit application fees, or (iv) raising the prices of credit-related goods. Consumers, in turn, may utilize extra-legal or extraordinary sources of credit if they can no longer obtain the credit they desire from conventional sources. Also, those who can still obtain credit may use more of it, if it is available, at lower rates than would otherwise be the case.

Creditors' Remedies. Theoretically, a restriction on creditors' abilities to collect fully on delinquent or defaulted loans will affect both the demand for and the supply of consumer credit. The demand for credit will rise for any consumer who (i) anticipates that his personal losses would be reduced because of the remedy restrictions, if he were to default, and (ii) thinks that he has a nonzero probability of default on his consumer debts. The presumed value of the remedy protection and, thus, the increase in credit demand, will be highest for those who perceive the greatest benefit from the remedy restrictions or who have the highest expected probability of default. The supply of credit will be reduced by creditors that anticipate higher collection costs or increased losses in a restrictive remedy environment. The supply of credit will be reduced most to those customers who are most likely to default. Reductions in credit supply can either result from explicit credit rationing or, where rate ceilings are permissive, elevated interest charges on consumer debt. In addition to credit availability restriction and possible credit rate increases, creditor remedy restrictions may alter creditors' willingness to supply credit in additional ways. For instance, creditors may try to reduce the probability of default by taking greater collateral,

or more frequently requesting co-signers on consumer loans. They also may devote relatively more resources to credit evaluation or credit collection – albeit such changes in their production functions cannot be achieved costlessly and, thus will likely affect credit rates.

TABLE 1

Data on Loan Rates & Creditors' Remedies for Selected States*

	Ark.	Ill.	La.	Wisc.
I. Remedies				
1. Fees clauses allowed	Yes	Yes		Yes
2. Conf. judgment allowed		Yes	No for small loans and after maturity	No
3. Blanket security	Yes	Yes	Requires notarized list of security	Restricted
4. Waiver of exemption	Yes	Yes	Yes	Yes
5. Repossession	Yes, UCC	Yes, UCC	No self-help	Judicial
6. Deficiency judgment	Yes, under UCC	Limited election	No UCC	Limited election
7. Garnishment (exemptions)	$200/person $900 HH head &25/week	$65/$50 week or 85% or Federal	$70 or prohibited	75% or 40 X min. wage + $15/dependent
8. Wage assignments	Yes but restricted	Restricted	Yes but restricted	Restricted
9. Late charges	No provision	5% or $10	Deemed interest must be less than max. rate 3% or $5	3% or $3
10. Collection charges	No provision	Attorney's & court fees	Attorney's fees up to 25% of balance due	Severely limited, No attorney's fees
II. Rate Ceilings				
1. Retail revolving: rates and point where lower rate is effective	10%	1.8% monthly, 70¢ min bank 1.5% monthly	1.5% A.D.B., monthly 50 ¢ min	1.5%, 1% above $500
2. $3,600 3 yr. new auto loan	10%	14.55%	15.00%	12.83%
3. $1,000 1 yr. small loan	10%	25.67% small loan or 18.57%, CI Loan Act refin. charge	35.45%	18.52% DLA or 16.31% WCA

*Sources are Feldman and Reiley (1977) and Gushee (1978).

The wide variety of possible responses of creditors to restrictive creditors' remedies have not been fully documented. Most studies have not looked at both the credit demand (consumer) and credit supply (creditor) side of the problem simultaneously. However, spurred on by proposed FTC regulations on creditors' practices, partial equilibrium or reduced-form model studies of the economic impact of creditors' remedy restrictions have been conducted in recent years. These studies include those by Barth and Yezer (1978), Greer (1973), Greer and Shay (1973), Johnson (1977), and Peterson (1977-a), (1977-b), (1977-c), (1977-d).

II. Responses of Creditors to Restrictive Rate Ceiling and Creditor Remedy Environments

Possible responses of consumer creditors to rate ceiling restrictions are numerous. If the rate ceilings are binding, creditors will offer credit at lower rates than they otherwise would. To compensate for the lost revenues, they may attempt to raise nonrate fees or charges. They also may take fewer credit risks, by engaging in greater credit screening, requiring more credit insurance (if profitable), offering credit on more restrictive terms, increasing downpayments or requiring greater collateral or security on a debt, or reducing credit costs – by offering larger size loans where overhead costs of loan origination are spread more thinly per dollar of loan extended.

Restrictions on creditors' remedies may also affect creditors' behavior in a number of ways. By increasing creditors' difficulties in collecting on delinquent or defaulted debts, loan losses or collection costs may rise. Creditors may adjust for this fact by raising loan rates, raising nonrate fees (if possible), requiring more credit insurance (if profitable), restricting credit availability to higher risk customers, running more complete credit checks or evaluations on potentially risky customers, requiring greater collateral or more frequent co-signers to reduce credit risks, raising downpayments, or taking other steps to reduce risk exposure (such as by making smaller loans to any one customer, limiting credit maturities, etc.).

Thus, one objective of our research was to analyze differences in creditors' policies among states. To do so, an attempt was made to survey all commercial banks, all savings and loan associations, and approximately half of all finance companies and credit unions participating in each local credit market.

Because of advance letters and phone calls from industry representatives and interviewers, nearly 100 percent of the institutions contacted complied with our requests for personal interviews. However, not all respondents provided all the information requested. In most cases, missing data resulted when respondents did not have all the information requested readily available (this was particularly true for finance companies that were affiliates of larger organizations and for credit unions with unsophisticated internal accounting procedures). Also, many respondents did not make the types of loans (mortgage loans or 48-month auto loans) about which specific questions were asked. In a very few cases, respondents considered the information requested to be proprietary, and would not

supply it. Overall, however, compliance with our requests for information was quite good. The most common reason for nonresponse was that the information was not available, usually because the institution surveyed did not make the specific type of loan about which questions were asked.

Considerable variation was expected in the responses given by individual institutions. However, consistent patterns were expected to exist in the behavior of creditors in states with different credit laws. Thus, the basic assumption of our analysis was that dummy variables that indicated where surveyed institutions were located, in either (i) a state with low loan rate ceilings or (ii) a state with restrictive creditors' remedies could be used to determine if systematic differences existed in the behavior of similar creditors operating in different regulatory environments. Those two dummy variables, plus information on each institution's size, were included in regression equations for each type of creditor to determine if loan rates, terms, security, or risk avoidance varied significantly according to the legal environment in which an institution operated.[2] Tables 2, 3, 4, and 5 summarize the results of those regressions.

[2] The regression equations used throughout the paper were of the form

$$\text{Dep} = \beta_0 + \beta_1 \times \text{SIZE} + \beta_2 \times D_{RC} + \beta_3 \times D_{CR} + \beta_4 \times D_{MD} + \epsilon \text{ where}$$

Dep = the dependent variable under consideration
SIZE = the asset size of the institution
D_{RC} = a dummy variable that takes the value of 1 when rate ceilings are restrictive,
D_{CR} = a dummy variable that takes the value 1 when creditor remedies are restrictive,
D_{MD} = a dummy variable for missing data that takes the value 1 when information on the dependent variable in the equation was either lacking or uncodable.

D_{MD} was used so that regressions could be run even if some data were missing. Its use also ensured that institutions in at least three states had provided useful information in response to each question. Since nonuseful responses were coded as 0, the coefficient for the missing data dummy usually approximately equalled the constant term in the regression.

Ordinarily the rate ceiling, restrictive remedy, and asset size variables explained a very large proportion of the variance in the responses. Usually only a limited number of observations were missing, except for longer maturity loans and certain classes of information that creditors found difficult to report. If a large number of responses were missing, that fact is noted in the summary tables. Because the missing data dummy explained variance when missing data existed, the correlation statistics associated with the regressions summarized in the tables were elevated by the use of the missing data dummy. Even though it was not needed in every equation, its use made regression correlation statistics rather poor indications of the goodness of fit of the equations. Thus, the tables do not report R^2's or other goodness of fit measures applicable to entire regression equations.

In addition, since the paper was not concerned with analyzing the effect of asset size on creditor behavior the tables do not report on the coefficients of the SIZE variable. To report on every coefficient in the equations would needlessly expand the paper since so many regressions are summarized in the tables. Thus, the tables only provide the coefficients for the dummy variables D_{RC} and D_{CR}.

Finally, rather than double the size of the tables to report standard errors or t-statistics, asterisks (*) are used to show which coefficients were significant. For the most part the rate ceiling and dummy variable restriction dummies easily qualified for acceptance as being significant. Many of them would have been significant at the 99.9 percent confidence level. However, the *a priori* confidence level that I was willing to accept for this paper was a 95 percent one-tailed confidence limit; thus, an asterick is used whenever the value of a coefficient satisfies the 95 percent one-tailed criterion.

Table 2 indicates that rate ceilings were effective and binding in the survey states. Unsurprisingly, actual loan rates were lower in states with restrictive rate ceilings; thus, the rate ceilings effectively reduced nominal rates.

The findings presented in Table 2 also suggest that (as expected) loan rates are higher when creditors' remedies are restrictive. A very interesting finding is that *the effect of creditors' remedies restrictions on loan rates is greatest for loans that are associated with the greatest risk.* For instance, the coefficient on the creditors' remedy variable tends to be greater on personal loans than on either auto or mobile home loans offered by the same creditor. Further, the creditors' remedy coefficient is consistently greater on unsecured $2000 personal loans than on equivalent secured personal loans offered by the same creditor. In fact, for both banks and credit unions, the creditors' remedy coefficient is less than half as large on secured as on unsecured personal loans, and for credit unions, it is significantly positive only for *unsecured* personal loans. Finally, for auto loans made by banks and credit unions – with the sole exception of 48-month used car loans, that were made by only a handful of credit unions – the creditors' remedy coefficient is always at least 50 percent larger for used car loans than for equivalent maturity (but less risky) new car loans made by the same type of creditor.[3]

Data presented in Table 3 and Table 4 reflect the impact of restrictive laws on loan terms offered by various institutions. Table 3 analyzes data on loan terms offered by banks and credit unions. Table 4 presents data on auto loans purchased by major auto finance companies. Table 4 considers both loan terms offered the customer (loan/value ratios) and loan terms applicable to dealers (recourse arrangements and dealer reserve requirements).

The data presented in Table 3 provide weak support for our *a priori* expectation that creditors will attempt to reduce their loan risk, and thereby raise their returns, by raising downpayments when the legal environment is restrictive. Only three coefficients in the loan/value ratio equations have the expected significantly negative signs. These coefficients suggest that sample banks offer smaller loans,

[3] Interestingly, the coefficients on the creditor remedy restriction variables for commercial banks are similar to coefficients found in other studies. For instance, the coefficient on 36-month new auto loans is almost identical to the 40 basis point coefficient applicable to 36-month new auto loans made by banks operating in states with restrictive remedy ceilings. That study analyzed bank loan rates in 49 states (Peterson, 1977d).

Further, in their initial studies, Barth and Yezer (1977) found that restrictions on creditors' remedies were associated with several hundred basis point increases in personal loan rates on finance company loans. In this study, coefficients of similar magnitude apply to personal loans made by commercial banks operating in restrictive remedy states. However, the impact of restrictive remedies on rates charged by finance companies and credit unions (see Table 2) are considerably smaller than those applicable to banks. Nonetheless, the several hundred basis point increase for commercial banks is not inconsistent with other previous findings. In addition to Barth and Yezer's findings, Peterson (1977d) found that restrictions on particular creditor remedy restrictions might increase bank personal loan rates by close to 100 basis points. While the cumulative effect of remedy restrictions might be greater, unlike Barth and Yezer's study, Peterson did not attempt to assess the cumulative impact of multiple remedy restrictions.

TABLE 2

Effects of Restrictive Laws on ("Most Likely") Direct Loan Rates Charged by Various Creditors

	Mean Rate Effect (in basis points) for					
	Commercial Banks		Credit Unions		Finance Companies	
Type of Loan	Restrictive Rate Ceilings	Restrictive Remedies	Restrictive Rate Ceilings	Restrictive Remedies	Restrictive Rate Ceilings	Restrictive Remedies
Auto Loans						
New 36 mo.	−60.13[a]	38.38[a]	−70.31[a]	18.62	Direct loan rates not available here	
48 mo.	−83.12[a]	30.03	−29.11	40.14[a]		
Used 36 mo.	−197.69[a]	125.53[a]	−71.23[a]	30.46		
48 mo.	−37.01[b]	45.33[a,b]	−0.10[b]	9.83[b]		
Mobile Home Loans						
10 yr. ($12K)	−70.03[a]	92.42[a]	−8.40[b]	−3.97[b]		
Personal Loans						
1 yr ($1K) uns.	−207.06[a]	286.92[a]	−49.41[a]	58.26[a]	−25.45[c]	33.37[a,c]
2 yr ($2K) uns.	−208.35[a]	223.81[a]	−32.76[a]	42.76[a]	40.62[c]	46.22[a,c]
2 yr ($2K) sec.	−307.64[a]	92.42[a]	−40.47[a]	22.51	40.14[c]	44.48[a,c]

[a]Significant at the 95% (one-tailed) confidence level.

[b]Less than half of the surveyed institutions made this type of loan.

[c]No finance companies operate in Arkansas. Thus, Wisconsin is the only "low-rate" state. However, under Wisconsin's Discount Loan Act, a rate of 18.87 percent can be charged on $2000, 2-year personal loans. At the same time, finance companies in Illinois cannot make loans greater than $1500 (on which they could earn 23.48%) under the Illinois Small Loan Law. Thus, they must make $2000 loans under the Illinois Consumer Installment Loan Law, which allows a rate of only 18.57% on 2-year, $2000 loans. While loans of longer maturity could earn a higher rate of return, the legal maximum 18.57% is *less* (rather than *greater*) than the rate allowed in Wisconsin. This accounts for the "wrong" sign on the restrictive rate ceiling dummy in the finance company equations for $2000 loans.

uns. = unsecured loans; sec. = secured loans.

relative to the value of automobiles financed, in states where rate ceilings are highly restrictive. This was true for all types of bank auto loans studied except 48-month used car loans (which were made by only a limited number of banks).

The data did not confirm our expectation that restrictions on creditors' remedies induce either banks or credit unions to seek larger downpayments on auto loans. In addition, credit union data did not support the hypothesis that credit unions require higher downpayments on auto loans when rate ceilings are restrictive. However, additional data from a limited number of credit unions do suggest that credit unions are likely to require that a higher percentage of both new and used auto loans be secured when they operate in states with restrictive rate ceilings.

The final set of results presented in Table 3 relates to personal loans. Those results are consistent in sign with our theoretical expectations but only the data for commercial banks are statistically significant. Because of the high fixed costs

TABLE 3

Effects of Restrictive Laws on Direct Loan Terms Offered by Different Creditors

	Mean Effect for			
	Commercial Banks		Credit Unions	
Type of Loan	Restrictive Rate Ceilings	Restrictive Remedies	Restrictive Rate Ceilings	Restrictive Remedies
Auto Loans, Loan/ Value Ratios (in % points)				
New Car Loans				
36 mo.	−18.13[a]	9.08	0.68[b]	0.66[b]
48 mo.	− 8.36[a]	1.55	0.18[b]	−0.37[b]
Used Car Loans				
36 mo.	−12.52[a]	0.42	−0.01[b]	1.37[b]
48 mo.	0.84[b]	−2.78	−2.58[b]	− 1.43[b]
Percentage of Loans Secured				
New Auto	N.A.	N.A.	+30.9[ab]	.003[b]
Used Auto	N.A.	N.A.	+29.1[ab]	.057[b]
Personal Loans Minimum Size Loan made (in $)	+524.93[a]	−621.75[a]	+142.50	−51.22

[a]Significant at the 95% one-tailed confidence level.

[b]More than half of all respondents did not make such loans. However, respondents in at least three states made such loans.

N.A. Not available

involved in making and servicing consumer loans, it was expected that lenders would be less willing to make small personal loans when rate ceilings were restrictive. For instance, if it costs $50 to make and service a loan regardless of size, on a $1,000 one-year installment loan nearly 10 percent of the total annual percentage rate of return will be needed to generate the $50 cost incurred just in making and servicing the loan. The remainder of the finance charge return will be needed to cover the return on capital requirements of the lender. Thus, if the lender needs a 10 percent return to provide an acceptable return on capital, he will need nearly a 20 percent return before he will make a $1,000 one-year personal loan. In contrast, under similar conditions, it would take slightly less than 5 percent of the total annual percentage rate to cover the lenders' $50 cost of making and servicing a $2,000 one-year personal loan. Thus, in our example, he would be willing to make such a loan if he could obtain an annual percentage rate of slightly under 15 percent. Consequently, when legal rate ceilings are restrictive, creditors will be able to cover administrative costs and earn their required rate of return only if they make larger minimum-size loans.[4] This is what we found for commercial banks, and the result was highly significant.

Credit unions also made larger minimum size personal loans in states where rate ceilings were restrictive – but the effect was not as pronounced as it was for banks. One reason for this could be that federally chartered credit unions are subject to a 12 percent loan rate ceiling that is usually lower than state legal rate ceilings (except in Arkansas). This fact may have reduced the magnitude of the effect that state rate ceiling limitations have on credit union loan sizes. In addition, many credit unions have lower (explicit) costs for making loans than commercial banks because they have access to volunteer labor and payroll deduction plans. Reduced costs may not apply to all credit unions, however, and that could introduce high variance into our observations. Thus, it is not surprising that while it was still positive and fairly large, the coefficient on the rate ceiling dummy variable for credit unions' minimum loan size is larger than that applicable to commercial banks. Also, in contrast with banks, it is statistically insignificant.

The effect of restricted creditors' remedies on personal loan minimum sizes is not as obvious as that of rate ceiling restrictions. One can hypothesize that where remedies are restricted, in order to minimize risk, creditors may be more inclined to make smaller personal loans, especially to first time borrowers whose

[4] In studies of the consumer loan operations of finance companies and commercial banks both Benston (1975) and Bell and Murphy (1968) found that overhead costs associated with extending and servicing a consumer loan were very significant. Benston found those costs might run as high as $70 (in 1970) on finance company personal loans, and Bell and Murphy found they were approximately $20 for commercial bank consumer loans. Inflation may have raised the minimum cost associated with making a consumer loan. Therefore, for purposes of this example, I have used a $50 cost estimate. This may be too low for some lenders, such as finance companies, that experience high delinquency rates, but it may be too high for other lenders, such as credit unions, that have much volunteer labor. In either case, the substance of our example remains the same; when creditors can only charge "low" rates, they must make larger loans in order to cover the overhead costs associated with making a loan and still earn an adequate return on capital.

potential payment performance is unknown. Smaller loans would reduce the total amount of money at risk if a loan should turn out to be uncollectible. Smaller loans will also tend to place a lower repayment burden on customers, thereby making it more likely that they can conveniently make their payments without experiencing financial distress. These considerations make it likely that creditors will make more provision for extending smaller loans in states with restrictive creditors' remedies, everything else being equal. However, one would not necessarily expect the effect to be large. Indeed, the credit union data do show the expected negative effect, but is not large enough to be significant. Nonetheless, the bank data suggest that creditor remedy restrictions are strongly and significantly associated with lower minimum personal loan sizes for commercial banks. The magnitude of the effect is very large. The fact that Louisiana allows quite high rates (36 percent) on smaller personal loans may have contributed to this result.[5]

When credit laws are restrictive, creditors may be able to evade the intent of such laws in various ways. For instance, in Arkansas, where rate ceilings are highly restrictive, it has been found that prices of durable goods (that are most likely to be sold on credit) tend to be higher than in surrounding states, see Lynch (1968 and 1974.)[6] In other words, retailers obtain part of the return they need to continue offering credit by raising the prices of the goods they sell on credit. While a financial institution has no leeway for directly raising prices of goods sold on credit, it may be able to increase its net returns on credit contracts by buying credit contracts from dealers at a discount. The dealers, in turn, knowing that they can sell their low interest rate paper only at discount, can then raise prices to consumers to compensate for any such loss. Thus, we expect that in states with low rate ceilings, creditors who have a choice of either making direct loans or purchasing consumer paper from dealers will tend to purchase a larger portion of their consumer paper from dealers – as by discounting purchased paper, they may be able to increase the net return on their consumer credit portfolios.

[5] In a conversation at the conference, George Benston observed that credit unions' close association with potential defaulters allows them to use wage assignment and social pressure to collect on delinquent and defaulted loans in many cases. Thus, credit unions may be less sensitive to restrictions on conventional legal remedies than would be the case for more impersonal and remote credit grantors. If so, one would expect the equations for credit unions to have smaller coefficients on the creditor remedy restriction variable than equations for other credit grantors. With only one exception, this is the case in the loan rate equations of Table 2. It also is the case in the minimum size personal loan equation, shown in Table 3.

[6] Lynch studied the price of consumer durable goods in Little Rock versus the price of equivalent baskets of durable goods in major cities in adjoining states. In his first study, in 1968, he found that there was a substantial difference in the prices of durable goods sold in Little Rock and the prices of durable goods sold elsewhere. In his 1974 study, he conducted very extensive work comparing the price of different market baskets of goods in numerous cities and again reached the same conclusion. The price difference was fairly substantial, around 4 percent. Since not all sales are credit sales, this implies that both credit and cash customers may be paying indirectly for the low interest credit that is available in Arkansas. However, cash purchasers do not take advantage of the relatively low interest rates available on credit.

In addition to the loan-to-value ratio information reported by credit unions, major auto finance companies in the various states were asked to report on their loan terms and credit experiences in their intrastate reporting areas that included the local markets we had picked for intensive study. So far, replies have been received from only two of the three major auto finance companies. Average values for the most interesting data reported by those companies are summarized in Table 4.

TABLE 4

Auto Finance Company Loan Terms in Various States

A. Usual Loan-to-Value Ratios on 48-month New Car Loans

	Restrictive Remedies	Nonrestrictive Remedies	Avg.
Restrictive Rates	Wisc. 88.5	Ark. 90.5	89.5
Nonrestrictive Rates	La. 99.5	Ill. 94.0	94.75
Avg.	92.0	92.25	

B. Usual Loan-to-Value Ratios on 36-month Used Car Loans

	Restrictive Remedies	Nonrestrictive Remedies	Avg.
Restrictive Rates	Wisc. 97.5	Ark. 94.5	96.0
Nonrestrictive Rates	La. 97.0	Ill. 101.5	99.25
Avg.	97.25	98.0	

C. Retention Rate on Loans Purchased from Dealers (Avg.)

Wisc. 6.5%	Ark. 10%
La. 6.625%	Ill. 6.625%

D. Dealer Recourse Agreements Required (# of Respondents)

Wisc. One	Ark. Both
La. Both	Ill. One

Analysis of the data presented in Table 4 suggests that the following conclusions can be reached about loan terms applicable to auto credit contracts purchased by auto finance companies in various states. First, on average, loan-to-value ratios are reduced (i.e., downpayment requirements are increased) for *both* new and used cars in states where rate ceilings are low. Second, creditor remedy restrictions have little effect on downpayment requirements. While, as expected, loan/value ratios were lower (on average) in states with restrictions on creditors' remedies, the differences were very small. Third, where rate ceilings are lowest, in Arkansas, finance company retention percentages on purchased contracts tend to be highest. Higher retention rates give the finance companies greater protection against losses and higher effective yields.

Dealer recourse agreements were most common in the Southern states. Arkansas has low rate ceilings and Louisiana has restrictive remedies, so it is understandable that finance companies would attempt to transfer loan risk back to the dealer. However, only one company has similar requirements in Wisconsin, where both remedies and rate ceilings are restrictive. Thus, no systematic pattern is discernible in the dealer recourse information.

Overall, the strongest effect of restrictive laws on auto credit contracts appears to be on downpayments. Restrictive rate ceilings seem to increase downpayment requirements substantially.

Table 5 reports on the proportion of loans that are directly made by creditors who also have an option of purchasing consumer credit paper from sellers of retail consumer goods. While many consumer finance companies specialize in small direct consumer loans, finance companies that also purchased credit from dealers made a much lower (and significantly lower) proportion of direct loans in states (actually Wisconsin, since there are no consumer finance companies in Arkansas) where rate ceilings are restrictive. This result held for all types of consumer loans where the finance companies had an option of either making direct loans or of purchasing paper from consumer durable goods dealers. In addition, for most types of loans where banks had the same option, they also made a substantially lower percentage of direct than indirect loans. These results support our hypothesis that where rate ceilings are restrictive, creditors are likely to favor dealer-originated consumer paper.[7] In that way they may be able to increase the net return that they earn on their consumer credit portfolios.

Where creditors' remedies are restrictive, one would also expect consumer creditors to be more inclined to purchase consumer paper from dealers. This

[7]In related work using the same data as this study, Johnson and Sullivan (1979) obtained mean values for a number of variables that they thought might reflect the influence of creditor remedy and rate ceiling restrictions on creditors in various states. It is pertinent to note here that they found that commercial banks in Arkansas made *85 percent* of their used car loans *indirectly*. They also made 48 percent of their new auto loans indirectly. In Wisconsin, which is also a low rate state, they found that banks made 43 percent of both their new and used car loans indirectly. In contrast, in Louisiana, which is the highest rate state studied, they found that banks made *only 12 percent* of their used car loans and 18 percent of their new car loans indirectly. Also, in Illinois, they found that banks made only 30 percent of their new and used car loans indirectly.

is so because, in the event the consumer defaults on the loan, the creditor may either have recourse against the dealer or may require that the dealer repurchase the contract. "Recourse" or "repurchase" agreements are frequently used when one financial institution sells its consumer paper to another. Such agreements, in essence, allow the creditor to transfer some of the risk associated with a consumer paper purchase back to the credit originator. Since creditors' remedy restrictions are likely to increase credit risk, one would expect creditors to be more likely to purchase paper as one means to reduce their total risk when creditors' remedies are restricted. The data presented in Table 5 suggest that, in fact, consumer finance companies do purchase a higher percentage of paper from dealers (and originate a lower proportion of their own portfolios) when creditors' remedies are restrictive. While this result holds for all types of loans surveyed, it is only statistically significant for automobile credit. Thus, the spreading of risk hypothesis is not strongly supported for finance companies, possibly because the effect is relatively weak (making a difference of only a fraction of a percentage point in terms of net yields on different types of consumer loans). Additional evidence that this phenomenon has, at most, only a weak effect is given by the bank regressions. There the effect of creditors' remedies restrictions

TABLE 5

Effect of Restrictive Laws on Loan Originations

	Percentage of Direct Loan Originations by			
	Commercial Banks		Finance Companies	
Type of Loan	Restrictive Rate Ceilings	Restrictive Remedies	Restrictive Rate Ceilings	Restrictive Remedies
Auto, New	−11.03	8.26	−26.71[ab]	− 6.41[ab]
Used	−22.83[a]	22.24	−73.39[ab]	−23.08[ab]
Total	3.92	15.85	−56.18[ab]	−21.39[ab]
Mobile Home, New	−21.54[ab]	−3.47	N.A.	N.A.
Used	−12.90[b]	−18.71[ab]	N.A.	N.A.
Total	−5.72	0.48	−16.75[ab]	− 4.09[b]
RV, Furn., Other Consumer Goods	−1.01	1.04	−20.32[ab]	− 6.11[b]
Home Improvement Loans	N.A.	N.A.	−22.43[ab]	− 3.18[b]

[a]Significant at the 95% (one-tailed) confidence level.

[b]Less than half of all respondents gave nonzero responses on this issue. However, respondents in at least three states gave nonzero responses.

on the percentage of consumer credit directly originated, rather than purchased, is highly variable, and is only significantly negative for the most risky class of secured consumer loans made, i.e., loans on used mobile homes. Further, it takes on a large positive sign for most other types of consumer loans. Overall, the effect of creditors' remedy restrictions on loan originations is weak, at best, but there is some evidence that such restrictions induce consumer finance companies to buy consumer paper rather than make direct loans somewhat more frequently – particularly for automobile loans.

Lenders can also reduce, or spread, their risks by requiring more frequently that credit insurance be obtained on their loans. Credit insurance, conceivably, could reduce their losses and thereby increase their net yields on their loan portfolios. Thus, one would expect that credit insurance would be used more frequently in states where rate ceilings or creditors' remedies were restrictive. An attempt was made to investigate that phenomenon but no dummy variables in the equations tested took on significant signs. Because sales of credit insurance can be a profit-generating service *per se*, creditors' decisions to offer credit insurance probably are more greatly influenced by considerations as to whether credit insurance rates allowed under existing state laws enable them to make a reasonable profit than by risk reduction considerations. Thus, creditor size information and the dummy variables for restrictive rate ceilings and remedy laws, alone, were unable to explain systematic variations in credit insurance use.

An additional factor that could reflect creditors' attempts to reduce risk is the extent to which creditors reject applicants for consumer credit. One would expect higher rejection rates to exist where rate ceilings were restrictive or creditors' remedies were restrictive. Rejection rates should be most elevated on loans made to the highest risk credit applicants. On the other side of the ledger, however, if individuals knew that they were likely to have a difficult time obtaining credit, they would not be likely to waste their time applying for a loan. Still, if their demand for credit were sufficiently strong at the going rate, one would expect many credit applicants to take the chance of being rejected. Analysis of credit rejection rates on new car loans and personal loans at commercial banks and credit unions did not provide any systematic evidence to support the notion that credit rejection rates rise when credit laws are restrictive. While banks rejected somewhat higher percentages where rate ceilings were restrictive, credit unions did the reverse, and in no case were the rate ceiling dummy variable coefficients significantly different from zero. As far as restrictive creditors' remedies are concerned, credit rejection rates generally were elevated for credit unions operating in restrictive remedy states, and reduced for banks operating in the same states. While most creditor remedy restriction coefficients were statistically significant, the variance in signs shows no systematic pattern in their action.

A possible clue to the lack of systematic pattern in credit rejection rates at banks and credit unions can be gleaned from analysis of data reported by two of the major auto finance companies. Both respondent companies reported substantially (10 to 15 percent) lower credit rejection rates in the southern states in our sample than in the northern states. Both southern states and both north-

ern states, meanwhile, had very little difference (1 to 3 percent) in their credit rejection rates. Consequently, even though the nonrestrictive and restrictive rate ceiling states showed the expected differences, when compared to each other, those differences were so small relative to the North/South differential that they probably would not be detectable on a systematic basis, if all data were pooled.[8]

Some other variables were tested to see if they varied significantly with consumer credit law restrictions. In particular, various portfolio differences were analyzed. None of these investigations proved fruitful. So few credit unions in the sample made mortgage loans that consumer loan/other asset comparisons were not useful for them. Also, banks in Arkansas are subject to 10 percent rate ceilings on all loans. Thus, they have no particular incentive to bias their portfolios to business rather than consumer loans (particularly since extra profits can be earned on dealer reserve accounts and discounts on purchased consumer loan paper). Thus, no systematic differences were found in the percentage of total consumer loans held by different creditors in the various states.

Summary of Findings

In this paper we have discussed, theoretically, how restrictions on creditors' remedies and rate ceilings can influence the supply and demand for consumer credit. We also have analyzed data obtained from creditors in different states to determine if systematic differences exist in their credit behavior when they are subject to different credit laws. Major findings were:

1) Restrictive rate ceilings effectively reduce consumer loan rates. However, restrictive creditors' remedies are associated with elevated consumer loan rates. Further, rate increases resulting from remedy restrictions appeared to be greatest on the riskiest classes of loans.[9]

2) Restrictive rate ceilings are associated with reduced loan/value ratios (increased downpayments) on auto loans. Restrictive creditors' remedies have little, if any, systematic effect on downpayments.

[8] In the companion Dunkelberg paper in this volume, a larger proportion of consumers reported loan rejections in Arkansas (the lowest rate state) than in any other state. That result could be reconciled with these findings if it were found that Arkansas applicants reduced their rate of credit search after one rejection, while rejected applicants in other states were more likely to search elsewhere (possibly at higher rate sources) following rejections.

[9] An interesting interpretation can be made of these results. Economic theory suggests that riskier borrowers will have to pay more to borrow when creditors' remedies are restricted. However, riskier borrowers may not be assessed price (rate) surcharges when they borrow – as such treatment could make lenders vulnerable to charges of discrimination. Instead, riskier customers may have to pay more to borrow because they are more likely to acquire (or be forced to acquire) riskier types of loans – and the *rate differentials* between *those types* of loans and less risky loans *is greater* in restricted remedy states than it is in nonrestrictive remedy states. Thus, they may pay higher rates because their credit portfolios differ from those of less risky borrowers. While I did not mention this interpretation at the conference, I feel it is sufficiently useful that it should be spelled out explicity.

3) Restrictive rate ceilings tend to increase the *minimum* size personal loan that can be obtained, while restrictive creditors' remedies apparently have opposite effects.

4) Restrictive rate ceilings cause creditors to prefer indirectly obtained credit to direct credit (since such credit can be discounted and retailers can raise prices on consumer goods). Restrictive remedies also may cause some creditors to prefer indirect credit – where the retailer absorbs some of the risk.

5) Systematic effects of credit law restrictions on credit rejections, portfolio composition, and credit insurance use were not found in the simple models tested here. Many other factors (such as geographic location, legal maximum insurance premiums, rates available on other credit instruments, and creditors' familiarity with or ability to use other credit instruments) may all affect creditors' behavior as much as or more than the credit laws discussed in this paper.

6) Highly restrictive rate ceilings can entirely eliminate some consumer lenders from the credit markets. In particular, it should be noted that no consumer finance companies, who usually specialize in relatively high risk, small personal loans, operated in Arkansas.[10]

7) Auto finance companies continued to operate in Arkansas, but they imposed higher dealer reserve requirements and more restrictive recourse agreements on dealers there than they did in the other sample states.

Integrated Conclusion

Overall, the findings of this study can be usefully integrated with those of Dunkelberg (in his companion study in this volume) to describe the functioning

[10] Commercial banks make *significantly* larger minimum-size cash loans in states with restrictive loan rate ceilings. Further, credit unions also tend to make larger minimum size cash loans in states with restrictive rate ceilings (albeit, for credit unions, the difference is not statistically significant). As a result, consumers may have difficulty obtaining small cash loans in low rate ceiling states. This is particularly true in Arkansas because no consumer finance companies operate in that state.

However, an interesting institution apparently has moved in to fill the gap between supply and demand for small cash loans in Arkansas. A comparison of pawnbrokers listings in phone books for each market area is very revealing. In Arkansas, seven pawnbrokers were listed in the yellow pages, while in all the other market areas combined, only three pawnbrokers advertised in the yellow pages. Further, one of those three was located in Chicago (the closest major metropolitan area) rather than in the (Illinois) market area selected for study.

Pawnbrokers have the ability to underappraise systematically the collateral value of goods offered for pawn. If they do so, they may be able to realize a higher than 10 percent return on their operations because they will net significant profits on sales of unredeemed collateral. This is similar in concept, but opposite in direction, to the fact that dealers may be able to increase their total returns from offering credit by raising the prices of goods that they sell on credit.

of consumer credit markets under different regulatory conditions. This study looks at changes in loan prices and terms offered by lenders, while the Dunkelberg paper analyzes credit use by consumers. Taken together, the two papers suggest that changes in *both* the *quantity* and in the *price and terms* of credit resulting from different legal restrictions can be identified.

A. Effects of Creditor Remedy Restrictions

In particular, this study shows that interest rates will tend to rise when creditors' remedies are restricted, while the Dunkelberg study shows that remedy restrictions *per se* do not have a significant negative effect on credit use by consumers in general. (See his Table 1). Evidently, consumer demand increases sufficiently when remedies are restricted that total credit use does not fall substantially in spite of the fact that rates increase. However, when rate ceilings are restrictive, rates cannot rise if creditors' remedies are reduced. Thus, if creditor remedy restrictions raise the supply curve, credit availability will fall. As a result, it is not surprising that Dunkelberg found (again in his Table 1) that credit use was significantly lower in Wisconsin where both rate ceilings and remedies were highly restrictive than in Illinois, where neither rates nor remedies were highly restricted. Consequently, it appears that creditor remedy restrictions raise the supply curve for credit, particularly on the riskiest types of debt (if the rate differentials found in this paper are taken as a guide).

Since riskier customers are more likely to acquire riskier types of debt, they may be most affected by any upward shifts in the supply curve caused by remedy reductions. Thus, it is not surprising that when Dunkelberg analyzed the riskiest members (lower 40 percent) of the credit risk distribution, he found that average debt use in Wisconsin was $700 per family unit below the predicted level (based on Illinois behavior – see his Table 4) while for all families it was only $440 lower – see his Table 2. High standard deviations rendered both of these last statistics insignificant, however. In Louisiana, where remedy restrictions could be offset by rate increases, reductions in credit use were not nearly as substantial as those recorded in Wisconsin. (See Dunkelberg's Tables 2 and 4.) Further, in his overall regression equation (Table 1), total credit use per family in Louisiana appeared to be significantly higher than in Illinois – possibly because the very high Louisiana rate ceilings allow more high risk customers to be accommodated.

B. Effects of Rate Ceiling Restrictions

Rate ceiling effects uncovered by these studies were very interesting. Rate ceilings clearly were effective in reducing loan rates. They also were associated with tightened credit terms, larger minimum size loans, and *most importantly*, a change in the structure of the credit markets toward the offering of more indirect credit (where prices of goods sold on credit and credit contract purchase prices and terms can be adjusted to provide the lender with a rate of return sufficient to compensate for the fact that his interest earnings are reduced).

The creditor data showed shifts of some banks and finance companies toward more indirect, rather than direct, loans in restrictive rate states. Also, the consumer survey data showed extensive consumer use of dealer credit in

Arkansas, the lowest rate state. These findings supported the hypothesis that indirect credit provides a relatively more important source of credit in states with low consumer credit rate ceilings. Other information has shown that prices on credit-related goods are higher in Arkansas than in surrounding states with less restrictive rate ceilings (see Lynch 1968 and 1974) and that pawnbrokers are much more prevalent in Arkansas than in other survey states (see footnote 10). Thus, it appears that creditors have adapted to the strict Arkansas usury rate ceiling in such a way that they can still earn an adequate return on their consumer lending activities. As a result, credit is more readily available in Arkansas than one would expect if he merely looked at the 10 percent rate ceiling. Dunkelberg found that the amount of credit extended per surveyed household was not significantly different from the amount available in Illinois, everything else being equal. However, he also found that a higher percentage of consumers reported credit rejections in Arkansas than in other states. Nonetheless, the creditor data indicated that, overall, no systematic difference in credit rejections existed between states. Possibly rejectees in Arkansas feel that they have little chance of obtaining credit elsewhere if they are rejected once – since all rates are uniform – and thus they apply for credit less frequently than rejected applicants in other states. Also, possibly, high variance in credit rejection data provided by different creditors accounted for the fact that the small increases in rejection rates reported by creditors operating in Arkansas were not found to be statistically significant.

C. Importance of Findings

The results of these studies should provide useful insights for those legislatures or regulatory bodies that are contemplating changes in creditor remedy restrictions or rate ceilings on consumer credit. They document a number of effects that are likely to occur when either rate ceilings or creditors' remedies are made more restrictive.

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Measuring the Impact of Credit Regulation on Consumers

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The main purpose of this paper is to develop and test a procedure for measuring the impact of credit regulation on consumer credit availability. The two types of regulations considered, rate ceilings and restrictions on creditor remedies, can lead to restrictions in credit availability. The incidence of these restrictions is not random in the population, but is dependent on the characteristics of consumers. The extent of the restriction depends on the severity of the regulations and the degree of successful evasion.

The first sections of the paper are devoted to the construction of a simple model of supply and demand that illustrates how credit is rationed to consumers in a market restricted by regulations. Based on this model, predictions are made which can be tested using consumer surveys conducted in four market areas which differ widely with respect to the regulations of interest. The empirical tests are presented in the final section of the paper.

The Supply of Credit

In order to simplify the analysis, assume that consumer credit is a homogeneous product characterized by a fixed sum of money for a fixed maturity (say, $1,000 for one year). The cost of producing this product can be characterized as a fixed cost, which includes the cost of capital to the firm, overhead costs, paperwork costs and the like, and a variable cost, which is the expected loss on a loan made to a given risk. In this context, the product is viewed as "leased" or rented to the customer. The expected loss on the loan is the expense incurred collecting delinquent amounts and writing off any bad debts. Thus, the firm will "lease" funds according to a risk-price schedule as illustrated in Figure 1 and Equation (1).

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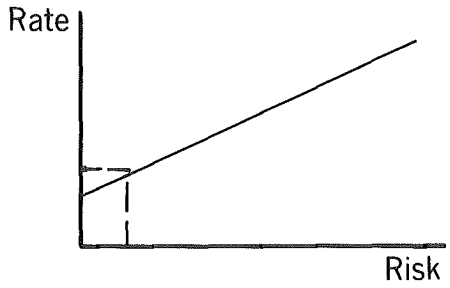
(1) r = r(R)
r = loan rate
R = borrower risk

The higher the riskiness, R, of the borrower, the higher the charge for the loan. For a small competitive lender, the supply of credit to any given risk is very elastic. The firm would make as many loans as demanded at the appropriate rate for the risk of the borrower.[1]

Figure 1
Risk-price curve



A somewhat different approach is to view the lender as the seller of different types of products, incorporating the riskiness of the loan into the production of the product. Thus, a riskier loan is more expensive to produce and must sell for a higher price. Either approach leaves us with the notion of supply curves for each product or each risk class.[2]

If the demand for consumer loans expanded, and lenders in general tried to borrow additional funds to make new loans, the cost of funds to the firms would rise. Thus, for the industry, the overall supply curve for credit is upward sloping.

[1] The average risk of the firm's portfolio, $\bar{R}$, would depend on the stream of applicants coming to the firm. For simplicity, the firm is treated as if it borrows funds for each loan as it is made. All loans are priced to yield the same certainty-equivalent return to the firm (e.g., the same return on investment).

[2] The provision of credit may also have some elements of market segmentation. If firms can differentiate customers in a manner related to differential elasticities of demand, then the firm could charge different prices for the same product. Some studies have identified types of consumers who are less sensitive to interest charges than others (Juster and Shay). Based on these studies, it would appear that classification by risk would identify such consumers with a reasonably high success rate. However, it is clear that riskier customers do in fact cost more to serve. In addition, there is substantial competition among lenders in virtually all major segments of the lending market.

This can also be seen by noting that the ultimate suppliers of loanable funds are in fact consumers, many of whom are also demanders of credit. If, overall, consumers increase their demand, then consumers must also provide the funds for lending (nominal government actions aside). Thus, rates would be bid up attracting funds away from other demanders such as firms and the public sector and inducing some consumers to save more or become savers rather than borrowers.

Risk, R, in this model is taken to be a simple function of a set of consumer characteristics P (such as age, family size, income stability, portfolio variables that may serve as collateral, etc.) and a measure of debt commitments relative to cash flow, the debt payment to income ratio, DP/Y.[3]

(2) $R = R(P, DP/Y)$

DP = monthly debt payment commitment

Y = consumer monthly income

P = consumer demographic and portfolio characteristics

R = borrower risk

Consider the formulation in equation (2), with P and Y (borrower characteristics, wealth holdings and income) held constant. Increasing the amount of debt commitments relative to income raises the borrower's risk classification. Thus, additional amounts of debt are available only at higher prices, so the supply curve facing the individual borrower is also upward sloping. In the simplified example presented here, the borrower faces a transformation of the risk-price curve which depends on how changes in the DP/Y ratio affect risk classifications.

The Demand for Credit

The demand for consumer credit is a derived demand based upon consumers' consumption decisions given their income and wealth (expected income). Using one equation from a stock adjustment system of equations describing consumer behavior (Dunkelberg and Stafford), the demand for new credit can be characterized as a function of consumption and portfolio stock-utilization disequilibria:

(3) $\Delta D = d(D_t^* - D_{t-1}, A_{j,t}^* - A_{j,t-1})$

where A_j represents such variables as the stock of durables, liquid assets and human capital.

*denotes "desired" or expected levels.

t = time period.

[3] In practice, collateral is, in many cases, difficult to acquire and liquidate if legal acceleration and collection of the debt are required. The ratio of debt commitments to income is a good measure of the consumer's ability to meet financial commitments.

Assuming linearity and rearranging terms, the level of debt held at any point in time can be expressed in terms of other portfolio disequilibria and the determinants of D*. This includes the characteristics set P, the relative price of debt, and the level of income.[4] Thus, the level of debt holdings can be expressed as in Equation (4):

(4) $D = D(P, r, Y, a_j)$ where a_j represent the disequilibria in the other behavioral equations in the stock adjustment model.

Holding the characteristics in P and the various disequilibria constant, the consumer's demand for credit can also be given a simple graphical representation in terms of the interest rate, r. However, the formulation presented here does not consider some very complex financial market relationships. Consumers are both the ultimate suppliers and demanders of credit, while government and business, including lenders, play the role of intermediaries of one sort or another. In a fundamental sense, shifts in the credit supply and demand curves will always be in equal but opposite directions. If all consumers want to borrow more against future income for current expenditure, they will save less today. Thus, the supply curve for loanable funds shifts to the left as the demand curve shifts to the right.

For the purposes of this paper, we will consider the supply decision (savings) to have been made exogenously and perhaps with a lag, establishing the total pool of funds available in real terms. The problem of the financial intermediary, then, is to allocate those funds. Each firm behaves as if it can get whatever supply of funds it needs from the market. The intermediary lending to consumers must compete with business and government for available funds. The next section focuses on how this allocation process works and how it is affected by regulations.

Regulation and the Credit Market

The basic model developed in the previous sections suggests that individual consumers can borrow all the money they want as long as they are willing to pay the price required. Why, then, are consumers turned down when they apply for credit? Assuming that lenders can assess risk, R, then any loan demand can be satisfied for an appropriate rate. In this simplified model of lender behavior, restrictions on creditor behavior will result in turndowns. In particular, by limiting the terms of the credit contract or by proscribing lender behavior in such areas as debt collection, regulators effectively deny certain consumers access to credit markets.

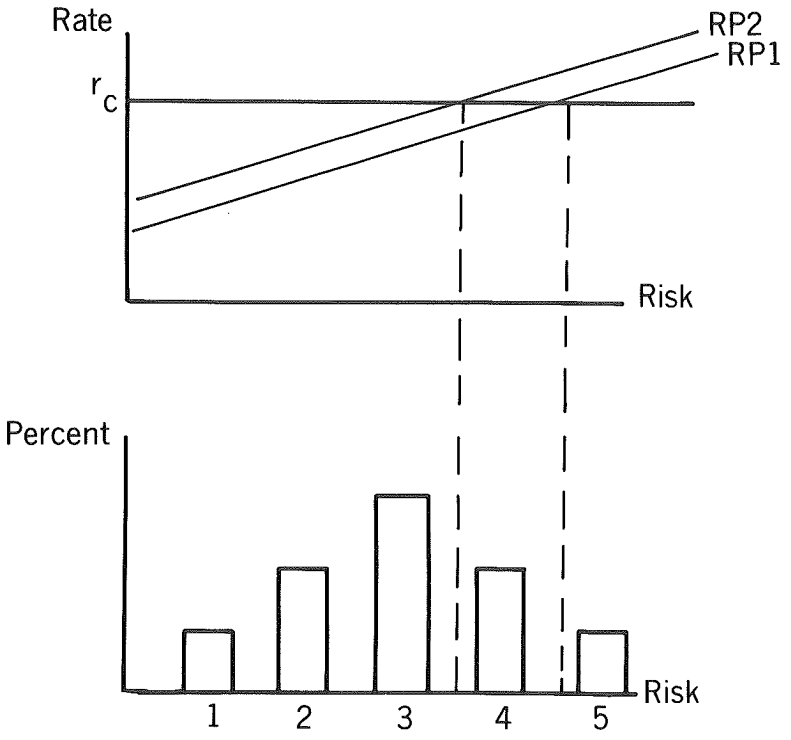
In a market for products such as gasoline, the customer is relatively homogeneous from the producer's point of view. Each consumer requires virtually the

[4] The appropriate measures to use here are human and nonhuman wealth. Those measures have not been developed in the study at this time, so are approximated by current income and variables in P related to human capital, plus a total financial asset variable.

same cost to serve. When shortages develop due to regulation, the allocation of the product is done by queue, with the last in line being "turned down." In credit markets, customers are identifiably different in terms of the costs that they generate. The allocation of available supply will be made by rationing out the most expensive customers whenever interest rate ceilings are imposed.

The rationing process is illustrated in Figure 2. The top half of the figure reproduces the risk-price curve derived earlier. The lower half of the figure assumes a hypothetical population distribution of the characteristic R. In an unrestricted market, virtually all consumers can be served. However, the imposition of a rate ceiling, r_c, makes it uneconomical to provide credit to consumers to the right of R. The cost of serving this group on average is higher than the revenue permitted.[5]

Figure 2



[5] With a continuous risk distribution, the lender would equate expected cost with the rate allowed. This analysis ignores the secondary effects of the decline in credit use (effective demand) on rates and availability to other risk segments and assumes stationary demands. For simplicity, the marginal cost of screening is assumed to be 0 for the firm.

Some of the characteristics of rationed consumers have been documented in simulation studies of the characteristics of "marginal" credit users. The general results showed that even when income did not appear explicitly in the point scoring model, lower income consumers were rejected at a substantially higher rate than their incidence in the population. In a simulation study incorporating a scoring model for a bank credit card, it was found that 95 percent of those disqualified at the margin had reported incomes below $7500 (1967 data), while only 55 percent of the population had incomes as low (Dunkelberg and Smiley). Eighty-six percent of the consumers disqualified by a retail evaluation score had incomes below $7500. The incidence of credit allocation clearly fell disproportionately on the lowest income consumers.

Restricting creditor remedies raises the cost of collecting debts. In addition, average losses increase in each risk group because remedies become less effective or more expensive to use. This is equivalent to shifting the risk-price curve to RP2 (Figure 2). With no effective rate ceiling, all borrowers would simply be charged enough more for their credit to cover the higher cost and/or losses. With an effective ceiling, however, the firm must again turn to rationing to adjust its costs to allowable revenue. In a similar manner, an increase in the cost of any of the inputs to the lending process such as labor or the cost of funds will shift the risk-price curve upward, resulting in rationing.

The model generates a large number of predictions about credit use when restrictions are placed on lender behavior. In markets where regulations are more restrictive, turndown rates will be higher and the proportion of consumers with debt will be lower. These effects will be modified to the extent that the evasion is successful. The more restrictive the regulations, the lower will be the average debt per borrower, particularly in the higher risk classes.[6] Where restrictions have differential impacts on lenders, relatively more credit will be extended by the less restricted firms or by those that can evade the restrictions at a lower cost. For example, banks and retail firms may have similar risk-price functions. However, retailers can more easily subsidize their credit operations from general revenues, lowering their effective risk-price curves relative to banks and increasing their market share.

A general test of the effects of regulation (net of evasion) on credit use is provided by using the least restricted of the four markets as a benchmark for comparing the effects of regulations in the other markets. Illinois represents the least restricted market, with the exception of rather tight restrictions on finance company loans in excess of $1,500. Louisiana is another candidate, since, although it has very strong remedy restrictions, it has very high ceilings which might, overall, qualify it as the least restricted market.

The reduced-form equation specified in (4) is estimated for all Illinois consumers as in (5). The resultant set of regression coefficients (β^*) are then used to generate an expected level of debt for consumers in each of the remaining three

[6] Given P and Y, raising D alters the risk class of the consumer. Restrictions prevent this movement at the margin and prevent borrowers with too high a risk level from additional borrowing.

markets (6). This step produces an estimate of debt use, D^e, for consumers in these markets which would be expected if these consumers operated in a market like that existing in Illinois.

(5) For Illinois, $D^* = \beta^* \ x^* + u$

where x^* represents the predictor variables for Illinois in Equation (4), β^* is the vector of parameters for Illinois

D^* = amount of debt owed by Illinois consumers

(6) For the remaining markets:

$D^e = \beta^* \ x$

where x represents the characteristics of consumers in the remaining three markets

D^e = the level of debt holdings expected for each non-Illinois consumer

(7) For the remaining markets:

$S = D - D^e$

where D = actual debt owed by consumers in the remaining markets

S = the difference between actual debt holdings and levels predicted by Illinois parameters

The supply effect of restrictions is then approximated by the difference between actual debt holdings in these three markets (D) and the expected level of debt holdings based on Illinois parameters (D^e) as in (7). This difference is denoted as S. If Illinois is the least restrictive state, then the mean value of S should be negative in each of the three remaining markets. If the elements of S are stratified by income decile or risk class within markets, the mean value of S should become more negative with decreasing income or increasing risk. The best (least risky) customers in each market are more likely to receive roughly equal treatment (i.e., be less affected by the restrictions). If, in fact, Louisiana is a less restrictive state, the mean value of S will be positive. If this is the case, Louisiana consumers will have more debt than similarly situated Illinois consumers.

These estimates of regulatory-induced supply effects may be compromised by at least two factors. Most important is the extent of evasion. Other things equal, the stronger the restriction, the more incentive there is for evasion. The most likely forms of evasion are the use of indirect credit and loans from friends, pawn shops and other less easily regulated lenders. A retail firm can issue a contract at the statutory ceiling. Then the firm can sell the paper to a financial institution at a discount and recover the difference in the price of the merchandise. In a study of the Arkansas situation, it was found that the time price of goods was virtually identical in Arkansas and surrounding states, but cash prices were much higher. (Lynch and Hardin).

In examining the differences in credit availability between markets, we begin implicitly with the basic premise that if transactions costs are zero, then, through evasion of one sort or another, similarly situated consumers will tend to use about the same amount of installment credit. This means that in spite of regulations, consumers would have the same levels of installment debt, each market approaching the condition it would have attained in the absence of regulatory interference. Since evasion is in fact costly and imperfect, differences between markets will be observed, but they will not be as striking as they would be under conditions in which the regulations imposed were fully effective.

A second factor of concern is that systematic differences in demand are not fully accounted for. Consumers in one market may be systematically more averse to or in favor of credit use. This is not captured by the demographic and financial variables used. The study will eventually permit the analysis of attitudes toward credit use which will allow empirical control for such factors. Those data were not available for this analysis.

Results

The data used to test the propositions derived from the model were collected through personal interviews with 3572 families in four market areas. The markets were selected to be maximally different with respect to creditor remedy restrictions and rate ceilings but minimally different with respect to such factors as industrial base, blue collar/white collar mix, economic environment, and market isolation. The cities selected and their position in the regulatory matrix are shown in the table below.

Regulations:	Restrictive Remedies	Less Restrictive Remedies
Low Rate Ceilings	Racine-Kenosha Wisconsin	Little Rock Arkansas
High Rate Ceilings	Lake Charles Louisiana	Waukegan-North Chicago Illinois

Approximately 1000 interviews were taken in Wisconsin and Illinois, the major matched pair of markets in the study. Approximately 750 interviews were taken in each of the secondary matched markets. The overall response rate was approximately 65 percent. The interviews were taken during the first six months of 1979. Analytically, it is possible to pool data down columns or across rows to study the effects of restricted creditor remedies or low rate ceilings respectively. Each of the four cells can be used to estimate the partial effects of each type of regulation.

Table 1 presents two regressions. The first column relates total installment debt holdings for all consumers in all four markets to the characteristics included

TABLE 1

Dependent Variable: Outstanding Installment Debt

	All Families (N=2248)		Illinois (N=623)	
	Percent of Sample	Coefficient (Std. Error)	Percent of Sample	Coefficient (Std. Error)
Approximate Income Quintile				
Lowest	19	−831(188)*	17	−800(358)*
Second	19	−578(167)*	22	−674(309)*
Third	23	—	24	—
Fourth	25	699(157)*	24	496(307)*
Highest	14	1388(197)*	13	1400(398)*
Asset Quintile				
Lowest	19	−709(247)*	23	−905(550)*
Second	20	−262(195)	18	−798(497)*
Third	21	—	18	—
Fourth	20	33(167)	22	209(333)
Highest	20	−637(182)*	19	−1036(366)*
Risk Quintile				
Lowest (highest risk)	26	620(166)*	24	1109(326)*
Second	21	3(168)	20	49(324)
Third	19	—	22	—
Fourth	18	−653(177)*	17	−495(341)
Highest (lowest risk)	16	−1083(197)*	17	−1052(379)*
Housing Status				
Owns home	68	—	63	—
Rents, furnished	8	50(257)	9	209(378)
Rents, unfurnished	22	−194(200)	26	−22(500)
Other	2	−452(427)	2	−191(803)
Age of Head				
Under 25	14	−188(207)	17	147(402)
25-34	25	−91(165)	24	−171(339)
35-44	19	—	20	—
45-54	13	−68(191)	10	−3(396)
55 or more	29	−402(185)	29	−50(360)
Marital Status/ Dependents				
Single/some	4	−372(281)	6	−459(476)
Single/none	6	−217(237)	10	−384(384)
Married/some	68	—	59	—
Been married/some	16	−203(165)	18	−220(302)
Been married/none	6	−446(227)*	7	−837(440)*
Restrictive Remedies[1]	—	−58(108)	—	—
Low Rate Ceilings[1]	—	−235(108)*	—	—
Constant	—	2396(227)*	—	2171(427)*
R^2 *(SE)*	—	.18(2452)	—	.20(2509)
Mean	—	$1590(2700)	—	1490(2750)

*Significant at the 10% level, two-tail test.

[1] State dummies, excluding Illinois, gave the following results:

Wisconsin	−275(136)*
Arkansas	120(147)
Louisiana	402(168)*

in the reduced-form equation.[7] Rather than using component parts of the risk measure, R, which are already in the equation from the demand side, an operational measure of risk based on a point score evaluation model (see Appendix A) was used in the hope of better representing the supply effects in the equation.

The actual measure of risk used includes as an input the ratio of monthly debt payments to monthly income. Since people who recently incurred a substantial amount of debt are likely to have high monthly payments, the ex post calculation of the risk measure may explain the positive association observed between risk and the total amount of debt owed. Excluding debt incurred in the 1978-79 period in constructing the risk measure, and then developing an equation to predict extensions during that period may prove to be a better approach to estimating the impact of regulations. For consumers who had debts at the beginning of 1978 but paid them off during the year these risk measures would be biased downwards. In general, the specification of the P vector should be improved.[8]

Two dummy variables were included in the first regression, one representing the markets with low rate ceilings and the other representing the two markets with restrictive remedies. Only the rate ceiling dummy coefficient was significant, although both carried the expected negative sign. Other things equal, consumers in low rate markets had less debt than their counterparts in markets where high ceilings were imposed.

The same regression was then estimated for Illinois consumers only. The results are shown in the second column of Table 1. These coefficients were used to generate predicted levels of debt holdings for consumers in the other three markets. The differences between actual debt holdings and expected levels based on Illinois parameters are summarized by risk class in Table 2.

As expected, the level of debt actually held in each market was lower than that expected based on Illinois parameters. Overall, and in most risk classes, the average difference between actual holdings and those expected is negative. Since the cell sizes become quite small in some risk classes, the mean values can be substantially affected by a few unusual cases. The standard deviations are all large, and none of the mean values in the three markets are statistically different from each other. This variance will be substantially smaller once the data have been corrected for processing errors (transcription errors, business debts mistakenly included, etc.).

This same experiment was performed using only the riskiest consumers in each market. Since highly qualified consumers may not be affected by regulations in any of the markets, their inclusion in the analysis may obscure the effects of regulations which have their primary incidence at the margin of the

[7] No measures of portfolio disequilibria were available for the analysis. These disequilibria may not be identically distributed in the markets since they depend, in part, on credit restrictions.

[8] Measures of portfolio disequilibria were not available for the analysis, although the reduced-form equation contains many of the determinants of desired stocks. Unless the omission bias is substantially different across markets, the comparisons should be relatively unaffected.

TABLE 2

Mean Difference between Actual and Expected Debt Holdings

	All Consumers		
Risk Class	Wisconsin	Arkansas	Louisiana
Lowest 5%	−870(2800)	−410(2430)	350(2790)
Next 5%	−700(2680)	−420(2620)	−540(2760)
Second decile	−1100(2730)	70(3020)	−1000(2640)
Third decile	90(2340)	470(2450)	320(2860)
Fourth decile	−528(2100)	−210(2150)	280(2950)
Fifth decile	−90(3300)	−290(1990)	320(2540)
Sixth decile	−330(2100)	90(3410)	−180(3600)
Seventh decile	−120(3500)	−80(2040)	−210(1600)
Eighth decile	−670(1170)	−610(1210)	−160(1980)
Ninth decile	−520(1340)	60(1980)	−220(1340)
Tenth decile (lowest risk)	−300(1390)	−360(1330)	−410(1250)
All	−440(2430)	−130(2390)	−150(2510)
N	959	748	663

(standard deviation)

accepted credit risk distribution. As a simple test of this possibility, the riskiest 40 percent of the consumers in Illinois were selected and the prediction equation re-estimated. The results are shown in Tables 3 and 4. Overall, and in each risk classification, high risk Wisconsin consumers had less credit than similarly situated Illinois consumers. Arkansas and Louisiana consumers also had less credit. Thus, consumers in the market with both restrictive rate ceilings and remedies had less credit than their counterparts in any of the other markets. Again, however, the standard errors are very large relative to the mean values. No means are statistically significant at the 10 percent level in spite of the large differences observed in Wisconsin.

When viewed as a percent of expected debt holdings, actual debt holdings appear to be relatively lowest in Wisconsin, where the average ratio of actual to expected debt holdings was .72 (Table 5).[9] Among the riskiest 40 percent of each market, the Wisconsin ratio was .83, compared to about 1.0 in each of the other markets (Table 6). This result is consistent with the view that if remedies are less restricted as in Arkansas, higher risk consumers are more likely to obtain credit, even with a low rate ceiling. Similarly, if rates are high enough, as in

[9] In this case, the measure of the supply effect is computed as the ratio of D, actual debt holdings, to D^e, expected debt holdings based on Illinois parameters.

TABLE 3

Dependent Variable: Outstanding Installment Debt

	Illinois High Risk[1] (N=274)	
	Percent of Sample	Coefficient (Std. Error)
Approximate Income Quintile		
Lowest	35	−1019(740)
Second	21	−1189(536)*
Third	20	–
Fourth	16	345(562)
Highest	8	2783(822)
Asset Quintile		
Lowest	16	−1081(1119)
Second	24	−914(1118)
Third	26	–
Fourth	26	−19(629)
Highest	8	−1800(839)*
Risk Quintile		
Lowest (highest risk)	54	1180(385)*
Second	46	–
Housing Status		
Owns Home	47	–
Rents, furnished	14	382(1159)
Rents, unfurnished	36	390(1096)
Other	3	150(1467)
Age of Head		
Under 25	28	−82(613)
25-34	41	−693(533)
35-44	20	–
45-54	7	−289(851)
55 or more	4	250(999)
Marital Status/Dependents		
Single/some	7	−305(826)
Single/none	15	−355(586)
Married/some	58	–
Been married/some	14	−632(609)
Been married/none	6	−871(826)
Constant		2558(719)*
R^2 *(SE)*		.19(2983)
Mean		2038(3188)

*Significant at the 10% level, two-tail test.

[1] Based on the highest 40% of the risk distribution measured by credit score.

TABLE 4

Mean Difference between Actual and Expected Debt Holdings

High Risk Consumers[1]

Risk Class	Wisconsin	Arkansas	Louisiana
Lowest 5%	−910(2970)	−370(2560)	330(2980)
Next 5%	−810(2600)	−410(2580)	−590(2850)
2nd Decile	−1250(2840)	−50(3050)	−1190(2720)
3rd Decile	−60(2390)	440(2610)	390(2890)
4th Decile	−620(2220)	−310(2200)	160(3090)
All	−700(2590)	−120(2650)	−220(2960)
N	415	360	281

[1] Based on the highest 40% of the risk distribution in each market. Expected debt level based on Illinois consumers.

(standard deviation)

TABLE 5

Mean Ratio of Actual Debt Holdings to Expected Holdings

All Families

Risk Class	Wisconsin	Arkansas	Louisiana
Lowest 5%	.74(1.54)	.90(1.20)	1.10(1.06)
Next 5%	.72(.92)	.77(1.00)	.73(1.13)
2nd Decile	.67(1.00)	.97(1.15)	.58(.97)
3rd Decile	1.01(1.38)	1.58(2.48)	1.05(1.83)
4th Decile	.67(1.00)	.81(1.31)	1.02(1.45)
5th Decile	.83(1.49)	.76(1.42)	.95(1.42)
6th Decile	.74(.98)	1.05(1.77)	.79(1.85)
7th Decile	.91(2.06)	1.10(2.13)	.88(1.75)
8th Decile	.64(1.77)	.85(2.10)	.68(1.38)
9th Decile	.39(1.30)	1.25(2.50)	.58(1.39)
10th Decile (lowest risk)	.60(1.55)	.51(.97)	.68(1.70)
All	.72(1.39)	.96(1.68)	.82(1.48)
N	905	692	617

(standard deviation)

TABLE 6

Mean Ratio of Actual Debt Holdings to Expected Holdings
High Risk Consumers[1]

Risk Class	Wisconsin	Arkansas	Louisiana
Lowest 5%	.66(1.24)	1.08(1.51)	1.24(1.24)
Next 5%	.70(.84)	.80(1.19)	.85(1.70)
2nd Decile	.76(1.45)	.98(1.15)	.58(.99)
3rd Decile	1.07(1.64)	1.59(2.51)	1.22(1.98)
4th Decile	.85(1.69)	.89(1.69)	1.27(2.18)
All	.83(1.46)	1.06(1.66)	1.00(1.67)
N	399	346	272

[1] Based on the highest 40% of the risk distribution in each market. Expected debt level based on Illinois consumers.

(standard deviation)

Louisiana, to compensate lenders for risks taken, risky borrowers can still obtain credit, even if it is relatively more difficult to collect debts.

As noted earlier, one way to evade the impact of low rate ceilings is to provide credit through indirect lenders such as retail stores or dealers. The dealer can lend to the consumer at the ceiling rate, and then rediscount the paper to a financial institution at the prevailing market rate. The cost difference can be made up in the price of the goods or services sold on credit.

The relative importance of indirect credit in Arkansas can be seen in Tables 7 and 8. Forty-nine percent of all the credit extended in Arkansas is through stores and dealers, compared to an average of 29 percent in all other markets. Banks, finance companies, and credit unions[10], the major direct lenders, generated only 41 percent of the dollar credit volume in Arkansas, compared to 67 percent in the three other states. After the paper is resold, Arkansas direct lenders end up with 77 percent of the debt, compared to 86 percent in the three other markets. So, about the same proportion of debt is held by the direct lenders in each of the four markets, but almost twice as large a share is generated by indirect lenders in Arkansas as in the other three states.

In Louisiana, where rate ceilings are quite high, stores and dealers retain almost half of the credit they generate, compared to 38 percent in Wisconsin, 36 percent in Illinois, and 34 percent in Arkansas (Table 8). The ratios of debt held by an institution to debt sourced by that institution are highest in Arkansas. The ratio for Arkansas banks is 1.36, compared to an average of 1.28 in the other markets. Arkansas finance companies held over $9 in debt for every dollar they generated compared to an average of about $2 in the other markets. Clearly,

[10] In Arkansas, *federally* chartered credit unions have been lending at 12 percent rather than at the state limit of 10 percent.

where rate ceilings are particularly restrictive, indirect credit becomes a major method of evading the effects of the ceiling.[11]

As further evidence of the importance of indirect credit as a device for evading the impact of rate ceilings, Table 9 shows that Arkansas consumers more frequently regard dealers as the easiest place to obtain credit. Credit is certainly harder to get in Arkansas, as is shown by Table 10. Twenty-eight percent of the consumers in Arkansas have been turned down for credit at one time or another. Most of these turn-downs were at banks or stores and dealers (Table 11).

Conclusions

It is a bit early in the analysis to draw many firm conclusions about the findings from such a large study. The basic objective of this paper was to apply one particular methodology to the problem of estimating the effects of regulations on the availability of consumer credit. Operationally, the procedure produced very reasonable predictions and the results were consistent with priors about the expected effects of regulations, although market evasion of the intended regulatory effects may have clouded the precision of the estimates.

One major difficulty is the measure of risk used. The only real supply variable in the equation is determined after the borrowing has taken place, making recent borrowers look "riskier" than others. If this bias is consistent across markets, perhaps the difficulties are minimal. Some simultaneity is also present in that lower credit availability means lower payment-to-income ratios and, ceteris paribus, less risky members in the population. Using a measure of risk developed outside of any of the markets may provide inaccurate weightings of this aspect of risk. Other risk measures should be used to examine the sensitivity of the findings to the measure of risk selected.

APPENDIX A

The model used to measure risk for this paper was developed in a state not included in the analysis. The following variables were used to construct the point score for each individual. The exact weights used are not shown because of confidentiality.

Age of applicant
Years at current address
Age of automobile
Monthly automobile payments
Checking and savings account references
Finance company references
Savings and Loan Association references
Credit card references
Ratio of monthly debt payment to monthly income

[11] This form of evasion introduces numerous subsidies, including support of the credit operation by cash purchasers.

TABLE 7

Market Share

	Wisconsin			Illinois		
	Sourced[2]	Held[3]	Direct[4]	Sourced	Held	Direct
Banks	41	52	50	39	49	51
Dealers	23	9	10	30	11	13
Finance Companies	8	12	9	6	16	8
Credit Unions	21	23	27	22	23	28
Employers	*	*	*	*	*	*
Other[1]	7	4	4	3	1	*
	100%	100%	100%	100%	100%	100%

	Arkansas			Louisiana		
	Sourced	Held	Direct	Sourced	Held	Direct
Banks	27	37	45	38	46	48
Dealer	49	16	26	34	16	19
Finance Companies	3	29	4	9	19	11
Credit Unions	11	11	18	16	17	19
Employers	1	*	*	*	*	*
Other[1]	9	7	7	3	2	2
	100%	100%	100%	100%	100%	100%

[1] "Other" lenders includes friends, relatives, pawn shops, etc.

[2] The borrower reported signing the documents for the loan agreement at this institution.

[3] The borrower reported making payments to this institution.

[4] The borrower makes payments to and signed loan documents at this institution.

TABLE 8

Ratio of Debt Held to Debt Sourced

	Wisc.	Ill.	Ark.	La.
Banks	1.31	1.29	1.36	1.24
Dealers	.38	.36	.34	.47
Finance Companies	1.47	2.77	9.54	2.07
Credit Unions	1.06	1.11	1.01	1.07
Other	.60	.18	.73	.66

TABLE 9

Consumer Perceptions of the Easiest Place to Get Credit

Lender	Wisconsin	Illinois	Arkansas	Louisiana
Banks	19%	19%	21%	18%
Dealers	16	22	26	20
Finance Companies	33	28	15	45
Credit Unions	28	26	33	12
Friends	1	2	1	*
Other	*	1	1	*
No answer	3	2	3	4
	100%	100%	100%	100%

*less than .5%

TABLE 10

Percentage of Consumers in Each Market Rejected for Credit

	Market			
Rejected for Credit	Wisconsin	Illinois	Arkansas	Louisiana
Yes	15%	19%	28%	12%
No	85	81	72	87
No answer	*	*	*	1
Total	100%	100%	100%	100%
n	1006	1030	787	749

*Less than .5%

Although the regression equation was used to predict the level of expected debt controls for many consumer characteristics, comparisons would be less acceptable if the distribution of the risk measure was widely different in one or more of the markets. After the risk measure was computed for each individual, the scores were ordered from low to high for all 3572 consumers and divided into quintiles. The distribution of the quintile measures is shown in Table A-1. The distributions are quite similar, and a CHI SQUARE test on the table produced a significance level of .11, supporting the observation that the distributions are not radically different.

TABLE 11

Percentage of Consumers Rejected for Credit In Each Market by Source of Credit Rejection

Source of Credit	Market			
	Wisconsin	Illinois	Arkansas	Louisiana
Inappropriate	84%	81%	72%	88%
Bank	5	6	11	4
Dealer or Store	5	6	11	5
Finance Company	3	3	2	2
Credit Union	1	2	*	*
Employer	*	*	*	*
Friends	*	*	*	*
Other	2	2	4	1
Total	100%	100%	100%	100%
n	1006	1030	787	749

*Less than .5%

TABLE A-1

Distribution of Credit Score by Market

Credit Score[a]	Market			
	Wisconsin	Illinois	Arkansas	Louisiana
Lowest 20%	22.5%	22.6%	27.8%	25.1%
Second	21.4	20.3	19.4	17.2
Third	19.0	20.2	20.2	18.8
Fourth	18.0	18.6	16.5	20.8
Highest 20%	19.1	18.3	16.1	18.1
	100%	100%	100%	100%

CHI Square = 18.01, .11 level of significance (12 d.f.)

[a]The credit source was computed for all 3572 cases. Then the entire population was divided into quintiles.

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Discussion

Thomas A Durkin*

The papers presented this morning by Bill Dunkelberg and Chip Peterson represent the first tiny peeks at the data they and their associates have collected as part of their research into the impact of government regulation in the area of consumer financial services. This large project, sponsored by the National Science Foundation and actually begun in 1976, is potentially one of the most important empirical studies ever undertaken in this field. However, the papers we have today must be classified as highly preliminary. While it seems appropriate to provide preliminary results of large projects at conferences such as this, I am sure the authors will agree that these papers represent only the briefest glimpse of the potential information from this study.

Because these papers are part of the same project, it seems reasonable, first, to offer some general comments about the two of them together. These papers address a question – the impact on credit markets of government-imposed restrictions such as rate ceilings – that is as old as economic analysis itself. In recent years there have been many studies of restrictions on consumer credit markets; Peterson references a number of them in his paper. In general, these studies take one or two of three possible approaches: theoretical analysis, empirical study of lenders and the supply of credit, and analysis of consumer surveys. The difference between these studies and the Dunkelberg, Peterson *et al.* project is that the latter combines all three approaches for the first time. So far, these researchers have generated some theoretical papers and have undertaken two massive surveys – one of creditors and the other of consumers – in four local markets chosen for regulatory diversity. These surveys should provide data of a kind not previously collected on portfolios of both lenders and borrowers in local markets. Not even the National Commission on Consumer Finance, which intensively studied rate ceilings and other questions in 1971 and 1972, undertook either a local-market survey of creditors or a broad survey of consumers.

As mentioned, these two papers represent the first peek at the data collected in the two surveys; however, like other peeks, these papers by themselves do not leave the reader fully informed. One will look in vain through the Peterson paper, for example, for answers to such simple questions as how many creditors were found in each local market and how the distributions of types and sizes of creditors vary by regulatory climate. Similarly, the Dunkelberg paper, which

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examines the consumer survey, could profit immensely from addition of simple comparative tables. Without them, probably the strongest general impression that emerges from these papers is that they do not reveal the scope and breadth of this research or its potential importance. The authors might contend that the purpose of these papers is more limited empirical analysis; but if so, they do themselves an injustice. Although fuller exposition may not have been possible in the short period between survey completion and the date of the conference, it still seems worth undertaking.

After some introductory discussion reviewing the reasons for selecting the four local markets surveyed, Peterson reviews, very briefly, some theoretical background concerning the impact on credit availability of rate ceilings and restrictions on creditors' remedies. In this section he correctly points out that rate ceilings and remedy restrictions, if effective, will affect both demand and supply, but that the exact nature of market adjustment is unclear. Possibilities include: (1) adjusting credit availability to riskier customers; (2) altering collection policies; (3) cross-selling other products such as credit insurance; (4) raising the prices of goods sold on credit; (5) requiring more collateral, co-signers, or higher downpayments; (6) changing production methods in other ways. A series of regression equations is then estimated, which provides the basic analysis in the paper.

All of Peterson's findings are consistent with expectations from theory, and they provide some insight into the kinds of adjustments that take place in constrained markets. These adjustments include lower rates where ceilings are binding but higher rates when creditors' collection remedies are restricted. The rate effect from limiting remedies appears greatest on unsecured loans, which Peterson suggests are the riskiest. He reports some support for the notion that higher automobile downpayments accompany restrictive rate ceilings and that the average size of personal loans at banks is larger when rate ceilings are binding. He contends, reasonably, that the latter result might be expected because low ceilings will make banks less enthusiastic about extending small loans where the small amount of revenue will be less likely to cover the fixed cost of credit investigation and loan acquisition. He also reports some other results where the statistical evidence is not strong enough to pass stringent tests. In these cases he lists the results with less confidence. Nevertheless, none of his findings are either anomalous or inconsistent with hypotheses about the likely effects of constraints in consumer credit markets.

Probably the greatest problem with the Peterson paper is its preliminary nature. Aside from the general difficulty, already mentioned, that both papers could benefit from addition of tables of frequencies and descriptive statistics, Peterson might also undertake additional statistical analysis. For example, he contends that the "basic assumption" of his analysis is that a pair of dummy variables indicating either low rate ceilings or restrictive remedies "could be used to determine if systematic differences existed in the behavior of similar creditors operating in different regulatory environments." However, this formulation assumes an additive model, although it seems more likely the effects are interactive. Examination for interaction effects might sharpen the statistical results

and provide better insights into the operation of constrained credit markets. Along the same lines, more subtle formulation of the dummy variables to account for distinctions in regulations affecting various credit forms in the states, might produce further interesting findings. The present formulation, which applies one equation with the same two dummy variables to every form of credit, seems too confining. In studying markets where adjustments may be subtle, a gross approach may miss some of the target. Also, the equation itself might be refined. The principal equation, outlined in footnote 2 of the paper, employs the unusual approach of including observations with missing data on the dependent variable and accounting for them with another independent dummy variable. Because this "missing data dummy" artificially improves goodness of fit, Peterson declines to report goodness-of-fit measures like R^2. It is not entirely clear, though, what is gained by this approach. If data are missing from some creditors for some types of loans because these creditors do not make these loans, the argument might be made that these firms are outside the limited universe being studied and the cases should be excluded. If, instead, these cases are part of the universe but they do not make these loans because of some constraint, it seems a more refined approach may be needed. It simply seems unlikely that the present approach adds any useful information.

The Dunkelberg-DeMagistris paper provides a first look at the consumer survey. This survey, undertaken in the same local markets and roughly at the same time as the creditor survey, represents the initial attempt at matching a consumer survey regarding credit matters with a corresponding creditor survey. The consumer survey is also the largest survey concerning consumers and credit regulations ever attempted, with more than 3,500 personal interviews. In time, a wealth of information should result from this phase of the project.

Like the Peterson paper, the Dunkelberg-DeMagistris paper introduces the empirical analysis with some theoretical discussion. Unlike the Peterson paper, though, this paper constructs a simple model for illustrative purposes. Both supply of and demand for credit are discussed along with the potential impact of government regulation. The theoretical analysis is followed by empirical work, which again highlights linear regressions. Although a few interesting tables are provided, space and time limitations apparently precluded extensive description of population characteristics. As with the credit survey, fuller review of this information is likely to reveal many findings that are interesting in themselves.

The theoretical discussion in the paper appears quite simple and straightforward, although it contains the usual kinds of ambiguities found in any early draft. Costs are expressed as a function of risk, which means that lenders' willingness to bear risk is a direct function of the rate ceiling. As a result, the supply of credit from both a firm and the industry is a positive function of the rate ceiling, and the supply curve is upward sloping. Unfortunately, the paper talks around this point somewhat, and in one place it seems to suggest that the upward-sloping supply curve results solely from the rising marginal costs of funds. Further consideration of firm effects and industry effects in a second draft of the paper would probably have eliminated problems of this kind. Ambiguities are also present in the sections on credit demand and market regula-

tion. For example, the section on credit demand appears to confuse somewhat the analysis of the individual case with the analysis of aggregate demand. The following section on market regulation implies that "characteristics" of "marginal" credit users will be discussed, but then only income in "point scoring models" is mentioned. Point scoring is not even defined and income is not the variable used in the paper's discussion of risk. Again, problems of this kind could be clarified in a later draft of the paper.

According to the authors, their theoretical model suggests a number of predictions about credit use when restrictions are placed on lender behavior: (1) turndown rates will be higher and the proportion of consumers with debt will be lower; (2) average debt per borrower will be lower, particularly in the higher risk classes; and (3) relatively more credit will be extended by the less restricted firms and by those that can evade the restrictions. To study these possibilities the authors employ the interesting approach of estimating a reduced-form equation using data from the least restricted state of their four (Illinois) and then using the parameters to make predictions about consumers in the other states. If the other states are more restrictive and the model is correct, then the restrictions should manifest themselves in the form of differences between predicted conditions and actual conditions in the restricted states. In addition, the differences should be most pronounced in the riskiest classes of consumers.

In general, the authors' statistical results are consistent with their expectations. The authors note a number of potential problems – including possible evasions of the restrictions, systematic differences in demand, and apparent inadequacy of the risk proxy employed – but these difficulties do not obscure the general thrust of the results. In many ways the results are exciting because they represent the first evidence from a micro consumer survey of the comparative effects of state credit regulations.[1] Again, however, the paper could have been crisper had there been more time for the authors to refine the analysis after receiving the data. Particular attention might have been given to studying the measure of risk used in the analysis. In its present form the risk measure used produces somewhat confusing results. Furthermore, it is not clear from the text or appendix how the risk measure was actually constructed. Certainly, the authors did not have accurate data on all the measures suggested in the appendix as used in constructing the risk measure. This problem compounds confusing findings.

In sum, the authors of these papers have provided only a glimpse of the huge structure and results of their project. While the papers may not provide all the answers, they certainly whet the appetite. While preparing a monograph takes somewhat longer, I encourage the authors to continue their work. The potential importance of their findings makes it worth the further wait.

[1] Eisenbeis and Murphy [1] used results of a consumer survey to study the impact of rate regulation in Maine, but this new project is both larger and useful in making comparisons among four states. In later work the authors might be able to use these data to generalize the work of Eisenbeis and Murphy.

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Regulation Q and Savings Bank Solvency — The Connecticut Experience

Richard W. Kopcke and Geoffrey R. H. Woglom*

Thrift institutions have traditionally borrowed short term and lent long term at fixed interest rates. This maturity pattern of assets and liabilities exposes these institutions to the risks of unexpected increases in interest rates. If open market interest rates rise, the thrift institutions' ability to pay competitive rates is limited because their assets are of long maturity at fixed rates. The severity of this problem was illustrated in the mid-1960s when unanticipated increases in inflation and the active use of monetary policy to fight the inflation led to substantial increases in interest rates (see Figure 1) and reductions in thrift earnings.

In 1966 the combination of rising interest rates and increased competition from commercial banks stimulated Congress to extend regulation Q ceilings to the federally insured thrift institutions while also granting these institutions the right to pay slightly higher deposit rates – the differential. The original Congressional authority to extend regulation Q ceilings was temporary, but in the intervening years Congress has continually renewed this authority. These renewals have come in spite of the fact that regulation Q ceilings and the differential are very controversial. At various times it has been argued that the ceiling rates have: 1. Provided thrifts with an incentive toward inefficient operation; 2. Sacrificed the interest income of the small saver; 3. Caused greater instability in the supply of funds to housing over the course of the business cycle; 4. Threatened the long-run viability of the thrift industry by encouraging competition for consumer deposits from other institutions (i.e., money market mutual funds) not shackled by regulation Q ceilings. Others contend that regulation Q ceilings are the only reason thrift institutions were able to survive the most recent experience of highly volatile interest rates.[1]

[1] For discussion of these issues, see: R. Taggart, Jr., "Effects of Deposit Rate Ceilings: The Evidence from Massachusetts Savings Banks," *Journal of Money, Credit, and Banking*, Vol. 10 (May 1978); R. Taggart, Jr. and G. Woglom, "Savings Bank Reactions to Rate Ceilings and Rising Market Rates," *New England Economic Review*, September/October 1978; C. Clotfelter and C. Liberman, "On the Distributional Impact of Federal Interest Rate Restrictions," *Journal of Finance*, Vol. 33 (March 1978), pp. 199-213; E. McKelvey, "Interest Rate Ceilings and Disintermediation," Board of Governors of the Federal Reserve System Staff Studies, April 1978; and E. Ettin and B. Opper, "Consumer Savings and Thrift Institutions," Board of Governors of the Federal Reserve System Staff Studies, June 1970.

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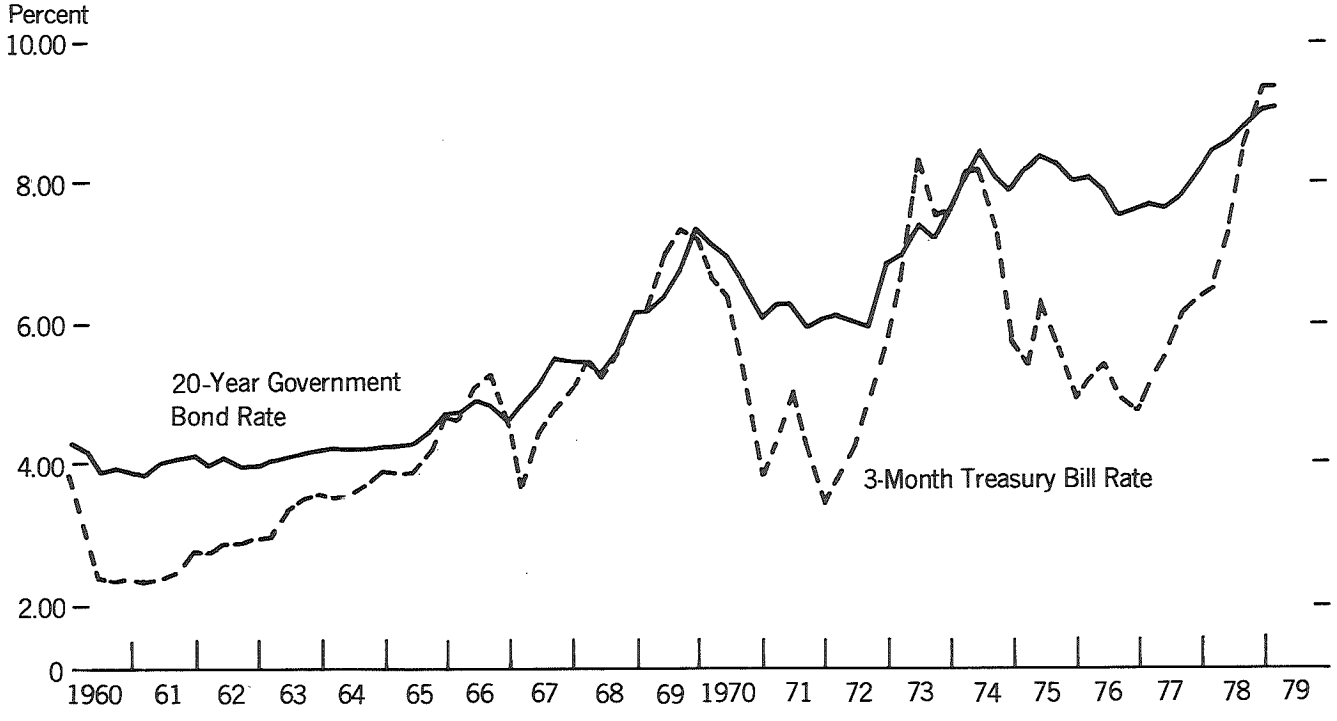
Figure 1 Yields on Treasury Bills and Treasury Bonds



Source: *Federal Reserve Bulletin*

While regulation Q and the differential have survived a number of Congressional attempts at financial reform, various inroads have been made against the ceilings: the 1973 experiment with "wild card" certificates, proposals to eliminate the ceiling on special accounts such as I.R.A. accounts, and finally and most dramatically the introduction of money market certificates with ceiling rates tied to Treasury Bill rates. It is likely that in the not too distant future thrift institutions will not be protected by the regulation Q ceilings, either because of the formal removal of the ceilings or because of financial innovations such as the money market certificates that make the ceiling rates increasingly irrelevant. Given the growing possibility of a financial environment for thrift institutions without ceiling rates, two questions are particularly important: 1. Has the extension of regulation Q, for all of its possible flaws, enabled the thrift institutions to weather the storm of the wildly gyrating interest rates? 2. To what extent have thrift institutions adapted to the new environment of volatile rates to protect themselves should regulation Q lapse?

In attempting to answer these questions some care must be taken in analyzing the impact of rising interest rates and regulation Q ceilings on thrift institutions. In particular, current accounting measures of earnings and net worth may give a distorted picture of the solvency of thrift institutions. Rising interest rates and rate ceilings affect current earnings and also expected future earnings. Current accounting procedures ignore the latter effects. It is our view that the latter effects are quite important in judging the solvency of thrift institutions. The importance of changes in expected future earnings can best be illustrated by examining the effects of different patterns of rising short- and long-term interest rates.

Savings Bank Earnings and the Yield Curve

A useful aid for studying the possible patterns of changes in interest rates is the yield curve. The yield curve plots the average annual yield to maturity against time to maturity for a similar class of assets, Treasury securities for example. The yield curve can assume a variety of shapes, but its most frequent shape is an upward sloping or ascending curve as depicted in Figure 2. The usual positive slope of the yield curve is explained by the preference of lenders for short-term assets and the preference of borrowers for long-term liabilities. The difference in maturity preference gives rise to a liquidity premium, the tendency for short-term rates to be below long-term rates. In other words, borrowers must pay a premium in terms of higher interest rates to induce lenders to accept longer term assets.

The yield curve is not always positively sloped, however; at times it has been descending (negatively sloped throughout) and at other times humped (first positively sloped and then negatively sloped). The most common explanation of these alternative shapes is provided by the expectations hypothesis: arbitrageurs will buy and sell securities of different maturities until the expected return adjusted for liquidity premiums is the same for all maturities. While a descending yield curve shows that yields on today's short-term securities exceed those on long-term securities, this curve also reflects the market expectation that, in the

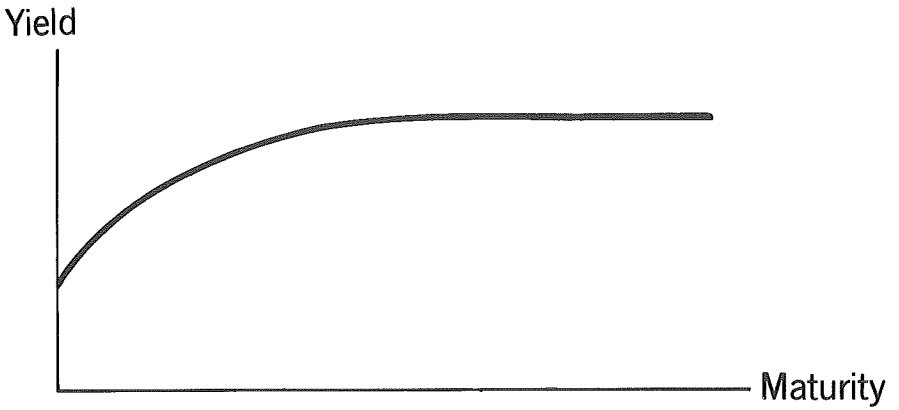


Figure 2

future, the yields on short-term securities will be below the current long-term interest rate. Thus the shape of the yield curve provides important information about financial market expectations of future interest rates.[2]

In analyzing the effects of rising interest rates on the earnings of a savings bank two special cases of upward shifts in the yield curve for Treasury securities will be analyzed. While the yield curve has never moved exactly in the way assumed in these two extreme cases, any upward movement in the yield curve can be described by some combination of the two. When rates on short-term Treasuries rise, the competitive deposit rates at a savings bank unprotected by ceilings would rise as well, and any change in Treasury bond yields will be reflected in newly issued mortgage yields. While these relationships do not hold exactly nor do the changes occur simultaneously, the approximation will not affect the qualitative results of the analysis.

First, consider a uniform upward shift in the yield curve, the yields on all maturities increase by the same amount. Under the expectations hypothesis this shift implies the expected rate of return on future securities has also risen so that the rise in short-term interest rates is not expected to be reversed. The early part of the most recent surge in interest rates provides an example of a uniform shift in the yield curve. From 1977:3 to 1978:2 the short-term bill rate rose 98 basis points to 6.48 percent while the 20-year government bond rate rose 83 basis points to 8.43 percent.

A savings bank that paid competitive rates on its short-term deposits would suffer an increase in interest expense following the rise in rates of Figure 3. Similarly, it would find it could charge higher rates on newly issued mortgages. The net impact of the rise in rates, however, is a substantial reduction in earnings, at least initially, because all of the savings bank's liabilities bear higher yields

[2] See for example, J.C. VanHorne, *Financial Market Rates and Flows* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1978).

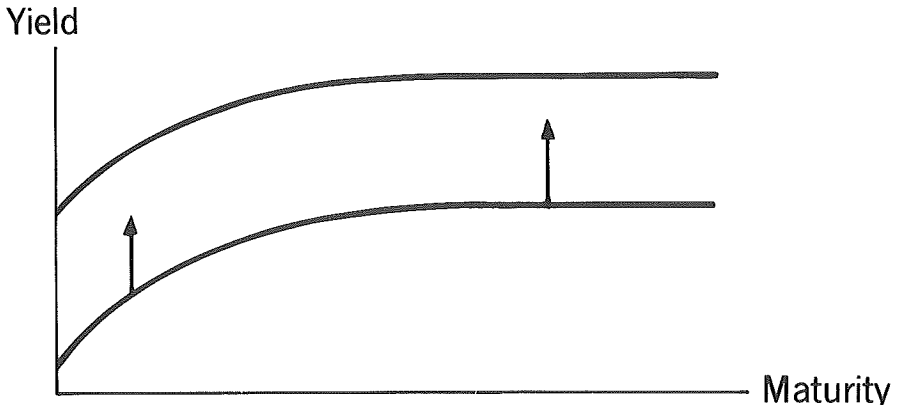


Figure 3

while only the newly issued mortgages are earning the higher rate.[3] Thus, the average rate of return on assets would not rise as much as the average deposit rate. Over time the earnings of the bank would improve as all the old mortgages were replaced with new mortgages at the higher interest rate.

The earnings reductions suffered by the unprotected savings bank can cause liquidity and solvency problems. The bank becomes insolvent if its losses exhaust its accumulated surplus. Even if the bank remains solvent, the rising rates may cause severe liquidity problems. The largest earnings reductions come in the first year of the higher rates, and the savings bank must find a way to finance interest expense in excess of interest income. It may be difficult for the bank to liquidate long-term assets to finance its cash flow problems in the initial years of rising rates.

The second type of shift in the yield cure is the case where short-term rates rise but long-term rates do not, so the yield curve changes from being ascending to descending (Figure 4). Under the expectations hypothesis, the expected rate of return adjusted for liquidity premiums should be equal for all maturities over any holding period. Thus the expected rate of return adjusted for liquidity premiums from continually rolling over short-term securities should equal the rate of return on the long-term security. Because the rate of return from holding the long-term security to maturity is unchanged, the expected return from continually rolling over short-term securities must also be unchanged. Thus the rise in the current short-term interest rates implies that these rates are expected to fall in the future.

It is difficult to find examples where short-term rates rise and long-term rates are unchanged. There are, however, a few instances where the rise in short-term rates far exceeds the rise in long-term rates. Between 1978:2 and 1979:1

[3] Throughout this section it is assumed that all savings bank deposits are passbook accounts. This assumption is relaxed later.

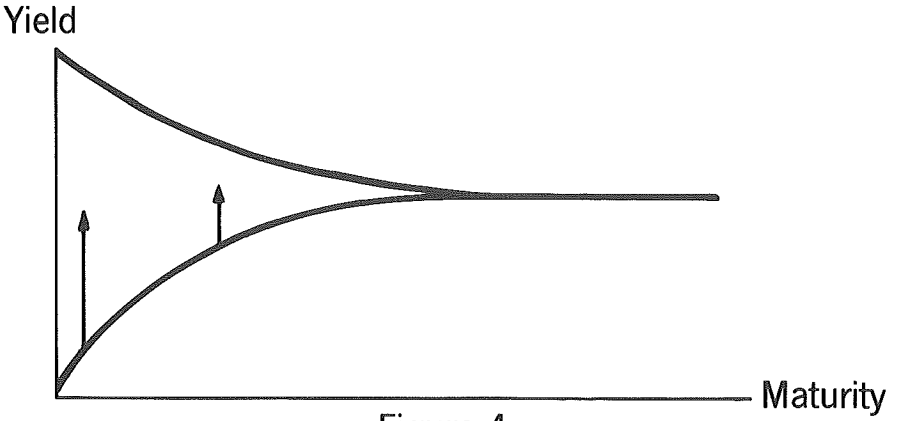


Figure 4

the short-term bill rate rose 290 basis points to 9.38 percent while the 20-year government bond rate rose 60 basis points to 9.03 percent. Initially, the rise in rates depicted in Figure 4 has the same impact on a savings bank's earnings as the uniform rise in rates of Figure 3. Interest expense on deposits rises with the short-term rates while the average return on assets is unaffected. However, a rise in short-term rates unaccompanied by a rise in long-term rates implies a market expectation of short-term rates below the original level sometime in the future. If this expectation is correct, the interest expense eventually will fall below its original level. The relatively high current interest expense is expected to be redressed by relatively low interest expense in the future. Thus a rise in short-term rates unmatched by a change in long-term rates implies a decline in current earnings matched by an expectation of an offsetting rise in future earnings.

A rise in short-term rates, therefore, unaccompanied by a rise in long-term rates implies no expected solvency problem, in spite of the reduction in current earnings. At times some argue that thrift institutions are in trouble whenever the rate paid on deposits approaches or exceeds the rate earned on new mortgages, as has been the case with the money market certificates. Though thrift institutions, once they are allowed to compete with the open market for funds, will pay high deposit rates during periods of high short-term open market rates, this is not necessarily evidence of the "irrationality" or "destructiveness" of a free market for deposits. Institutions that are only willing to pay competitive rates when short-term rates are low may have a high and stable spread between the return on assets and liabilities, but they are unlikely to attract a large volume of deposits.

Rising short-term rates with constant long-term rates pose problems of illiquidity, rather than insolvency for savings banks. Those paying competitive rates still must find a way to finance the earnings reduction during the period of relatively high short-term rates. Just because the yield curve implies higher than normal earnings in the future does not solve the problem of financing current

deficits. In fact, the initial liquidity problem is likely to be just as severe if both short-term and long-term rates increase by the same amount.

The severity of any expected solvency problems faced by a savings bank in a period of rising rates depends to a large extent on the pattern of rate increases. The most severe solvency problems occur when long-term rates rise unexpectedly. If only short-term rates rise, financial markets anticipate that today's depressed earnings will not threaten savings bank solvency. The analysis also indicates that one cannot estimate the potential solvency problems of savings banks by looking solely at current income or current spreads between interest expense and interest income. While short-term rates above long-term rates imply deficits today, they may hold the promise of above normal earnings in the future. Current earnings and current interest spreads are, however, appropriate measures of possible liquidity problems faced by thrifts in the face of rising short-term rates.

Ceiling Rates and Savings Bank Earnings

Imposing ceiling rates on savings banks to solve the problems of rising interest rates certainly helps the initial liquidity problems. As soon as the deposit rate is at the ceiling, any further rise in rates will have no impact on interest expense. Thrifts unable to pay competitive rates on deposits, however, will experience slower deposit growth. If, on the other hand, below-market deposit rates encourage withdrawals, or if ceilings cause disintermediation, a potentially more dangerous form of liquidity problem may result.

The ceilings have a number of effects on the current and future earnings of savings banks that affect their solvency. Not having to pay competitive deposit rates tends to raise earnings by holding down interest expenses during periods when short-term rates exceed the ceiling rates. Interest rate ceilings, however, may also depress savings bank earnings. For example, ceiling rates can act as a floor on deposit rates as well as a ceiling. While the ceilings hold down interest expense during the periods of high short-term rates, they may support interest expense in the periods of low short-term rates. In addition, ceiling rates undoubtedly have slowed the growth in deposits at savings banks. While ceilings make each deposit more valuable, the savings banks are limited in their ability to attract or retain deposits if they cannot offer competitive yields. Slower deposit growth prevents the savings bank from taking advantage of profitable investment opportunities, particularly given the growing sophistication of savers and increased competition for consumer accounts – money market mutual funds, for example, do pay market rates of return.

Finally, because the ceiling rates have predominantly been below competitive rates, savings banks have sought other means to compete for funds. Nonrate forms of competition such as increased advertising, additional branches, longer hours, are not as efficient as rate competition in attracting deposits. Therefore, to the extent that nonrate competition increases expense, but does not yield the same volume of additional deposits as higher rates would, savings bank earnings are depressed. A study by Taggart and Woglom estimated that nonrate competition at mutual savings banks in Massachusetts and Connecticut led to an increase

in operating expenses of as much as 25 percent by 1975 and the percentage of additional expenses was rising over time.[4]

In summary, not only may ceiling rates on deposits support savings bank earnings, they may also depress earnings. The effects of ceiling rates do not happen all at once and their impact on earnings changes over time. Conventional accounting measures of earnings and net worth do not measure expected future earnings and may be a poor guide in gauging savings bank solvency either in the presence or absence of regulation Q.

Section II: Measuring Savings Bank Performance

Ironically, though the problems of managing a mutual savings bank are commonly recognized, there is no consensus about measuring earnings and net worth when the level and pattern of interest rates are changing. While some believe that current accounting and reporting conventions provide the most relevant measures of bank earnings and net worth, others contend that significant reform is needed before depositors, management, or regulators can adequately assess savings bank performance. Even those who would reform banking financial statements do not agree.

Two general reform proposals have attracted substantial attention: general purchasing-power reporting (GPPR) and current value reporting (CVR).[5] Each recognizes that financial statements reporting the book value of bank assets and liabilities can be misleading; however, as the conflict between the proponents of these approaches reveals, the appropriate restatement is not evident. The traditional appeal of conventional accounting practice arises from its use of objective numbers – the par value of a mortgage or bond, for example –, not equivocal assessments of asset values; nevertheless, these reforms are attracting attention because "book values" may no longer provide an accurate, objective measure of bank performance when the level and pattern of interest rates vary.

Strictly speaking GPPR and CVR are not rivals. GPPR adjusts the unit of measure in financial statements so that entries reflect units of purchasing power, "real dollars." Even though a bank may report higher earnings, due to higher asset yields, the bank's real net worth may be growing no faster than it had before earnings apparently rose if the high asset yields are accompanied by a high inflation rate. CVR attempts to adjust financial reports to represent the

[4] R. Taggart, Jr., and G. Woglom, "Savings Bank Reactions to Rate Ceilings and Rising Market Rates."

[5] See, for example, Financial Accounting Standards Board *Exposure Draft*, "Financial Reporting in Units of General Purchasing Power," December 31, 1974 and *Exposure Draft*, "Financial Reporting and Changing Prices," December 28, 1978; *FASB Discussion Memorandum*, "Conceptual Framework for Accounting and Reporting: Elements of Financial Statements and Their Measurement," December 2, 1976; Securities and Exchange Commission, *Accounting Series Release No. 190*, "Notice of Adoption of Amendments to Regulation S-X Requiring Disclosure of Certain Replacement Cost Data," 1976; and Touche Ross, *Economic Reality in Financial Reporting* (New York, 1975).

current market prices of the bank's assets and liabilities. Although CVR and GPPR could be combined so that financial statements report earnings and net worth in purchasing-power units that also embody the relative price changes of assets and liabilities, these reforms, unfortunately, often are introduced as mutually exclusive alternatives.

General Purchasing-Power Reporting (GPPR)

With GPPR, bank financial statements would reflect the changing "value of money" by restating financial data in units of general purchasing power. Proponents stress that GPPR, by itself, represents a change in the unit by which earnings, assets, and liabilities are valued; no changes in other accounting principles are entailed.

To best understand how GPPR affects mutual savings banks' earnings and net worth, consider the hypothetical bank described in Table 1. According to the upper panel, the bank has earned $2 million on its $200 million of assets, enabling it to expand its capital and, ultimately, its assets by 10 percent. Apparently the bank enjoys the rewards of successful investment strategies. The lower panel, however, presents a less encouraging description of the bank's performance. The bank not only earned the reported $2 million but, according to GPPR, the bank also must consider the holding gains and losses on its financial assets and liabilities. Assuming the inflation rate is 10 percent, the bank's real debt burden to its depositors has declined $18 million while the real value of its mortgage assets has dropped $19.5 million – the holding loss on *net* financial assets, therefore, has been $1.5 million. According to GPPR, the real net worth has risen only 2.5 percent, suggesting, in turn, that the bank is not expanding so dramatically – the real assets the bank can finance may be growing only one-fourth as fast as conventionally reported net worth.

GPPR, unlike conventional reporting alone, facilitates the year-to-year comparison of financial statements because it attempts to record performance in terms of the bank's command of real assets. For example, a savings bank may be able to earn a return large enough to pay competitive deposit yields, but if the growth of its surplus does not comfortably offset its holding losses on net financial assets, in time a greater share of its community's real estate will be financed by other lenders. When prices are rising, GPPR can show whether earnings have risen enough to attain management's goals or earnings are barely adequate to compensate the bank for its purchasing power losses on net financial assets.

Despite its attributes, GPPR, coupled with conventional reporting, still has its faults. The adequacy of a bank's earnings or its solvency are questioned most often when the level or pattern of interest rates changes. Yet, according to conventional accounting principles, assets and liabilities are appraised as though interest rates do not change; curiously, a bank's mortgages, for example, are valued at par even though they bear many different rates of return. Financial reports using conventional accounting principles and GPPR therefore cannot provide the best measure of a financial institution's solvency when interest rates are changing. A more substantive reform is needed.

Table 1

Financial Statements for a Hypothetical Savings Bank
(in millions of dollars)

Conventional Reporting		
Assets		$ 200
Mortgages	$ 195	
Real Estate	$ 5	
Liabilities		$ 200
Deposits	$ 180	
Surplus	$ 20	
Income		$ 2
General Purchasing-Power Reporting Adjustment		
Income		$ 2
Inflation Rate = 10%		
Purchasing-Power Loss on Financial Assets $19.5		
Purchasing-Power Gain on Financial Liabilities $18.0		
Net Purchasing-Power Gain		$–1.5
Income After Net Purchasing-Power Gains		$ .5

Current Value Reporting (CVR)

The second proposal, CVR, attempts to record the "current" market value of assets and liabilities in financial reports, not par values or acquisition prices (book values). The current value of a security is the present value of its stream of payments. Unfortunately, this current value is not always well defined. Despite the sizable and expanding secondary mortgage market, for instance, there is no unique market value quoted for each mortgage contract in a savings bank portfolio. Not only may mortgage indentures differ, but each savings bank may possess special information about the nature of its loans. Nevertheless, existing markets do provide benchmarks for estimating the current value of existing mortgages, and this alternative measure is less arbitrary than book values when interest rates are changing.

An example of CVR is provided in Table 2. Once again the hypothetical bank earns $2 million. At the beginning of the year it held $195 million of mortgages yielding 8 percent, and its deposits cost 6.5 percent. At year end, however, the competitive deposit rate rose to 7.5 percent and the mortgage rate rose from 8 to 9 percent – a rise in interest rates accompanying a uniform upward shift of the yield curve described in Figure 3. If the bank's deposits are of very short maturity, depositors will earn competitive yields, so the higher interest rates will not depress the value of these deposits. The current value of the bank's

Table 2

Financial Statements for a Hypothetical Savings Bank
(in millions of dollars)

Conventional Reporting		
Assets		$ 200
Mortgages	$ 195	
Real Estate	$ 5	
Liabilities		$ 200
Deposits	$ 180	
Surplus	$ 20	
Income		$ 2
Current Value Reporting Adjustment		
Income		$ 2
Net Change in Market Value of Assets and Liabilities		$ −12
Assets		
Value of Mortgages Jan. 1 $195		
Value of Mortgages Dec. 31 $183		
Income After Net Capital Gains		$ −10

assets, however, will decline by $12 million because these assets are invested in mortgages yielding 8 percent while similar securities yielding 9 percent are available. According to CVR, then, the savings bank's net worth fell $10 million during the year – $12 million capital loss on mortgages plus $2 million operating income.

Many critics of CVR believe that the $12 million capital loss should not be recorded in the bank's balance sheet; unless the bank is to be liquidated, the mortgages eventually will be paid, and the bank's capital will be $20 million plus accumulated earnings. Indeed, had mortgage rates risen to 11 percent, the decline in asset values would exceed the reported $20 million of net worth. If the 11 percent mortgage rate were accompanied by a 9.5 percent deposit rate – borrowers and lenders believe that all interest rates will be 300 basis points higher from now on –, the institution would be bankrupt if these rates prevailed. The bank will not be able to meet its expenses without exhausting its surplus.

The $12 million loss shown in Table 2 cannot be ignored for it is the present value of the bank's lost earning opportunities. Given current market rates of interest, the value of the bank to its trustees and depositors has fallen substantially. Another bank with $20 million of capital holding $195 million of mortgages yielding 9 percent would be able to pay higher dividends and grow more rapidly than the bank shown in Table 2. Strictly speaking, both these banks cannot be worth $20 million; according to current market valuation, the

hypothetical bank in the table is worth only $10 million at year-end while its competitor is worth twice that much. In other words, if, in the absence of regulation Q restrictions, the bank holding mortgages yielding 8 percent attempts to maintain its market share by paying competitive dividends, then it must sell mortgages to cover its added interest expense. The present value of this drain on surplus is $12 million, and, of course, the bank eventually must acquire an equal amount of new reserves if it is to avoid depressing its capital-asset ratio.

With CVR, the net worth of the bank holding 9 percent mortgages exceeds that of the bank holding 8 percent mortgages, even though conventional financial statements may show that both have $20 million of net worth. The difference in net worth – the present value of the first bank's opportunities for greater earnings and growth at existing interest rates – is $12 million which equals the decline in current value of the second bank's assets due to their below-market yields. Should regulation Q ever be modified permitting more competition among banks, the information provided by CVR would be essential for managers, regulators, and insurers.

For a second example of CVR, consider two banks of equal size holding identical assets, but the first bank has issued many more long-term deposit liabilities than the second. If interest rates should rise, the first bank, for a time, may report lower earnings (longer term deposits tend to pay higher yields) and net worth than the second bank, with conventional accounting. According to CVR, however, the market value of the first bank's liabilities declines more than that of the second bank – the first bank's depositors are "locked in" and cannot withdraw their funds or negotiate higher yields as soon as the second bank's depositors. Accordingly, the net worth of the first bank does not decline as much as that of the second, reflecting the market value of the first bank's opportunities for greater earnings at prevailing interest rates.

A principal advantage of CVR, then, is to report each bank's comparative net worth given prevailing interest rates. Although CVR's critics claim that interest rates and, therefore, financial statements will be ever changing, CVR's proponents welcome these revisions because they provide timely descriptions of each bank's competitive position. Because the par values or acquisition prices of a bank's assets and liabilities were appropriate for conditions that prevailed when these securities were obtained, conventionally reported net worth for each bank embodies an arbitrary blend of past credit market conditions. Not only is this blend, perhaps, irrelevant for today's structure of interest rates, but, with conventional accounting, the reported net worth of banks cannot be compared easily because they are measured according to different yardsticks; the blend of credit market conditions embodied in each bank's balance sheet is unique. CVR attempts to remedy these failings by reporting the current value of assets and liabilities so that prevailing market conditions become a common standard of measurement.

In fact, CVR's extensive use of prevailing interest rates to value securities may encourage longer run earnings analysis. Should short-term interest rates rise well above long-term rates, as illustrated in Figure 4, savings banks paying competitive yields on money market certificates may complain that their losses imperil the well-being of their industry. Yet, according to the argument of the

previous section, the term structure of interest rates suggests that today's losses will be redressed by tomorrow's gains when short-term rates decline. (Indeed, falling short-term interest rates are frequently accompanied by declining yields on bonds and mortgages. In these cases, the strategy of having issued money market certificates to acquire high-yielding mortgages would be extremely lucrative.) In Figure 4, then, the current higher-than-average short-term yields presage lower-than-average short rates in the future, and, according to the expectations hypothesis, a savings bank is not courting insolvency by paying competitive yields on its short-term deposits that temporarily exceed the return on its long-term assets.

A uniform upward shift in the yield curve, however, may depress CVR net worth. If all interest rates rise uniformly, as shown in Figure 3, not only have current interest rates risen, but, according to the expectations hypothesis, investors believe that future interest rates will remain high. Accordingly the expected earnings for a savings bank paying competitive rates on its short-term deposits will decline because this bank holds mortgages bearing below-market yields. The present value of this earnings loss is measured by the drop in the market value of the bank's mortgage portfolio that in turn depresses CVR net worth by an equal amount. Unless interest rates drop unexpectedly, restoring the market value of mortgages, a bank experiencing declining CVR net worth cannot accumulate surplus as rapidly as it had planned previously if it attempts to maintain its market share without raising new capital. Any decline in CVR net worth, then, indicates the need to raise new capital if the bank is to maintain both its market share and its capital-asset ratio.

A savings bank may be insolvent when the market value of its liabilities exceeds the market value of its assets so that its CVR net worth is negative. In the unlikely event depositors attempt to withdraw all their funds, a bank with negative CVR net worth would be unable to satisfy their claims by selling its assets. Of course, deposit insurance essentially has eliminated panic withdrawals; nevertheless, insurors examine banks to rectify these problems before they create substantial risks.

Should the interest rates implied by the term structure prevail, then a bank with negative CVR net worth may be insolvent because it ultimately may sell assets whose face value exceeds conventionally reported net worth. The bank is not necessarily insolvent, however. First, interest rates are volatile, and though a bank may report negative CVR net worth today, tomorrow's yields may restore its capital. Even so, today's term structure reveals the prevailing forecast of future yields, and it is risky to presume that future yields will depart fortuitously from this forecast to restore CVR net worth. Second, because depositors value the convenience of short-term accounts and because savings banks may enjoy local market advantages due to limited competition for depositors' funds, the yields on long-term assets may exceed the average expected deposit rate by more than enough to cover operating expenses. Accordingly, even though all interest rates may rise uniformly and the bank is locked into low-yielding mortgages, producing negative CVR net worth, the new deposit rate still may not exceed the bank's return on assets. Therefore, the bank can still pay its expenses without exhausting its net worth. Though negative CVR net worth in this case does

not imply insolvency, the bank is no longer able to accumulate surplus as rapidly as it had planned, so it must either lose market share or tolerate declining capital-asset ratios. Of course, this initial gap between long-term yields and expected short-term yields may not be very large, so a modest rise in interest rates may overcome the cushion it affords.

In summary, CVR net worth provides a particularly useful measure of savings bank solvency. A bank with declining net worth is confronted with the need to raise new capital, and should its capital-asset ratio fall excessively, the bank's ability to serve the public safely may be questioned.

Section III: The Performance of Connecticut Savings Banks

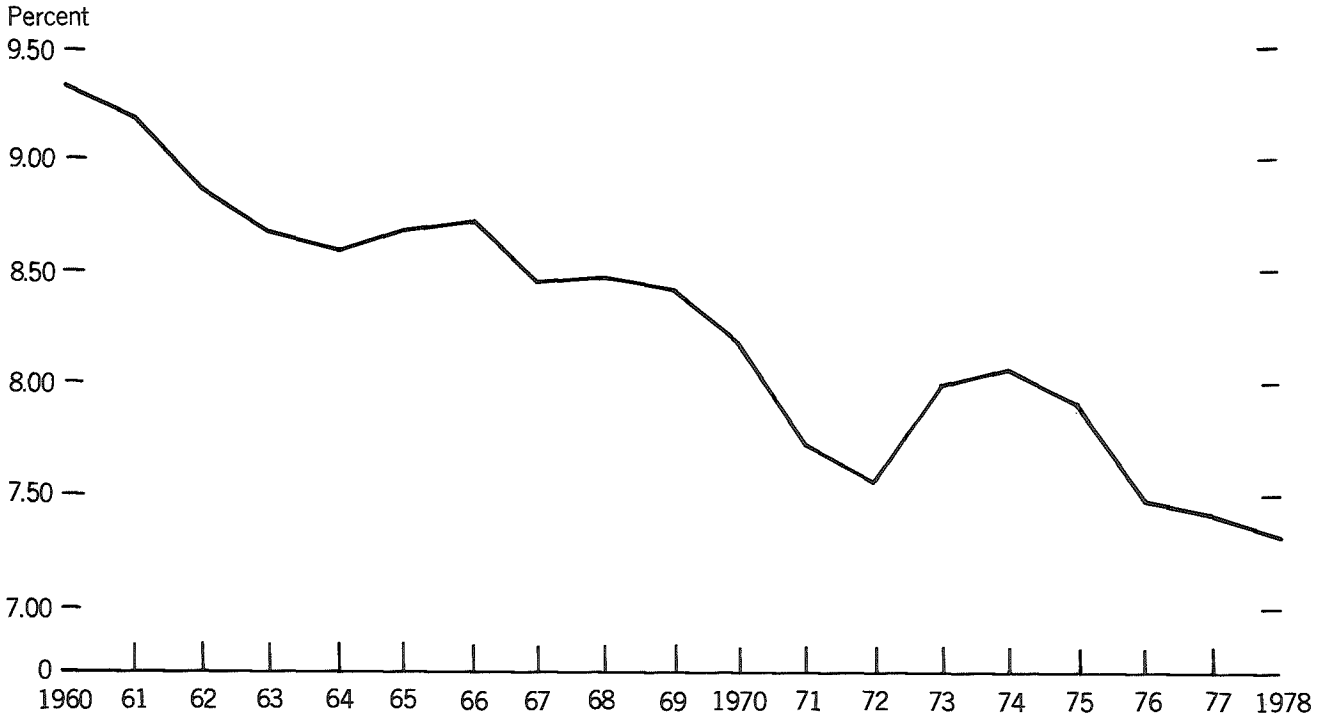
Within every debate on the merits of interest rate ceilings resides a question whose answer often decides the controversy, frequently by default: Do thrift institutions still require the protection of interest rate ceilings to survive? It is often presumed that these ceilings enabled thrifts to endure when interest rates rose sharply in the middle and late 1960s. By estimating the CVR net worth of Connecticut savings banks, one can appreciate the importance of interest rate ceilings for maintaining savings bank solvency since 1970.

Reported Net Worth

Figures 5 and 6 describe the capital-asset ratios of savings banks reported in the *Annual Report of the Bank Commissioner of the State of Connecticut* from 1960 to 1978. The first chart reports the aggregate ratio of net worth to the book value of assets for all savings banks in the state. The capital-asset ratio fell almost steadily from approximately 9.4 percent in 1960 to 7.4 percent by 1978. The pattern of annual declines was interrupted in only a few years – the increases in 1973 and 1974 are most notable.

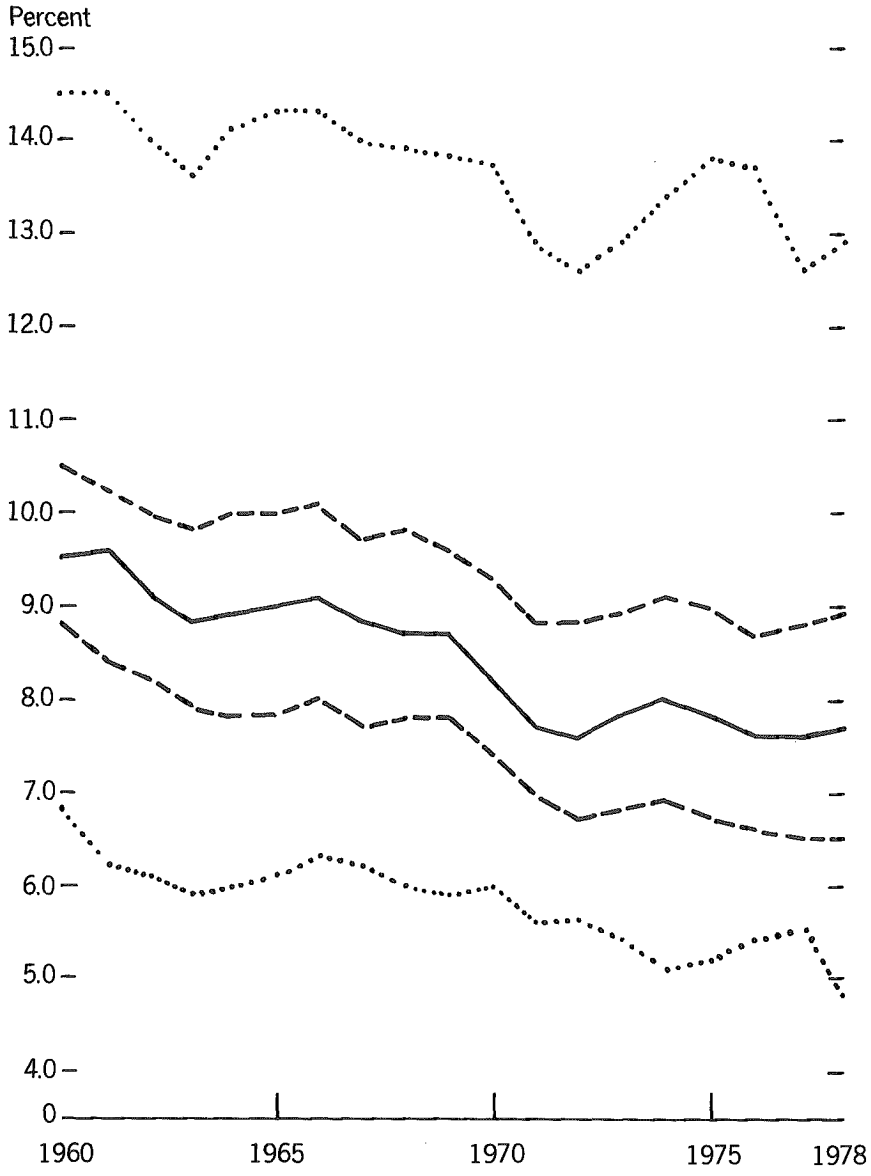
Figure 6 describes the distribution of capital-asset ratios for the various chartered savings banks. The solid line is the median ratio of net worth to reported assets – half of the banks in each year have more capital and surplus relative to assets, half have less. Like the average ratio for the state, the median falls from 9.3 percent in 1960 to 7.3 percent by 1978. The two dashed lines represent the median ratios for those banks having the highest and lowest net worth – of all banks with capital-asset ratios exceeding the state-wide median in each year, for example, half have ratios exceeding the upper dashed line, half have ratios falling between the dashed line and the solid line. Finally, the two dotted lines mark the minimum and maximum capital-asset ratios reported by Connecticut savings banks for each year. Although, the ratios for most banks tend to cluster around the median (half of all the chartered savings banks fall between the two dashed lines), the range of capital-asset ratios is very great: in 1978, for example, the highest ratio was 13.0 percent, the lowest was 4.8 percent. The banks with the highest capital-asset ratios tend to be relatively small banks: in 1978, only 13 percent of the state's deposits were held by those banks ranked in the top 25 percent of all the state's savings banks in Figure 6.

Figure 5 Ratio of Net Worth to Assets



Source: See Technical Appendix

Figure 6 Distribution of Net Worth to Asset Ratios



Source: See Technical Appendix

In summary, the net worth of most Connecticut savings banks has deteriorated steadily since 1960. The banks reporting the highest capital-asset ratios, however, have increased their net worth more rapidly than their assets; yet, these banks generally are roughly half the size of the average state savings bank. This steady decline in the mean statewide capital-asset ratio worries many who consider relaxing or abolishing deposit rate ceilings: savings bank net worth is being eroded in spite of deposit rate regulation; perhaps more, not less, assistance is warranted.

CVR Net Worth: Revaluation of Assets

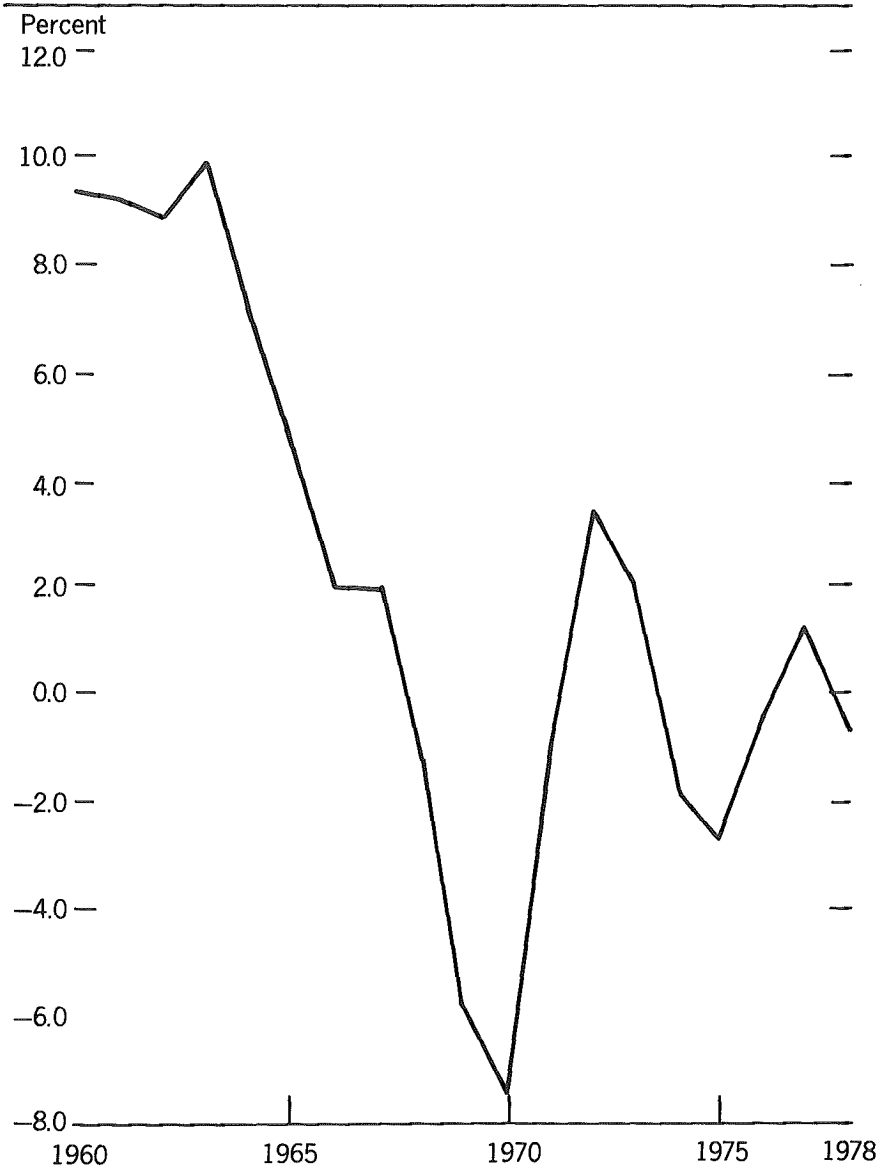
Figure 7 reports the aggregate ratio of CVR net worth to the market value of assets for all state savings banks. For this chart, CVR net worth is the difference between the current value of assets and the reported value of liabilities. This chart, therefore, estimates savings bank solvency had these banks paid competitive yields or their liabilities. Because the state's savings banks had issued certificates of deposit, thereby locking depositors into term liabilities with a fixed yield, Figure 7 shows the minimum capital-asset ratio that the abolition of deposit rate ceilings may have produced in each year. This minimum does not markedly underestimate net worth in these circumstances because CDs accounted for only 40 percent of the deposits at Connecticut savings banks in 1977, for example, and many of these CDs had average maturities less than two years.

Figure 7 shows that the CVR capital-asset ratio fell almost without interuption from 1960 to 1970, dropping from 9.4 percent to -7.5 percent. Unlike reported net worth, however, CVR net worth then oscillated about zero since 1971. The behavior of the CVR capital-asset ratio in Figure 7 is explained by the pattern of long-term interest rates shown in Figure 1. The ratio's peaks in 1963, 1972 and 1977 are matched by troughs of the 20-year government bond rates in the same years. Conversely, the ratio's troughs in 1970 and 1975 coincide with bond rate peaks. The two principal declines in the CVR capital-asset ratio – 1963 to 1970 and 1972 to 1978 – are not equally great partly because long-term interest rates increased more during the former period, 340 basis points, than during the latter, 250 basis points.

Figure 8 describes the distribution of CVR capital-asset ratios for the various Connecticut savings banks. In this figure, as in Figure 6, the solid line shows the median capital-asset ratio of all Connecticut savings banks for each year, in turn, the dashed lines show the median ratios for those banks having the highest and lowest net worth, and, finally, the dotted lines show the extreme capital-asset ratios. The ratios for most banks are clustered about the statewide median, and, like the average shown in Figure 7, they fall sharply from 1960 to 1970 then oscillate around zero until 1978. The lowest capital ratios are generally closer to the statewide median than the highest ratios – in 1977, for example, the lowest ratio was -3.4 percent while the highest was 14.9 percent, the median was 1.5.

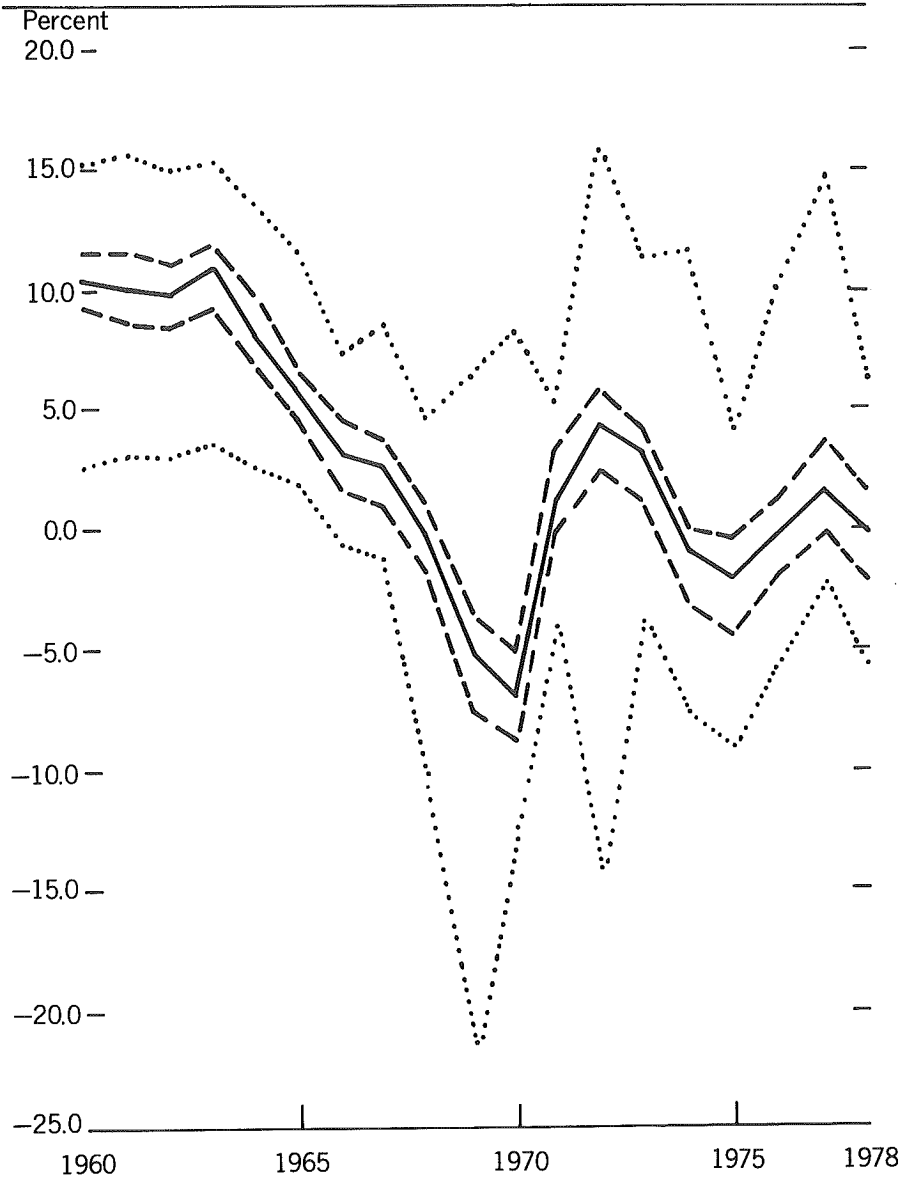
Therefore, if Connecticut savings banks had been required to pay competitive yields on all their deposits at any time during the past decade, most would

Figure 7 Ratio of CVR Net Worth to Assets - Asset Revaluations Only



Source: See Technical Appendix

Figure 8 Distribution of CVR Net Worth to Asset Ratios - Asset Revaluations Only



Source: See Technical Appendix

not have been able to maintain their share of household savings without seriously depleting their accumulated capital and surplus; many banks eventually would have become insolvent. Only a few of the state's savings banks have had high CVR net worth throughout the period; these banks could have maintained, or increased, their market shares by paying competitive deposit rates. Of course, these estimates may understate savings bank net worth to a degree because many deposits are secured for a fixed term, and banks may benefit from holding these deposits at below-market yields when interest rates rise.

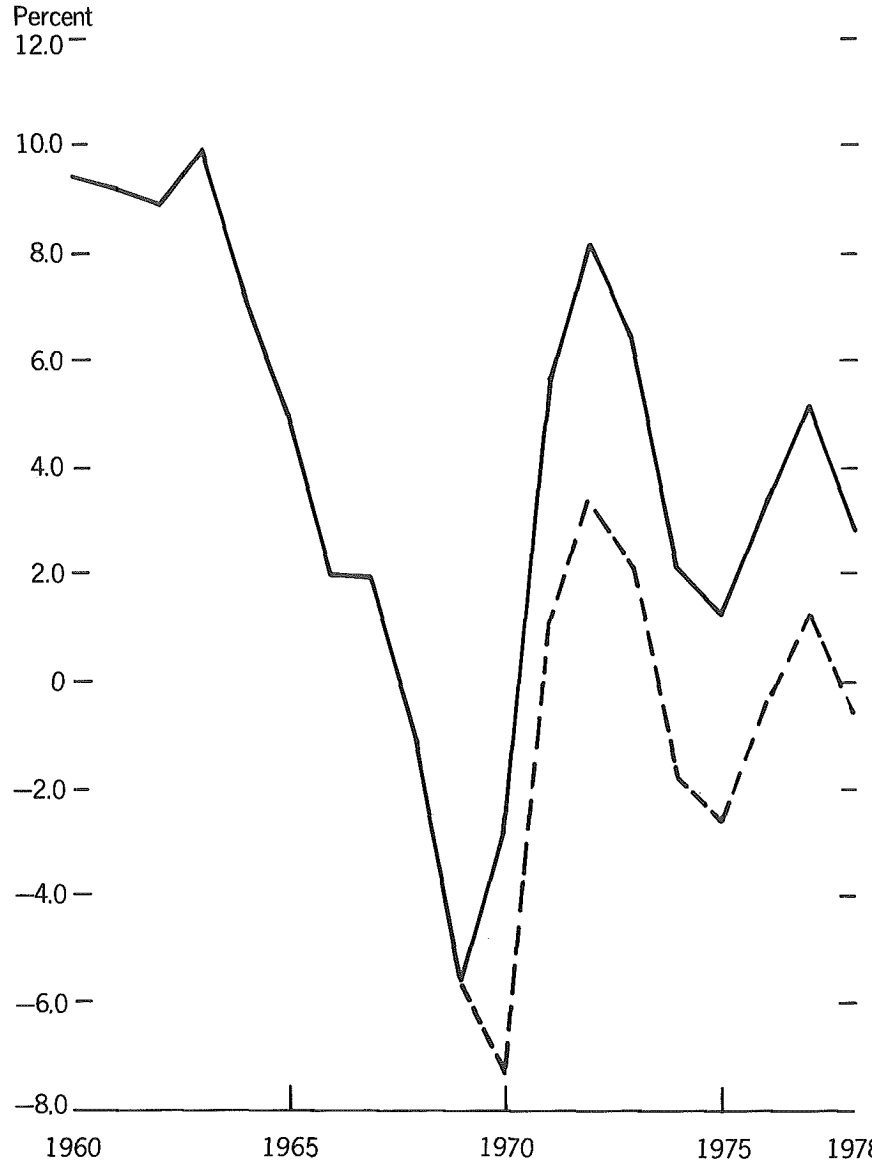
CVR Net Worth: Revaluation of Liabilities

Because interest rate ceilings and term deposits permit savings banks to pay below-market yields on deposits, the market value of liabilities should fall along with the market value of assets when interest rates rise. When ceilings hold deposit rates well below what they otherwise might have been and depositors cannot easily purchase high-yielding open market securities, interest rate regulations support savings bank net worth considerably. The more accessible are open market investment alternatives – money market mutual funds – or the closer deposit rates are to competitive yields – money market certificates – the less interest rate regulation can bolster savings bank net worth. Figures 9 and 10 show how ceiling rates may have assisted savings banks during the past 10 years; however, these charts do not estimate how the growing competition from open-market investment alternatives may have depressed net worth by reducing savings bank growth when interest rates were high. Therefore, though the charts show a considerable benefit from ceiling rates, the benefit can be smaller and it may shrink with each passing year.

These charts omit another relevant adjustment, however, that would tend to bolster estimated CVR net worth. Connecticut savings banks have issued certificates of deposit; these liabilities secure funds for a specific term, bearing a fixed yield until they mature. When interest rates unexpectedly rise, a savings bank that had issued long-term certificates of deposit would enjoy higher earnings and greater CVR net worth than a bank that had relied on short-term deposits. To the extent the Connecticut savings banks have locked in low-yielding deposits, the charts understate CVR capital-asset ratios. Since the early 1970s, roughly 40 percent of these banks' liabilities are certificates of deposit. Although Individual Retirement Accounts and Keogh plans may have attracted many depositors to certificates with maturities of six years or more, many of these term deposits have average maturities not exceeding one year. Therefore, the estimates shown in Figures 9 and 10 are not badly biased for this omission.

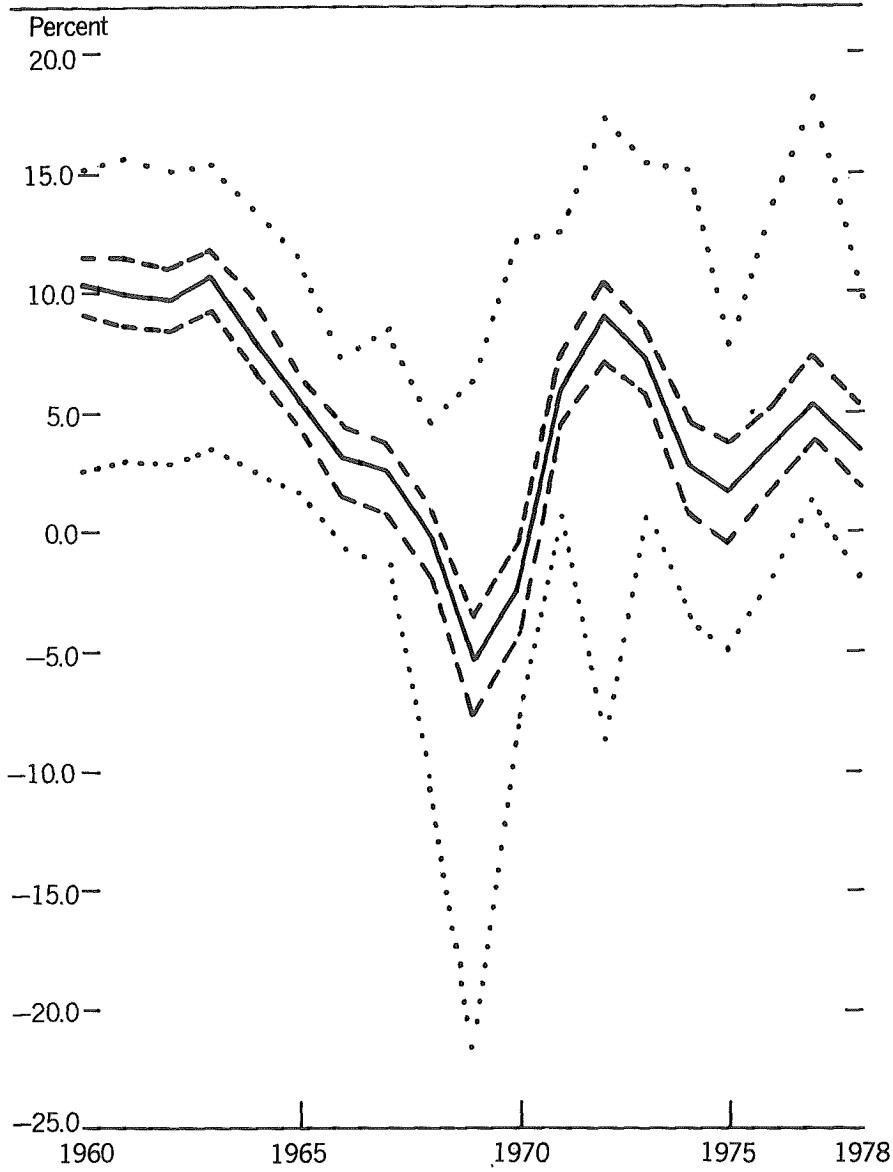
Figure 9 compares the aggregate CVR capital-asset ratio from Figure 7 (the dashed line for which assets alone have been reappraised) with the ratio after reported liabilities have been revalued as well (the solid line). For this chart, and Figure 10, we assume that all savings banks would have paid yields 35 basis points higher, on average, than their actual deposit rates to maintain their

Figure 9 Ratio of CVR Net Worth to Assets - Asset and Liability Revaluations



Source: See Technical Appendix

Figure 10 Distribution of CVR Net Worth to Asset Ratios - Asset and Liability Revaluations



Source: See Technical Appendix

existing deposits had ceiling rates not restricted them.[6] This advantage of lower deposit yields uniformly raises the CVR capital-asset ratios approximately 4 percentage points after 1969. Accordingly, from 1960 to 1970, the fully adjusted ratio falls from 9.4 percent to -7.5 percent, it then oscillates around 4 percent.

Figure 10 describes the distribution of fully adjusted CVR capital-asset ratios for the state's savings banks. In this figure, as in Figures 6 and 8, the solid line shows the statewide median capital-asset ratio for each year, the dashed lines show the median ratios for those banks having the highest and lowest net worth, and finally the dotted lines show the extreme ratios. Once again, the ratios for most banks are clustered about the statewide median, and, like the average shown in Figure 9 they fall sharply from 1960 to 1970, they then oscillate around 4 percent until 1978. The lowest capital-asset ratios generally are much closer to the statewide median than the highest ratios – in 1977, for example, the lowest ratio was -1.5 percent, the highest was 18.3 percent, and the median was 5.5 percent.

The low CVR capital-asset ratios in Figures 7 and 9 help explain the steady deterioration of reported savings bank net worth shown in Figure 5. Rising open-market interest rates have depressed prospective earnings and, in turn, CVR net worth. Therefore, savings banks have not been able to compete for deposits without reducing their contribution to surplus accounts. Unless interest rates fall unexpectedly, the persistent drop in reported capital-asset ratios will continue for several more years, perhaps falling below 5 percent eventually.

It is difficult to estimate exactly what open-market interest rates would have been in the absence of regulation Q, and thus it is also difficult to measure exactly how much the ceilings have raised CVR net worth. At least one effect, however, that has not been accounted for in Figures 9 and 10 suggests these estimates overstate the benefits of the Q ceilings. As noted earlier, Taggart and Woglom found that ceiling rates on deposits induced savings banks to compete for funds using nonrate methods, such as remaining open for longer hours and opening more branches. According to this study the additional expenses associated with nonrate competition may have dissipated up to half of the benefits of deposit rate ceilings to savings banks.

Although interest rate ceilings have bolstered savings bank solvency by reducing interest expense during the past decade, rising yields and increasing competition from open-market securities will erode this support as interest expense rises or savings banks lose depositors seeking higher yields elsewhere.

[6] See also D. Pyle, "Losses on Savings Deposits from Interest Rate Regulation," *The Bell Journal of Economics and Management Science*, Vol. 5 (Autumn 1974), pp. 614-22; R. Taggart, Jr. and G. Woglom, "Savings Bank Reactions to Rate Ceilings and Rising Market Rates." A deposit equation, described in the Technical Appendix, was estimated from 1951 to 1969; after 1969, Connecticut savings banks were subject to deposit rate ceilings. The average spread between the equation's projected deposit yield and the actual yield has been 35 basis points during the 1970s. Now that savings banks are issuing more term accounts that, on average, are more expensive than passbooks, this estimated spread may understate the true gap between potential and actual deposit yields.

Interest rate ceilings, therefore, have maintained the solvency of most Connecticut savings banks for the past 10 years, but these ceilings constitute a temporary remedy only. When open market yields exceed the ceilings, saving banks competitors – principally investment funds and life insurance companies – are seizing the opportunity to offer attractive alternative investments to all savings bank depositors. With the growth of mutual funds and investment trusts as well as single- and multi-payment deferred annuities, savings banks not only lose potential deposits when interest rates are high, they may not regain their share of household savings when open-market yields decline.

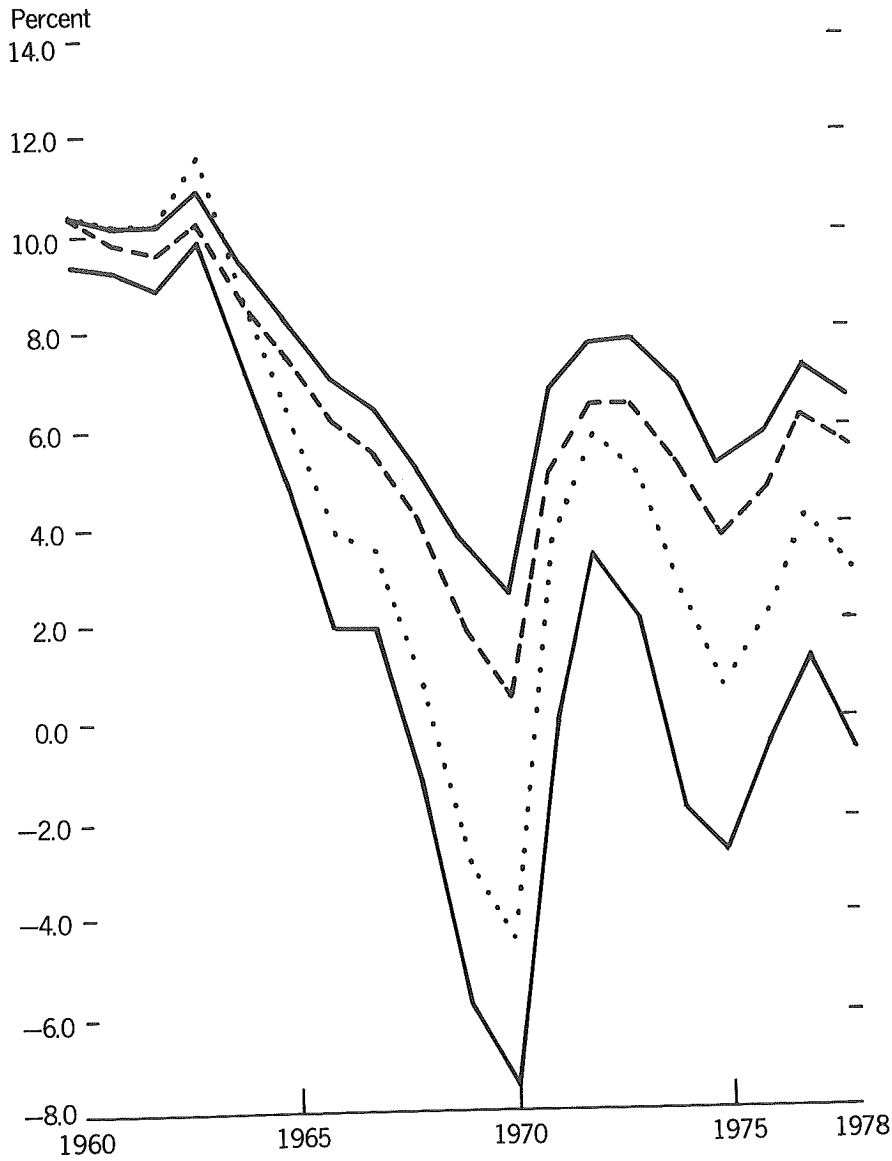
Volatility of CVR Net Worth

Perhaps the most striking feature of Figures 7 to 10 is the volatility of the CVR net worth of Connecticut savings banks. As explained earlier, these charted swings in the capital-asset ratio are due to varying mortgage interest rates that change the market value of bank assets, and, in turn, CVR net worth, because the bank's assets no longer provide competitive earnings. Of course, if the bank had secured long-term, fixed-yield liabilities, an unexpected rise in market yields need not reduce CVR net worth because the below-market yield on mortages would be matched by a low cost of funds – the low market value of mortgages would be matched by a low CVR value of liabilities thus CVR net worth would not decline.

Savings banks, therefore, can reduce the volatility of their CVR net worth if they match the effective maturity of their liabilities to that of their assets. This may entail either issuing more long-term certificates of deposits or holding shorter term assets including variable rate loans. By taking these steps, savings banks can reduce or eliminate the risk of unexpected changes in market yields altering expected earnings and CVR net worth.

The heavy solid line in Figure 11, taken from Figure 7, represents the aggregate CVR capital-asset ratio of Connecticut savings banks. The dotted line, however, simulates this ratio assuming that the average duration of savings bank liabilities was four years. The dashed line simulates the ratio assuming that the average savings bank had purchased mortgages of five years duration. Finally, the light solid line simulates the capital-asset ratio assuming that savings banks had issued liabilities with an average duration of four years and had purchased mortgages of five years average duration. It is evident that any of these alternative asset and liability management strategies would have done much to protect savings banks during the past 20 years of rising interest rates. While a close matching of mortgage and deposit maturities eliminates most of the volatility in net worth, even a modest effort to lengthen the duration of liabilities or shorten the duration of assets reduces the risk substantially. Of course, issuing longer term liabilities or holding shorter term assets may have reduced the bank's earnings margins somewhat, but, in retrospect, this insurance would have been inexpensive.

Figure 11 Effect of Selected Financial Strategies on the Net Worth to Asset Ratio



Source: See Technical Appendix

Section IV: Conclusion

Any attempt to estimate a financial institution's economic performance from conventional accounting reports, designed for other purposes, is subject to error. Our analysis is no exception. Nevertheless, the results depicted in Figures 5-11 are striking, and they suggest four general conclusions:

1. Regulation Q ceilings have provided only limited, but critical, aid to savings banks in Connecticut, and the benefits have decreased over time. Because savings banks have held long-term assets during a period of rising interest rates, their capital losses have been large compared to the benefits offered by Q ceilings. Increasingly, though, the competition from open-market investment alternatives has eroded the value of deposit rate ceilings.

2. With or without Q ceilings the prospects for many savings banks in Connecticut are not promising. CVR net worth, shown in Figures 9 and 10, describes the performance of Connecticut savings banks more discouragingly than reported net worth. The two measures, however, are not totally unrelated. If interest rates do not decline unexpectedly, the low value of CVR net worth during 1978 for most banks implies a continuing decline in reported net worth, shown in Figure 6.

3. Connecticut savings banks bear considerable risks by financing long-term assets at fixed yields with short-term deposits. Figure 11 shows, however, that these risks can be reduced substantially if savings banks, perhaps through regulatory reform, compete more for longer term liabilities while reducing the maturity of their asset portfolios.

4. Although rising interest rates have seriously eroded the expected earnings of Connecticut savings banks, not all thrift institutions have experienced similar losses. Newly chartered banks or savings and loan associations and thrift institutions in rapidly growing localities hold relatively more new, higher yielding mortgages than the average Connecticut bank. Without regulation Q ceilings, then, these relatively new institutions could safely offer depositors higher deposit yields than established banks. By more closely matching the maturities of their assets and the maturities of their deposits, however, established savings banks can compete with relatively younger institutions.

Technical Appendix

Figures 5 and 6

The ratio of net worth to assets equals the total of reported surplus accounts divided by reported total assets. All data are taken from the *Annual Report of the Bank Commission of the State of Connecticut*, 1960 to 1978. Figure 5 reports the aggregate ratio for all savings banks; Figure 6 describes the distribution of the ratios for the various banks.

Figures 7 and 8

The ratio of CVR net worth to assets equals the total of surplus accounts divided by the estimated market value of total assets. For these charts, surplus equals the market value of assets less reported liabilities (other than reported surplus).

The market value of all mortgages and loans is estimated as follows: For each bank and for all banks, the nominal annual loan rate (RN) equals the interest and fees received on loans divided by the reported value of these loans (MLPAR). The market loan rate (RM) is a constructed series. For the years 1960 to 1962, RM equals the three-year average of RN for all savings banks; for 1963 and later years, the annual change in RM equals the annual change in the average national conventional mortgage rate for newly issued mortgages on existing homes. Assuming the average duration of mortgage loans is 10 years, the market value of all mortgages and loans (MLCVR) equals

$$(1 - 10^* (RM - RN) / (1 + RN)) * MLPAR.$$

The market value of investments is estimated as follows: For each bank and for all banks, the nominal bond rate (RBN) equals the interest and dividends received on investments divided by the reported value of all bonds and equity (BPAR). The market bond rate (RBM) is a constructed series. For the years 1960 to 1962, RBM equals the three-year average of RBN for all savings banks; for 1963 and later years, the annual change in RBM equals the annual change in the three to five-year Treasury note rate. Assuming the average duration of investments is five years, the market value of all investments (BCVR) equals

$$(1 - 5 * (RBM - RBN) / (1 + RBN)) * BPAR.$$

The remaining assets are not revalued. Figure 7 reports the aggregate CVR net worth to asset ratio; Figure 8 describes the distribution of the ratios for the various banks.

Figures 9 and 10

Assuming that savings bank liabilities bear below-market yields, the reported value of these liabilities exceeds their market value. Consequently, the capital-to-asset ratios in Figures 7 and 8 are underestimated. The capital-asset ratios in Figures 9 and 10 equal

$$CA + (DEP/ACVR) * (.0035/RM)$$

from 1970 and later years. CA is the corresponding capital asset ratio from Figures 7 and 8; DEP is the reported value of deposit liabilities; ACVR is the market value of assets; and .0035 is the average difference between the unconstrained deposit yield and the constrained deposit yield. The unconstrained yield is estimated by the following equation, fitted from 1951 through 1969:

$$\begin{aligned} RDEP = &-.584 + .166 * RDEP(-1) + .009 * R3M \\ &\quad (.238)\ (.228) \qquad\qquad (.029) \\ &+ .786 * RRA, \\ &\quad (.233) \end{aligned}$$

standard error of estimate = .067

serial correlation coefficient = −.109,

where RDEP is the deposit rate offered by Connecticut savings banks, R3M is the three-month Treasury bill rate, and BRA is the rate of return on assets of Connecticut savings banks. See R. Taggart, Jr., and G. Woglom, "Savings Bank Reactions to Rate Ceilings and Rising Market Rates," *New England Economic Review*, September/October 1978, p. 30, equation (A.4).

Figure 11

The solid line is taken from Figure 7. For the dashed line, MLCVR (from Figure 7) is re-estimated assuming the average duration of loans is five years:

$$MLCVR2 = (1 - 5 * (RM - RN)/(1 + RN)) * MLPAR.$$

For the dotted line, MLCVR is used instead of MLCVR2, but the market value of deposits is re-estimated as follows:

$$DEPCVR = (1 - 4 * (RDM - RDN)/(1 + RDN) * DEP.$$

RDM is the predicted deposit rate from the Taggart-Woglom equation; RDN is the nominal deposit rate paid by savings banks. Assuming all deposits have a four-year duration maturity,

$$RDN_t = \sum_{i=0}^{4} RDM_{t-1} * (1+g)^{-i} / \sum_{i=0}^{4} (1+g)^{-i}$$

RDN is a weighted average of past offering rates, RDM; the weights depend on the growth rate of deposits, g.

The light solid line uses both MLCVR2 and DEPCVR to simulate the capital-asset ratio.

Discussion

Donald P. Tucker*

As many of you know, I spent several years at the Board of Governors in Washington, but I am now on Capitol Hill doing Congressional oversight on banking issues, including oversight on Federal Reserve System activities. It is an opportunity that I really enjoy because I no longer have to come up with the answers: I get paid for asking questions, and that is a relief.

When Bob Eisenmenger asked me to come up and comment on this paper I couldn't help wondering whether he was hoping that I would drop some hints about where the Congressional oversight spotlight was going to fall next on the Federal Reserve. I wish I could take advantage of that opportunity since the Fed, like any good bureaucracy, looks for ways to defuse an oversight hearing in advance if it can. I would be delighted if some hint from me could scare the Federal Reserve into getting us out of the Regulation Q morass quickly, so we could get to more juicy topics such as how the Boston Fed gets to spend taxpayers' money year after year at this resort. I will do my best with Kopcke's and Woglom's paper as my starting point.

I wish I could say that the paper was a dynamite paper. It isn't really dynamite, but it is a thorough piece of research on what is an extraordinarily difficult problem: trying to quantify the financial soundness and viability of thrift institutions. To give you a capsule of where I am going to come out, everybody knows that the current accounting methodologies give a badly distorted picture, not only for financial institutions but for nonfinancial corporations as well. Getting more meaningful and informative accounting statements of both income and financial condition is really crucial for a number of purposes including, of course, the regulatory purposes of the financial agencies in determining when and by how much to adjust their Regulation Q ceilings. Thus this paper addresses an area which is very central to policy concerns, and I fully endorse the efforts that have been put into it.

The current value reporting (CVR) framework that this paper presents is, in principle and conceptually speaking, the right way to look at financial institutions, especially thrift institutions. However, as is true of any accounting approach, CVR accounting involves a number of thorny conceptual issues and inherently arbitrary conventions that must be worked out, and doing this right so that everyone can accept the results is difficult. I don't think that this paper,

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as it now stands, has resolved all these issues and come up with numbers that we can truly believe.

My reservations on the results presented in the paper are of a somewhat technical nature, so I will try to summarize them fairly quickly and move on to other more general comments on accounting and its role in the policy arena.

I have three reservations about the charts showing the current value of Connecticut savings banks' surplus accounts, two of which have to do with the valuation of the mortgage portfolios. The appendix has a formula stating the market value of a portfolio of mortgages is the par value of all the mortgages, minus two correction terms times the par value. The two correction terms are, first, a rate differential term based on the differentials between the current market rate and the original contract rates and, second, a duration term showing the average duration of mortgages in the portfolio.

My first reservation is with the 10-year duration used in this formula. I have no qualms about a 10-year duration period for *new* mortgages, but I need to be convinced that an entire portfolio including both new and old mortgages has a duration of 10 years. Maybe it's true in Connecticut – I do not have contrary evidence – but it is something about which I would want to see more evidence in the paper before I could believe it. If the duration of a whole portfolio in Connecticut is really only eight years, then that would alter the results fairly significantly.

My second and most serious reservation is that I do not believe it is correct methodologically to calculate the correction for the whole portfolio in a single formula treating the whole portfolio as a unit. I want to give you a quick numerical example to illustrate the problem that I see with how they have done it. I have not recalculated any actual portfolios, but if my example holds up, the implication is that the net worth position of the savings banks is probably not nearly as bad as these charts look.

Let's assume an institution that has a $100,000 portfolio made up of two sets of mortgages. The first set is $60,000 of mortgages that have just been issued at an 11 percent current market rate, with a 12-year average duration. Then suppose that they issued $60,000 of mortgages several years ago but that now, through pay-downs and early repayments, only $40,000 is left. Those earlier mortgages were issued at 7 percent, and their current average duration is seven years. Thus the average duration of the portfolio is 10 years, and the average yield is 9.4 percent.

If you apply the single formula correction to the combination, noticing that the current market rate is 11 percent but the average nominal rate on the portfolio is 9.4 percent, then the correct market value using their formula is a little over $85,000. If, on the other hand, you do the correction separately to the two pieces, you will get a total of $89.5 thousand. There is no correction on the $60,000 because its yield is the same as the current market rate. Then applying the correction to the $40,000 portion and adding the corrected value of $40,000 to the uncorrected $60,000 gives a substantially higher market value than is obtained from the method employed by Kopcke and Woglom.

The reason, in conceptual terms, is that the correction is based not just on a rate differential only but on a rate differential times a duration. Those mortgages

with the large rate differentials are generally those with a shorter duration and therefore smaller weight in the adjusted value than the mortgages with the small rate differentials. Thus treating the mortgages all together as a single composite results in an overstatement of the market value loss. Correcting this methodological problem can cause a fairly major alteration to the numerical results, and so it is possible that Kopcke's and Woglom's numbers significantly overstate the seriousness of the capital account deterioration in the savings banks.

My third reservation is with revaluations on the liability side, the deposit side. I do not know how you are supposed to value liabilities when they are not things you can trade in the market place. You are not in fact simulating an actual market value for something for which there is a market. This is one of the areas where inherently one has to be engaged in putting together arbitrary accounting conventions, and there is ample precedent for that. I am not saying that making an arbitrary convention is the wrong thing to do, but I am not convinced that they have done it the right way.

Ideally what you want, as Jeff himself said, is something which represents the present discounted value of anticipated future cash inflows and outflows. That implies that, if you are evaluating the liability side separately, you want to set up conventions that take account of how the expenses for nonrate competition are different under rate ceilings than they are without rate ceilings. But the numbers in this paper don't do that – in fact, the authors acknowledge that they don't do that. This omission means that the liability valuations in this paper tend to be too optimistic.

Let me turn to some more general comments on accounting and how we use it. Because of the arbitrary nature of accounting, the question of having confidence in the statements is very central, very crucial. If you think of the people who sit on the Interagency Coordinating Committee and must decide what to do about Regulation Q, they have to feel in their guts that they really believe numbers like these before they can act on them. They can't make policies on the basis of numbers derived from novel accounting theories of current value correction until that kind of confidence is created.

At present people have lost confidence in the conventional accounting numbers but they have not yet arrived at a point where they can feel confidence in the more modern or radical or unconventional types of accounting. So I believe that we definitely need to pay a lot more attention to polishing up and solidifying the technique for correct current value reporting, and I would be delighted to see the Federal Reserve put a high priority on that project. I think it is an excellent project.

But let me point out that only one of the several purposes of accounting is to make policy decisions on Regulation Q. Another related arena in which current value reporting potentially can be very valuable is for the investment market place to value the equity shares of stockholder-owned institutions. Of course there are no such things as stockholder-owned savings banks, but there are stockholder-owned S&Ls which are similar, and if current value accounting can be refined to the point where people can feel confidence in the numbers, they should not be kept locked up just for the regulators. They should be out where the public can see them, and then the regulators in turn should be very

interested in how the market place values the equities on the basis of that information.

The point is that a market evaluation given by the investment community when it has good information is really an independent aggregate judgment on the going-concern value of those institutions, as opposed to their liquidation value, and the going-concern value is what the regulators are most concerned about in setting the Regulation Q ceilings. I do not happen to believe that the regulators are inherently better than the market place in making that judgment about going-concern value. I don't say they are worse either; they simply ought to know what the market valuation is and take it into account.

Current value accounting reporting has not much value, I think, as a basis for deriving income statements. Its focus is on financial and balance sheet conditions. Current value income statements are basically dominated by unrealized capital gains which I think are a poor measure of management success and a poor basis for income taxation. Here I think general price level accounting has a unique role as the basis for income statements to reflect the impact of inflation. That, however, is somewhat more remote from the particular concerns of the financial regulatory agencies.

Now, getting back finally to the policy arena and the oversight interest of the Congress, as many of you know my subcommittee and Senator Proxmire's committee in the Senate (the Senate Banking Committee) and some other committees as well have held hearings within the past few months on the Regulation Q ceilings and especially on the plight of the small savers. From these hearings I developed a fairly strong perception of what homework the various regulatory agencies had done and what homework they had not done in deciding what to do about Regulation Q ceilings. Speaking personally, I am convinced that the agencies, in their background research work, simply never worked through the technical analysis of the consequences of a program of gradual future changes in Regulation Q. In preparing for the hearings they seem to have analyzed only how the *current* income of financial institutions would be affected by a once-and-for-all change in the ceilings. They have no methodology for working through a program of future changes that would enable them to say, for example, that because of what current value reporting could tell, we know we might be able to tolerate a program of such and such a rate of increase in the ceilings in the future. I will also say on the side that I do not believe that even in their homework on the consequences of a once-and-for-all immediate change in the ceilings, they really looked hard and thoughtfully at how the expenses for nonrate competition would be altered, i.e., *reduced* by a lifting of the ceilings.

So I think there is important uncompleted homework that needs to be done to really get the best handle on Regulation Q ceilings, and this homework is very centrally connected to the work that Jeff and Dick have done. What I am saying is that although the paper isn't dynamite now, it is just possible that the paper may be dynamite when it is done correctly. It just might show that the capital problems of the savings industry really aren't as bad as we've thought.

Chart 7, which shows the average adjusted capital of the savings banks using the asset corrections, basically confirms the common expectations. It shows what

people have been telling themselves for a long time about what is happening to the market value or current liquidation value of those institutions. But if the numbers are done right, the results really might *violate* those expectations. If that were to happen, the bottom just might fall out of the support for the Regulation Q ceilings.

Financial Institution Regulations, Redlining and Mortgage Markets

James R. Barth, Joseph J. Cordes and Anthony M. J. Yezer*

Part I: Introduction

Government regulations of market transactions have increased in recent years. The objectives of these new regulations are at least as noteworthy as their proliferation. Traditional forms of government regulation, such as antitrust and utility regulation, have sought either to reduce market power or to prevent its abuse. By comparison, many recently enacted regulations attempt to deal with various perceived failures of the market to achieve certain social goals.[1]

Government regulation of financial institutions is no exception. Prior to the 1970s, these institutions were subject to regulations governing entry into markets and mergers as well as numerous restrictions on interest rates that could be paid to depositors or charged to borrowers. Recent major new regulations include: (1) the Equal Credit Opportunity Act; (2) the Fair Housing Act; (3) the Home Mortgage Disclosure Act; and (4) the Community Reinvestment Act. All of these new regulations are administered by organizations already established to enforce earlier statutes. But regulatory objectives of recent legislation differ substantially from previous ones.

This new generation of legislation governing financial institutions attempts to address a perceived failure of private markets to provide "equal" access to credit. The Equal Credit Opportunity Act attempts to provide individuals with equal access to both consumer and mortgage credit. The Fair Housing, Home Mortgage Disclosure, and Community Reinvestment Acts are intended to improve the availability of mortgage credit to certain individual borrowers, and/or to certain neighborhoods.

This paper focuses on those regulations enacted to deal specifically with the perceived social problem of "redlining." These regulations impose and/or suggest limits on criteria that may be used in granting mortgages and hence may limit

[1] For a recent discussion of the evolution of regulations see Joskow and Knoll (1978).

*James R. Barth is an Associate Professor, Joseph J. Cordes an Assistant Professor and Anthony M. Yezer an Associate Professor, all in the Department of Economics at George Washington University. This paper is part of a larger study of the impact of government regulation on personal loan and mortgage markets funded by the National Science Foundation (contract DAR78-09873). The authors are grateful for excellent research assistance provided by Steve Bender, Joan Duncan, and Karen Hamrick. The authors also acknowledge helpful comments provided by A. Thomas King, C. Duncan MacRae, Robert van Order, and P.A.V.B. Swamy.

the ability of firms to make economically efficient lending decisions. Any loss in economic efficiency would be a cost of the regulation that must be weighed against any benefits it generated. In the case of redlining regulation, if property location is important in determining default risk on home mortgages, limitations on use of location in the lending decision may impair efficient mortgage market operation. Empirical tests of the effect of location on mortgage default risk are developed here to determine if significant costs are associated with failure to consider property location. We begin our analysis with three sections discussing the relationship between legal and economic definitions of redlining. Readers only interested in economic analysis may skip much of this material but we feel that it is important to understand both legal and economic approaches to redlining. Part IV examines some empirical studies of redlining and Part V develops our own empirical model of the determinants of default probabilities. Some implications of this study for measuring the costs of redlining regulation are drawn in the concluding section.

Part II: Definitions of Redlining

Concern about redlining is virtually synonymous with concern about the behavior of lenders in mortgage markets. Indeed, redlining may be defined as lender behavior that, without justification, denies or limits credit to specific neighborhoods.[2]

Although this broad definition is generally agreed upon, considerable controversy exists about which neighborhood characteristics lenders are justified in using to limit credit. Two definitions of redlining may be distinguished. Lender behavior towards neighborhoods which is designated unjustified by statute constitutes the *legal definition* of redlining. Behavior which is inconsistent with certain forms of economic rationality represents an *economic definition* of redlining.

Both the legal and economic definitions of redlining emphasize similar phenomena in mortgage markets. However, legal definitions of redlining generally designate fewer market factors as justifiable, either implicitly or explicitly, than do economic definitions of redlining. Consequently, more forms of lender behavior will be classified as redlining under the legal than under the economic definition.

A. *Legal Definitions of Redlining*

Access to credit may be denied or restricted in several ways. First, individuals seeking credit may be discouraged from applying. Second, individuals may be encouraged to withdraw an application for credit. Third, individuals who apply for a loan may be rejected. Fourth, individuals may be granted credit, but on relatively onerous terms. Such terms would include higher interest rates, higher required downpayments, higher closing costs, and shorter loan maturities.

[2] See, for example, Dennis (1979), Guttentag and Wachter (1978), King (1979), and Van Order (1979).

The examination procedures established by federal regulatory agencies in response to both Fair Housing and Community Reinvestment Acts emphasize the detection of such occurrences. For example, any of the following practices would be subject to scrutiny under the Fair Housing Act:

(1) rejection of mortgage applications

(2) imposition of onerous interest rates, terms, conditions, or requirements for borrowers;

(3) imposition of onerous penalties on borrowers in the event of delinquency or default;

(4) prescreening of potential borrowers with the intent of discouraging some from applying for loans.

Any of these practices would also be critically evaluated under the Community Reinvestment Act.[3] In addition, considerable attention is given to the placement of loans as compared to the source of deposits. This reflects the concern of anti-redlining groups about "disinvestment" in urban neighborhoods. "Disinvestment" is presumed to occur when local lenders "withdraw" funds from particular neighborhoods through deposits and "export" these funds through loans made elsewhere. This particular type of activity is viewed by some as a denial or restriction of credit to neighborhoods as a whole.

There are, of course, sound economic reasons for denying or limiting credit to certain borrowers. The redlining controversy arises largely from divergent views about when lenders are justified in using neighborhood as a criterion for denial or limitation of credit.

The Fair Housing Act permits lenders to take some neighborhood characteristics into account, but not others. Characteristics that are permissible include:

(1) the condition or design of the proposed security property, or of nearby properties which clearly affect the value of that property;

(2) the availability of neighborhood amenities or city services;

(3) the need of the bank to hold a balanced real estate portfolio, with a reasonable distribution of loans in various neighborhoods, types of property, and loan amounts.

However, lenders are enjoined from:

(1) denying or restricting mortgage credit in certain neighborhoods in the lender's service area because of race, color, religion, or national origin of the residents;

(2) relying on appraisals that assign a lower value to a neighborhood because of a mix of races and national origins;

(3) equating a racially mixed neighborhood with a deteriorating neighborhood;

[3] See Federal Reserve press release of November 22, 1978.

(4) incorporating the idea that deterioration of a neighborhood is inevitable;

(5) equating age of the property with the value of the property;

(6) prescreening of loan applicants.

Lenders deemed in violation of the Fair Housing Act are assumed, *a priori*, to violate performance standards of the Community Reinvestment Act. Consequently, the forms of lender behavior described above are also proscribed under the Community Reinvestment Act. However, the range of lender behavior subject to scrutiny is wider under the Community Reinvestment Act than the Fair Housing Act.

In particular, emphasis is given in the Community Reinvestment Act to possible "errors of omission" that discourage potential borrowers from applying for loans. This is in contrast to the Fair Housing Act which singles out errors of commission in the form of prescreening. Prescreening is also viewed with suspicion under the Community Reinvestment Act. However, lenders are also judged on whether they make affirmative efforts to encourage applications for credit. Specific assessment factors are:

(1) activities conducted by the institution to ascertain the credit needs of its community, including the extent of the institution's efforts to communicate with members of its community regarding the credit services being provided by the institution;

(2) the extent of the institution's marketing and special credit-related programs to make members of the community aware of the credit services offered by the institution;

(3) the institution's record of opening and closing offices and providing services at offices.

By implication lenders that devote more resources to identification of community needs in some neighborhoods than others, or that open (close) offices in some neighborhoods but not in others, could violate the standards of the Community Reinvestment Act.

The various definitions of redlining identified in both the Fair Housing and Community Reinvestment Acts are summarized in Table 1. In principle, a variety of market outcomes may be classified as "redlining" according to the legal definitions of the term.

B. *Economic Definitions of Redlining*

Differential treatment of neighborhoods by mortgage lenders could be an economic problem for two reasons. It would clearly be a problem if such differential treatment *did not* correspond to differences in costs and risks of making loans. However, even if differential treatment did reflect costs and risks, it might still be a problem if the more stringent mortgage terms were faced by those least able to pay. In the former case "redlining" would reflect imperfections in the mortgage market. That is, redlining would be a form of economic *inefficiency*. In the latter instance redlining would be the result of interactions between a

TABLE 1

Definitions of Redlining under Fair Housing Act and Community Reinvestment Act

Manner in Which Credit is Denied or Limited	Fair Housing Act	Community Reinvestment Act
Applicant discouraged from applying for credit to purchase dwelling in a particular neighborhood.	Prescreening of applicants.	(1) Prescreening of applicants; (2) failure to ascertain credit needs of the community; (3) failure to communicate with community members regarding credit services offered; (4) limiting marketing efforts and special credit-related programs; (5) closing offices, particularly in low and moderate income neighborhoods.
Applicant rejected for credit to purchase dwelling in a particular neighborhood.	Higher standards applied for acceptance of a loan application based on: (1) racial, religious, and/or ethnic composition of the neighborhood; (2) appraisals based on racial, religious, or ethnic mix or neighborhood; (3) age of property; (4) prejudicial belief that racially mixed neighborhoods must inevitably deteriorate.	Arbitrary exclusion, based on criteria such as those proscribed under the Fair Housing Act, of certain neighborhoods from the lending area of institutions.
Credit granted but on relatively onerous terms or in smaller amounts.	More onerous terms required for loans made in certain neighborhoods based on four factors listed immediately above.	Same as under Fair Housing Act; also limiting amount of credit granted in some neighborhoods when such limitations are based on unjustified neighborhood characteristics described above.
Disinvestment in certain neighborhoods caused by net outflows of loanable funds.	Not applicable.	Refusal of institutions to make loans in communities from which their deposits originate when such refusals are based on unjustified neighborhood characteristics.

well-functioning mortgage market and an unequal income distribution. Redlining would reflect distributional *inequity*.

Restriction of credit to various neighborhoods may, therefore, be economically undesirable for two distinct reasons. However, it is only the first form of "redlining" that is directly attributable to imperfections in the mortgage market. By contrast, the second form of "redlining" is a problem of income distribution rather than market performance. With one notable exception, Guttentag and Wachter (1978), the economics literature has defined redlining as a problem of market performance rather than income distributional equity. Consequently, economic definitions of redlining typically include the first, but not the second form of "redlining". This convention will be followed here. That is, the economic definition of redlining will focus on differential treatment of neighborhoods not based on differences in costs and risks of making loans.

When mortgage lenders engage in this type of redlining, they fail to make loans that would be profitable. As a result, some economists have tended to view redlining as irrational behavior. We do not subscribe to this view. Redlining may imply nonprofit maximizing behavior by lenders. However, this may be rational if lenders strive to maximize a broadly defined utility function that includes profit as just one of several arguments. This concept of redlining is analogous to models of discrimination in product and factor markets. For example, models of labor market discrimination assume that employers maximize a utility function consisting of profits as well as the ethnic and racial characteristics of their employees. Of course, this type of behavior, though rational, may still be deemed socially undesirable.

Consider first how redlining would be defined if there were no possibility of default or delinquency on the part of borrowers. Maximization of lender's utility would require that mortgage funds be allocated among properties so as to equalize utility per dollar lent. For any property j, the utility per mortgage loan would be determined by equation (1).

$$(1)\quad U_j = U[R_j - C_j, N_j] = U[R(i_j, T_j, L_j, F_j) - C(\lambda, L_j, X_j, N_j), N_j],$$

where

U_j = utility per mortgage loan
R_j = revenue per mortgage loan
C_j = cost per mortgage loan
i_j = interest rate charged on mortgage for property j
T_j = term of mortgage
L_j = amount of mortgage
F_j = mortgage fees and charges
λ = opportunity cost of lender's funds (assumed equal for all properties)
X_j = a vector of borrower and/or property characteristics which affect the per dollar costs of servicing and processing the loan
N_j = a vector of characteristics of the neighborhood in which property j is located.

In equation (1) neighborhood characteristics may affect lender utility in two distinct ways. First, property location would affect utility by affecting

profits whenever $\partial C/\partial N_j \neq 0$.[4] For example, the costs of processing and servicing loans might be lower in some neighborhoods than in others.[5] Lenders would, *ceteris paribus*, earn relatively high profits in neighborhoods requiring relatively low processing and service costs. Utility maximization by lenders would favor such neighborhoods. However, in such cases, *utility maximization* would be equivalent to *profit maximization*. No redlining would be present in the economic sense of the term.

Second, property location could affect lender's utility directly, whenever $\partial U/\partial N_j \neq 0$. Presumably such effects would be due to lenders' subjective attitudes toward lending in different neighborhoods. Utility maximization by lenders would cause them to "value" loans made on some properties more highly than loans on others solely because of neighborhood location. In these cases, utility maximization would not be equivalent to profit maximization and redlining of some form would be present.

The analysis is complicated somewhat by introducing uncertainty about the repayment of loans. If such uncertainty were present, the revenue term in equation (1) would be a random variable whose value would depend on the terms of the loan (particularly owner's equity), property characteristics, borrower attributes, and location of the property. If lenders were assumed to be *risk-neutral*, equation (1) would be rewritten as

$$(2)\quad U_j = U[E(R_j - C_j), N_j] = U\{E[R(i_j, T_j, L_j, F_j, E_j, X_j, N_j)] - C_j(\lambda, L_j, X_j, N_j), N_j\},$$

where

E_j = owner's equity in property j
E = expectation operator
and all other variables are defined as in equation (1).

[4] It should be noted that lenders who have market power can charge prices above marginal cost, or offer loans on terms which produce relatively high expected returns. If lenders have different degrees of market power across neighborhoods, or if the elasticity of demand varies by neighborhood, expected returns may also vary by neighborhood. Guttentag and Wachter (1978) have observed, however, that the market power hypothesis is unlikely to be appropriate for mortgage lenders, given the large number of lenders.

[5] Note also that with nonconstant returns to scale, mortgage terms depend on the number of mortgages written in a neighborhood. If mortgage demand is larger in area A, then some lenders would specialize in lending in this area. If not, then each lender makes the same ratio of mortgages in area A and B and, given returns to scale, there will either be unexploited returns to scale in lending to area B (lenders on the falling portion of their average cost curve) or lenders in area A will be operating on the rising portion of their average cost curve. This makes it difficult to identify unwarranted *lender* price discrimination because firms specializing in area A will have more stringent terms for mortgages in area B than in area A, while their terms for area B will be stricter than those of other lenders who are lending in area B. However, observed differences in "market" mortgage terms across neighborhoods will still constitute price discrimination. If the "technology" for "producing" loans differed systematically by neighborhood, each neighborhood would, in effect be a distinct market, and loans in different neighborhoods would be heterogeneous products. There would, therefore, be no reason for even "market" mortgage terms to be the same across neighborhoods. Detecting price discrimination would require that mortgage terms be compared only after adjustments were made for the legitimate impact of neighborhood characteristics on the "production" of loans.

In equation (2) neighborhood characteristics also affect lender utility through their impact on expected revenue. It is quite plausible to expect default probabilities and, hence, expected default losses to vary systematically by neighborhood. Other things equal, expected profits would be relatively high in neighborhoods with relatively low expected default losses. Lender behavior that favored such neighborhoods through more lenient credit terms would not be redlining because maximization of expected utility would be tantamount to maximization of expected profits.[6]

In the case described by equation (2), redlining would occur in two ways. Redlining would occur if property location affected lender's utility directly. Redlining could also occur if lenders made use of "systematically biased" information in assessing the impact of neighborhood on expected revenue. For example, appraisers might systematically undervalue property in some locations because of class and/or racial prejudice.[7] If lenders relied on such appraisals, they would form a biased estimate of $\partial R/\partial N_j$. Differential treatment of borrowers on the basis of neighborhood would result in the maximization of a biased measure of profits. Unless lenders willingly cooperate, the profit incentive should eliminate any reliance upon such biased information. However, it may take time for this type of bias to be eliminated.

Thus, under the assumptions of certainty or risk-neutrality, redlining, in the economic sense, occurs whenever utility maximization of lenders is not consistent with maximization of an unbiased measure of profits. However, if lenders are assumed to be risk averse, the link between redlining and nonprofit maximizing behavior is broken. This is illustrated in equation (3), in which lender-utility depends upon expected profits, risk, and property location.

$$(3)\quad U_j = U[E(R_j - C_j), \sigma_j, N_j],$$

where σ_j is the "risk" associated with a loan on property j.

Risk-averse lenders would forego the maximization of expected profits in order to reduce "risk." Other things equal, lenders would favor "low risk" relative to "high risk" neighborhoods. Lender behavior of this sort would maximize lenders' expected utility, but not their expected profits. However, if aversion to risk were viewed as a "permissible" preference, differential treatment of loans

[6] A complete theoretical development of the supply of and demand for mortgage loans is presented in the Appendix.

[7] Lenders may also have biased information on the relationship between neighborhood characteristics and mortgage default losses. Such biased perceptions are likely because the data requirements needed to validate a model of default behavior are quite extensive compared to the limited portfolio of any particular lender. Biased information is potentially a cause of both lender price discrimination and spatial mortgage market price discrimination. However, because of the difficulty in measuring default risk and the substantial lags between endorsement of a mortgage portfolio and full observation of the pattern of default on that portfolio, this process could easily require several years.

based on location would not be considered as redlining, provided that differential treatment corresponded to differences in risk.[8]

There is another situation in which the link between redlining and nonprofit maximizing behavior might be broken. Government regulation of usury rates and maximum risk exposure levels serve as constraints when lenders maximize expected utility. When these constraints are binding, lenders achieve lower expected utility and lower profits than in the unconstrained case. For example, low usury rate ceilings may preclude lenders from making potentially profitable high risk loans. Any differential treatment of borrowers on the basis of neighborhood, directly due to these regulations, would not be defined as redlining.

C. *Role of Prejudice and Discrimination*

In all the cases considered, it is evident that economic notions of redlining are ultimately based on the concept of prejudice. It is therefore appropriate to define this term more precisely, as well as the related, yet distinct concept of discrimination.

In the neoclassical model of discrimination, *prejudice* is an inflexible attitude of prejudgment on the part of economic agents. In spatial mortgage markets, prejudice would exist whenever attitudes were formed about the desirability of making a mortgage in a particular neighborhood that were independent of the profitability and risk on the mortgage. More formally, prejudice would exist whenever neighborhood characteristics appeared in lenders' utility functions for reasons other than those related to revenue, cost, and/or risk.

Discrimination occurs whenever prejudicial attitudes lead to differential treatment of economic agents. However, it is important to distinguish between firm discrimination and market discrimination.

Firm or lender discrimination exists when individual lenders treat borrowers differently because of prejudicial attitudes about neighborhood location. Government regulations of lenders are primarily aimed at detecting *firm* discrimination. Spatial mortgage market discrimination would occur if such differential treatment were present in the market as a whole. In general, discrimination at the firm level is a necessary but not a sufficient condition for market discrimination. That is, even if *some* firms discriminate, the class discriminated against may be able to participate in a separate nondiscriminatory market. Such an outcome

[8] Risk-aversion raises several difficulties with respect to economic definitions of redlining. If lenders are risk-averse, the detection of redlining requires that differential treatment of neighborhoods due to risk-aversion be distinguished from differential treatment due to prejudice. Since both risk-aversion and prejudice imply that lenders would not maximize expected profits, such distinctions may be difficult to make, unless one is able to measure "risk" across neighborhoods. Unfortunately, the relevant measure of risk would not be the variance of expected profits. Rather, the relevant notion of risk would be the marginal contribution of a loan made on property j to the lender's portfolio risk. This, in turn, depends on the covariance between the return to a loan on property j and that of the lender's portfolio. Furthermore, one would need information about a lender's preference toward risk. Differences in risk preference may also explain why some lenders are willing to make loans in some areas, while others refuse to do so.

would be termed market segregation. Thus, lender discrimination against mortgages made in certain neighborhoods need not affect the terms of mortgages written in those areas if there is a segregated market in which other nondiscriminatory lenders participate.

D. *Legal and Economic Concepts of Neighborhood*

Like the concepts of prejudice and discrimination, the concept of neighborhood plays an important role in legislation and in economic studies of redlining. Indeed, determining whether redlining has occurred depends crucially on how neighborhood boundaries are drawn.

When defined explicitly in government regulations, neighborhood boundaries are based either on official units, such as census tracts and zip codes, or on the judgment of the regulatory examiner. For example, the Home Mortgage Disclosure Act requires lenders to provide information on loans granted or purchased by census tract, or by zip code if census tract information is not available. Under the Community Reinvestment Act, examiners are advised to identify low- and moderate-income neighborhoods by identifying census tracts in SMSAs where median family income is less than 80 percent of median family income for the entire SMSA. When such data are not available, examiners are advised to rely on "personal knowledge of the area, physical inspection as necessary, discussion with institutional personnel, or a combination of these."[9]

Though the concept of neighborhood appears frequently in the urban economics literature, there is no precise economic definition of the term. The closest approximation to such a definition is the identification of neighborhood with homogeneity of characteristics such as housing or socioeconomic status. Empirical studies, both of housing market discrimination and redlining, have used operational concepts of redlining similar to those appearing in government regulations – namely census tracts, zip codes, and intuitive judgment. In addition, some studies have relied on larger geographical units such as central city-suburb, and county.[10]

None of the operational delineations of neighborhood appearing in regulations or in empirical studies is sufficiently homogenous to be a true neighborhood. Census tracts are probably the best approximation because their boundaries are drawn to reflect uniformity of characteristics such as housing and income. However, since roughly 4000 persons reside in each census tract, considerable heterogeneity is likely within each tract. Like census tracts, zip codes are relatively small geographical areas. However, zip code boundaries are based on mail volume and natural boundaries. Similarity of housing and other characteristics is not explicitly used as a factor in determining zip codes. Larger geographical units such as counties, suburbs, central cities, and so forth, bear still less relation to the concept of neighborhood. Consequently, such geographical units are less satisfactory for purposes of defining and detecting redlining.

[9] See Federal Reserve press release of November 22, 1978, page 12.

[10] These empirical studies are discussed in more detail in Section IV.

E. *Comparison of Legal and Economic Definitions of Redlining*

It is clear from the above discussion that important similarities and differences exist between the legal and economic definitions of redlining. In this section we compare and contrast some main features of each conception of redlining.

In contrast to economic definitions, legal views are ambiguous as to whether redlining is a problem of market performance or distributional inequity. This is particularly true in the case of the Community Reinvestment Act where lenders are explicitly and repeatedly admonished to pay special attention to the mortgage credit needs of *low* and *moderate* income neighborhoods. Indeed, portions of the Act are easily interpreted as proscribing lender actions that reduce the flow of credit to "low and moderate income" communities, even though such actions might be based on legitimate cost and risk considerations.

Economic definitions of redlining based on the concept of *price discrimination* differ from legal views of discrimination in several respects. Of the four types of actions viewed with suspicion under the law, two correspond quite naturally to the notion of price discrimination. These are the rejection of applicants and the imposition of "onerous" terms as a condition for mortgage acceptance. As noted above, discouraging individuals from applying for credit would not necessarily be reflected in *price* discrimination among those actually applying for loans. Such prescreening could constitute redlining under the legal definition even though no price discrimination was observed.

The legal notion that redlining occurs when "local" lenders "export" deposit funds may be interpreted in several ways. Net outflows of deposits may be viewed by some as proxies for price-discrimination and/or prescreening. If so, disinvestment definitions of redlining would be equivalent to price-discrimination and prescreening definitions. However, price-discrimination neither implies nor is implied by net outflows of deposits. This is also true for prescreening. Consequently, if "disinvestment" is to be a meaningful concept, it should describe a phenomenon not included under the notions of either price discrimination or prescreening. It is, however, difficult to discern such a phenomenon apart from the vague notion that neighborhoods, as well as individuals, have some form of entitlement to mortgage credit. This view has some support among anti-redlining activists, but not among economists, who regard the individual as the correct "unit of analysis."

Perhaps the most important distinction to be made between the legal and economic definitions of redlining is that the economic definition provides a standard for comparison of actual lender behavior. Only in this way is it possible to distinguish between redlining and nonredlining behavior.

Part III: Other Possible Causes of Spatial Mortgage Market Price Discrimination

Several potential causes of "redlining" have been cited in the literature which do not cause the type of price discrimination discussed in the previous section. In many cases these other causes of "redlining" reflect the failure of urban *housing* markets rather than a failure of spatial *mortgage* markets.

Because rehabilitation and maintenance of existing housing generate spillover benefits for other units in the neighborhood, landlords making the investment may not capture the full benefits of their efforts. Rothenberg (1967) and others have noted that this situation may lead to underinvestment in some neighborhoods. Such market failure in housing markets should not be confused with price discrimination in spatial urban mortgage markets. Lower rates of investment in particular neighborhoods may contribute to differences in mortgage lending terms by affecting the expected default probability and expected return of some mortgages. However, if lenders react to this situation by making mortgage loans on the same terms (adjusted for differences in expected return), there is no redlining given the economic definition adopted here. It might be argued that the prisoner's dilemma facing landlords also affects lenders. That is, if some lenders believe that other lenders redline a neighborhood, they may also restrict their lending in that area. This argument ignores the possibility that a lender may internalize any externalities created by the failure of other firms to make mortgages in an area by making those mortgages itself. The property rights arguments of the housing market failure model, in which landlords cannot capture spillover benefits of their investments, do not apply to mortgage markets.

Lastly, "statistical discrimination" has been mentioned as a cause of redlining. In this case, lenders have unbiased estimates of the expected return and risk on mortgages across neighborhoods but it is too costly to collect information on the characteristics of individual mortgage applicants. These unbiased estimates may not be minimum variance estimates because the screening devices used by lenders to identify default probability are not elaborate.[11] As a result, many applicants will be offered mortgage terms which differ from those which would be offered if lenders used a minimum variance screening process. However, this type of "statistical discrimination" would not necessarily cause redlining because mortgage terms would not necessarily differ across neighborhoods.

Many possible causes of redlining have been advanced in the literature. The appropriateness of these causes depends on the definition of redlining adopted. Given our economic definition, potential causes of redlining include lender prejudice and biased information on expected profits due, for example, to biased estimates of appraisals and/or default losses. However, problems caused by market failure in housing markets or by statistical discrimination must be distinguished from redlining.

Part IV: Empirical Studies of Spatial Mortgage Markets

Both the economic and legal definitions of redlining discussed earlier pertain to differential treatment of mortgage applicants based on property location.

[11] The degree of precision in screening devices is determined by an extremely complex market for information. Lenders produce both mortgages and information on creditworthiness. The amount of information produced by lenders will depend on their ability to capture gains from this information and/or on the willingness of applicants to pay for production of this information. Full specification of this market for information on the probability of default is beyond the scope of this paper.

This differential treatment may manifest itself at any stage of the borrower's interaction with the lender. Specifically, it may appear at the prescreening stage when the initial inquiries are made, at the application stage when there is a formal written contract with the lender, or at the endorsement stage when the final terms of a note are formulated. Previous empirical studies of redlining have either been direct attempts to observe differences in treatment of individuals at one or more of these stages, or indirect attempts to separate out those actions of lenders which unambiguously indicate redlining behavior from those actions which do not. Clearly, the validity of these studies depends on the definition of redlining which is adopted and the model of lender behavior used to generate testable consequences. In many cases these empirical studies permit one to determine whether redlining has occurred in the legal, but not in the economic sense of the term.

Some basic problems are common to the general empirical literature on redlining and spatial mortgage markets. First, it is difficult to define neighborhood. Given existing data limitations, the census tract is the finest level of geographic differentiation that may be used in empirical work. Many studies analyze spatial variation at the level of the county or similar geopolitical unit, which corresponds to the concept of community rather than neighborhood. The area suspected of being redlined is then a set of census tracts with distinctive mean or median values of family income, racial composition, percentage of units lacking plumbing, and percentage of foreign born population. The implicit assumption is that if lenders redline, they use variables available in the fourth-count census of population and housing summary tables (or other variables highly correlated with the census variables) to distinguish target areas for redlining. The alternative approach is to identify neighborhoods or areas which, based on expert opinion, might be targets of redlining. Although such definitions of neighborhood are arbitrary, data availability requires their use by the researcher.

Problems are also posed by the prevalence of single equation models in empirical research on mortgage markets. Mortgage flows are generated by the interaction of lenders and borrowers. Hence, single equation estimates must, at best, be viewed as reduced-form estimates. Since formal definitions of redlining pertain to lender behavior, single equation estimates may not provide the information needed to determine whether redlining has occurred.

Empirical studies of spatial urban mortgage markets may be grouped by the type of data used. The five basic categories of data used in these studies are: (1) data on the spatial distribution of annual mortgage activity or of the mortgage portfolio of lenders, (2) data on the terms of loans made in different neighborhoods by lenders, (3) data on the terms of loans offered to applicants by specific lenders, (4) survey data on the mortgage problems of recent house buyers and sellers, and (5) data on default or default loss on loans made in different neighborhoods by specific lenders.

A. Data on the Spatial Distribution of Mortgage Activity

Studies of the spatial distribution of mortgages contributed significantly to testimony in support of current regulations on redlining.[12] Indeed, the Home Mortgage Disclosure Act requires that financial institutions make available data on the location, by census tract, of mortgages made and held in their portfolios. State provisions in Massachusetts, New York, and California requiring regulated lenders to disclose the geographic location of their mortgage loans have also provided data for these studies. Many of these studies only examine the geographical distribution of mortgages made by selected lenders, excluding much of the mortgage market.[13]

Perhaps the most comprehensive mortgage flow study was undertaken for Baltimore. This study relied on a complete record of all housing purchases for 1971, and found a systematic spatial pattern of lender behavior with FHA financing and mortgage bankers more prevalent in lower income inner city areas.[14] This basic empirical relationship has also been found in subsequent studies using more elaborate theoretical and econometric approaches. Hutchinson, Ostas, and Reed (1978) use Home Mortgage Disclosure Act data to estimate a lending flow equation for Toledo, Ohio, with the ratio of government-insured to conventional mortgages as the dependent variable. They find that the proportion of conventional mortgages is smallest for census tracts with about 45 percent black population but that it is higher for larger or smaller percentages of black population. Fullerton and MacRae (1979), for Philadelphia; and Austin, MacRae and Yezer (1979), for Philadelphia, Pittsburgh, Chicago, Houston, and San Diego, model the flow of FHA-insured mortgage activity by census tract. These studies find strong statistical support for the hypothesis that FHA programs serve moderate to middle-income households in border or racially mixed neighborhoods. FHA mortgage insurance activity declines, as expected, in low income areas due to the lack of units which meet the economic soundness criterion. FHA activity also declines in higher income areas. This occurs because FHA mortgage insurance must be purchased at a single premium regardless of expected default loss. As a result, profit-maximizing lenders have an incentive to offer more attractive mortgage insurance terms to "low risk" borrowers by offering them conventional mortgages.[15] In the debate concerning both the

[12] In particular see: U.S. Senate, Committee on Banking, Housing, and Urban Affairs, *Hearings on the Home Mortgage Disclosure Act of 1975*, S1281, May 5-8, 1975.

[13] Studies based on the Home Mortgage Disclosure Act have the hidden problem that only recent mortgages held in the portfolio of the lender at the date when disclosure is required are contained in the data. Any mortgages sold off are exempt from the disclosure requirement.

[14] The data were recorded in Lust, "Maryland Real Estate Guides." See Home Ownership Development Program, "Home Ownership and the Baltimore Mortgage Market," in the U.S. Senate, Committee on Banking, Housing, and Urban Affairs, *Hearings on the Home Mortgage Disclosure Act of 1975.*

[15] In view of this effect, it is not surprising that studies of the impact of neighborhood effects on the volume of lending by particular financial institutions, such as Muth's work on state chartered savings and loan associations, show a significant fall in the volume of lending in inner city or minority residential areas.

Home Mortgage Disclosure Act and the Community Reinvestment Act, the concentration of FHA activity in moderate income neighborhoods was cited as evidence that FHA mortgage activity follows the spatial patterns noted in these debates. However, this is not evidence of redlining in the economic sense of the term.

These results have been augmented by numerous descriptive studies using data on mortgage lending by census tract.[16] There is, however, a general problem with existing analyses of mortgage flows. As noted by King (1979), both supply and demand determine the quantity of mortgage credit extended in a neighborhood. Single equation models of mortgage flows therefore describe a reduced-form relationship between mortgage activity and neighborhood characteristics, rather than the supply behavior of lenders. If redlining is associated with differential supply behavior across neighborhoods, then mortgage flow studies have little ability to isolate markets in which redlining has occurred.[17]

An additional weakness of mortgage flow studies is that they fail to take into account the geographic distribution of lender portfolios. If lenders are risk-averse, it is rational for lenders to evaluate additional loans on the basis of those loans' contribution to portfolio risk. This contribution is partly based on loans already in the lender's portfolio.

B. Data on Loan Terms Observed in Different Neighborhoods

Disclosure requirements imposed on lenders in California, Massachusetts, and New York have produced data on individual loan terms along with borrower, property, and neighborhood characteristics. These data have also been used to analyze allegations of redlining.

Benston, Horsky, and Weingartner (1978) use such data to determine whether loan terms differ significantly between neighborhoods alleged to be redlined and "nonredlined" neighborhoods. Their study, using data from Rochester, New York, finds little support for the hypothesis that loan terms differ systematically by the neighborhood classification used in their analysis. A recent study by Muth (1979) contains similar findings. That is, mortgage terms at state-chartered Savings and Loan Associations in Oakland, California did not vary significantly among neighborhoods, though racial composition and lack of plumbing had small significant effects on interest rates. Recent work by Schafer (1978) is perhaps the most comprehensive study of how con-

[16] Among the most ambitious is Schafer's study of mortgage lending in New York State. Schafer estimates separate mortgage flow equations for areas deemed a priori to be redlined in other areas. Using the coefficients of the estimated nonredlined equation, he is able to predict mortgage flows for redlined areas and then compare actual with predicted flows. Similarly, it is possible to compute predicted flows for nonredlined areas using the coefficients of the redlined areas equation. In many cases, the mortgage flows predicted are greater than the actual flows.

[17] Models based on mortgage flow data may have some potential for use in analysis of lender price discrimination. Once again, there is a problem of separating supply behavior of individual lenders from effects based on the demand curves which they face. But it might be possible to model the determinants of demand facing individual lenders based on characteristics of the borrower and hence separate supply and demand effects.

ventional mortgage terms on 1-4 family homes are influenced by neighborhood characteristics. He estimates a simultaneous equation system in which maturity, loan-to-value ratio, and interest rate are related to one another and to neighborhood characteristics. The results are mixed in that some neighborhood characteristics have effects on loan terms counter to theory, though most neighborhood attributes have the expected impact. Though Schafer finds evidence of discrimination in housing markets, there is no strong evidence of redlining in mortgage markets.

Like mortgage flow studies, most analyses of mortgage terms are based on reduced-form equations that do not permit one to determine whether mortgage terms differ because of neighborhood differences in loan supply or loan demand. Moreover, studies of mortgage terms are limited to transactions actually made, and consequently, cannot determine whether redlining occurs at the prescreening or application stages in mortgage markets. Finally, unless information on default losses is available, it is difficult to determine whether any observed differences in loan terms reflect redlining, or instead compensate for neighborhood differences in default losses.

Another potential issue is raised by balance sheet constraints facing lenders. Because of such constraints, mortgage decisions made by banks and savings and loan associations are not independent of decisions pertaining to nonmortgage lending and deposits. Consequently, mortgage terms depend upon nonmortgage lending rates and rates paid on deposits. For example, mortgage interest rates will change in response to changes in binding Regulation Q deposit rate ceilings. This interdependence of interest rates should be reflected in properly specified models of determinants of mortgage terms.

C. Data on the Terms of Loans Offered to Loan Applicants

A third type of redlining model focuses on differences in loan terms offered to individual applicants. Applicant data, unlike data on loan terms, include information on treatment of borrowers during the application stage. However, they provide no information about the prescreening stage of borrower/lender interaction. Problems persist in using applicant data to identify demand and supply effects and in determining whether different treatment of applicants reflects variation in default losses. However, these studies are still in a preliminary stage and some of these problems may be resolved in future work.

Using applicant data from regulated financial institutions in Columbia, South Carolina, Warner and Ingram (1979) estimated two discriminant functions. The first used only risk and return variables to distinguish between accepted and rejected mortgage loan applications. The second discriminant function contained risk and return variables as well as "prohibited variables," including race, sex, and neighborhood median income. The second function did not discriminate between accepted and rejected applications better than the first discriminant function. The implication is that "prohibited variables" were not used to supplement risk and return variables in making lending decisions.

However, the authors note, with apparent surprise, that only 6 percent of all applicants, including all races, ages, sexes, and neighborhoods, were rejected.

This is consistent with Benston and Horsky's (1978) estimates of the percentage of home buyers with mortgage problems. Overall, this small incidence of rejection suggests that applicant data are not likely to reveal sharp differentials in treatment of borrowers based on neighborhood location.

D. Survey Data on the Mortgage Problems of Recent House Buyers and Sellers

A fourth approach to the analysis of redlining relies on surveys of recent buyers and sellers of houses. Testimony in support of the Home Mortgage Disclosure Act was, in part, based on informal surveys of this sort. Benston and Horsky (1978) recently conducted an elaborate, systematic survey of buyers and sellers in both an inner city area with high redlining potential and a suburban control area. Survey questions dealt with a range of mortgage finance problems, including reasons for rejection of applicants.

Such surveys provide interesting information on the functioning of local housing markets. However, there is little survey evidence that mortgage problems are systematically related to neighborhood location. A higher proportion of potential buyers in inner city areas experienced difficulty in securing mortgage financing that prevented a housing purchase (8.1 percent vs. 2.4 percent for suburban areas). However, this was apparently due to borrower income and creditworthiness rather than property location.

It is possible that fear of violating the Community Reinvestment Act may prevent lenders from citing neighborhood location as a reason for loan rejection. Nevertheless, survey approaches reveal whether redlining is perceived as a problem by borrowers and sellers. Hence, Benston's and Horsky's suggestion that more surveys of this type be conducted prior to implementing regulations is of some merit.

E. Data on Default or Default Loss on Loans Made in Different Neighborhoods

A fifth type of data set used to analyze spatial urban mortgage markets consists of observations on default and/or default loss experience. Single equation models of default experience on FHA-insured mortgages estimated by Von Furstenberg (1969), and Jackson, Kasserman and Thompson (1979) have shown that default probability increases with the loan-to-value ratio and term of the mortgage, and is also affected by borrower characteristics, particularly income, and by property attributes.

Studies done by Von Furstenberg and Green (1974) of mortgage delinquencies (payments 40+ days in arrears) in the portfolio of a Pittsburgh savings and loan association indicate that loan terms and borrower income affect delinquency much as they do default. Neighborhood racial composition is significant only when age of the unit is omitted from the regression. Von Furstenberg and Green conclude that borrower and property characteristics dominate neighborhood location as determinants of delinquency on home mortgages.

The most ambitious study of the spatial variation in probability of delinquency and foreclosure was conducted by Schafer (1978) using data from regulated lenders in Buffalo, Rochester, New York and Nassau-Suffolk. Descriptive tabulations of the data indicate substantial variation in foreclosure and delin-

quency rates across neighborhood and lenders. However, differences in these rates were not systematically related to neighborhood income. Equations relating the probability of delinquency, of severe delinquency, and of foreclosure to economic burden (ratio of monthly payment to income, etc.), equity, building characteristics, borrower attributes, and neighborhood characteristics were estimated by ordinary least squares. These estimated equations produced mixed results. Economic burden and equity variables often affected delinquency and default in ways anticipated by economic theory. However, reasonable and reliable parameter estimates appeared difficult to obtain from delinquency and foreclosure models estimated with micro data. Most notably, neighborhood characteristics failed to exhibit a consistent and significant relationship to the probability of delinquency and serious delinquency.

F. Summary

Empirical analyses of redlining have relied on various types of data to determine whether neighborhood location has a discernible impact on: (1) mortgage flows, (2) mortgage terms, and (3) mortgage default. For several reasons, mortgage flow studies provide limited evidence about either the presence or absence of redlining. First, most of these studies fail to distinguish differences in mortgage flows caused by demand factors from those caused by supply. Since both legal and economic definitions of redlining emphasize lender behavior, only differences due to supply are relevant for detecting redlining. Second, even if differences in mortgage flows could be attributed solely to lender behavior, this would, at best, be indirect evidence of redlining in the economic sense. This is so because price discrimination neither implies nor is implied by specific mortgage flow patterns. For example, two neighborhoods could receive identical mortgage flows, and yet redlining could still occur if mortgages were offered on different terms to each neighborhood. Conversely, portfolio diversification by lenders could produce mortgage flow patterns that appeared to be redlining when in fact redlining was not taking place.

Empirical analyses of the relation between mortgage terms and neighborhood attributes are directly related to both legal and economic definitions of redlining. However, so long as redlining is viewed as a supply phenomenon, single equation models of loan terms cannot provide definitive confirmation that redlining does or does not occur. A further limitation of many models is their failure to include neighborhood variations in default experience as a determinant of loan terms.

Analyzing the impact of neighborhood characteristics on default experience of lenders is not a direct test of whether redlining occurs. However, determining which neighborhood characteristics, if any, affect default, is essential for both detection and regulation of redlining. A common defense by lenders against allegations of redlining is that lending in certain neighborhoods is riskier than lending in other areas. Government regulations prohibit lenders from using certain neighborhood characteristics. Empirical studies of the spatial determinants of default should therefore provide evidence both of the validity of lenders' claims, and the impact of various government regulations.

With the exception of Schafer's study, there has been little systematic analysis of the relation between neighborhood characteristics and default. Our empirical analysis presented below provides further evidence on the spatial determinants of default.

Part V: Empirical Models of Default Risk

A. Specification of a Single Equation Default Model

In this section, we present an empirical analysis of the relationship between the probability of default on a mortgage and the characteristics of the neighborhood in which the property is located. We first estimate a single equation specification and then estimate a multiple equation model in which loan terms and the *ex ante* probability, P, that the borrower will default on his mortgage are determined simultaneously. P is determined jointly with the terms of the loan, including the loan amount, L, and the interest rate, i:

$$(4) \quad P = P\,[L,i,y_1,r_1,a,f(r_2)]\,,$$

where y_1 is the borrower's income, r_1 is the flow of consumption services provided by the property, a is the rate of return on nonhousing assets, and $f(r_2)$ is the lender's subjective distribution of the uncertain rate of return on the property in the second period. The second period rate of return is based on the house's selling price in that period which is unknown at the time of the initial mortgage loan. Substitution of the endogenous loan terms in equation (4) also yields a reduced-form relationship between *ex ante* default and the exogenous variables of the model:

$$(5) \quad P = P\,[y_1,r_1,a,\lambda,f(r_2)]\,,$$

where λ is the lender's cost of capital (See Appendix for a derivation of these relationships).

Data on *ex ante* default probabilities are not available. However, *ex ante* default equations, structural or reduced form, may be estimated if it is assumed that *ex ante* perceptions are based on past observations of actual defaults. The structural expression for *ex ante* default, equation (4), can thus be used to specify an estimating equation with *ex post* default probability as the dependent variable:

$$(6) \quad D = P[y_1, r_1, a, L, i, f(r_2)] + u\,,$$

where: D equals 0 in the absence of default and 1 if default actually occurs, and
u is a disturbance term including factors which cause *ex post* default to diverge from *ex ante* default.

Because actual default is known with certainty, the *ex post* probability equals either 0 or 1. Default equations similar to (6) appear frequently in the existing literature. These studies typically include mortgage terms such as the

loan amount, maturity, downpayment amount, and/or interest rate as determinants of default. However, in relying on single-equation estimation methods, these studies implicitly assume that the error term in equation (6) is uncorrelated with the regressors. To deal with this issue, we also estimate a multiple-equation default model that does not require this statistical assumption.

B. Data and Empirical Specification of a Single Equation Default Model

The basic mortgage data used in the empirical work are obtained from the 1975 Annual FHA-Master Statistical File (FHA-MSF).[18] This data set contains information on FHA mortgage insurance written under various sections of the National Housing Act. Our analysis was confined to transactions involving existing units under Section 203(b) because this unsubsidized program most resembles conventional mortgage insurance activity in cities.

The FHA-MSF is a sample of all FHA mortgage insurance activity. Insuring offices are sampled at a rate that varies inversely with the level of insurance activity at each insuring office. Within each office, the sample of insured loans, representing new endorsements, is chosen randomly. In creating the Annual FHA-MSF (F31), detailed data on loan terms, borrower characteristics and property characteristics are taken from FHA forms 2800, 2900 and 9100. This file is updated annually so that it is possible to observe which mortgages are terminated.[19] Because our goal is to distinguish determinants of default, a 10 percent random sample of endorsements not in default and 100 percent of default terminations were used. As a result the ratio of default terminations to total endorsements in the final sample rose to 12.78 percent from 1.44 percent.[20]

Most of the variables required to estimate equation (6) were taken directly from the FHA-MSF. The income term, y_1, was measured by net effective income (Y), an FHA estimate of the borrower's expected after-tax income during the early years of the mortgage. Information was also available on terms of the loan, including the term to maturity, a variable included in the empirical analysis but not in the theoretical model.[21]

[18] The authors are indebted to William Shaw and Barbara Mariner-Volpe for their aid in obtaining the sample drawn from the FHA-MSF used in this study. Thorough documentation for the FHA-MSF is provided in Royster (1975). Most of the discussion in the text is based upon this source. Our sample actually consists of endorsements in 1974 and 1975 and those mortgages which were in default (foreclosed) by the end of 1977.

[19] FHA mortgage insurance may terminate due to default and foreclosure, in which either the mortgage or the property is typically conveyed to HUD and the mortgagee claims the insurance benefits. This is the notion of default termination adopted in this paper so that the observation of a default termination is an indication that the market value of the property was insufficient to cover the principal outstanding. However, nondefault terminations may also arise due to prepayment, voluntary agreement between mortgagor and mortgagee, etc. Only cases of actual default terminations were regarded as indicating mortgage default in our analysis.

[20] In interpreting our empirical results presented below it is therefore important to adjust for the over-sampling of default terminations. This is done by multiplying percentage defaults by a conversion factor of 0.113. In other words, one should multiply our estimated coefficients by 0.113 to get effects in terms of percentage points of the true default rate.

[21] Term to maturity is not discussed in the theoretical appendix because of the two-period time horizon used in the utility maximization model.

Because the FHA data were taken from a cross section, some arguments of the default equation, namely, a and λ, may be treated as constant. Obtaining suitable measures of $f(r_2)$ is more complex. If r_2 is assumed to be normally distributed, the expected value and variance of r_2 completely describe $f(r_2)$. In this case, variables which determine the expected value and variance of r_2 are appropriate proxies for $f(r_2)$.

In our two-period model, the change in the asset price of housing, r_2, is given by equation (7)

$$(7) \quad r_2^{ijk} = [(V_2^{ijk} - V_1^{ijk}) / V_1^{ijk}] = [(p_2^{ij} Q_2^k - p_1^{ij} Q_1^k) / (p_1^{ij} Q_1^k)] ,$$

where: subscripts 1 and 2 refer to time periods of the theoretical model,
superscript k refers to a particular housing unit,
superscript i refers to the city in which the unit is located,
superscript j refers to the neighborhood in which the unit is located,
V is the asset price of the housing unit,
p is the price of housing services,
Q is the quantity of housing services provided by the unit.

The variables V_2, p_2 and Q_2 are all random variables. Consequently, the expected value and variance of r_2 are ultimately determined by the expected values and variances of V_2, p_2 and Q_2.

The future price of housing services, p_2, is clearly determined by market supply and demand based on location effects at both the city and neighborhood level. Evidence presented by de Leeuw and Struyk (1975) suggests that the price of housing services is positively affected by growth in urban population and income. Such growth should also be reflected at the neighborhood level but it is difficult to obtain direct indicators of the economic vitality of individual areas in a large city. Indirect measures are sometimes available. For example, future expectations of housing prices may be reflected in the current condition of structures in a neighborhood. That is, current owners have an economic incentive to reduce property maintenance if they expect future housing prices to fall or rise less rapidly than in the past.

The future quantity of housing services, Q_2, is determined by structural attributes of the property itself, as well as by the behavior of the mortgagor/occupant. Structural attributes such as type of construction, age, and overall condition are likely to affect the flow of housing services from a given unit. Changes in income, cost of producing housing services, and prices of other goods, may also cause desired housing services to diverge from actual ones. In the absence of transactions costs, households could obtain the "desired" level of housing simply by moving from one unit to another. However, because moving entails considerable transactions costs, households may choose instead to adjust the level of services obtained from the unit in which they live. For example, a household might respond to a decline in desired housing services by remaining in the same unit while lowering maintenance levels. Hence, household characteristics related to the desired quantity of housing services may affect Q_2. Particularly relevant would be any characteristics reflecting the stability of household income.

Thus, several variables have been identified that affect p_2 and Q_2, and therefore, r_2. The future price of housing services, p_2, should vary with housing market conditions in both cities and neighborhoods. The future quantity of housing services, Q_2, should vary with property attributes and borrower characteristics. Consequently, vectors of city, neighborhood, property, and borrower characteristics are included as proxies for $f(r_2)$ in our default equation. Determinants of the variation in r_1, the last argument of the structural default equation, are essentially identical to those for r_2.

Empirical specification of the single equation default model is completed by choosing a particular function form for the relationship. The general form of the specification is:

$$(8)\quad D_i = a_0 + a_1\,(L/V)_i + a_2\,(TERM)_i + a_3\,(MP/Y)_i + a_N N_i + a_C C_i + a_B B_i + a_S S_i + u_i,$$

where: i is an index of individual mortgage transactions, i = 1.....number of cases,
D_i is a dummy variable equal to 1 if default occurs and 0 otherwise,
(L/V) is the loan-to-value ratio,
(TERM) is the term to maturity,
(MP/Y) is the monthly payment-to-income ratio,
N is a vector of neighborhood location characteristics including dummy variables for central city and rural location and a dummy variable indicating location in a code enforcement or blighted neighborhood.
C is a vector of city location characteristics including the rate of new single-family housing starts, fraction of housing built before 1940, SMSA size, city population growth, SMSA income growth, SMSA income per capita, and SMSA percentage black population.
B is a vector of borrower demographic characteristics including dummy variables for minority status, marital status, sex of family head, and multi-worker family status, as well as a continuous variable reflecting years of marriage.
S is a vector of structure condition variables including dummy variables for FHA appraisal as fair or poor structural condition, type of construction, and continuous variables reflecting structure age, and the number of housing units in the structure.
a_N, a_C, a_B, and a_S are appropriate vectors of coefficients, and
u_i is an error term.
(Note: A glossary of variables is at the end of the paper)

If the disturbance term, u, satisfies the conventional assumptions, equation (8) may be estimated by ordinary least squares and the coefficients interpreted as marginal effects of the regressors on the expected probability of default. Probit and logit estimation techniques are often used for models with binary dependent variables.[22] However, the size of our sample is large, OLS estimates of the parameters are consistent, and a number of applied econometric studies have found that these techniques yield essentially the same results as OLS.

[22] For a discussion of estimation issues, see Pindyck and Rubinfeld (1976).

In equation (8) the loan terms are entered in a functional form common in the literature. The loan amount and equity, taken together, determine the loan-to-value ratio. Although term of the loan was not considered in the two-period default model, it influences the rate at which the principal is retired and, hence, the rate of equity accumulation in the unit. The monthly payment is approximately equal to one-twelfth the product of interest and loan amount. Thus the interest rate enters the default equation through the monthly payment-to-income ratio.

As noted in data discussion, location characteristics (both neighborhood and city attributes) enter the default equation because they influence both r_1 and the mean and variance of r_2. Structure characteristics enter the equation for similar reasons. The borrower characteristics in equation (8) were included for a variety of reasons. First, they represent "prohibited" borrower attributes which may not be used by lenders under equal credit opportunity regulations. Second, they separate groups which may differ systematically in variables omitted from the equation, such as wealth, and human capital. Third, they differentiate households that may be subject to discrimination in labor and housing markets.

C. Single Equation Estimation Results

Ordinary least squares estimates of equation (8) are presented in Table 2. Nine different specifications of the default relationship are presented to illustrate the sensitivity of results to inclusion of various categories of regressors. These equations show the impact on default of four categories of explanatory variables: (1) loan terms, (2) borrower characteristics, (3) structure condition, and (4) location characteristics, including both neighborhood and city characteristics.

Terms of the loan are almost always significant determinants of default. Both the loan-to-value ratio and the monthly payment-to-income ratio have the expected positive signs. This finding is consistent with those of most existing default studies. The term to maturity is negative and significant in eight of the nine equations, and positive but insignificant in the remaining equation. Some other studies have produced opposite results. For example, Jackson, Kasserman, and Thompson (1979) and Herzog and Early (1970) find that term to maturity has a positive and significant impact on default.

Borrower characteristics have mixed impacts on default probability. The probability of default is not significantly different for Hispanic mortgagors than for the reference group of white, male-headed, newly married households. The default probability of female-headed households differs from that of the reference group by an amount equal to the sum of the coefficients of the not married and the female-headed family variables. Borrowers who have been married for some time are significantly less likely to default than newly married households. Black borrowers appear to have significantly higher default probability. As noted above, the estimated impacts of these demographic variables, particularly race, reflect a variety of omitted factors, including wealth and human capital, and discrimination in labor and housing markets.

Some, but not all, property condition variables have an impact on default probability. Condition of the structure and construction type both significantly

TABLE 2

Single Equation Estimation of Probability of Default
Dependent Variable – Default Probability
(One if Foreclosed; Zero Otherwise)

Dependent Variable	Eq. R1	Eq. R2	Eq. R3	Eq. R4	Eq. R5	Eq. R6	Eq. R7	Eq. R8	Eq. R9
Intercept	−0.3957**	−0.4204**	0.0559	−0.4464**	0.0527	−0.4122	0.0676	−0.4652	0.1062
Loan Terms									
Loan-to-Value Ratio	0.6279**	0.6394**	0.6193**	0.6222**	0.5894**	0.6370**	0.5776**	0.5613**	0.5127**
Term-to-Maturity (months)	−0.0002*	−0.0002*	−0.0006*	−0.0002	−0.0005**	−0.0002*	−0.0005**	0.00002	−0.0004**
Monthly Payment-to-Income Ratio		0.1012*	0.1947**	0.1359**	0.2315**	0.1055*	0.2442**	0.1524**	0.2593**
Borrower Characteristics									
Hispanic								−0.0136	−0.0136
Black								0.1136**	0.1087**
Years Married								−0.0009*	−0.0010*
Not Married								0.0132	0.0071
Female Head of Household								−0.0271*	−0.0308**
Property Characteristics									
Structure: Fair to Poor Condition						0.0381**	0.0325**		0.0316**
Age of Structure						−0.0002	−0.0002		−0.0004
Wood Construction						0.0006	0.0213**		0.0233**
Neighborhood Characteristics									
Central City				0.0177**	0.0269**		0.0265**		0.0125*
Rural				−0.0016	0.0132		0.0096		0.0120
Blighted				0.0411**	0.0496**		0.0518**		0.0338**

TABLE 2, *continued*

	Eq. R1	Eq. R2	Eq. R3	Eq. R4	Eq. R5	Eq. R6	Eq. R7	Eq. R8	Eq. R9
City Characteristics									
Fraction of New Single Family Starts			−0.8136**		−0.8261**		−0.8398**		−0.7597**
Fraction of Pre-1940 Housing			−0.4582**		−0.4996**		0.5053**		−0.4688**
SMSA Size			0.0042*		0.0049**		0.0067**		0.0043*
City Population Growth (1970-1975)			−0.5115**		−0.5573**		−0.5579**		−0.4883**
City Income Growth (1970-1975)			−0.0113		0.0112		−0.0089		0.0004
SMSA Per Capita Income (1975)			−0.00000004**		−0.00000004**		−0.00000004**		−0.00000005**
Percentage Black Population (1970)			0.0016**		0.0013**		0.0014**		0.0002
R-Square	0.0100	0.0103	0.0315	0.0121	0.0346	0.0113	0.0361	0.0323	0.0525
F-Statistic	50.56	34.73	31.66	20.56	26.83	19.2	22.7	41.85	25.6
Sample Size	10050	10050	9731	10050	9731	10050	9731	10050	9731
Mean Value of the Dependent Variable	0.1279	0.1279	0.1279	0.1279	0.1279	0.1279	0.1279	0.1279	0.1279

* denotes significance at the 90% level

** denotes significance at the 95% level

A complete description of the variables is contained in a Glossary of Variables at the end of the paper.

affect default. Structures in only fair-to-poor condition, and those constructed out of wood, both have significantly higher default probabilities. However, age of the structure does not have a significant impact on default. These results are consistent with some of Schafer's findings (1978). However, they differ from those of Jackson, Kasserman, and Thompson (1979), who find no significant impact for their measure of structural and locational quality.

Property location influences default probability through both the neighborhood and city characteristics variables. Neighborhood characteristics generally affect the probability of default. More specifically, the default probability is significantly higher if a mortgage loan is made in a central city or slum area. This finding is invariant with respect to the specification of the default equation in Table 2. Thus, the risk of default on a mortgage does vary significantly and systematically by neighborhood. As a result, one would expect lenders to adjust loan terms to reflect neighborhood differences in risk. Such differences in loan terms by geographical area, however, would not imply redlining. Indeed, if the loan terms were uniform across neighborhoods, price discrimination would be present.

City characteristics generally have the expected impact on default. Of the seven variables representing these characteristics, only one is consistently insignificant. This variable is SMSA income growth. Four of these variables have a negative and significant effect on the probability of default. These variables are the rate of new single-family housing growth, the fraction of housing built before 1940, city population growth and SMSA per capita income. Therefore, higher levels or growth of city economic activity reduce defaults. The SMSA size variable has a significant and positive impact on default. The coefficient of the racial composition variable, percentage black population, is positive and highly significant in three of the four regression equations in which it appears. However, if borrower characteristics are controlled for, this variable ceases to be significant. Since there are sound economic reasons for including borrower characteristics, this finding indicates some of the consequences of excluding relevant variables from the default equation.

D. Specification and Estimation of a Multiple Equation Default Model

The default probability model estimated above included terms of the loan as regressors. Single-equation estimation techniques seem justified because the dependent variable is *ex post* default which occurs some time after endorsement of the loan. Such sequencing in time appears to impart a single direction to the causal relationship among variables so that loan terms may be regarded as uncorrelated with the error term in the estimating equation.

The theoretical model developed in Section V implies that loan terms are determined simultaneously with the *ex ante* default probability, P. Equation (8) may be viewed as an *ex ante* default probability equation, with *ex post* default used as the dependent variable because *ex ante* default probabilities are not observable. It is this *ex ante* default equation that is relevant for assessing the determinants of loan supply and demand in the theoretical model. Clearly, loan terms are not exogenous in the true *ex ante* default equation. Consider a simple

model in which mortgage amount and term are fixed so that the interest rate is the only variable term of the mortgage. The structural equations of this model would be:

(9) $i = b_o + b_1 P + b_2 X + u$, and

(10) $P = c_o + c_1 i + c_2 X + e$,

where the Xs are appropriately chosen vectors of exogenous variables. In this case, i and P are jointly dependent variables so that P and i are not independent of u and e, respectively.

It is plausible to assume that *ex ante* default differs from *ex post* default by a random variable, so that:

(11) $D = P + f$,

where f is a random disturbance term. Equations (10) and (11) may be combined to form an expression for *ex post* default in terms of the determinants of *ex ante* default:

(12) $D = c_o + c_1 i + c_2 X + e + f = c_o + c_1 i + c_2 X + (e+f)$.

Since i is not independent of the error term, (e+f), in equation (12), use of ordinary least squares will result in coefficient estimates that are both biased and inconsistent.

An additional statistical problem of selection bias should be given attention when estimating models of mortgage supply, mortgage demand, and default. Rejection of applicants on the basis of formal credit scoring procedures means that *observed* defaults are drawn from a population with an *ex ante* default which is less than or equal to a certain "critical" value. That is, the dependent variable is censored from above. Heckman (1979) has shown that sample selection bias of this sort leads to specification error that is analogous to the problem of omitted variables. Both FHA and conventional mortgage applications are evaluated with reference to certain formal criteria. However, FHA insurance criteria exclude both neighborhood economic and demographic variables. This reduces the likelihood that estimates obtained from data on FHA-insured mortgages will suffer from the bias discussed by Heckman. By contrast, estimates based on conventional mortgage data are more likely to suffer from such bias because more latitude may be exercised in using formal credit scoring procedures.

A multiple equation model was formulated with loan terms from the default equation expressed as endogenous variables. On most mortgages, these loan terms, including the loan-to-value ratio, term to maturity, and monthly payment-to-income ratio, are the result of simultaneous interaction of supply and demand forces. The estimated coefficients of such equations would normally be difficult to interpret because supply and demand effects often work in opposite directions. However, because section 203(b) insurance is provided to all qualified borrowers

at a fixed premium, the final combination of loan terms should reflect demand side effects only. That is, FHA insurance eliminates the normal lender incentives to raise interest rates to maintain expected profit when an increase in the loan-to-value ratio raises the expected default loss.

The multiple equation system consists of five equations, including equations for housing expenditure, monthly payment-to-income ratio, term-to-maturity, loan-to-value ratio, and the probability of default. These are discussed in turn below.

Total housing expenditure is based on housing demand, which is determined by family income, demographic characteristics, and the price of housing services. Unfortunately, there is no direct measure of the price of housing services on individual units. However, indirect measures are available including the ratio of house value to number of rooms or number of bathrooms, and city characteristics which are related to differences in housing prices. In addition, total expenditure on the housing unit should rise if the unit includes appliances such as a stove, refrigerator, washer, etc. In effect, the consumer purchases more than structural services when such consumer durables are part of the transaction. Therefore, the housing expenditure equation has the form:

$$(13)\quad V_i = b_o + b_1 Y_1 + b_B B_i + b_C C_i + b_O O_i + b_A A_i + u_i\ ,$$

where: i is an index of the observation number,
V is the FHA assessed value of the property,
Y is family net effective income,
B is a vector of demographic characteristics of the family,
C is a vector of city characteristics for the area in which the unit is located,
O is a vector of other variables, specifically the appraised value-to-rooms ratio and the appraised value-to-bathrooms ratios,
A is a vector of dummy variables reflecting the presence of various appliances in the housing unit,
u is a disturbance term, and
the b's are appropriately scaled vectors of parameters.

The estimates are presented in Table 3, and are generally consistent with expectations. Family income and the presence of appliances have significant positive effects on expenditure. Price effects, as reflected both in the value-to-rooms and value-to-bathrooms ratios and in the city characteristics, were generally positive and significant. Such an expenditure effect is consistent with the inelastic own-price elasticity of demand for housing generally reported in the literature.

The monthly payment-to-income ratio, like other loan terms, is determined by borrower preferences. From the borrower's perspective, a higher monthly payment-to-income ratio implies a greater commitment of current household income or cash flow to housing. The willingness of households to commit a large fraction of cash flow should vary inversely with the importance of the alternative uses of cash. Possibly the best measure of the value of this cash flow is the family's net effective income per person which should vary inversely with

TABLE 3

Multiple Equation Estimation of Probability of Default
(One if Foreclosed; Zero Otherwise)

Independent Variables	Dependent Variables: Probability of Default	Loan-to-Value Ratio	Term-to-Maturity (Months)	Monthly Payment-to-Income-Ratio	FHA Appraisal Value Including Closing Costs
Intercept	−1.0362*	0.9968**	326.3289**	1.3641**	−5926.0075
Probability of Default		0.0683**	115.7114**		
FHA Appraised Value		−0.000002**	0.0008**	−0.000001**	
Loan Terms					
Loan-to-Value Ratio	1.7851**			−1.5287**	
Term to Maturity	−0.0009			0.0011**	
Monthly Payment-to-Income Ratio	0.6160**				
Borrower Characteristics					
Hispanic	−0.0224*	0.0039*	2.7513	0.0067*	−468.3823**
Black	0.0964**	−0.0036**	−15.0040**	0.0009	−181.9307*
Years Married	0.0001	−0.0005**	0.0586	−0.0015**	
Not Married	0.0120	−0.0061**	−2.9212*	0.0011	
Female Head of Household	−0.0348**	−0.0049**	8.7174**	0.0005	185.9844
Both Work		0.0031**	3.2146**	−0.0280**	
Number of Dependents					400.9344**
Net Effective Income per Person		−0.0000007	0.0060**	−0.00004**	−0.1937
Net Effective Income					5.4562**
Property Characteristics					
Structure: Fair or Poor Condition	0.0263*	−0.0029*	−5.6981**	−0.0047	
Age of Structure	−0.0007	−0.0002**	−0.4752**		
Wood Construction	0.0177*				
Number of Living Units				−0.0103	2139.8583**
Oven Only		−0.0029	−1.5367	0.0086*	903.0171**
Oven with Other Kitchen Appliances		−0.0106**	−3.4593**	−0.0109**	3467.2107**
Washer or Dryer		−0.0100*	−3.3867	−0.0077	940.2452**
Washer and Dryer		−0.0075**	2.5590	−0.0097*	1023.6095**
Carpeting		0.0077**	3.7222**	0.0108**	234.6987**
Central Air Conditioning		−0.0033**	−2.4299**	−0.0105**	902.5475**

TABLE 3, *continued*

Independent Variables	Dependent Variables: Probability of Default	Loan-to-Value Ratio	Term-to-Maturity (Months)	Monthly Payment-to-Income-Ratio	FHA Appraisal Value including Closing Costs
Neighborhood Characteristics					
Central City	0.0070	−0.0011	0.2768		
Rural	0.0156	−0.0081	−0.6133		
Blighted	0.0368**	−0.0059**	5.6121**		
City Characteristics					
Fraction of New Single-Family Starts	−0.8560**				3244.7213*
Fraction of Pre-1940 Housing	−0.4256**				894.0734*
SMSA Size	0.0023				94.4469**
City Population Growth (1970-75)	−0.4645**				2350.2833**
City Income Growth (1970-75)	0.0177				−348.0559
SMSA Per Capita Income (1975)	−0.00005**				0.2288**
Percentage Black Population (1970)	0.0007				25.0791**
Other Variables					
Mortgagee Not a Mortgage Banker				0.0079**	
Value/Bath Ratio					0.0588**
Value/Room Ratio					4.0525**
Sample Size	9727	9727	9727	9727	9727
Mean Value of the Dependent Variable	0.1270	0.9465	350.9932	0.2182	23614.7710

* denotes significance at the 90% level

** denotes significance at the 95% level

A complete description of the variables is contained in a Glossary of Variables at the end of the paper.

the value of cash flow. Similarly, families purchasing more expensive houses and accepting higher loan-to-value ratios might have smaller cash flow problems. Also, households purchasing a variety of appliances with the housing unit might accept higher monthly payment-to-income ratios because they are financing consumer durables as well as the housing structure. The overall monthly payment-to-income ratio equation then becomes:

$$(14)\quad (MP/Y)_i = c_o + c_1 V_i + c_2 (L/V)_i + c_3 TERM_i + c_4 (Y/N)_i + c_B B_i + c_A A_i + c_O O_i + u_i ,$$

where: i is an index of the observation number , i = 1. . . . .N,
MP/Y is the monthly payment-to-income ratio,
V is FHA appraised property value,
L/V is the loan-to-value ratio,
TERM is the term to maturity
Y/N is the net effective income per person,
B is a vector of borrower demographic characteristics,
A is a vector of dummy variables reflecting the presence of various appliances in the housing unit,
O is a dummy variable equal to unity if the loan was not made by a mortgage broker and zero otherwise,
u is a disturbance term, and
the c's are appropriately scaled vectors of parameters.

Results obtained by estimating equation (14) using instrumental variables for the included endogenous variables (V, L/V, and TERM) are shown in Table 3. Family income per person, appraised value, and the loan-to-value ratio all have negative signs and are highly significant. The positive and significant effect of term to maturity seems puzzling. However, households desiring longer term mortgages would be expected to have greater cash flow problems. The effect of appliances was generally random. The other variable, a dummy variable reflecting a mortgagee which was not a mortgage banker, was inserted on the theory that screening processes might direct borrowers with cash flow problems toward mortgage bankers rather than financial institutions. The positive and significant coefficient suggests just the opposite effect.

Demand for longer term-to-maturity of the loan should be based, in part, on borrower perceptions of default risk. Longer term means slower retirement of principal and hence smaller losses for the borrower if the value of the property falls. Therefore, *ex ante* default probability should have a positive effect on the term-to-maturity demanded. Property characteristics and neighborhood characteristics should not have an influence on the term to maturity independent of their impact on borrowers' uncertainty over future market price. However, these variables were included in the analysis to capture any effects not included in the endogenous default variable. In part this reflects an attempt to demonstrate the ability of *ex post* default to capture *ex ante* default perceptions. The general term-to-maturity equation is written as:

$$(15)\quad TERM_i = d_o + d_1 D_i + d_2 V_i + d_3 (Y/N)_i + d_B B_i + d_S S_i + d_A A_i + d_N N_i + u_i ,$$

where: i is an index of the observation number, i = 1. . . . . .N,
TERM is the term-to-maturity in months,
D is the default probability,
V is the FHA appraised value,
(Y/N) is net income per person,
B is a vector of borrower demographic characteristics,
S is a vector of structure characteristics,
N is a vector of neighborhood characteristics,
u_i is a disturbance term, and
the d's are appropriately scaled vectors of parameters.

Estimates of equation (15) using instrumental variables for default, D, and appraised value, V, are presented in Table 3. Both included endogenous variables, have positive signs and are highly significant. Also, with the exception of the blighted neighborhood dummy, the structure and neighborhood variables included in the equation do not have the positive effect on term to maturity that would be expected. This indicates that the included default variable is effective in capturing the influence of anticipated default on the borrower's demand for a longer term mortgage.

Demand for higher loan-to-value ratios, like the demand for longer term to maturity, should increase with the borrower's perception that future property value may fall. Higher loan-to-value ratios mean lower downpayments and hence less equity at risk in the event of default. As with the term-to-maturity equation, both property characteristics and neighborhood characteristics were added to the equation to determine if they had an impact on the demand for a higher loan-to-value ratio independent of the influence which they exert through an increase in *ex ante* probability of default when structure condition and/or neighborhood are poor. The general form of the loan-to-value equation is:

$$(16) \quad (L/V)_i = e_o + e_1 D_i + e_2 V_i + e_3 (Y/N) + e_B B_i + e_S S_i + e_A A_i + e_N N_i + u_i,$$

where: i is an index of the observation number, i = 1. . . . .N,
(L/V) is the loan-to-appraised value ratio,
D is the default probability,
V is the FHA appraised value,
(Y/N) is net family income per person,
B is a vector of borrower characteristics
S is a vector of structure characteristics,
A is a vector of dummy variables reflecting the presence of various appliances in the housing unit,
u is a disturbance term, and
the e's are appropriately dimensioned vectors of parameters.

Table 3 contains estimates of equation (16) using instrumental variables for the included endogenous variable, D and V. Note that default probability has the expected positive sign and is highly significant. The structure and neighborhood variables also have negative signs and small magnitudes (half are statistically sig-

nificant). This indicates a negative effect of poor structure and neighborhood quality on the loan-to-value ratio demanded.

The four equations discussed thus far are not intended to represent a formal model of the demand determinants of loan terms and housing expenditure. Rather, these four equations have been presented to indicate that reasonable estimates of the multiple equation system could be obtained. They also indicate that use of *ex post* default probability as a substitute for the unobservable *ex ante* default probability produced reasonable results.

The default equation of the multiple equation model is based on equation (8). Consequently the results reported in Table 3 may be compared directly with those in column R9 of Table 2. Instrumental variables are used for the loan terms, (L/V), TERM, and (MP/Y). Both the loan-to-value ratio and the monthly payment-to-income ratio have the anticipated positive and significant effect on default probability. The marginal effects of these variables on default are considerably greater than in the single equation model. However, term to maturity no longer has a significant effect on default. This result may be contrasted to the negative and significant effect of term to maturity in the single equation model.

The exogenous variables of the default equation have similar effects in both the single and multiple equation model. Location of the property has the anticipated effect, with significantly higher default probability in blighted neighborhoods and in cities with lower per capita income and slower growth in the population and single-family housing stock. Note that two location variables, SMSA size and central city location, which were positive and significant in the single equation estimates have smaller and statistically insignificant coefficients in the multiple equation estimates. This is an important difference. The multiple equation result suggests that geographic location of the property in a larger city or nearer the city center has no independent effect on default probability when neighborhood condition and city economic vitality variables are present in the estimating equation. Borrower characteristics, with the exception of years married, have similar effects in both models. Structure condition also influences default in the expected direction, with inferior condition and wood siding increasing default. The location effects are most critical to the analysis of redlining. The results are discussed in the final section of the paper.

Part VI: Conclusions and Policy Implications

Regulators of financial institutions have recently become concerned about redlining. This concern is reflected in some parts of the Fair Housing Act of 1968, in the Home Mortgage Disclosure Act of 1975, and the Community Reinvestment Act of 1977. In particular, the Community Reinvestment Act (CRA) provides a statutory framework for vigorous enforcement of anti-redlining provisions, as illustrated by a recent case in Brooklyn, New York. In April 1979, a savings bank was denied permission by the Federal Deposit Insurance Corporation (FDIC) to open a branch in Manhattan because the bank "failed to meet the residential mortgage needs of the community." This denial was the first significant test of the CRA. In commenting upon this decision, Alan Miller, deputy to

FDIC Board Chairman Irving H. Sprague, noted that ". . . . . it means we fully intend to uphold the Community Reinvestment Act."[23]

Regulators are, therefore, likely to include CRA criteria in deciding upon all future branching, merger, and acquisition decisions. Consequently, financial institutions should have a much stronger economic incentive to take into account the Fair Housing, Home Mortgage Disclosure, and Community Reinvestment Acts when making mortgage lending decisions. The potential impact of these regulations on mortgage markets requires that one be able to determine whether redlining has taken place. An important related issue is whether criteria that lenders are and are not allowed to use by regulators are economically justified.

Definition is the first step toward identification of redlining. There are both legal and economic definitions. The legal approach to defining redlining is to list those features of property location that lenders may and may not take into account in the loan negotiation process. The economic approach evaluates lender behavior against the standard of profit maximization under risk. Redlining in the economic sense occurs when actual lender behavior departs from profit maximizing behavior. There are several major differences between these two definitions. Economic conceptions of redlining tend to focus on inefficiency in mortgage markets rather than income distributional inequality. Legal conceptions often blur the distinction between equity and efficiency. Perhaps more significantly, the benchmark used for identifying redlining differs under the two definitions. The statutory approach presumes that certain actions by lenders will produce undesired outcomes in mortgage markets. Consequently, redlining is defined in terms of those actions. The economic approach distinguishes between profit and nonprofit maximizing actions. Redlining is presumed to occur when actions are not consistent with profit-maximizing behavior of mortgage lenders.

Vigorous enforcement of anti-redlining regulations may impose substantial costs on financial institutions and the public. The Home Mortgate Disclosure Act has imposed additional record-keeping requirements, while other record-keeping is required to demonstrate compliance with the CRA. This is in addition to the monitoring and enforcement costs incurred by regulators. Furthermore, if regulations compel or induce institutions to grant more credit than warranted to "truly" risky applicants, default losses experienced by some lenders may increase. Some portion of such cost increases would be passed on to borrowers.

Given the potential costs of anti-redlining statutes, it is appropriate to ascertain the magnitude of the problem addressed by such regulations. An economic (as opposed to legal) test of whether redlining has occurred involves determining whether terms of mortgage loans vary systematically by location after all factors affecting profits in a risky environment have been taken into account. If, after controlling for such factors, loan terms vary systematically by location, it is plausible that redlining exists.

A major difficulty in performing such tests is to determine what constitutes profit-maximizing behavior by lenders. Another difficulty arises in distinguishing

[23] Mr. Miller's statement was quoted in the *Washington Star*, April 27, 1979.

differences in outcome due to lender behavior from those reflecting borrower preferences. Much existing research on mortgage flows fails to distinguish between supply and demand effects. Data on applicant rejection rates may allow one to detect redlining at the application stage. However, the usefulness of such data may be limited by the apparent low incidence of rejections. Moreover, determining whether redlining occurs at the application level does not provide information about whether discrimination occurs through prescreening or after the loan application has been accepted.

An alternative approach to detecting redlining is to: (a) estimate the degree to which default risk varies by location, (b) estimate the adjustments in loan terms justified by such differences, and (c) compare the estimated adjustments to those actually made by lenders. Using FHA data to estimate an empirical default model provides information on the spatial determinants of default. Our results indicate that default risk is significantly affected by location based on both neighborhood and city characteristics. This implies that appropriate adjustment of mortgage terms based on location is consistent with profit maximization. This type of adjustment would not be redlining in the economic sense.

The estimated coefficients of the default model may also be used to estimate the size of appropriate adjustments in mortgage terms. As an illustration we used the estimated default equations to determine the default probability of a hypothetical property located in a blighted neighborhood of a central city with income per capita, income growth, population growth, and rate of single-family housing growth all one standard deviation below their sample means. The estimated default probability was then compared to the average default probability of the sample. For this rather extreme case, the default probability was estimated to be roughly 2.4 times greater than average using the single-equation estimates, and roughly 2 times greater than average using the multiple equation estimates. In order to reduce the estimated default rate to the average default rate the downpayment ratio would have to rise roughly sevenfold in the single equation case and by 2.4 times in the multiple equation case.

Estimates such as these indicate the "appropriate" difference in loan terms between an "extremely risky" and an "average" property location. One could, in principle, use such estimates to adjust the loan terms of conventional lenders to determine whether any differentials remained on loans made in "risky" and "average" locations. Any such differentials, particularly if they discriminated against the "risky" area, would indicate the potential presence of redlining. Ideally, such calculations would be done for each SMSA, using estimates of spatial default variation within each SMSA.

In general, our results indicate that many, but not all, property and locational characteristics affect default. From the standpoint of regulatory policy, these characteristics can be grouped into three categories; those prohibited by regulations, those permitted by regulation, and those potentially prohibited. Currently, lenders are proscribed from limiting credit due to the age of the property and racial composition of the neighborhood. Our results indicate that neither prohibited attribute has a significant impact on default once other factors are taken into account. By contrast, the Fair Housing Act allows lenders to take into account both the structural condition of the property itself and the

structural condition of nearby properties. Our results indicate these characteristics do significantly affect default rates. Finally, future enforcement of the CRA may make it more difficult for lenders to use neighborhood income as a criterion. Our results indicate that SMSA income per capita is a significant geographical determinant of default. This suggests that neighborhood income may also significantly affect default rates. If so, compelling lenders to grant more credit to "low and moderate income" neighborhoods may increase their exposure to default losses. Such increased exposure would raise the costs of mortgage credit in some areas.

In sum, anti-redlining regulations may require considerable changes in lender behavior. However, defining and detecting redlining is extremely complex. These complexities should not be ignored in regulatory efforts to deal with redlining.

Glossary of Variables

FHA Appraised Value: FHA appraised value in dollars [V].

Loan Terms

Loan-to-Value Ratio: Ratio of endorsed loan amount to FHA appraised value. [L/V].

Term to Maturity: Loan duration in months. [TERM]

Monthly Payment-to-Income Ratio: Ratio of mortgage payment including taxes and insurance to mortgagor's monthly effective income. [MP/Y]

Borrower Characteristics

Hispanic: Variable coded 1 if mortgagor is Hispanic; coded 0 otherwise.

Black: Variable coded 1 if mortgagor is Black; coded 0 otherwise.

Years Married: Variable coded number of years mortgagor has been married; coded 0 otherwise.

Not Married: Variable coded 1 if mortgagor is not married; coded 0 otherwise.

Female Head of Household: Variable coded 1 if female is head of household; coded 0 otherwise.

Both Work: Variable coded 1 for husband-wife family with both working; coded 0 otherwise.

Net Effective Income per Person: Ratio of monthly net effective income in dollars to persons in family. [Y/N]

Property Characteristics

Structure: Fair or Poor Condition: Variable equals 1 if FHA appraisal of condition of house is fair or poor; variable coded 0 otherwise.

Wood Construction: Variable coded 1 if exterior finish of house is wood; coded 0 otherwise.

Number of Living Units: Number of housing units in structure (range 1-4)

Oven Only: Variable coded 1 if oven is only kitchen appliance in unit; coded 0 otherwise.

Oven with Other Kitchen Appliance: Variable coded 1 if oven plus 1 or more kitchen appliances are in unit; coded 0 otherwise.
Washer or Dryer: Variable coded 1 if only washer or dryer laundry equipment in unit; coded 0 otherwise.
Washer and Dryer: Variable coded 1 if both washer and dryer laundry equipment are in unit; coded 0 otherwise.
Carpeting: Variable coded 1 if unit is carpeted; coded 0 otherwise.
Central Air Conditioning: Variable is coded 1 if unit is centrally air conditioned; coded 0 otherwise.

Neighborhood Characteristics
Central City: Variable is coded 1 if property is in central city of SMSA; coded 0 otherwise.
Rural: Variable is coded 1 if property is in rural location; coded 0 otherwise.
Blighted: Variable is coded 1 if property is in blighted or code enforcement neighborhood; coded 0 otherwise.

City Characteristics
Fraction of New Single-Family Starts in 1975-1976: Variable equals total number of new private housing unit building permits x percent of single unit structures of the total number of private housing unit building permits divided by number of owner-occupied housing units x 100.
Fraction of Pre-1940 Housing: Number of units in SMSA built before 1940 divided by number of all occupied housing units in 1970.
SMSA Size: SMSA population in 1974 divided by 1000.
City Population Growth (1970-1975): (1975 population – 1970 population) divided by 1970 population.
SMSA Per Capita Income (1975): Total personal nonfarm income by SMSA in 1975 divided by SMSA population in 1974.

Other Variables
Mortgagee Not a Mortgage Banker: Variable coded 1 if mortgage was made by an institution other than a mortgage banker; variable coded 0 otherwise.
Value/Bath Ratio: Ratio of FHA appraised value to number of half and full bathrooms in house.
Value/Room Ratio: Ratio of FHA appraised value to number of rooms in house.

APPENDIX

A SIMPLE MODEL OF THE DEMAND FOR AND SUPPLY OF A SINGLE MORTGAGE LOAN

In this Appendix, we present a simple two-period model of a single mortgage transaction. This entire section draws heavily upon an analysis of the borrower-lender relationship presented in a series of articles by Smith (1971a,b, 1972a,b). These articles demonstrate that the existence of equity generates an externality, so that the competitive equilibrium solution is not Pareto optimal. Smith shows, however, that credit rationing can generate a solution which is Pareto efficient. Smith's approach is used here to analyze the interrelationships among the key variables in a mortgage transaction, including the risk of default.[24] The model is based on expected utility-maximizing behavior by both the individual borrower and the lender.

A. Borrower Behavior

The individual is assumed to maximize the following two-period utility function

$$(1) \quad EU(c_1, c_2) = V(c_1) + EW(c_2),$$

where c_1 and c_2 are consumption in each of the two periods. It is further assumed that both V and W are twice continuously differentiable with positive and diminishing marginal utilities, thus assuring that the individual is subject to risk aversion. Uncertainty is present in this model because an individual purchases a home in the first period with known return but with unknown return in the second period. The known return in the first period $0<r_1<1$ is due to the flow of consumption services produced by the house. In the second period the house yields a return of $-1 \leqslant r_2 \leqslant \infty$ based upon its second-period price which is unknown at the time of the purchase. This return r_2 depends upon factors such as age of house, condition, size, location, and services in the area. Since most, if not all, home purchases involve a mortgage loan and a downpayment, it is also assumed that the individual borrows an amount L at a rate of interest i and makes a downpayment of E, the equity in the house, at the time of the purchase.[25]

The individual's optimal consumption pattern is also assumed to depend on default. We assume that default occurs when

$$(2) \quad (1+r_2)(E+L) \leqslant (1+i)L.$$

This expression states that an individual will default on a mortgage loan when the total dollar value of a house is less than the total cost of the loan. This equation may be rewritten as

$$(3) \quad \frac{L(1+i)}{(E+L)(1+r_2)} \leqslant 1,$$

[24] It should be pointed out that in an interesting paper, Jackson, Kasserman and Thompson (1979) also rely upon a version of the model developed by Smith. Unlike our paper, however, they concentrate exclusively on the risk of default and default losses.

[25] It is assumed here that the contract rate of interest is a datum. Baltensperger (1976) argues persuasively, however, that one should make the borrower's payment to the lender depend upon both the size and quality of a loan. Since such a change would not affect our basic results, the simpler assumption is retained.

which states that an individual will default when the loan $[L(1+i)]$ to value $[(E+L)(1+r_2)]$ ratio is greater than one.[26]

At the time the mortgage is negotiated, borrowers and lenders know only the expected value of the loan-to-value ratio because the return r_2 is uncertain.[27] However, if the lender and the borrowers know the subjective distribution of r_2, they can estimate the expected value of r_2 and, therefore, the expected loan-to-value ratio. The lender and borrower, however, may have different beliefs about the subjective distribution of r_2. If so, the expected loan-to-value ratios for the lender and borrower will differ. This may explain why borrowers receive a mortgage loan which is less than requested.

Equation (3) may also be rearranged to determine the rate of return which triggers a default. This expression is:

$$(4) \quad r_2^* \leqslant \frac{iL-E}{E+L}$$

The two-period consumption pattern depends upon whether an individual defaults. In the event of default the consumption pattern is

$$(5) \quad c_1 = y_1 - M - E + r_1(E+L)$$

$$(6) \quad c_2 = (1+a)M ,$$

where y_1 is the initial endowment, M is the amount of nonhousing assets, and a is the certain return on those assets. M represents the amount of secure or safe assets held for purposes of diversification.

In the event the individual does not default the consumption pattern is

$$(7) \quad c_1 = y_1 - M - E + r_1(E+L)$$

$$(8) \quad c_2 = (1+a)M + (1+r_2)(E+L) - (1+i)L ,$$

since it is assumed that M is not held as collateral for the mortgage loan.

The individual maximizes expected utility by choosing values of c_1 and c_2 or, after substitution, values for M, E and L that maximize equation (1). The specific maximand is

$$(9) \quad E(U) = V[y_1 - M - E + r_1(E+L)] + \int_{-1}^{r_2^*} W[(1+a)M]\, f(r_2)\, dr_2 + \int_{r_2^*}^{\infty} W[(1+a)M + (1+r_2)(E+L) - (1+i)L]\, f(r_2)\, dr_2 .$$

[26] If an individual attaches some positive costs to a lower credit rating in the event of a default or there is additional collateral on the loan, this equation would have to be accordingly modified. Note also that an individual may acquire more than one asset by borrowing funds. In such a situation, the probability of default on a mortgage loan may not be independent of the risk of default on, say, an automobile loan, especially if the house serves as collateral for the auto loan. Such complications are ignored here.

[27] Of course, information may be acquired and used to reduce the variance of the return. The optimal amount of information will be such that the marginal return from an additional unit of information will equal the marginal cost. This optimization process, however, may be constrained by precluding lenders from collecting and using information relating to race, sex, and age, among other factors. Such government regulations may therefore hinder lenders from using certain types of information, even if it is economically profitable to do so. The correct assessment of risk is thereby made more difficult.

The first-order conditions for a maximum are:

$$(10)\ \frac{\partial E(U)}{\partial M} = -V_{c_1} + \int_{-1}^{r_2^*} (1+a)W_{c_2} f(r_2)dr_2 + \int_{r_2^*}^{\infty} (1+a)W_{c_2} f(r_2)dr_2 = 0$$

$$(11)\ \frac{\partial E(U)}{\partial E} = -(1-r_1)V_{c_1} + \int_{r_2^*}^{\infty} (1+a)W_{c_2} f(r_2)dr_2 = 0$$

$$(12)\ \frac{\partial E(U)}{\partial L} = r_1 V_{c_1} + \int_{r_2^*}^{\infty} [(1+r_2)-(1+i)]W_{c_2} f(r_2)dr_2 = 0.$$

These are both necessary and sufficient conditions for a maximum since strict concavity was assumed for $V(c_1)$ and $W(c_2)$. The first of these equations states that the marginal rate of time-preference $([V_{c_1}/E(W_{c_2})]-1)$ equals the return to the safe asset. The second equation is interpreted in a similar manner. The third equation states that the expected marginal utility from a unit of L weighted by its return $[E(r_1 V_{c_1} + r_2 W_{c_2}]$ should equal the expected marginal utility weighted by its cost $[E(iW_{c_2})]$.

Equations (10), (11) and (12) imply the following structural demand equations for M, E and L as well as the following probability of default equation:

$$(13)\ M^D = M^D[y_1, E, L, r_1, i, a, P]$$

$$(14)\ E^D = E^D[y_1, M, L, r_1, i, a, P]$$

$$(15)\ L^D = L^D[y_1, M, E, r_1, i, a, P]$$

$$(16)\ P = P[E, L, i, f(r_2)].$$

These equations indicate the interdependence among M, E, L and P. Clearly, the probability of default depends upon the terms of the loan (E, L and i) and $f(r_2)$, though not directly y_1.[28] As we discuss below, ordinary least squares estimation of equation (16) may suffer from simultaneous equation bias. [29]

B. *Lender Behavior*

The lender's utility is assumed to be linear in profits over the two-period time horizon. As a result, expected utility is maximized whenever expected profits are maximized.[30] When the borrower does not default, profits are:

$$(17)\ \pi_1 = (1+i)L-(1+\lambda)L,$$

where π_1 is profits and λ is the cost of capital. When default occurs, profits are:

$$(18)\ \pi_2 = (1+r_2)(E+L)-(1+\lambda)L.$$

[28] In the empirical work, account must also be taken of the term to maturity on the mortgage loan. This factor is not considered in the simple two-period model presented here.

[29] The probability of default considered here is the ex ante probability. Once a default has occurred, the probability of default becomes an ex post probability. The difference between these two probabilities should be a random error with a mean of zero. The reason is that lenders will presumably form expectations about default risk which are, on average, correct. This means that lenders should not systematically under- or over-estimate default risk.

[30] It is therefore assumed here that the lender is risk neutral.

Total expected profits are therefore:[31]

$$(19)\quad E(\pi) = \int_{r_2^*}^{\infty} [(1+i)L-(1+\lambda)L]f(r_2)dr_2 + \int_{-1}^{r_2^*} [(1+r_2)(E+L)-(1+\lambda)L]f(r_2)dr_2 .$$

The firm maximizes this expression with respect to L, obtaining the first-order condition:

$$(20)\quad \frac{\partial E(\pi)}{\partial L} = \int_{r_2^*}^{\infty} [(1+i)-(1+\lambda)]f(r)dr + \int_{-1}^{r_2^*} [(1+r_2)-(1+\lambda)]f(r_2)dr_2 = 0.$$

This expression may be rewritten as

$$(21)\quad Pr(r>r^*)(1+i) + Pr(r\leqslant r^*)(1+r) = 1+\lambda ,$$

which states that expected profits are maximized by equating expected marginal revenue with expected marginal cost.

It is important to note that expected profits increase as E rises. Therefore, *ceteris paribus*, the greater the downpayment, the greater the firm's expected profits. The firm's supply of L may thus be written as

$$(22)\quad L^S = L^S[E, i, \lambda, f(r_2)] .$$

Combining equations (15) and (16) with equation (22), after eliminating M and E through the appropriate substitutions, yields the three-equation system:

$$(23)\quad L^S = L^S[y_1, r_1, a, i, \lambda, P]$$

$$(24)\quad L^D = L^D[y_1, r_1, i, a, P]$$

$$(25)\quad P = P[y_1, r_1, a, L, i, f(r_2)] .$$

Several remarks about these equations are in order. First, since L, i, and P are simultaneously determined, these equations should be estimated by simultaneous equation methods. Second, when the loan is guaranteed, as in the case of FHA insured mortgages, the lender faces no default risk. Profit maximization in this case requires that $i=\lambda$, which implies that the L^S curve is horizontal. In this particular case, it is only equations (24) and (25) that need to be estimated simultaneously. Lastly, if r_2 depends upon neighborhood characteristics, P will also depend on those characteristics, even when L^S is horizontal. That is, P will still vary by neighborhood, even though the lender need not take such variations into account because of mortgage insurance.

[31] It is assumed that defaults result in foreclosures. No distinction is made between these two types of events nor are compliance and penalty costs associated with various government regulations. As regards this latter point, a firm may weigh any returns associated with not complying with a regulation against the expected costs or penalties associated with noncompliance. These particular factors are omitted from the model presented here.

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Mortgage Redlining Research: A Review and Critical Analysis Discussion

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Redlining as a Subject for Research

The research on mortgage redlining is, perhaps, even a more interesting phenomenon worthy of study than the subject of the research. Allegations of redlining – the refusal of lenders to make mortgages or their imposition of more onerous terms on mortgagors because of (noneconomic) bias related to the location of the property – are of quite recent origin. Before the early 1970s, the term, redlining, was used almost exclusively to describe an alleged practice by insurers of drawing a red line around sections of a city to delineate an area within which they would not write policies. While mortgagees (and others) had been accused of discriminating against borrowers solely because of their race, national origin, sex, and age, the term "redlining" was not employed to describe these deplorable practices. By now the term is used as a general pejorative description of some institution's alleged refusal to serve some area or even group (e.g., "credit card redlining" and "Hispanic redlining").

The extension of the term "redlining" testifies to the remarkable effectiveness with which it has been used to characterize alleged behavior. I believe that the occurrence is due, in large measure, to the effective public presentation of data by community group activists to support their charges. They have succeeded in getting laws of farreaching importance enacted, including the Home Mortgage Disclosure Act of 1975, the Community Reinvestment Act of 1977 and a number of similar state laws and regulations. This may be considered the first phase of redlining research. The second phase began with the entrance of academic researchers. The third phase, blissful forgetfulness, may already have begun. If so, we will have lost an opportunity to examine, scientifically, the empirical basis on which a considerable extension of regulations rests. I consider first some of the conditions that gave rise to the research attempts by community groups, a remarkable phenomenon in itself. Then I review empirical studies on redlining grouped according to the type of question considered.

Community Concerns and Allegations of Redlining

The late 1960s and early 1970s saw many older urban neighborhoods defaced by abandoned, boarded-up and burned-out buildings. The populations of

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many of these neighborhoods also changed as new people purchased or rented the houses of former residents who had moved to the suburbs. Often the newcomers were of a different religion, ethnic background, or race. The world of the remaining residents had changed, and not (as they perceived it) for the better. Not surprisingly, the concerned people in these disrupted communities did not conduct careful, well-reasoned analyses of the reasons for neighborhood change, abandonments, and deterioration. Had they done so, they might have considered the role of population movements, particularly the effect of the movement of increasingly affluent white city people to suburbs and the in-migration of poor, often black people to the older parts of the cities. When the numbers of families who moved out exceeded the numbers who moved in, dwelling units necessarily became vacant and often buildings were abandoned by owners who preferred not to accept negative cash flows.[1] They also might have analyzed the effect of government highway programs that decreased the cost of transportation to and from suburban areas by workers and businesses. The role of the FHA's programs in the late 1960s that made funds available at low and even zero downpayments and below market interest rates to purchasers of houses in older, declining urban areas was particularly important.[2] In approving loans on properties that did not meet ordinary underwriting standards and in encouraging the purchase of homes by poor people who ordinarily would not be considered financially qualified, the FHA was responsible for much of the neighborhood change and for the abandonments that upset the remaining original residents.[3]

Rather than address themselves to these causes, the community activists concentrated on the lending practices of banks and savings and loan associations. One reason for this approach may have been reaction to the FHA's expanded, lower standards lending program. There appeared to be a clear association between the in-migration of newcomers (such as blacks), abandoned housing and FHA loans. In fact, the term "FHAing a neighborhood" was coined and repeated often as a means of describing the presumably conscious destruction of an area by a malevolent force. That force was not identified as the federal government, HUD or the FHA, but as the chartered financial institutions and mortgage bankers that made the FHA-guaranteed mortgages. Though a complete analysis of the reasons for this choice of targets has not been made, to my knowledge, the following explanations may suffice. First, public criticism of the FHA for extending its guarantees to poorer, often black, people who previously were unable to utilize them is not appealing to people, though they profess sympathy and concern for these groups. Rather, demands that financial institutions make

[1] See Berry [1976], who points out that, over the decade 1960-70, 482,000 new units were constructed in the Chicago SMSA, while the number of new households increased by only 285,000.

[2] Section 104 of the Housing and Urban Development Act of 1968 established a Special Risk Fund for interest-subsidized home mortgages, mortgagors eligible for credit assistance, and properties not meeting the requirement of economic soundness which had to be met in the FHA's ordinary section 203(b) mutual mortgage insurance program.

[3] For a somewhate more extensive discussion, see Benston [1977], pp. 63-73.

conventional loans rather than FHA-guaranteed loans is equivalent to having them deny loans to people who would only qualify for FHA mortgages. Second, middle-class people who wanted to move into the older neighborhoods and who preferred conventional mortgages (perhaps because they did not qualify for interest subsidized FHA mortgages) may have been refused by banks, because the banks perceived the neighborhoods to present bad risks, either because the banks approached did not serve the areas (a not uncommon situation in the then unit banking environment of Chicago, where the anti-bank movement was the strongest), or because the bankers they approached were biased. Therefore, these relatively vocal, action-motivated people saw the banks in the role of villains. Finally, chartered financial institutions make very attractive targets. They are regulated by the federal and state governments, and therefore are amenable to political pressure. They appear to have control over a great amount of resources that could be directed in alternative ways. And since they characterize themselves as serving the public, why should they not be required to serve a given neighborhood?[4]

Community Activists' Research on Redlining

Either by chance or design, the community activists enlisted research in their campaign against FHA lending and towards forcing banks and savings and loan associations to make more conventional loans to buyers of property in older urban areas. They sought to prove to the press, the public and the legislators that the lenders were not serving these areas. They were remarkably successful in this endeavor, in part as a consequence of the brilliant organizational and publicity skills of Gail Cincotta, organizer and leader of the National Peoples Action in Housing and the National Training and Information Center. Studies were conducted by community groups in cities around the country, reported to the press and presented before congressional, state and local government committees.[5] As a consequence, laws were passed and regulations promulgated that have resulted in a great amount of data on mortgage activity by chartered financial institutions being made available. These and other data are now being used by community and professional researchers. An assessment of that research follows.

Basic Requirements for a Study of Redlining

For valid conclusions to be drawn, any study of redlining requires the following minimal conditions, at least, to be met:

1. If the focus is on the terms of the mortgage – such as the interest rate charged, the downpayment required or the term to maturity given – economic factors that impose greater costs on the lenders must be accounted

[4] See Benston [1978A] for additional discussion.
[5] See Agelasto and Listokin [1977] for a summary of these efforts.

for. A model that describes the mortgagee's decision function using only variables that provide estimates of economic costs and benefits should be constructed and specified. Its outcome with respect to mortgage terms then can be compared to the actual terms experienced by mortgagors in situations where it is claimed that the terms charged were based on non-economic considerations. If this is not done, there will be no way of concluding whether the terms charged reflect only cost differences among mortgages, in which event income redistribution is the appropriate response (such as direct subsidies to mortgagors and house sellers or forced wealth redistributions from financial institutions and savers to mortgagors and home sellers).

2. If the focus is on the supply of mortgages, either in terms of numbers or dollars, a demand as well as a supply function must be constructed and specified. When demand is not accounted for, there is no way to determine the reason for any given level of supply.
3. Furthermore, if the focus is on the effects of redlining on consumers and on local areas, data from all mortgage lenders must be included in the study. When this is not done, the most that can be demonstrated is that a particular lender (or subset of lenders) serves areas differently, since other lenders not included in the study may be a preferred or equivalent source of funds.

It is not reasonable to expect community activists to develop and specify, formally, the mortgage decision function model required for an analysis of mortgage terms or the supply and demand functions required for an analysis of the supply of mortgages to areas. However, it is reasonable to expect them or those who rely on their presentations to consider the effect on mortgage terms of property characteristics, such as the past variability of house prices and prospects for increases or decreases in value, and the borrower's financial situation, such as wealth, income, job, and credit record. Moreover, consideration of the demand for mortgages is a crucial aspect of any study of the number or dollars of mortgages supplied. If these variables are disregarded or not adequately accounted for in a study, the only conclusion that should be drawn is that the situation may be worth a well-constructed study.[6]

Types of Redlining Research

Research on redlining may be grouped into six categories: (1) analyses of the supply of mortgages in terms of number and dollars; (2) measurement of the relative risk of lending in areas or to borrowers in terms of defaults and foreclosures; (3) estimates of the terms charged to mortgagors; (4) comparison of the ratios of appraisal values of purchase prices of properties; (5) evaluation

[6] I assume (naively, perhaps) that the purpose of the laws and regulations is the removal or mitigation of an inequity rather than the redistribution, via political power, of wealth from banks, savers and the general public to home owners and buyers in older urban neighborhoods.

of the extent and determinants of denials of applications for mortgages; and (6) estimates of the demand for mortgages by actual and potential home buyers. The first type of research (supply) cannot demonstrate or disprove redlining, but may give some insights into lending patterns. The second type (defaults) can indicate whether risk considerations are a factor in the lending patterns observed. The third type (terms) can provide some evidence of discrimination, given that mortgages are made. The fourth (appraisal ratios) examines an alleged method of discrimination. The fifth (denials) seeks to determine whether mortgages were not granted because of discrimination. Finally the sixth (demand) attempts to determine if applications were discouraged by lenders for unacceptable discriminatory reasons or whether supply patterns reflect demand. The studies in each category are reviewed and evaluated briefly in the balance of the paper, and in greater detail in the appendix.

Analyses of the Supply of Mortgages

Research by Community Groups

The principal procedure employed by community groups was to count mortgages made by a subset of lenders to property buyers in a city area compared to a suburban area. The period over which mortgage lending was measured often was quite short, generally a half year to a year and a half. No attempt was made to measure the costs of lending (in particular the expected cost of defaults) on property located in the areas of concern. However, since few of the studies included measurements of mortgage terms, this omission is not too important. Failure to measure or even consider the demand for mortgages is a more serious shortcoming. Absent demand analysis, one cannot conclude from the fact that more mortgages were made in, say, a city area compared to a suburban area, that the lender discriminated against purchasers of city property. Nor can one infer from a finding that relatively more FHA-insured mortgages and fewer conventional mortgages were made on city property than on suburban property that lenders "pushed" FHAs on or denied conventionals to buyers of city property. In addition, almost none of the studies attempted to measure the mortgage activity of more than a subset of lenders, usually savings and loan associations and savings banks. Mortgages made by commercial banks and mortgage bankers almost never were included in the data. Furthermore, the periods over which mortgage lending activity was considered generally were quite short, with no account being taken of the prior lending practices of the institutions studied. Hence, even were demand equal in the areas compared, one cannot conclude that a specific institution was or was not deliberately neglecting some area. Nor can one conclude that an area was under- or over-served (in some sense).

Perhaps the only meaningful data presented in these studies are reports of the experiences of individuals. These case studies may provide evidence that a specific lender or employees of the lender denied mortgages to individuals primarily on the basis of socially unacceptable criteria, such as the applicant's race or sex. However, without some evidence of independent verification, there is no way to tell whether the applicant's perception of discrimination was correct.

Nor can one determine if the practices reported were specific to an individual lending officer, an institution, or to lenders in general. In any event, my reading of the community activists' studies revealed very few reports of individual discrimination. Considering other evidence on the biases held by many white, married, middle-class males who tend to live in suburbs (a group that dominates mortgage lending officers), I was surprised to find so few specific complaints.

The generalizations presented above can be illustrated, in part, by reference to a few of the more prominent studies. In addition to the shortcomings discussed above, some of these studies have presented data and conclusions that can be characterized fairly only as fraudulent. A few of these situations are pointed out in the brief reviews given in the appendix.[7]

Research by Professionals

Since "redlining" often is defined as the non- or reduced-availability of mortgage financing for house purchases in discriminated-against areas (or to persons), some researchers have attempted to use supply and demand analysis (formally or implied) to determine whether a particular area or group received fewer mortgages than would be expected were discriminating practices not present.[8]

The first (to my knowledge) of these studies, Devine [1973], actually only presents an analysis of supply. Indeed, the possibility that the amount of mortgages supplied could be a function of the amount demanded was not even mentioned. This study is much more sophisticated than the community group studies, both in language (a dispassionate discussion of presumed lending behavior is presented at some length) and method (multiple regression analysis). Perhaps as a consequence, it was cited often in the hearings preceding enactment of the Home Mortgage Disclosure Act of 1975. It is seriously deficient, though, even as a supply study. The 14 geographical observations (Community Planning Districts) are too heterogeneous with respect to race, income, housing and other important variables. The data include less than 22 percent of the mortgages in the area. And the regressions indicated that the proportion of minorities in an area was related to mortgages granted only if some observations were dropped and independent variables redefined.

The studies following Devine's effort were much more carefully modeled and specified. Ahlbrandt's [1977, pp. 474-475] paper provides a succinct illustration of the type of model developed. Four equations (slightly changed here) are presented:

(1) mortgages demanded, $M_d = f_d\ (T, P, i)$

[7] See Benston, Horsky and Weingartner [1978], Chapter 1 for a detailed critique of nine studies. Also see King [1979A] for a critical review of 14 studies and papers.

[8] See the appendix for more detailed reviews of the eight studies mentioned that support the conclusions given here.

(2) mortgages supplied, $M_s = f_s (i, C, N, P)$

(3) potential real estate transactions, $T = f_t (i, M_s, P, C, N)$

(4) in equilibrium, $M_d = M_s = M$

where P = price of land and housing

i = loan terms (a vector interest rate, downpayment, and term to maturity)
C = creditworthiness of loan applicant
N = neighborhood characteristics (current and expected change).

The model then is simplified by substitutions to obtain the following reduced form:

(5) $M = f_m (P, C, N)$.

The reduced form then is specified with mortgage flow data (M) from a subset of lenders, aggregated by census tracts, with borrower and neighborhood characteristic variables (C and N) obtained from census data (usually from the 1970 census).

Ahlbrandt [1977] used an expanded version of equation (5) in his study of mortgage lending in Pittsburgh. Mortgages made, by census tracts, was regressed on percent black and other variables. His study is a considerable improvement over earlier supply studies in several important regards. He included mortgages made by all financial institutional lenders (though other sources of funds were excluded). Variables other than race (or area) are included (though the values are four years out of date).

However, the reduced form of equation cannot yield estimates of mortgage over- or under-supply, since demand for mortgages is not accounted for. If census tracts occupied largely by whites are characterized by greater mobility and hence greater demands for mortgages, "percent black" will be negatively associated with the number of mortgages demanded and supplied. Or if blacks are discriminated against by mortgage lenders, they may obtain funds at more onerous terms but these terms will not be revealed by the analysis. Or blacks may prefer to borrow from noninstitutional lenders because the terms offered (such as low downpayments) are less onerous or the service supplied is better. Furthermore, other independent variables (such as family income and the crime rate) are likely to be associated with percent black because of the economic condition of blacks due to past (and present) discrimination in employment and education.[9] In this event, the relationship between race, demand for mortgages, and risk cannot be separated.

Hutchinson, Ostas and Reed [1977] used data provided by Toledo, Ohio savings and loan associations. Though their study is more elaborate than Ahlbrandt's, it suffers from the same serious shortcomings. At most, they find that

[9] See Hauser and Elkhanialy [1978] and Dingemans [1979].

the mortgages made by these lenders in 1975 may have been related to the average percent black in census tracts. Based on an analysis of the data, the researchers conclude: "These results are consistent with the hypothesis that redlining takes place on the basis of risk aversion . . . [rather than] on a taste for discrimination." [p. 469]. In another updated and better paper, (Ostas, Reed and Hutchinson [1979]), they used an improved variable to measure demand – the number of one-to-four family units shown in real estate brokers' multiple listing guides. The results are similar to those found in their earlier paper. But the reduced-form equations cannot provide information as to why or whether more or fewer loans were made in census tracts.

Hauser and Elkhanialy [1978] present data on lending by savings and loan associations in Chicago. They show that relatively fewer loans were made in census tracts that are heavily black, and that "black" is positively correlated with low family income, nonowner occupied, and low home values, variables which explain much of the differences in lending.

Dinglemans [1979] also finds that factors other than minority status explain differences in lending by savings and loan associations. His careful study of Sacramento describes the activities of real estate agents and mortgage bankers in providing mortgages and shows that if their supply is excluded, areas not said to be redlined will appear to be so.

Whalen's [1976] study of Flint, Michigan attempts to separate the effect of variables such as income and quality of housing from race by regressing mortgages made first on these "prudent lending" variables (as he calls them) and then on race and other "discrimination" variables. With respect to race, he finds only that the average price of houses in a census tract (which he mistakenly identifies as the average mortgage amount) is negatively related to the percent black and racial change.

Schafer's [1978, Chapter 5] study of New York City represents the only example of which I am aware of measuring the possible shortfall of mortgage funds rather than simply the relationship between the characteristics of census tracts and the amount of mortgages made (and perhaps demanded). The three counties in New York City studied, Bronx, Kings (Brooklyn) and Queens, were dichotomized into neighborhoods that are alleged to be redlined and neighborhoods that are not. The identifications were based on interviews with people from community organizations and from published reports.[10] A model relating mortgage lending to explanatory variables was estimated for each area separately, and the coefficients compared. The coefficients from the presumably unconstrained (by redlining) data then were multiplied by the values of the independent variables from the alleged redlined observations and then aggregated to predict the expected amount of mortgage funds, were there no redlining. The predicted compared to the actual provides an indication of the extent to which mortgage funds are undersupplied to the alleged redlined neighborhoods.[11] The

[10] This procedure previously was employed by Benston, Horsky and Weingartner [1978] in their study of Rochester, New York.

[11] A similar procedure was followed for mortgage terms by Benston, Horsky and Weingartner [1978], as is discussed below.

data are mortgages made by a subset of savings banks in 1975. Schafer finds no evidence of redlining with respect to conventional one-to-four family mortgages. Indeed, he finds that two of the seven alleged redlined neighborhoods would receive more funds if they were redlined than if they were not. The exercise was also undertaken for FHA and VA one-to-four family mortgages and the multifamily mortgages, with similar results.

Finally, Koebel [1978] presents a very detailed description of all sources of mortgage funds in Louisville, Kentucky, which reveals the considerable extent to which chartered financial institutions are not the sole source of housing finance.

In summary, the reports of differences in the quantity of mortgages made to city compared to suburban areas clearly demonstrate very little and certainly prove nothing about the existence of redlining or are inconsistent with the claim that redlining is practiced. Though professional researchers have attempted to structure theoretically based supply and demand models, with a few exceptions they employed supply models, at best. For the most part, they examined data that are the result of the interaction of supply and demand as reflected in the records of a subset of lenders. A few studies employed better instrumental variables for demand (in particular, the real estate listings used by Ostas, Reed and Hutchinson [1979]), but at best all that can be demonstrated is that some lenders did not serve all markets equally. For this purpose, Schafer's [1978, Chapter 5] procedure of applying a supply function derived from assumed non-redlined data to estimate supply to an allegedly redlined area might be preferable. However, as Dingemans' [1979] and Koebel's [1978] studies show, lenders tend to specialize in serving different areas, which need not disadvantage borrowers. Therefore, other subjects of research must be considered before any knowledge about redlining can be obtained.

The Relative Risk of Lending – Defaults and Foreclosures

The possibility that borrowers may default on their obligations, thereby imposing costs on lenders, is a factor that obviously must be considered in studies of lender performance. Default costs include additional administrative expenses of processing notices when loans become delinquent less late fees collected from delinquent borrowers. When defaults are repaired, the net cost usually is small or there even may be a net benefit. However, when a mortgage must be foreclosed, the costs usually are positive, since if the net market value of the property exceeded the loan balance, the mortgagor could have benefited by selling the property, thereby protecting his or her credit rating as well as gaining directly. The costs to the lender of foreclosed mortgages include legal and other expenses related to processing documents to obtain possession of the property, expenses related to the maintenance of the property until it is sold, legal and other selling expenses, the loan balance owed and interest foregone on funds invested. These costs are reduced by the amount received for the foreclosed

property, either from sale[12] or from an insurance agency, such as the FHA, VA, or private mortgage insurance company.

Lenders may adjust to the expected loss from foreclosures in several ways. The most direct method would be to charge sufficient interest yields to offset the net costs (adjusted for the time of occurrence). But this price adjustment is constrained where state usury ceilings are effective or where the cost of adverse publicity and criticism by regulators makes raising interest rates infeasible. The lender then can reduce the risk of default by requiring higher downpayments and shorter terms to maturity. Borrowers who present a higher probability of default, such as those with lower levels of present and future income and wealth, and those for whom the cost of default in the form of a poor credit rating is low, can be screened out. Similarly, properties which present a relatively high probability of a market value decline below the mortgage balance can be screened out. (Indeed, where neighborhood factors are believed by lenders to offer an efficient means of identifying such properties, the areas may be "redlined," though not in the pejorative discrimination sense of the word.) Therefore, since lenders usually cannot be compensated with higher yields, they will tend to accept only mortgages on which the expected cost of default is equal, given the other terms, etc.[13]

Defaults nevertheless occur because of errors, regulation, and possibly, lenders' biases. The errors could be caused by unexpectedly changed events, such as an unexpected economic decline that reduces borrowers' wealth and the market value of houses. Or the default experience could be caused by regulatory or political agencies that force lenders to make mortgages on properties in particular areas. Alternatively, risk-averse regulators (such as bank examiners before the enactment of the Community Reinvestment Act of 1977) could cause a less than desired level of defaults if they imposed costs on lenders who wanted to make mortgages on properties in certain areas. Or the lenders could be biased against or for persons or neighborhoods despite the expected economic consequences of their lending decisions. Only the last possibility should be considered to be redlining or favoritism in its pejorative sense. But it does not seem possible to distinguish between the bias motive, prediction errors, and regulatory influences by examining data on mortgage defaults.

Therefore, a default study should use data that were not prescreened by lenders. Conventional mortgages made by chartered financial institutions generally do not meet this criterion, particularly in a state (such as New York) that imposes a restrictive usury ceiling on interest rates. FHA insured and VA guaranteed loans would meet the criterion, except that the lenders and the government agencies have incentives to prescreen applicants. The lenders bear costs when mortgagors with FHA and VA loans default because these agencies do not com-

[12] If the property is kept by the lender, this is the equivalent of a sale.

[13] This equality holds across mortgages and is equal, on the margin (on a present value basis), to the revenue from risk premiums charged on mortgages (relative to risk-free alternative investments and net of administrative and transactions costs).

pletely reimburse the lenders for the economic costs incurred.[14] The agencies bear most of the costs of default. They have an even greater incentive to deny risky loans, particularly because the insurance premium charged is the same for all loans. However, they are supposed to disregard general neighborhood factors and such borrower characteristics as race and sex. A particular exception to the usual lending criteria is the FHA's Special Risk Fund loans (e.g., section 235 and 221 (d)(2)) and the post-1968 policy imposed on the agency of accepting loans on properties in declining urban areas that previously would not have been accepted. Data from these loans would be very useful for a study of default experience related to neighborhood characteristics.

Only one of the six studies reviewed very briefly below (Marcis and Hull) meets the full sampling criterion and another (Barth, Cordes and Yezer) meets it partially. Therefore, the relevance of the others to the redlining question is limited. Nevertheless, they provide some information on the actual experience of some lenders.[15]

Characteristics that usually describe older, poorer neighborhoods, with other factors held constant, are found to be positively associated with higher foreclosures in most of the studies. In Williams, Barenek and Kenkel's [1973] study of Pittsburgh, this variable is the unemployment rate in a census tract. Percent black was excluded as an independent variable because it was correlated at .75 with the unemployment rate. (Per capita crimes against persons and median family income also were omitted for that reason.) The unemployment rate is significantly, positively associated with defaults, though it is not as statistically significant as some of the other explanatory variables. In Morton's [1975] study of Connecticut, the neighborhood variable is three-family houses. These generally were converted from older houses in declining neighborhoods. His findings indicate that neighborhood quality, as measured by this variable, affects defaults positively.

Schafer's [1978, Chapter 3] study of foreclosures in alleged redlined and other New York City neighborhoods shows some evidence of greater foreclosures in the former. A multiple regression analysis, which did not include alleged redlined and other neighborhoods as variables, shows statistically significant coefficients indicating higher foreclosures in census tracts with higher percentages of poor condition buildings, multiple-wage earner households, and single-family houses. His studies of four upstate New York cities [Schafer, 1978, Chapter 8] also found some (weak) evidence of relatively greater foreclosure rates in alleged redlined compared to other neighborhoods. The borrowers' race was not included in any of his analyses.

[14] The FHA does not fully reimburse the lender for interest lost on the first 60 days after default, for one third of direct foreclosure and acquisitions costs, or for the lender's own (internal) foreclosure expenses. Furthermore, interest on the lender's investment (after 60 days) is allowed at the FHA's debenture rate. The VA does not reimburse the lender for attorney's fees greater than $250 or for the lender's own expenses. However, the principal balance due is credited at face value, gross of unamortized points. The expected cost is the present value of the increased probability of default times the unreimbursed cost.

[15] See the appendix for detailed reviews of the methodologies and findings of the six studies.

Marcis and Hull [1975] is the only study to use largely unscreened data on FHA section 221(d)(2) and 235 insured mortgages. For the former, they found the zip code area characteristics of higher percentage of female family headship, lower family income, greater instability of occupancy, and lower level of education to be associated with higher foreclosure rates. The percentage differences found are considerable (e.g., a 10 percent increase in the percentage of female heads of households is associated with a 1.5 percentage point increase in foreclosure rates, which averaged about 5.5 percent). This study also did not specify the borrower's race or the racial characteristics of the area.

Finally, Barth, Cordes and Yezer [1979] used nationwide FHA data for regular, section 203(b) insured mortgages. As compared to conventional mortgages, these mortgages are less likely to have been prescreened to reduce defaults. The study also benefits from a large set of carefully sampled data. The authors found that defaults are statistically significantly higher on mortgages made to blacks (1.2 percent), lower to female heads of household (0.3 percent), higher for wood constructed houses (0.2 percent), higher on buildings located in the central city (0.1 percent) and in blighted areas (0.3 percent), compared to an overall average default rate of 1.5 percent.

Thus all the studies report data that are consistent with the conclusion that foreclosures are higher in areas often alleged to be redlined or to some persons alleged to be discriminated against, even though all but two used data that were screened to reduce (if not eliminate) foreclosures, and the least screened of the two used overly aggregated data. (I should note, again, that "black" is likely to be a surrogate for other variables.)

Terms Charged to Mortgagors

The most direct measure of bias against mortgagors is the price paid for the funds they receive compared to the price paid by others, *cet. par.* Two problems must be solved for such an analysis to yield meaningful findings: price must be defined and measured and all the other factors that result in price differences must be accounted for. Price for mortgages essentially is the interest rate paid (including points). However, it also includes other mortgage terms, particularly the downpayment required and the term-to-maturity offered. The others consist primarily of those that affect the expected cost of nonrepayment and noneconomic factors, including possible bias against or for certain mortgagors. The four studies reviewed below represent different attempts at quantifying these variables and measuring their relationship.[16]

The studies reviewed are inconsistent with the hypothesis that buyers of houses in allegedly redlined areas, defined by community groups or as census tracts with a high percentage of blacks, were discriminated against. Schafer's [1978, Chapter 6] study of New York City is the most elaborate. He computed simultaneous equations that included the average mortgage terms, in census tracts, of the interest rate, loan-to-value ratio, and term to maturity. The regres-

[16] See the appendix for more detailed reviews on which the conclusions given here are based.

sions have 45 independent variables, including dummy variables for six alleged redlined neighborhoods, and the percentage nonwhite and change in the percentage nonwhite. The results for conventional one-to-four family mortgages generally are inconsistent with the hypothesis that terms are more onerous for alleged redlined neighborhoods or groups. However, the results are mixed, indeed a bit confusing. Few of the coefficients have statistically significant coefficients and some have the "wrong" sign. These results also are reported for data from a special study and for multifamily houses. However, the quality of the data are so questionable that they limit acceptance of his results severely.

Muth's [1979] study of terms on 1903 conventional one-to-four family mortgages made by state-chartered savings and loan associations in Oakland, California in 1976 and 1977 is very well designed. As he points out:

> For redlining if it exists would imply a reduction in the supply of mortgage loans. Fewer loans might also result from a smaller demand for conventional mortgage loans, either because potential purchasers of homes prefer other methods of finance or because the demand for purchase itself is lower in areas where fewer mortgage loans were made. A reduction in the supply of mortgage loans, given their demand, would lead to higher prices or mortgage yields on such loans. Alternatively, if fewer loans are made because the demand for them is smaller, the yields on loans made would tend to be the same or lower than those on loans made in other areas. In seeking to determine why fewer conventional mortgage loans are made in certain parts of cities, then, the variation of mortgage yields is of critical importance. [pp. 1-2]

Muth calculated the theoretically correct rate of interest (which is not constrained by a usury law) for each mortgage and regressed it on variables that measured borrower and property characteristics. The coefficients calculated indicate very slightly higher interest rates (which averaged 9.3 percent) associated with black male borrowers (on average, .02 higher), other minority males (.03 higher), but lower rates with females (.03 less). Loan-to-value ratios are slightly higher for black than for white male mortgagors (.84 compared to .79) and maturities averaged 5 percent less in all black compared to all white census tracts. However, when variables for the quality of housing and family income were included in the regression, the coefficients for "black" became small and insignificant. Muth concludes: "This suggests to me that the higher riskiness lenders may attach to loans in black neighborhoods is not due to race *per se* but rather to the poorer quality of dwellings and lower borrower income on loans in such areas." [p. 15]

Benston, Horsky and Weingartner's [1978] study of mortgage terms in Rochester, New York is unique in that they obtained data on 712 one-to-four family house mortgages made over a three-year period from all the lenders in an area, including mortgage bankers. They also employed the technique of applying a lending function from a control to an alleged redlined area (as defined by anti-redlining group leaders), and vice versa. Analyzing mortgages by type (conventional, FHA and VA) separately, they found almost no difference in

interest rates between the areas. Loan-to-value ratios, the number of months to maturity and a variable that combined the terms were regressed separately on variables that characterized the borrowers and the properties. Separate regressions were computed for each area and for conventional, FHA, and VA mortgages. The analysis showed that virtually all of the differences between the areas in loan-to-value ratios and most of the differences in months to maturity were due to factors other than area. The combination variable showed almost no difference between the areas, even though account was not taken of area-related risk factors.

Finally, King [1979B] analyzed the terms on mortgages made by savings and loan associations in Miami, San Antonio and Toledo on 1960, 953 and 559 owner-occupied, residential properties made during three months in 1978. For mortgages made in each city he regressed interest rates, term to maturity, loan-to-value ratios, and fees on variables that specified the borrower's characteristics (particularly minority and marital status, sex and age), the age of the structure mortgaged, neighborhood characteristics (particularly the percentage of minority population in census tracts in 1970), the neighborhood in which the property is located (for Toledo only), and the savings and loan association that made the loan. With OLS and simultaneous equations, he found almost no evidence of more onerous terms related to possible discriminatory factors (such as race or sex), particularly with respect to the difference between the requested and granted term to maturity and loan-to-value ratios.

Appraisal Values and Purchase Prices of Properties

Critics of bank lending practices claim that appraisers systematically underappraise properties in some areas and/or on which minorities or others make offers. Consequently, they claim, the potential purchasers either must make larger downpayments or are prevented from purchasing the houses. Alternatively (and perhaps partially) the sellers can reduce the price of the houses.[17] Four studies analyze this situation in various ways. None of them find evidence that supports the biased appraisal hypothesis.[18]

Schafer's [1978, Chapter 4] study of the New York City area used data from a long period (at least 27 years) gathered from savings banks. He regressed the ratios of appraisal to selling price on variables measuring the age of the building, the type of mortgage, the neighborhood in which the building is located (alleged redlined or other in New York City), and the year in which the mortgage was made. The regressions also were computed separately for alleged redlined, other New York City neighborhoods, and three suburban counties. The analyses reveal no evidence that the banks systematically underappraised older houses or properties in the allegedly redlined neighborhoods, either for one-to-four family

[17] It is worth noting that if the selling price of a house were depressed because of underappraisals, the purchasers would benefit at the expense of the sellers, but there is no other necessary effect. See Benston [1978] for an analysis.

[18] See the appendix for details.

or multifamily houses. Schafer [1978, Chapter 9] repeated the analysis for four upstate New York cities and their suburbs for one-to-four family properties, with similar results.

Benston, Horsky and Weingartner's [1978] study of Rochester, New York mortgages compared the ratios to appraisal to selling price in an allegedly redlined area with a presumably favored suburb. Conventional, FHA and VA mortgages were scheduled separately. Virtually no differences were found between the areas for each type of mortgage.

King's [1979B] study of savings and loan associations in Miami, San Antonio and Toledo is unique in that he included mortgages applied for and denied as well as mortgages made. He first reviewed the reasons given for denials and found very few to be "inadequate appraised value" and these few were not related to the borrower's race. Second, he regressed the appraisal ratio on variables representing the type of mortgage, age of property, the borrower's race, sex and age, and neighborhood characteristics that might be associated with redlining. This analysis also found no evidence of discriminatory behavior by the associations; to the contrary, significantly higher ratios were found for blacks in Miami, and Spanish-American and some city neighborhoods in Toledo.

Denials of Mortgage Applications

The studies reviewed to this point present findings that either are not meaningful or that are inconsistent with the hypothesis that mortgage lenders discriminate against areas or minority persons. However, except for King's study of appraisals, they use data that results from a mortgage having been made. It may be that lenders discriminate by denying mortgages applied for by minorities or for houses located in allegedly redlined areas. They also might accept such mortgage applications, but only with modifications that impose harsher terms on those against whom they are biased. But if this practice had occurred, mortgages with harsher terms would have been written and should have been discovered by the studies of mortgage terms reviewed above. Since these studies reach contrary conclusions, the modification method of discriminating does not seem likely as a practice. Two other possibilities remain. Lenders could be so negative that they cause potential borrowers to withdraw their applications. But considering the cost of filing an application (the borrower's time and effort plus application and appraisal fees charged by lenders), it seems much more probable that completed applications were withdrawn because borrowers found superior alternatives. The other possibility, that potential borrowers are discouraged from applying or are turned down before filing an application, seems a much more likely possibility. Research on this possible redlining method is reviewed in the next section.

The studies of mortgage applications seek to determine whether applications are denied for reasons not associated with ordinary economic considerations, but rather with the applicant's race or the location of the property. The possible limitations of this type of analysis are well stated by Schafer [1978, p. 7-4], as follows: "If the discrimination variables [e.g., applicant's race] are not statisti-

cally significant, however, it can be inferred that discrimination is not a factor, provided that the race variable is not correlated to any relevant variable that has been excluded because of inadequate information. If the discrimination variables are statistically significant, it can only be stated that these results are consistent with the existence of discrimination. The extent to which a result is taken to support some form of discrimination depends on how complete the rest of the model is; that is, on how well the model controls for non-discriminatory factors that enter into the decision to lend."

The six studies reviewed apply somewhat different approaches to different sets of data and report somewhat different results.[19] The first study suffers from a paucity of denied mortgages. As is elaborated below, I believe that the Warner and Ingram study is superior to Schafer's two studies. King's study is more comprehensive than the other studies in that it covers three cities. The last study is included for completeness.

Black, Schweitzer and Mandel [1978] used data from a survey of applications filed at 176 banks nationwide (out of 300 asked to participate). Problems with the data reduced the number of observations to less than half the original amount, which limits the conclusions that can be drawn from the study. The data show a denial rate of only 2.7 percent. A probit regression model was employed, from which they found a positive relationship between black race and the probability of denials that is statistically significant, but at the .10 level. Inclusion of the applicant's race in the probit regression, though, improves the fit of the model but slightly. Unfortunately, the authors do not give (nor can the reader compute) the amount of the greater probability of denial associated with the applicant's race.

Schafer [1978, Chapter 7] used data derived from Equal Housing Opportunity Lender forms filed at 27 mutual savings banks in New York City. His study also suffers from missing data, which reduced the number of usable observations considerably. Nine percent of the applications analyzed are denials. From logit and OLS analyses of denials and acceptances, he found statistically significant relationships between the applicant's race and denials which imply that compared to a white applicant, black and other minority applicants have a greater probability of denial of from 9 to 21 percent (depending on the procedure employed). He also found that the location of the property on which a mortgage is desired was *not* a factor in the denial or acceptance of the application.

Schafer [1978, Chapters 11 and 12] also studied applications at savings banks in the Albany-Schenectady-Troy SMSA, Buffalo, Rochester and Syracuse, New York. The denial rates in these areas averaged 8, 8, 3 and 6 percent. The data base also was greatly reduced because of missing information in the forms. His logit regressions lead him to reject the hypothesis that the institutions denied relatively more applications from buyers of properties in alleged redlined areas.

[19] See the appendix for more detailed reviews and analyses on from which these brief synopses are derived.

(The exception is two neighborhoods in Albany, from which five applications were denied.) But he reports strong estimates that blacks faced statistically significantly greater probabilities of having their mortgage applications denied that are about twice those of similar whites in all areas except the Albany SMSA. But these findings are based on only 45 denied applications from blacks in Buffalo, 6 in Rochester and 5 in Syracuse.

King [1979B] analyzed applications recorded at savings and loan associations in Miami, San Antonio and Toledo from September through November 1978. He found evidence of no adverse selection of borrowers or properties, with the exception of Hispanic borrowers in Miami and San Antonio; denial rates for them average about .03 higher than the mean rates of .12 for Miami and .05 for San Antonio.

Warner and Ingram [1979] studied the behavior of almost all the chartered financial institutions in Columbia, South Carolina. These institutions denied about 5 percent of the conventional mortgage applications made. The authors use multiple discriminant analysis to test the hypothesis that the addition of variables that might be used for noneconomic discrimination affected the institutions' denials. They first used a function that includes only economic variables (e.g., applicant's credit rating, loan-to-value ratio requested, and applicant's tenure in current occupation) to distinguish between accepted and rejected applications. Then they added "discrimination" variables, such as the applicants' age, marital status, age of dwelling, sex, and race. They found that the additional variables did not significantly increase the predictive power of the function. Their results were confirmed with a validation sample. Tyree and Yeager [1979, Chapter 10] study of applications for high-risk loans in St. Louis also found no evidence of different denial rates associated with the applicant's race or the location of the property.

Thus all the studies found no evidence of differential denial rates related to the area in which a house is located. These findings, therefore, are inconsistent with the hypothesis that lenders redline by denying prospective mortgagors' applications. However, the studies conducted by Schafer (and possibly by Black, Schweitzer, and Mandel) report evidence of higher denial rates related to the applicants' black race. King finds some evidence of higher denial rates for Hispanics but not for blacks. None of the studies determine whether the results are due to risk-related or other nonobjectionable discriminatory factors. Warner-Ingram and Tyree-Yeager find evidence of no discrimination. The evidence, therefore, is not consistent, except in finding that denials apparently were not a form of area redlining.

The Demand for Mortgages by Actual and Potential Home Buyers

The applications data analyzed may not reveal discrimination by lenders against minorities or people who want to buy property in certain areas if the lenders are able to discourage these people from filing an application. This form of redlining is relatively easy to do. As Dingemans [1979] describes, real estate agents are a major source of information about the availability of mortgage

funds. The agents have a considerable economic incentive (the commission) to "close the deal," for which a mortgage usually is required. Therefore, they are likely to avoid lenders who have let it be known, by word or past actions, that they are unlikely to approve applications from certain types of people on certain properties. Lenders also require an appraisal for which they usually charge a fee. Thus they can discourage a potential mortgagor from filing an application by indicating that the appraisal will be delayed or that the application is likely to be turned down. Since there are no reported data on these discouraged applicants, special studies are required.

Direct analysis of the demand for mortgages also is necessary to determine whether the lower amount supplied to certain areas (as shown by many studies) is due to lack of demand or to lender discrimination. Instrumental variables, such as the stock of existing houses and other census tract data, are unlikely to be effective for this purpose. (Additionally, the census data are now 10 years out of date.) While the number of houses listed for sale with real estate agents (the multiple listing data used by Ostas, Reed and Hutchinson [1979]) are perhaps as good a proxy for demand of this type as one can obtain, it cannot distinguish between demands for conventional as compared to FHA, VA or private mortgages. Nor can its use reveal whether potential home sellers did not list their homes because they believed that buyers could not get mortgages. Hence it is necessary to obtain information directly. This is what the two studies reviewed next attempted.[20]

Benston and Horsky [1979] employed survey methods to determine whether the demand for mortgages and home improvement loans by owners and potential buyers of homes in the allegedly redlined area of the city had been met and whether home buyers received the type of mortgages and service they wanted. The allegedly redlined area was defined by community group leaders and other experts; essentially it is the central city of Rochester, New York. A suburb, suggested by these experts, was chosen as a control area. Because potential home buyers cannot be identified and located, home owners were interviewed, since a potential home buyer necessarily would have to contact the owner before attempting to get a mortgage. The home owners in both areas reported that none of the problems they encountered in selling their homes over the past five years were due to difficulties encountered by prospective buyers in getting mortgages because of the location of the house. However, three times as many central city as suburban home owners (36 percent vs. 13 percent) said that no potential buyer had inspected their homes that were offered for sale. Of the home buyers interviewed, all but 0.4 percent (one person) who bought homes in the central city and wanted a mortgage, got one. Mortgages were obtained predominantly at the first lending institution contacted (84 percent of the central city and 89 percent of the suburban mortgagors). The data also indicate that very few people got FHA insured or conventional mortgages for reasons other than their choice. Nor did home owners in either area experience difficulty in obtaining home improvement loans.

[20] See the appendix for more detailed summaries.

Tyree and Yeager [1979] interviewed all the community leaders in St. Louis, Missouri who could be contacted. Many indicated dissatisfactions with real estate lending institutions, which they considered to be biased against their areas. The leaders also spoke of people's experiences with redlining. When pressed to identify specific people, repeated requests and consultations yielded but seven names. Of these two could not be found, four denied they had the problem, and the seventh appeared to be a case of lack of creditworthiness.

The two studies reviewed used different methods for determining the extent to which the demand for mortgages from allegedly redlined areas was not met. Both provide evidence that this demand was not present and that allegations of redlining were based on misperceptions. Their principal limitation is their use of stated experiences and opinions rather than the hard data that economists prefer (which often are obtained by someone else from interviews). This limitation is particularly important for the Benston-Horsky method of asking home owners about the problems encountered by potential buyers of their homes. Unfortunately, to my knowledge, no one has designed a better method.

Summary and Implications for Further Research

It seems clear that the studies of the supply of mortgages to specific areas and groups by subsets of lenders are of very little value. They cannot be used to determine whether potential borrowers are well served or discriminated against. At the least, data also are required on mortgages made by other lenders. The role played by such usually omitted sources as mortgage bankers and private funds is revealed by Dingemans [1979] and Koebel [1979]. The demand by home buyers for mortgages is an even more important factor that must be considered. Only the Ostas, Reed and Hutchinson [1979] study employed a possibly valid measure of demand – houses for sale as reported in multiple real estate listings. But this approach would be useful only if the activities of all lenders in the area were included. And even then, one could not know whether private or any specific type of financing was used because it was preferred or the only alternative available. Schafer's [1978, Chapter 5] procedure of estimating a supply function for areas acknowledged as nonredlined and applying the coefficients estimated to determine the expected supply to allegedly redlined areas offers some promise. But unless all lenders are included, it cannot begin to speak to the hypothesis that potential borrowers are disadvantaged. Nor can the quality of the activities of a particular lender or group of lenders be determined without knowledge of demand and of the past lending behavior of the institution(s) in question. Therefore, I can see very little, if any, research value in studies that use data such as those made available by the Home Mortgage Disclosure Act.

Studies of the relative risk (actually cost) of lending on properties in allegedly redlined areas or to allegedly discriminated-against persons could be useful for determining whether the terms charged are based on economic or noneconomic factors. But data on loans made in the ordinary course of business are unlikely to provide these estimates because lenders can be expected to avoid loans that offer more than a minimal expectation of default. Rather, studies should use

essentially unscreened or differently screened data, such as the experience from the FHA's programs to make funds available to borrowers and on properties that do not meet ordinary underwriting standards. High-risk lending programs, such as the St. Louis Savings Service Corporation whose denial decisions are analyzed by Tyree and Yeager [1979, Chapter 9], are another source of such data. Only the Marcis and Hull [1975] study used such data; they found significantly higher foreclosures in zip code areas that are characterized by female heads of households, low income and education, and greater instability of occupancy. Barth, Cordes and Yezer [1979] used regular program (203b) FHA insured mortgage data, which are not screened as completely as are conventional mortgages. They found that mortgages made to blacks had almost twice the default rate of the average mortgage, *cet. par.* Considering that the other studies reviewed used data that had been screened by lending officers, it is interesting to note, nevertheless, that they found significantly higher foreclosure rates on mortgages made on properties located in possible or allegedly redlined areas and to allegedly discriminated-against persons.

Comparison of the terms of mortgages between areas and persons offers a better opportunity to determine whether or not redlining is practiced. If it is, the interest rate, downpayment requirement and/or term to maturity should be harsher for the discriminated-against mortgagors than for others, *cet. par.* Schafer's [1978, Chapter 6] study used simultaneous equations; Muth's [1979] study used OLS; Benston, Horsky and Weingartner's [1978] study used a loan offer function estimated for a presumably favored area and then applied to an allegedly redlined area; and King [1979B] compared requested with granted terms and included an analysis of fees. The first study used data from a subset of New York City state-chartered banks, the second Oakland, California state-chartered savings and loan associations, the third all the major institutional lenders (including mortgage bankers) in Rochester, New York, and the fourth savings and loan associations in Miami, San Antonio, and Toledo. The four studies reviewed report that mortgage terms do not differ much (if at all) between mortgages made on properties in allegedly redlined and other areas and by blacks, Hispanics, women, older people or unmarried people. Because higher prices (terms) charged to borrowers provides a meaningful measurement of the presence of discrimination, given that the effect of economic factors is accounted for, the extension of such studies to other areas would be useful.

The allegation that lenders systematically underappraise property located in certain areas or purchased by minority buyers also was studied. Schafer [1978, Chapters 4 and 9] studied appraisals on mortgages granted in New York City and in four upstate New York cities and Benston, Horsky and Weingartner [1978] analyzed appraisals in Rochester, New York. King [1979B] included denied applications in his study of Miami, San Antonio, and Toledo. All the studies find evidence contrary to the underappraisal allegation.

However, analyses of mortgage terms can reflect only mortgages made. Therefore, studies of denials of mortgage applications can provide insight into the possible existence of redlining. Four of the studies reviewed report some evidence of racial discrimination. Black, Schweitzer and Mandel [1978], using nationwide data in a multiple variable probit analysis, found some weak evidence that blacks experienced higher rates of denials, *cet. par.* Schafer [1978, Chapter

7] found strong evidence of this situation in New York City mutual savings banks. His studies of mutual savings banks in four upstate New York cities [Schafer, 1978, Chapter 12] also reports similarly strong evidence, but three of these studies are based on very few observations. All of his studies found little or no evidence of higher denials related to applications for mortgages on properties located in allegedly redlined neighborhoods. However, his analyses suffer from possible collinearity and other serious problems. King [1979B] found evidence of higher denial rates to Hispanics in Miami and San Antonio but no evidence of adverse selection of blacks or other persons or applicants for loans on properties located in possibly redlined areas. Warner and Ingram's [1979] multiple discriminant analysis of most of Columbia, South Carolina banks and savings and loan associations found no evidence of discrimination. Nor did Tyree [1979]. Hence, I conclude that the weight of the evidence is contrary to the hypothesis that lenders discriminate against minority borrowers or areas by denying mortgage applications, but there is also some reason to believe the contrary with respect to some minority borrowers. Clearly, more research on mortgage denials is desirable.

Since lenders might redline by not permitting mortgage seekers even to file applications, studies of the demand for mortgages and of the experiences of possibly discriminated-against home buyers in obtaining financing are necessary. Only one study, by Benston and Horsky [1979], addressed this question. Their interview survey of home owners and home buyers in Rochester, New York provides evidence that mortgage seekers in an allegedly redlined area experienced almost no difficulty in obtaining funds because of the properties' location. (The sample size, however, was small and the information "second hand.") Home buyers in that area and in a presumably favored (control) area equally had little trouble obtaining the type of financing they wanted. Tyree [1978] polled community organization leaders for their beliefs about bank lending practices in their areas. Despite their often negative attitudes and assertions about the prevalence of redlining, they were able to identify only seven instances, none of which was found to have occurred as claimed. More studies like these are needed, however, before one can generalize.

On the whole, then, only two studies of the research reviewed (all that I could find) reveals evidence of possible redlining, and this is only in a higher rate of denial of mortgage applications by blacks or Hispanics. But the second study's findings are not consistent. Another, very well constructed study finds no evidence of bias. Furthermore, foreclosures appear to be more probable in areas characterized as redlined and on mortgages made to blacks. But "black," or "Hispanic" also might be proxy variables for omitted economic factors in the analyses of mortgage denials and foreclosures. Virtually all of the other studies either do not speak meaningfully to the redlining question or provide evidence that is contrary to the redlining hypothesis. The question is still open, however, since this conclusion is based on data from only a few cities. More research on the demand for mortgages, in particular, would be helpful. Studies of why such strong legislation as the Mortgage Disclosure Act of 1975, the Community Reinvestment Act of 1977, state laws and state and federal regulations was enacted on the basis of such poor evidence as is reviewed above also would be interesting.

APPENDIX

Review of Studies Referred to in the Text

Community Group Studies of Mortgage Supply

The following three studies, two of which were presented to the U.S. Senate Committee on Banking, Housing and Urban Affairs' hearings in May, 1975 are representative of the evidence presented by community activists that apparently was instrumental in influencing the Congress to enact the Home Mortgage Disclosure Act of 1975.[21]

Redlining and Disinvestment in Buffalo [1975] is typical of many community activist studies. It was based solely on the number of dollars of mortgages made by commercial banks, savings banks and savings and loan associations in Erie County over an 18-month period (June 1973 through December 1974). Because fewer mortgages were made in the city of Buffalo compared to its suburbs (26 percent in number, 18 percent in dollars), the authors conclude that the city was redlined. They further assert, without any reasoning or evidence, that "The evidence has been amassed, pointing the way powerfully and clearly to a new perspective on the root cause of blight: 'redlining' and 'disinvestment.' For the first time in the City of Buffalo, the blueprint of these bank policies are hereby laid open for public scrutiny." [p. 7]

Where the Money Is: Mortgage Lending, Los Angeles County [1975] presents a more extensive analysis, since it presents data on downpayments and interest rates as well as the number and dollar amount of mortgages, aggregated by census tract. Mortgages on other than single-family houses were included. However, only mortgages made over a five-month period (January through May 1974) by state-chartered savings and loan associations were included. Charts were used to compare mortgage lending terms and activity in the first five months of 1974 with the 1970 values of percent minority population, median family income and median home value in census tracts. No other variables were included to account for differences in mortgage terms, numbers or amounts. Nor was the possible relationship between income, price of house and minority considered. Despite these shortcomings and the limited coverage of the data, the report concludes: "'patterns of discrimination' are shown [and] ... over a million people live in neighborhoods where there is no prospect of lending at all." [p. 5]

Home Ownership and the Baltimore Mortgage Market [1975] employed by far the best data base of any of the studies presented at the hearings. Included were all Baltimore real estate transactions in 1971, and thus mortgage loans made by all lenders. The study finds that different types of lenders tend to specialize in different types of neighborhoods. For example, savings and loan associations and savings banks made relatively more loans in high income, high house price, high home ownership, white areas, while mortgage companies that made FHA insured loans and cash sales dominated the low income, low house price, black areas. The study suggests that FHA insured mortgages are undesirable, primarily because points are charged. However, neither the effective interest rate paid (the annual interest equivalent of points plus interest payments) nor the relatively low downpayment required were considered. In any event, the study essentially is limited to description: redlining and racial discrimination are not charged.

A number of other studies were presented at the 1977 Hearings on Community Credit Needs that preceded enactment of the Community Reinvestment Act of 1977. The following two studies are representative of the papers presented there and elsewhere by community activists.

Take the Money and Run! Redlining in Brooklyn [1976] was prepared by the New York Public Interest Research Group. They analyzed mortgages made in 1975 by seven savings banks according to zip code and census tract areas. The number of mortgages made in one year were related to the number of owner-occupied houses in the areas and the dollar amounts of mortgages made were compared to the total assets of the savings banks. From

[21] See U.S. Senate Committee on Banking, Housing and Urban Affairs. *Hearings on the Home Mortgage Disclosure Act, 1975.*

these relationships, the authors concluded that all except one of the banks studied redlined Brooklyn. The distribution of mortgages made by zip codes is used to suggest that "black neighborhoods fare worse than white neighborhoods." [p. 5] This conclusion is illustrated by reference to four census tracts. Two tracts that are mostly black received zero and three mortgages while two tracts that are mostly white received the highest number and relatively many (65) mortgages. From these data, the study concludes: "All seven of the banks surveyed have discriminated against the black population of Brooklyn by channeling mortgage money to those neighborhoods that are predominately white." [p. 7] The study does not mention that the two predominantly black census tracts cited contain mostly multifamily buildings while the predominantly white tracts contain mostly single-family houses. Nor is mention made of other lenders (including the omission of two major savings banks) nor is any consideration given for the demand for mortgages.

Redlined: A National Survey by National Peoples Action (NPA) of Mortgage Lending Policies in the United States [1976] is perhaps the most extensive study in terms of coverage of cities. Data made available by the Home Mortgage Disclosure Act of 1975 from financial institutions in 25 cities in many states for the year ended September 30, 1976 were used. Specifically, dollars of conventional mortgages plus home improvement loans made by two institutions in two neighborhoods (selected by the NPA) in each city are presented in tables. Nothing is said about possible differences in the demand for mortgages or of other sources of supply. Nevertheless, based only on these tables, the authors incorrectly conclude: "In every case the data supports the existence of redlining – the refusal to make conventional loans."

Professional Studies of Mortgage Supply

Devine [1973] (Bronx, New York). Where the Lender Looks First: A Case Study of Mortgage Disinvestment in Bronx County, 1967-70 is important because of its historical role (particularly in the hearings preceding enactment of the Home Mortgage Disclosure Act of 1975). This monograph (a doctoral dissertation which was prepared for and published by the National Urban League) presents a discussion of the possible relationship between lending by financial institutions and community decline, with particular emphasis on racial discrimination. The empirical work consists of multiple regressions relating the number and dollar amounts of mortgages made per 1,000 occupied housing units in 1960 and 1970 and the change between these dates in 14 Community Planning Districts. The explanatory variables are the proportion of blacks and Puerto Ricans (race, the proportion of one-to-four family homes, and total or median rent in each district). (Other variables were tried but the results are not presented.) The data were obtained from 12 savings banks: these banks made less than 22 percent of the number and less than 18 percent of the amount of mortgages in the Bronx in the years studied. Changes in the amount of mortgages *made* in the Bronx by subsets of the institutions studied also were compared to changes in their *total* savings balances, a curious comparison of a short-term flow with a stock.

The regressions show race not to be a statistically significant explanatory variable, with two exceptions. In the 1970 "number of mortgages per 1,000 occupied units" regression, the coefficient of race is negative and statistically significant when total rent was substituted for median rent and when the proportion of one-to-four family homes variable was omitted. In the 1970 "amount of mortgages per 1,000 occupied units" regression the (negative) coefficient of race is significant when median rent was used instead of total rent, one institution's mortgages in a district were excluded, and the proportion of one-to-four family homes variable was omitted. Nevertheless, after qualifying his conclusions ("Our statistical analysis is neither definitive, nor exhaustive. It does *not* suggest that race is the only or primary variable being considered by mortgage lenders."), Devine concludes: "It does, however, disprove the assertion that race has no significant bearing on mortgage lending." [p. xii] But even this limited conclusion is not supported by the regressions. Nor can any meaningful conclusions be drawn from this study, considering the quality of the data (the community planning districts are very heterogeneous), the lack of a model or other rationale for the inde-

pendent variables, the small fraction of the mortgage lenders included, and the omission of demand and risk considerations.[22]

Ahlbrandt [1977] (Pittsburgh). Ahlbrandt [1977] estimated an expanded version of equation (5) (in the text above) with data from 162 census tracts in Pittsburgh. (Tracts dominated by public housing, business or industry were excluded.) The dependent variables used were the total value and number of residential mortgages made by financial institutions in 1973 and 1974, adjusted for the number of occupied units. Financing by individuals, real estate firms or other organizations or institutions (not otherwise described) was excluded. The independent variables included median family income in 1969, percent of units owner-occupied in 1970, percent of units vacant in 1970, change in percent of black population 1960-70, percent of black population in 1970, and crime rate in 1970. Because an interactive relationship was assumed, the data were transformed to logarithms. Three sets of regressions are presented: the first with all the data (135 observations), the second with census tracts having less than 20 percent black population (100 observations) and the third with census tracts having more than 20 percent black population (28 observations). One variable that possibly might indicate redlining (were demand accounted for and the equation well-specified), the change in percent of black population 1960-70, had statistically significant coefficients only in regressions run with the third set of data – census tracts with black population over 20 percent. Ahlbrandt concludes: "although racial concentration is not statistically significant and racial change is positively associated to mortgage lending, this does not conclusively refute the hypothesis that racial redlining exists." [p. 479]

Although his study is considerably better than the community group's and Devine's study, it still is seriously deficient. In addition to the factors mentioned in the text above (in particular, a reduced-form, equilibrium equation cannot measure shortfalls in demand), the independent variables are likely to be collinear. Family income is likely to be negatively correlated with percent black, while owner-occupied, percent units vacant and crime rate are likely to be positively associated with percent black. Ahlbrandt also warns: "A problem could arise in the interpretation of the results if there is not a reasonably good correspondence between the characteristics of the mortgage applicant and those of the census tract in which the loan is made (or turned down). . . . [In particular], since the race of the applicant is unknown, it is not possible to conclude the degree of racial discrimination against mortgage applicants (sic). The interpretation of race in the regression analysis is thus limited to the racial characteristics of the areas in which the loans are granted." [p. 480] But, considering the other problems with the study, even this interpretation is not warranted.

Hutchinson, Ostas and Reed (HOR) [1977] (Toledo). Reduced-form equations similar to, but more elaborate than, Ahlbrandt's were used by HOR to estimate the determinants of commercial and government-insured mortgage flows and home improvement loans. They used data provided by "the four savings and loan associations which dominate the mortgage loan market in the Toledo, Ohio SMSA." [p. 464] Loan data for 1975 aggregated by 123 census tracts were regressed on independent variables derived from 1970 census data.

The dependent variables are the total number of mortgages on owner-occupied houses, the percentage of conventional mortgages to the total, the number of conventional mortgages, the number of government-insured mortgages, the number of home improvement loans, and the percent of home improvement loan applications accepted, all in 1975. The independent variables are the percent black population (B), its square (B^2), the change in B from 1960 to 1970, the average age of residential structures, the unemployment rate, median years of education, median income, number of owner-occupied one-to-four family dwellings, median property value, percent of population over 55 years of age, average duration of residency, percent of population having moved into the tract from 1968-1970, and

[22] Furthermore, the conclusions given in the introduction to the study, on the importance of "the active presence of institutional lenders such as savings banks and savings and loan associations in a housing market," have been cited in community activist studies and in Congressional hearings as if they were derived from Devine's data, even though they are but assertions that are not otherwise addressed in the monograph.

the number of persons per household, all as of 1970 (except the variables measuring changes, as noted).

The coefficients of the independent variables representing race (percent black, B, and its square) are statistically significant only for the percent conventional (negative B, positive B^2), number of insured mortgages (positive B, negative B^2), and percent of home improvement loan applications accepted (negative B, positive B^2). HOR conclude that "the racial composition of a neighborhood has no significant effect on the total number of loans made in the neighborhood" [pp. 468-469] but "racial composition affects the percentage of loans transacted that are conventional (PC) and the percentage of home improvement loan applications that are accepted (PA). These results suggest that PC and PA are both significantly lower in racially mixed neighborhoods than in racially homogeneous neighborhoods." [p. 469]. However, the interaction of B and B^2 result in estimated minimum values for PC at 45 percent black and PA at 28 percent black. HOR state: "These results are consistent with the hypothesis that redlining takes place on the basis of risk aversion. However, they would not be consistent with a redlining model based on a taste for discrimination. In a model such as this, PC and PA would be expected to decrease as B increases." [p. 469]. The coefficients of the average age of structures variables have significantly negative signs for all except the number of insured mortgages and number of home improvement loans regressions, which, HOR state, "strongly support the hypothesis of redlining on the basis of neighborhood age in the conventional and home improvement loan markets." [p. 470].

Ostas, Reed and Hutchinson (ORH) [1979] (Toledo). The data for Toledo were expanded and updated in another paper by Ostas, Reed and Hutchinson. They re-estimated the relationship between the number of mortgages made and percentage of conventional mortgages made and percentage of conventional mortgages made by savings and loan associations in 1975 and 1977, excluding a few of the independent variables used in their previous paper.[23] For the number of mortgages regression, the percentage of black in 1970, B, and B^2 variables are statistically insignificant in 1977 as in 1975. The average age of house variable still is significantly negative, though its magnitude is -1.039 in the 1977 regression and $-.008$ in the 1975 regression. The greatest difference with respect to the "redlining variables" is the insignificance of the "black" (B and B^2) variables in the 1977 regression. ORH conclude: "In general, the equation appears unstable between the two periods, and suggests little evidence of conventional loan restriction on the basis of racial considerations." [p. 18] However, the average age of house variable is significantly negative and of similar magnitudes in both years' regressions.

The new version of their study was improved over the previous one in three important regards: commercial banks were included (presumably all those in the Toledo SMSA); two new variables, the number of one-to-four family units shown in real estate brokers' multiple listing guides (NMLS) and the number of one-to-four family houses constructed in 1977 were included to replace the number of owner-occupied one-to-four family dwellings as a proxy for demand, and dummy variables were added to estimate more complex forms of the relationship between the percentage black and the dependent variables. The new variables (NMLS in particular) improved the fit of the equations considerably. The regressions presented show no statistically significant relationship between the commercial bank data and the "redlining" variables – percentage black in its various forms and average age of house. However, significant coefficients are reported for the savings and loan data. With respect to the percentage black variables, ORH state: "racial composition has a significant effect on the distribution of the total loans and S&L loans. Often this effect conforms to a risk aversion hypothesis based on a "tipping point" argument. However, it should be noted that this result is not apparent unless NMLS data is incorporated into the model. . . . In 1977 race appears to have a negative effect on the percentage of loans which are conventional." [p. 25] Finally, "age of structure is observed to have a negative impact on the percentage of loans which are conventional, but this effect is complicated by an apparent significant quadratic relationship." [p. 26] It also is negatively related to the number of

[23] The percent of population over 55 years of age and the percent of population having moved into the tract from 1968-1970 were excluded.

S&L loans. Calculation of the magnitudes of the possible effects (e.g., the decrease in the number of loans associated with an increase in the percentage black over some range) is not given in the paper.

The first Toledo paper (HOR) suffers from the same shortcomings as Ahlbrandt's Pittsburgh analysis, in that 1970 data were used to explain 1975 lending activity, demand for mortgages was not accounted for and percent black, average age of houses and many of the other independent variables are likely to be correlated. In addition, by including data only from savings and loan associations, at most all that can be considered is the lending activity of these institutions; the availability of mortgage funds to home buyers cannot be estimated from these data. The second Toledo paper (ORH) presents a considerably improved variable that might serve to measure demand – the number of multiple listings (NMLS). This variable is far preferable to the number of owner-occupied dwellings, since there is no reason to believe that the same percentage of houses in all areas are likely to be sold.[24] Inclusion of the number of newly constructed dwellings also improves the specification of demand. The nonlinear forms of the "percent black" variable also are positive aspects of the analysis. However, the reduced-form equations do not permit one to determine whether fewer mortgages were made in census tracts because of racial considerations or because of differences in demand for mortgages available from other lenders (such as mortgage bankers and individuals), or whether race is a surrogate for other variables not related to discrimination (as ORH suspect).

Hauser and Elkhanialy [1978] (Chicago). The lending activities of 22 of the 32 federal savings and loan associations (or 86 percent of total assets) in Chicago for 1977, aggregated by 862 census tracts, were related to 1970 census data on percent black and other variables. When the tracts were grouped according to predominantly white (0 to 9 percent black), racially mixed (10 to 74 percent black), and predominantly black (75 to 100 percent black), the average number and total amount of loans made clearly are negatively related to the percentage black. The average size of mortgages is lower as the percentage black is higher. A correlation analysis reveals the following relationships with the number of loans per tract: median family income, .46; percentage black, –.31; median value of home, .16; percent owner-occupied, .11; built before 1949, .05; and living in the same house, .02. However, percent black is strongly correlated with some of the other variables, as follows: median family income, –.45; owner-occupied, –.13; and median value of home, –.11. In a partial correlation, the correlate between the number of loans made and percentage black drops from –.31 to .12. Similarly, the partial correlation coefficient of percent black with the dollar amount of loans is –.07 compared to –.29 for the simple correlation. The authors also emphasize that the percent of variance jointly explained by the seven variables (R^2) is only 24 and 27. They state: "It is clear, then, that variables other than those considered are involved. Such variables, for which data are not available, undoubtedly include risk of investment, differential market forces, laws and regulations, etc." [p. 31]

The study is valuable primarily because it points out that, in the authors' words, "to conclude that the differential lending practices are interpretable as racially discriminatory is simplistic. In the light of the complexities involved, it is sounder to conclude that the disadvantaged position of blacks with respect to home ownership and financing is among the indications of the disadvantaged economic and social condition of blacks." [p. 16] But the study fails to consider the possibility that differences in demand for single-family house mortgages among census tracts and alternative sources of supply (such as mortgage bankers and commercial banks) might account for (or exacerbate) the differences found. Also not mentioned are risk considerations which are particularly important in Illinois. The state foreclosure law is the most severe in the country. It requires foreclosure by sale in a three-step judicial procedure: filing a complaint, entry of a decree or judgment by the court, and the foreclosure sale. The time between the date a mortgagor stops payments and the lender can acquire the property was found to average 816 days.[25] This compares to 398 days in

[24] Benston and Horsky [1979, p. 76] found an average home ownership duration of 26 years in the central city and 14 years in a suburb of Rochester, New York.

[25] Touche, Ross & Company, 1975, Table 1.

California and 261 days in Texas. The direct cost less revenue per loan averaged $6,031 in Illinois, $61 in California and $25 in Texas.[26] Thus, the risk of default is quite a serious consideration in Chicago, particularly for conventional mortgages.

Dingemans [1979] (Sacramento). Further evidence on the association between mortgage lending patterns and minority status is provided in this very good article, in which the author shows how misleading impressions can be drawn from this correlation.[27] Dingemans recorded data on 8124 single-family homes made in 1976 by the 50 banks and savings and loan associations that serviced the areas, by census tract. (Loans made by mortgage companies were not included, since they are not required by the Home Mortgage Disclosure Act of 1975 or by state regulations to report their activity.) The number of mortgages made per existing single-family housing unit, aggregated into 114 census tracts, were correlated with 13 variables that measured tract characteristics, mostly drawn from a special census conducted during 1975. Statistically significant (at the .01 level) correlates with the number of mortgages made are reported for the following variables: upper status employment (.74), Chicano residents (.73), median household income (.72), blue collar employment (−.68), distance to minority tracts (.64), black residents (−.60), nonminority residents (.60), income change, 1970-75 (.57), age of housing stock (−.51), distance to central business district (.44), and percentage of owned housing units (.35). The only statistically insignificant variables are mobility 1968-70 (−.18) and average household size (.08). Similar correlates were found when these variables were correlated with the number of loans made per owned unit. Loans on used homes only (11 census tracts that received more than 50 new home mortgages, also were excluded) are significantly correlated only with blue collar employment (−.68), Chicano residents (−.47), median household income (.41) and black residents (−.39).

However, Dingemans points out that these correlates can be very misleading. When the number of mortgages made per unit is regressed, stepwise, on the variables, he finds that "sixty percent of the variance is explained, with the major contribution resulting from just one variable, median household income. . . . [The] other significant (.05 level) variables (in order of entry) were household size, distance to CBD [central business district], and no minority population; none of these added more than seven percent to explained variation." [p. 231] When mortgages on used houses were regressed on the variables, the first variable to enter the regression was upper status income, which explained 55 percent of the variance, followed by age of housing, household income, and household size. None of the other variables added more than 5 percent to the 63 percent of the variance explained, [p. 232]. Thus, mortgage lending patterns by financial institutions appear to be related primarily to the income status of an area, which (as Hauser and Elkhanialy also found) can be confused with the area's minority population.[28]

Dingemans attempted to separate the joint influence of income, minority, and locational variables with case studies of four neighborhoods. In 1976, the inner city neighborhood (Old City) received 2.1 loans per single-family unit compared to a region-wide rate for used homes of 2.8 percent. Between 1976 and 1977 the rate increased sharply. Few applicants in 1977 (the first year that these data were available) were turned down (23), though the rate was twice as high as the regional average. An analysis of lending in areas that included a relatively high concentration of minority (black and Chicano) residents revealed lower loans per unit, but few rejected loan applications (in 1977). A comparison of a blue collar, middle income suburb with a white collar, upper income shows a much lower number of loans per unit in the former than the latter. More detailed analysis reveals that mortgage bankers are very active lenders in the blue collar and minority areas. Dingemans explains:

[26] *Ibid.*, Tables 8, 9, and 10. The California net costs were reduced considerably by the increase in market value of the foreclosed properties.

[27] An excellent introduction and overview of writings and studies on mortgage lending and urban change is provided in the second section of the paper.

[28] Similar analyses are presented for home improvement loans. In that regression, distance to the CBD entered the regression first.

"Most homes in Sacramento are bought with the aid of a real estate agent. One of the services that the agent normally performs (in return for the fee . . .) is help in securing a mortgage loan. . . . The agents of mortgage bankers [who are paid commissions rather than the salaries paid to bank employees] are extremely aggressive in maintaining ties with sales persons who work in . . . moderate income neighborhoods. This is because mortgage bankers know that moderate income neighborhoods are the most likely locations for FHA and VA loans, and they issue primarily the federally insured loans for which a ready secondary mortgage market exists." [p. 238]. His final conclusion also deserves quotation: "The lack of data for some major loan sources and the fact that nearly identical patterns [of Home Mortgage Disclosure Act data] are found in Sacramento – a metropolitan area where few complaints about redlining are heard – should act as reminders that the examination of Disclosure Act data above may not be a sufficient basis for making final conclusions about the processes and behaviors that underlie the patterns that are being found." [p. 239] Based on his analysis, he should have said, "is not" rather than "may not" be sufficient.

Whalen [1976] (Flint). "An Analysis of Mortgage Lending Activity in Flint Michigan" represents an interesting attempt to analyze the effect of race on mortgage lending after account was taken of other explanatory variables. It was designed and conducted by the Chief of Informational Services at the Michigan State Housing Development Authority for the Governor's Task Force on Redlining. The number and amounts of mortgages recorded in 47 census tracts over the 18 months from January 1975 through June 1976 were analyzed with respect to the following: prudent lending variables (an occupational income index as a measure of creditworthiness, the percentage of homes reported in a local survey to be well maintained as a measure of the structural condition of housing, and effective demand as measured by owner-occupant mobility and the net change in the number of households), and redlining variables (racial composition as measured by the percent Negro in the 1970 census, racial change as measured by the change in percent black from 1970 to 1975 from a special survey, proximity to racial change as measured by the average racial change in adjoining census tracts, and the relative age of houses from the 1970 census). I believe that two-stage regressions were computed (the text is not clear), with the dependent variables regressed first on the "prudent lending variables" and the residuals regressed on the "redlining variables."

The coverage of the data, the model and method of analysis, and the measurement of the independent variables are greatly superior to many of the studies reviewed above. The only problems are the dependent variables. The text states them to be the number amount and average amount of mortgages made per census tract. From personal inquiry I learned that most of the homes mortgaged were financed with FHA insured mortgages and the dollars (amounts and averages) are the selling prices of the houses, since these almost equal the mortgage amounts but were more readily available. Therefore, the interpretation of the findings is not what it appears to be. In fact, none of the coefficients of the independent variables in the total dollars of mortgages made regression are statistically significant. Only the percentage of housing built 1950-59 in the number of loans made regression is statistically significant, and the percent black in 1975 and racial change variables in the incorrectly described average mortgage amount regression are statistically significant.[29] But since the average mortgage really is average selling price, the regression would appear to indicate that lower house prices, not redlining, were associated with race. In addition, the demand for mortgages is not accounted for.

Schafer [1978, Chapter 5] (New York City). Neighborhoods in three counties in New York City, the Bronx, Kings (Brooklyn) and Queens, were studied. The data used were obtained from reports filed by a subset of state-chartered financial institutions pursuant to a regulation imposed by the New York State Banking Department. Schafer reports, "the lenders in the sample supplied only 13.9 percent of the dollar value of transactions in 1975." [p. 5-10]. Consequently the findings can be interpreted, at most, as applying only to those institutions included and not to the overall borrowing experience of property buyers in the three New York city counties considered.[30]

[29] Standard errors are not given; only the designation "significant at the .05 level."

[30] The model could not be applied to other areas because of data limitations.

Neighborhoods in the three counties were dichotomized into those alleged by community groups to be redlined and others (a procedure similar to that used by Benston, Horsky and Weingartner [1978]). A regression was computed for each area (redlined and other) separately. Each observation is a census tract: 110 in the alleged redlined area and 640 in the other. Conventional mortgage lending (dollars) per existing one-to-four family buildings in allegedly redlined and in other neighborhoods are the dependent variables. The 33 independent variables include: transactions per building (dollars), mortgage prices on conventional mortgages (3 variables – interest rates, maturity, and loan-to-value ratio), the stock of mortgages held by the banks per building (4 variables – conventional and federally insured, one-to-four family and multifamily), neighborhood attributes related to risk of loss (20 variables, including pending and past housing code violations, building vacancies, tax arrearages, structural fires, per capita welfare and change in population), risk of loss in mortgage lending (2 variables – ratios of foreclosure and delinquencies to total loans), percentage of housing stock built before 1939, and racial composition (percent nonwhite in 1974 and change in percent nonwhite, 1974 less 1970).

The computed R^2s are .68 for the alleged redlined sample and .25 for the other neighborhoods sample. Few of the coefficients are statistically significant, which is not surprising considering the great likelihood of collinearity. However, it is interesting to note that the coefficients of the "transactions" variable (a proxy for demand) is significant (at less than the .01 level) and is five times greater for the alleged redlined than the other sample. Also, the stock of conventional one-to-four family mortgages is significant (at less than the .01 level) for the alleged redlined sample but trivial and very insignificant for the other sample.

The coefficients from the alleged redlined census regression were multiplied by the values of the independent variables in each census tract and then aggregated according to neighborhood.[31] The same procedure was followed for the coefficients from the other neighborhoods regression. The aggregates then were used to compute ratios, by neighborhood, of predicted lending from the alleged redlined regression to predicted lending from the other neighborhoods regression. In two of the seven alleged redlined neighborhoods the ratio is greater than a one, indicating, as Schafer put it, "that these neighborhoods would receive more funds if they were redlined than if they were not." [p. 5-29] (The aggregate ratio is .67.) In two of the four other neighborhoods the ratios are slightly greater than one, indicating again that they would receive more funds if they were redlined than if they were not, *cet. par.* (The aggregate ratio is 1.02.) Because the two areas with ratios greater than one may have been incorrectly identified as redlined, data from these areas (34 tracts) were removed and the alleged redlined regression rerun. The ratios computed with the resultant coefficients are below one for all neighborhoods, aggregating .49 for the alleged redlined neighborhoods and .56 for the other neighborhoods.

A similar exercise was undertaken with the amount of federally assisted (FHA and VA) mortgages per building as the dependent variable. The coefficients of the demand proxy variable (transactions per building) are statistically significant in both regressions, but twice as large in the other neighborhoods regression. The ratio of aggregate predicted lending (alleged redlined/other neighborhoods) is 1.28 for the alleged redlined areas and 1.20 for the other areas. However, as was found in the conventional mortgage analysis, one neighborhood[32] of the six alleged redlined areas has a ratio of 3.70, which indicates that it got three times more dollars of federally assisted loans because it was (allegedly) redlined. One of the five other neighborhoods also has a high ratio (2.62). The regressions were recomputed with observations from these neighborhoods omitted. The results were similar to those from the complete data set (aggregate ratios are 1.36 for the redlined areas and 1.43 for the other areas), except that the ratio for the questioned alleged redlined neighborhood is 8.90 and for the other neighborhood is 2.68.

[31] A similar procedure was used previously by Benston, Horsky and Weingartner [1978, Chapter 2] in their analysis of mortgage terms.

[32] This one is a combination of the two problematic neighborhoods in the conventional analysis.

Conventional multifamily mortgages were available for an insufficient number of census tracts to allow application of the two regression technique. Therefore, Schafer computed a single regression, specified similarly to the others, with dummy variables for the census tracts in neighborhoods alleged to be redlined. As Schafer summarizes the findings: "The age of housing stock, racial composition, and neighborhood variables are not statistically significantly related to conventional multifamily mortgage lending at even the 10 percent level. The estimated model ... does not support allegations on redlining on multifamily buildings." [p. 5-69]

Koebel [1978] (Louisville, Kentucky). This study is probably the most complete record of the sources of house purchase financing yet produced (or perhaps producible). All property sales and mortgages recorded in Jefferson County between June 1, 1976 and May 31, 1977 were recorded, including those sales made with a contract for deed that were listed in the *Louisville Daily Record.* Transfers that were not arm's length sales were eliminated. Among the data reported by area of the city and county are the types of property (the 5 percent represented by multifamily houses are located in the city), the types of purchasers and sellers of the properties (mostly individuals to individuals), the prices of the houses sold (lower in the city), the source and type of financing, downpayments and interest rates, the resident status of new owners, and the incidence of second mortgages, all reported by area and, in many instances, by the price of house sold.

The study documents that some 36 percent of city properties were financed by individuals (cash and personal loans) compared to 14 percent in the rest of the county (hereafter called the suburbs). The median priced city home purchased in this manner sold for less than $8,700. Kentucky's usury law specifies an interest rate of 8.5 percent on mortgages of $15,000 or less; at that time the prevailing rate for other loans was between 8.5 and 8.75 percent. (Koebel failed to relate these facts causally.) The median prices of suburban houses sold for cash or financed with personal loans was about $25,000, roughly equal to the median prices of houses otherwise financed. In general, banks (which made very few mortgages) and savings and loan associations financed more expensive houses in areas with rising prices and higher incomes, primarily with conventional loans. Mortgage companies tended to finance the purchase of average priced houses in areas with declining prices and lower incomes, primarily with FHA and VA loans. They also tended to serve areas with predominantly black populations. Among the institutions, downpayments were lowest for mortgage company loans, since they made mostly FHA and VA loans. Much more data are presented, defying a concise summary. Most of these presentations are interesting primarily to someone concerned with the Louisville area.

As Koebel puts it, "And although this study does not prove or disprove prejudicial disinvestment (or redlining), it thoroughly documents housing prices and the availability of financing throughout the county." [p. 9] Actually, it documents the incidence of financing, since nothing is known about demand, except that one can infer that mortgages on low priced houses would be demanded but not supplied when the state usury ceiling is below opportunity cost (market interest rates and transactions costs). However, the complete coverage provided does show the extent to which chartered financial institutions are not the sole source of housing finance, for whatever reason.

The Relative Risk of Lending – Defaults and Foreclosures[33]

Williams, Beranek and Kenkel [1973] (Pittsburgh). The data analyzed were obtained from a savings and loan association. Data on all 125 defaulted mortgages made from 1962

[33] All of the papers except Barth, Cordes and Yezer [1979] include analyses of delinquent mortgages. Since these loans generally do not represent a net cost to lenders, and since the studies find that delinquencies are not highly correlated with foreclosures, the delinquencies findings are not discussed here.

However, a study by Von Furstenberg and Green [1974] of 1236 delinquent single-family mortgages at a Pittsburgh savings and loan association should be mentioned because

to 1972 and a random sample of 1405 good loans were recorded.[34] In addition to variables obtained from the loan files, data from the 1960 and 1970 censuses, by tract, were included in the analysis to account for neighborhood factors. One stage least squares (OLS) analysis was used, where the dependent variable is dichotomous, equal to 1 if a loan is a default and 0 if it is good. The independent variables included measure quality of the loan (loan to value over 90 percent and 85-90 percent, term to maturity, and payment to income over 30 percent, and 22-30 percent), type of loan (VA, FHA, FHA-235, refinanced, and loan with junior financing, all in dummy variable form), characteristics of the borrower (age over 50 or below 30, number of years with employer, number of children, and monthly income – price-level-adjusted), characteristics of the property (price – price-level-adjusted, age, and whether or not multifamily), and neighborhood characteristics (unemployment rate, and per capita changes in crimes against property). Other variables were excluded because of correlations with included variables. For example, the following sample correlations with the unemployment rate are reported: percentage black, .75; per capita crimes against persons, .73; median per capita income, –.78. The correlation between median per capita income and percent black is –.61. Thus the unemployment rate variable carries a lot of freight.

Statistically significant (.10 level) positive coefficients were found for the following independent variables: loan-to-value ratio over 90 percent, payment-to-income over 30 percent, refinanced loan, junior financing, age of mortgagor over 50, and unemployment rate. Significant negative coefficients include FHA insured loan, number of years with employer, and price of the property. To the extent that one can draw inferences from the significance of coefficients, considering the effect of collinearity on measures of significance, the most important determinant of defaults is a high loan-to-value ratio.[35] The unemployment rate variable is the only included measure of neighborhood characteristics – it is positive and positively correlated with percent black and negatively correlated with median per capita income. But in terms of the magnitudes of the t values, at 2.12 it is tied for next to last place among the significant variables.

Morton [1975] (Connecticut). Data on 545 randomly sampled mortgages made by equal numbers of commercial banks, mutual savings banks, and savings and loan associations (24 in all) were analyzed. Multiple discriminant analysis was used to identify the variables associated with a loan being current, delinquent or foreclosed. The variables that are significant in a function distinguishing loans as foreclosed or not foreclosed (current and delinquent), in the order they entered stepwise calculations, are: three-family property (generally large houses converted to rental units), junior financing, five or more dependents, loan amount/appraisal, self-employed, employed as a salesman, borrower has nonreal estate debt, four dependents, and no dependents. The signs of all but the last variable are positive.

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of the superior methodology employed. They classified mortgages into cohorts that relate the year a mortgage is made to the year in which it became delinquent. The percentage delinquent in that year to the number in the year the loan was made originally is the dependent variable. This is the annual delinquency rate. Each loan was identified additionally as being in one of five loan-to-value categories, in one of five borrowers' income classes, a loan in the center city area (Allegheny county) or in the suburbs, and a loan on a new or previously occupied house. The interest rate in each of the 12 years over which the data are drawn also was specified. A logarithmic multiple regression was run ($R^2 = .11$, statistically significant), from which the authors draw the following conclusions: "mortgages on existing homes are 43 percent more risky that those on new homes," significant at the .05 level; and "*Ceteris paribus,* the riskiness of a mortgage declines by over 47 percent . . . when it is on a single-family home located outside rather than inside the center city county of Pittsburgh [significant at the .01 level]. Since Allegheny county includes many high-class residential areas and is by no means confined to deteriorating areas in the inner city, this effect is stronger than expected." [p. 12].

[34] Missing numbers are said to have limited severely the usable data.

[35] This finding is consistent with the conclusions of a large scale study of FHA-insured loans by Von Furstenberg [1969].

Among the insignificant variables, only "one-family property" and "two-family property" are related to area. The race of the borrower was not included. The function correctly classified 74 percent of the original sample and 72 percent of a holdout sample.

Morton identifies the three-family property variable as "a proxy for property and/or neighborhood quality. . . . Many of the three-family dwellings included in this study involved large older homes, in declining neighborhoods, that have been subdivided into apartments." [p. 74] Thus the data are consistent with the hypothesis that neighborhood quality affects defaults.

Schafer [1978, Chapter 3] (New York City). Data from two sources were used in this study. A subset of state-chartered commercial and mutual savings banks and savings and loan associations in Kings (Brooklyn), Bronx, and Queens counties reported the number and dollar values of their loans foreclosed in the past five years, by census tract, to the Banking Department. Additional data were gathered with a special study of New York State mutual savings banks in Kings, Bronx, Queens, and downstate suburban counties, excluding Manhattan. Approximately 100 loans were sampled from each bank: 25 active and current loans, 25 active and delinquent loans, 25 foreclosed loans, and 25 satisfied loans.

The data are presented in tables listing the average foreclosure rate (foreclosures over the past five years divided by outstanding mortgages for the data reported to the Banking Department and foreclosures divided by paid-off plus foreclosed loans for the special study).[36] Average rates are given for individual neighborhoods, identified as those alleged to be redlined and other,[37] and also by type of mortgage – one-to-four conventional, one-to-four family federally assisted, and multifamily conventional. The tables of the Banking Department data show higher than average rates[38] for two of the three alleged redlined neighborhoods for conventional one-to-four family and multifamily loans, and one of the three alleged redlined neighborhoods for the one-to-four family federally assisted loans. At most, only one of the four other neighborhoods had higher than average rates. Schafer's special study yielded relatively few loans for several of the 11 neighborhoods scheduled. With respect to the four allegedly redlined neighborhoods, these limited data show no above-average-foreclosure-rate neighborhoods for the one-to-four family loans and one above-average-rate neighborhood for the other two categories of mortgages. Among the seven other neighborhoods, higher than average rates are as follows: one in the one-to-four conventional category, three in the one-to-four federally assisted category, and none in the multifamily category. Overall, then, there is some evidence of greater foreclosures in the alleged redlined areas.

Schafer also computed a multivariate analysis of one-to-four family (conventional and federally assisted) foreclosures using 113 inactive (98.6 percent paid-off and 1.4 percent foreclosed) loans from his special study.[39] Twenty-six independent variables were included, but a dummy variable for alleged redlined area was not included because there were too few observations. For some unexplained reason the borrower's race was not included, even though it was asked for on the forms.[40] Nor was the racial composition of the census tract in which the mortgaged property is located included. The only statistically significant (at the .05 level or less) coefficients reported are for "poor condition of building" (positive), borrower married (positive), multiple-wage earner household (positive), and "two-to-four-

[36] This procedure does not link the defaults with the portfolio of loans made of which it was a part. See Von Furstenberg [1969] for a careful discussion of the shortcomings of not using the cohort analysis method.

[37] See description of Schafer's mortgage supply study above for details.

[38] Where a rate is within one significant digit above the average, I counted it as not above the average.

[39] A multivariate analysis of the Banking Department data is not presented. See the description of variables used in his analysis of mortgage terms with these data for a list of variables that could have been used for such an analysis.

[40] "Female ," though, is included as a variable in the delinquency analysis and is mentioned in the text on the foreclosure analysis as omitted because of too few observations.

family house" (negative). The presumably unadjusted R^2 is .40. A similar analysis was calculated on 45 multifamily loan foreclosures. Among the 14 independent variables is a dummy for "property located in area alleged to be redlined." The coefficients of this variable and "initial equity" are positive and are the only ones that are statistically significant (but at the .11 level) and the regression is not statistically significant, even at the .34 level.

Schafer [1978, Chapter 8] (Upstate New York). A similar analysis with similar data was conducted with data gathered from state-chartered banks in the Albany-Schenectady-Troy SMSA, Buffalo, Rochester, and Syracuse. The foreclosure rates (dollars of foreclosed mortgages to mortgages outstanding) derived from the data reported to the Banking Department are greater than the regional averages for the following number of alleged redlined (AR) neighborhoods and other neighborhoods (ON) (number with ratios greater than the average/total number of neighborhoods):

	one-to-four conventionals		one-to-four federally assisted		multifamily conventionals	
	AR	ON	AR	ON	AR	ON
Albany SMSA	3/9	7/7	3/9	2/7	1/9	1/7
Buffalo	2/6	1/10	5/6	1/10	0/6	1/10
Rochester	3/3	3/11	3/3	2/11	0/3	1/11
Syracuse	1/2	3/5	2/2	1/5	0/2	1/5

The rates calculated with Schafer's special study data show similar patterns.

Two multiple regressions also were computed with the special study data. The dependent variable equals one if foreclosed and zero if not. One regression for the Albany SMSA used 117 observations and 25 independent variables. The statistically significant (.05 level, one tail) coefficients include downpayment (negative), poor condition of building (negative), four of the six age of structure dummy variables (all less than 39 years, positive), one age of borrower dummy variable (46 to 49 years, negative), multiple wage earner household (positive), FHA mortgage (positive), and property located in area alleged to be redlined (positive, with the largest t value). The presumably unadjusted R^2 is .54. The other regression combined observations from the other cities (150 in all) and included the same types and number (25) of independent variables. The statistically significant coefficients include two age of structure dummies (20-29 years and 40-49 years, both negative), and percent of housing units built before 1940 (positive). The coefficient of the property located in an area alleged to be redlined is positive but not statistically significant. The R^2 is .19.

In sum, all the Schafer studies indicate some weak evidence that foreclosures are relatively greater in allegedly redlined than in other neighborhoods. Variables for the mortgagor's race and for the racial characteristics of census tract were not included in the analysis.

Marcis and Hull [1975] (National FHA inner city subsidized mortgages). The mortgage foreclosures analyzed were those made under the FHA's section 221(d)(2), which provides insurance on low downpayment, single-family property mortgages purchased by low or moderate income families, and section 235, a subsidy program aimed at increasing home ownership for people who otherwise could not afford it. The mortgage data are the Federal National Mortgage Association's 1972 foreclosures to mortgages outstanding, aggregated by zip code area. These foreclosure rates (dependent variables) were associated first with the average weighted family income for zip code areas in each of eight randomly selected cities. Statistically significant negative relationships in simple regressions are reported for six cities (Detroit, Philadelphia, Chicago, Los Angeles, St. Louis and Seattle, the first two at the .01 level, the balance at the .05 level) and negative, but not significant, relationships for two cities (Atlanta and Dallas). Similar results are found when the percent of families with incomes under $600 was used (except that the relationship is positive).

Since family income is only a partial measure of neighborhood quality, multiple regressions were computed with data from 123 zip code areas obtained from the Department

of Commerce's 1970 Census of Population and Housing. The independent variables on which the foreclosure ratio was regressed, listed in order of their importance as measured by beta coefficients, are the number of pending indictments for criminal violations of federal laws related to FHA mortgages, instability of population (percentage of population who moved into the area since 1965), income (weighted average family income), and education (percentage of population with some high school). (Other variables that were correlated at over .7 with an included variable are said to have been discarded. They are not identified.) The R^2 of the section 221(d)(2) foreclosure rate is .44 and all of the coefficients are significant at the .05 level, except for education which is significant at the .10 level. The signs indicate that foreclosures were higher in zip code areas where the average population is less stable, has lower income (a decrease of $1,000 is associated with an increase in the foreclosure rate of 1 percentage point), has a higher percentage of female heads of households (a 10 percent increase is associated with a higher foreclosure rate of 1.5 percentage points), and lower levels of education, given the number of indictments (which are positively associated with foreclosures). For the regression of section 235 foreclosures, the R^2 is only .07 and only the negative coefficient of education is significant (at the .10 level). Considering that zip code areas often are not very homogeneous and that the foreclosures are not directly related to the original portfolio of loans made (as in a cohort analysis), this study indicates that the population characteristics of neighborhoods are important determinants of mortgage foreclosures where the usual lending criteria were relaxed or disregarded.

Barth, Cordes, and Yezer [1979] (National FHA Insured Mortgages). This study is by far the most ambitious analysis of defaults related to the redlining question. The data (about 10,000 observations) are a 100 percent sample of all FHA 203(b) insured mortgages endorsed in 1974 and 1975 that were in default by the end of 1976 and a 10 percent random sample of other mortgages from this period. This sample certainly exceeds any used by the other researchers whose work is reviewed. However, the two year or less horizon is very short – several years less than the three or four years that Von Furstenberg [1969, p. 468] found was the peak for defaults.

The researchers used multiple regression (OLS) analysis. The dependent variable is a dummy equal to 1 if a default occurs, 0 otherwise. The independent variables include the following: loan terms (loan-to-value ratio, term to maturity, and monthly payment-to-income ratio), borrower characteristics (number of years married, and as dummies, Hispanic, black, not married, and female head of household – coded 1 if condition applies, 0 otherwise); property characteristics (structure in fair or poor condition, age of structure, and wood construction – all except "age" are dummy variables), neighborhood characteristics (central city, rural, and blighted – all as dummies), and city characteristics (new single-family starts in 1975-76 to owner-occupied units, pre-1940 housing to all occupied housing, SMSA population in 1974, city population growth 1970-75, city income growth 1970-75, SMSA 1975 per capita income, and percentage black population). Though the choice of variables is said by the authors to be based on a theoretical model (which is developed at length), the variables do not differ much from the variables used by other researchers who were not quite as formal in their presentation. However, the dates of the data used to specify the independent variables are coincident with the dates of the dependent variable, which is a considerable improvement over much other research.

Nine combinations of independent variables are presented. The statistically significant variables (at the two-tail .05 level) that are of interest to the redlining question (and their coefficients adjusted for the sampling proportions of defaulted and not defaulted mortgages to give estimates of the increased or decreased (–) probability of default, the mean of which is .015) are black (+.012), female head of household (–.003), wood construction (+.002), central city (+.001), and blighted (+.003). Hispanic, age of structure and percent of black population in city (given that the borrowers' characteristics are included) have statistically insignificant adjusted coefficients of zero. It also is interesting to note that the other city characteristics variables, which if positive indicate a growing, prosperous area, all have statistically significant, negative signs, with the exception of city income growth.

In sum, as the authors conclude: "Our results indicate that default risk is significantly affected by location based on both neighborhood and city characteristics. This implies that appropriate adjustment of mortgage terms based on location is consistent with profit-

maximization. This type of adjustment would not be redlining in the economic sense." [p. 51] Considering that the FHA interest rate is not adjusted for risk, these data indicate that the FHA and/or lenders, advertently or inadvertently, discriminated *in favor* of some of the areas and people said to have been redlined.

Terms Charged to Mortgagors

Schafer [1978, Chapter 6] (New York City). As is described below, Schafer used data reported to the New York State Banking Department by a subset of state-chartered financial institutions on mortgages made in 1975. These data were aggregated by and averaged over census tracts in the counties of Kings (Brooklyn), Queens and the Bronx that were identified through interviews with and reports by community groups) as allegedly redlined. Three equations were stated and solved simultaneously, with maturity, loan-to-value, and interest rate as the dependent variables. The 45 independent variables include: mortgage prices (two of the three dependent variables predicted from the first state estimates with their equations), neighborhood attributes (six variables on housing code violations, four variables on the fraction of buildings vacant, four variables on tax arrearages, two variables on structural fires per building, two variables on per capita welfare, per capita income, and change in population – most of these variables measure the current level and change from a previous date, usually 1970), risk of loss in mortgage lending (ratio of dollars of foreclosures over past five years to amount outstanding, and ratio of dollars of 60-day delinquencies to amount outstanding), income and assets (1970 per capita income, percent of households in 1970 with incomes less than $15,000, and average 1975 property value), mortgage stocks (four variables, one-to-four family and multifamily mortgages, conventional and federally assisted), transactions predicted from the first stage, age of housing stock (fraction built before 1940), racial change (percent nonwhite in 1974 and change in percent, 1974 less 1970), neighborhoods (six alleged redlined and three others, in dummy variable form with one other – not redlined – neighborhood omitted to avoid overidentification), and the constant.

Simultaneous equations were run with data on conventional one-to-four family mortgages (801 observations).[41] With respect to the variables of interest for the redlining question, the following were found to be statistically significant (at the .05 one-tail level) for the one-to-four family regressions: interest rates – for one alleged redlined neighborhood interest is 1.33 percentage point lower and for one .34 percentage point higher (all of the other coefficients were not significant and less than .26); maturity – lower for fraction built before 1940, higher for increase in nonwhite population, lower by 7 and 10 years for two alleged redlined neighborhoods (the interest rate is significantly lower by –1.33 percentage point for the latter) and by 1.6 and 1.1 years for two other neighborhoods; loan-to-value ratio – higher for fraction built before 1940, lower for percent of population nonwhite (a tract greater by 50 percentage points averages 7 percentage points higher, higher for change in percentage nonwhite (a change by 50 percentage points averages a ratio lower by 11 percentage points), lower for three alleged redlined neighborhoods averaging 4, 29, and 44 percentage points (the latter two have significantly shorter average maturities of 7 and 10 years), and lower for one other neighborhood by an average of 6 percentage points. Few of the coefficients of the other variables are statistically significant, and many have signs the opposite of those expected.

A similar set of two-stage regressions were computed for data on conventional multifamily mortgages (118 observations). The only change was the combination of the neighborhood dummy variables into one for "alleged redlined" and two for "other." Among the variables related to the redlining question, the only statistically significant coefficients show lower interest rates (–1.04 percentage points) and shorter maturities (– six years) in the alleged redlined neighborhoods and lower loan-to-value ratios (–16 percentage points) in one of the other neighborhoods. However, considering that relatively few multifamily houses in a census tract are mortgaged in a year, these findings are of questionable value.

[41] R^2s are given, but how they were calculated for a system of simultaneous equations is not explained.

Simultaneous equations also were computed with data on mortgages made over 25 years and collected in a special survey from a subset of mutual savings banks.[42] The 40 independent variables include mortgage prices (two of the three dependent variables), building characteristics (age and wood construction or not), borrower characteristics (income and wealth), age of housing stock (percent built before 1940), neighborhoods (alleged redlined and six other neighborhoods with the balance omitted to avoid overidentification), year of loan (18 dummy variables), time and location interaction (each neighborhood dummy variable was multiplied by a reciprocal of the average number of years from which loans were made), and the constant.

The conventional one-to-four family regressions used 265 observations. Only two of the "redlining" variables have statistically significant coefficients (at the .05 one-tail level): lower interest rates in one other neighborhood (of −.33 percentage point) and shorter maturity in another neighborhood (− seven years). Similar regressions were run with data on one-to-four family federally assisted mortgages (283 observations), except that two alleged redlined and six other neighborhoods were specified. The only statistically significant coefficients of redlining related variables are: higher interest rates in one other neighborhood (1.39 percentage point), shorter maturity in one alleged redlined neighborhood (− seven years) and longer maturity in another alleged redlined neighborhood (16 years), and lower loan-to-value ratios in two other neighborhoods (−33 and −7 percentage points).

If these results are taken seriously, they indicate little evidence that the alleged redlined neighborhoods are discriminated against with respect to the mortgage terms. However, the often theoretically unexpected signs of many of the variables and their statistical insignificance and the quality of the data used lead to doubts about the validity of the analysis.

Muth [1979] (Oakland, California). Muth's study used data on 1903 conventional loans made by state-chartered savings and loan associations in 1976 and 1977, as reported to the State Commissioner.[43] This limitation of the lenders who provide mortgage funds in Oakland to SLAs is not serious, however, since he primarily analyzed the yields on mortgages in a state where yields are market determined.

Interest on a loan was calculated to include points. It is the internal rate of return that equates the initial loan amount less fees and discounts paid by the borrower to the present value of monthly payments plus an assumed repayment of the unpaid balance after 12 years. This dependent variable was regressed on the following independent variables: term and amount of the loan, borrower characteristics, most of which are related to possible discrimination (black male, other minority male, female, and property not owner-occupied – all as dummy variables), age of building, neighborhood characteristics (percentage of occupied dwellings units black occupied, and percentage of year-round dwellings lacking some plumbing facilities – all by census tract, 1978 pretest data), a dummy variable that equals 1 if a loan was made in 1977, and the constant. The variables were transformed to natural logarithms. Each observation is a loan.[44]

Most of the coefficients are statistically significant at the .05 one-tail level; the R^2 is .34. Before considering the redlining related variables, it is interesting to note that the coefficients of the term to maturity and loan amount variables are negative and highly significant. The former indicates that the shorter maturity and higher interest rates are complements, *ex post,* though they may be substitutes, *ex ante.* When the term to maturity variable was removed from the regression, the coefficients of the loan amount and nonowner-occupied variables increased considerably. With respect to borrower characteristics, the following levels of statistically significant coefficients are reported: black male (.10), other minority male (.04) and female (.04). In terms of signs and magnitudes, with an average

[42] See description given above under "The Relative Risk of Lending – Defaults and Foreclosures."

[43] The data were screened for errors, which eliminated less than 100 mortgages.

[44] Average contract rent of rented dwellings, median value of single-family owner-occupied units, and percent of dwellings built prior to 1940 also were included initially, but later discarded.

interest rate of 9.3 percent, the coefficients indicate that, on average, black male borrowers (who made about 20 percent of the loans analyzed) paid .02 percentage point more, other minority males paid .03 percentage point more, and females (who made 17 percent of the loans) paid .03 percentage point less than others, *cet. par.* The statistically significant coefficient for age of house indicates that a loan on a 40-year old dwelling required a yield of about .10 percentage point more than a loan on a new dwelling. Finally, the statistically significant (.03 level) coefficient of percentage black residents in a census tract indicates that mortgages in all black tracts bore interest rates that were .07 percentage point higher than rates in all white tracts. Thus the estimated effect of possible discrimination on interest rates is very small.

Muth also regressed the debt-to-equity ratio on the independent variables, excluding the term to maturity and loan amount variables; the R^2 is .12. Three variables have coefficients that are statistically significant at the .05 level. They indicate that black male borrowers experienced loan-to-value ratios of .84 compared to .79 for white male borrowers; the ratios for borrowers in all black census tracts were roughly one-fourth less than those of borrowers in all white tracts, and mortgages on 40-year old buildings were about 5 percentage points lower than on new buildings.

The term to maturity was regressed on the same variables; the R^2 is .21. All the coefficients are statistically significant. The signs are positive (longer terms) only for black male borrowers and female borrowers. The magnitudes, though, are quite small for the borrower characteristics, but indicate 5 percent shorter maturities for mortgages on properties in all black compared to all white census tracts. However, when two additional variables, market value per square foot of living area of the mortgaged property and the borrower's monthly income, were added,[45] the percentage of black residents and the other minority male coefficients became very small and not significant and the R^2 increased to .26. The age of house coefficient also declined to half its former value. Muth concludes: "This suggests to me that the higher riskiness lenders may attach to loans in black neighborhoods is not due to race *per se* but rather to the poorer quality of dwellings and lower borrower income on loans in such areas." [p. 15]

Muth's study thus indicates that the terms on mortgages made by state-chartered savings and loan associations were not significantly worse for possibly discriminated-against people or areas. Though he found, as did other researchers, that the institutions made far fewer conventional, one-to-four family mortgages in census tracts with higher proportions of black residents, his findings with respect to terms lead to the conclusion that either the supply is demand-determined or if it is supply-determined, the demand for conventional mortgages is highly elastic. As he concludes: "on either interpretation, the fact that fewer conventional mortgages are made in black and other inner-city areas would not appear injurious." [p. 17]

Benston, Horsky and Weingartner [1978, Chapter 2] (Rochester, New York). The researchers gathered data on 712 one-to-four family house mortgages made by the principal mortgage lenders in Rochester (three mutual savings banks, two commercial banks, one savings and loan association, and two mortgage companies) over the period September 1973 through September 1976. The mortgages were made in an area of Rochester identified by community activists as redlined (the central city) and in a control area, a suburb. Mortgages were identified as conventional, FHA and VA. Because the terms on mortgages can be demand- as well as supply-determined, loans with downpayments of 50 percent or more or maturities of 10 years or less were excluded. As other researchers have found, conventionals are predominant in the suburb (in terms of numbers, 59 percent of suburban mortgages), but not in the central city (12 percent of central city mortgages). Within each area and type of mortgage, there is virtually no difference in the interest rates charged. In the suburb compared to the central city, the average loan-to-value ratios are higher on conventionals by .027 but lower on FHAs and VAs by .034 and .025. The greatest differences between the areas are in the number of months to maturity, as follows: conventional, 98

[45] Their coefficients are significant at better than the .0001 level.

months; FHA, 96 months; and VA, 80 months. Because a lower loan-to-value ratio and shorter term to maturity are alternative means of reducing the risk to the lender of defaults, a variable that combined their effect was constructed. The accepted risk of decline (ARD) is the complement of the rate at which a house's price could decline before the end-of-period owner's equity would be zero. The higher the loan-to-value ratio and the more the months to maturity, the higher the ARD and hence, given the interest rate, the more risk the lender is accepting in granting the mortgage. For all three types of mortgages, the ARD is slightly higher on average for suburban than for the central city mortgages, which indicates that these mortgages were perceived as less risky or that lenders were biased against central city properties.

To assess whether the differences in loan-to-value ratios, months to maturity, and the ARD were due to the area of the properties or to other characteristics of the borrowers and properties, a mortgage supply function was specified. For each type of loan (conventional, FHA, and VA) in each area (central city and suburb), the loan-to-value ratio, the number of months to maturity, or the ARD was regressed on the following variables: borrower characteristics (family income, age less than 35, married, previously a home owner, co-borrower used, and low or no credit rating – all but the first are dummy variables), property characteristics (price of the house, appraisal/price of the house, built before 1941, built 1941-1960, built after 1960,[46] and private mortgage insurance on conventional mortgages – the latter four are dummy variables), and census tract changes (median house price 1970/1960 and occupancy rate 1976/1970 included for the central city observations only since the suburb, effectively, is a single census tract). Since the observations cover three years, two additional variables were included to adjust for changes over the period – the long-term yield on U.S. bonds and the monthly flow of savings deposits in the area. The statistically significant (.05 level) coefficients varied between the areas, implying different mortgage lending functions for each area. They also differed among the terms analyzed. The regressions were rerun with the nonsignificant variables omitted (which changed the coefficients of the significant variables but little). These coefficients were used to specify the lending functions. The coefficients estimated from, say, the central city mortgages (excluding the census tract changes) then were multiplied by the mean values of the suburban mortgage variables to obtain the terms that these mortgages would have gotten had the suburban lending function been applied. The same procedures was followed for estimating the terms that the suburban mortgages would have obtained had the central city lending function been used.

The exercise leads to the following conclusions, first with respect to loan-to-value ratios. Were the suburban lending function used rather than the central city lending function, the average central city conventional mortgage would have a slightly higher loan-to-value ratio than when the central city function is used (.779 vs. .760). But the average suburban mortgage would have a higher loan-to-value ratio were the central city lending function used rather than the suburban function (.884 vs. .793). Similar predictions were calculated for FHA and VA mortgages. Thus it appears that the loan-to-value ratio for each type of mortgage is not a function of the area in which the property is located.

With respect to the number of months to maturity on conventional mortgages, application of the suburban lending function to the average central city borrower and property characteristics (primarily family income, age under 35, and the price and age of the house) predicts a term of 285 months compared to the actual average of 247 months. When the central city lending function is applied to the suburban borrower and property characteristics (primarily the price and age of the house), 331 is the predicted number of months to maturity, compared to the 345 actually experienced. Thus some 38 or 14 months of the "raw" difference of 98 months are unexplained and appear due to unspecified area-related factors. These fewer months to maturity translate into higher monthly payments by a buyer of the average priced central city house of $5 or $2. Most suburban FHA and VA mortgages carry 30-year mortgages. (The coefficient of variation is only .04.) Hence the suburban

[46] Overidentification was avoided because from 8 to 42 percent of the properties were not identified as to age. These observations were coded 0. Tests indicated that this procedure did not bias the coefficients.

multivariate analysis explains very little, and application of the suburban lending function to the central city values predicts almost the same number of months to maturity as the average suburban loan, due mostly to the constant term. When the central city lending function is applied to the suburban values (primarily the price of the house), the predicted number of months to maturity is 355 compared to the central city average of 258 months. Thus 27 months of the "raw" difference of 96 months appear due to the area. This works out to a higher monthly payment for the average central city home buyer of $4. The VA analysis produced similar findings. It is interesting to note that the results for the conventional and the FHA and VA mortgages are almost the same, which implies that the lenders and the government assessed the area-related characteristics similarly.

The accepted risk of default (ARD) variable provides a measure of the joint effect of the loan-to-value ratio and term to maturity of a mortgage. Application of the mortgage lending functions (as described above) indicates that the average central city mortgage would have slightly better terms were the suburban rather than the central city function used, but the suburban mortgage would have slightly better terms were the central city rather than the suburban function applied. These results are found for all three types of mortgages. The authors conclude: "Thus the data do not reveal any appreciable difference in mortgage terms between the areas, even without accounting directly for differences in risk faced by lenders in granting mortgages in the central city. These findings for Rochester are completely contrary to the allegation of those who assert the existence of 'redlining' by mortgage lenders." [p. 73]

King [1979B] (Miami, San Antonio and Toledo). The data were derived from registers of loan applications made in September, October and November 1978 at all the federal savings and loan associations in the SMSAs studied. The cities studied were chosen to include those with substantial proportions of minorities, allegations of redlining or other forms of discrimination, nonexternal statewide branching, and adequate loan volume and the presence of one or more minority operated associations. The loan terms studied (the dependent variables) are the interest rate, number of months to maturity, loan-to-appraisal value ratio, and fees. Because mortgagors could have demanded the terms they received (particularly downpayments), King also used the difference between each of the terms (with the exception of fees) asked for and received as a dependent variable. In this important regard, his study is unique. The independent variables included the following: mortgage characteristics (FHA-VA and private mortgage insurance as dummy variables, dollar amount of loan, and loan-to-appraisal value of property – except for loan-to-value ratio regression), borrower characteristics (combined gross monthly income and net wealth of applicant and co-applicant, ratio of monthly gross income of co-applicant to total for applicant and co-applicant, age of applicant and age squared, and dummy variables equalling 1 if applicant is black, Hispanic, other minority, female or unmarried), property characteristics (age and its square), neighborhood characteristics (by census tracts, 1970 data – percent black, percent Spanish-American, percent of households having incomes below the poverty level, percent of owner-occupied units, percent owner-occupied units built before 1939, and for Toledo, 29 dummy variables designating defined city neighborhoods compared to the suburbs), the time in days from September 1978 to the approval of the mortgage application to account for the upward trend in mortgage rates, and dummy variables for each savings and loan association, less one. The sample sizes are 1960 in Miami, 559 in San Antonio, and 953 in Toledo. About the same number of applicants had to be omitted because of missing data.

Ordinary least squares regressions were computed, from which the coefficients of the variables that would be considered as measuring discrimination (e.g., the applicants' race) provide estimates of the magnitude of the possibly discriminatory effect. King also used simultaneous equations, but these did not change his conclusions. The regressions indicate that ordinary economic variables, such as the presence of mortgage insurance, other mortgage terms, and the borrowers' income, and the dummy variables representing the individual associations are the most important explanatory variables. With respect to each of the mortgage terms he found that the following are statistically significantly (.05 one-tail level) related to possibly discrimination factors, *cet. par.*:

Interest rates. Miami (R^2 of .28)[47] – Rates averaged 9.59 percent. They were higher for females by 3 basis points and for census tracts with 50 percent more Spanish-Americans by 4 basis points and lower for census tracts with 50 percent more blacks by 3 basis points and for census tracts with 50 percent more of the houses built before 1939 by 6 basis points. San Antonio (R^2 of .58) – none. Toledo (R^2 of .51) – Rates averaged 9.86 percent. They were lower for other minorities by 17 basis points, and for three of the 29 neighborhoods by 13, 27 and 35 basis points.

Number of months to maturity. Miami (R^2 of .10 for level and .02 for difference) – Maturities averaged 344 months. For levels, building age showed longer maturities until age 54, then shorter maturities, and mortgages in census tracts with 50 percent more of the houses built before 1939 were five months shorter; but the coefficients of the later two variables are not significant for the difference between actual and requested maturities. San Antonio (R^2 of .34 for level and .03 for difference) – Maturities averaged 350 months. There were shorter maturities of 10 months for Hispanics, 74 months for mortgages in census tracts with 50 percent more blacks, and 10 months for mortgages in census tracts with 50 percent more houses built before 1939; but only the coefficient of the black census tract variable is significant for the difference between actual and requested maturities, indicating 16 months fewer in tracts with 50 percent more blacks. Toledo (R^2 of .46 for level and .08 for difference) – Maturities averaged 321 months. There were shorter maturities of 22 months for a 50-year old house compared to a new house, of 26 months for Hispanics, of 37 months for other minorities, of 11 months for unmarrieds, of 21 months for applicants age 60 compared to applicants age 40, and of 30 and 87 months for 2 of the 29 neighborhoods specified; but only the coefficient of the age of house and of two of the neighborhood variables are significant for the differences between actual and requested maturities.

Loan-to-value ratio. Miami (R^2 of .28 for level and .01 for difference) – Ratios averaged .79. They were lower by 2 percentage points for females for the level but not significant for the difference between actual and requested. San Antonio – none. Toledo (R^2 of .42 for level and –.01 for difference) – Ratios averaged .75. They were higher for blacks by 4 percentage points and lower by 49 percentage points for census tracts with 50 percent more Spanish-Americans, but neither of these are significant for the difference between actual and requested; only unmarried is significantly lower, by 1 percentage point.

Fees. Miami (R^2 of .68) – Average amount of $1472. They were higher by $136 for blacks and by $106 for other minorities (significant only at .10 level) but lower by $217 in census tracts with 50 percent more blacks (significant at less than the .001 level) and by $93 in census tracts with 50 percent more Spanish-Americans (significant at the .10 level) (these findings appear to cancel each other), and higher by $316 in census tracts with 50 percent more houses built before 1979. San Antonio (R^2 of .79) – Average amount of $421. They were lower for other minorities by $73. Toledo ($R^2$ of .52) – Average amount of $626. They were highest for applicants about 45 years old and in two of the 29 neighborhoods specified, by $90 and $112.

In summary, few statistically significantly more onerous mortgage terms are related to variables that measure possible discrimination. These few are of small magnitudes, with the exception of the percentage black census tracts in San Antonio, a city with relatively few blacks. And, at least as often statistically significant *less* onerous terms are associated with these variables. Thus the findings are inconsistent with the hypothesis that the institutions studied discriminated against borrowers or areas in the form of worse terms.

Appraisal Values and Purchase Prices of Properties

Schafer [1978, Chapter 4] (New York City and Nassau-Suffolk SMSAs). The data were gathered in Schafer's special survey savings banks files that included at least a 27-year period, wherein 100 loans were sampled from each bank. Of these, complete information were ob-

[47] R^2 are adjusted for degrees of freedom.

tained on the 1832 observations of one-to-four family mortgages used for this analysis.[48] The dependent variable is the ratio of the appraisal value to the purchase price. It has a mean value of .98 with two-thirds of the values falling between .90 and 1.06. (Values below .4 and above 1.6 were omitted.) The independent variables include the type of the building (percent of housing stock in census tract built before 1939 per 1970 census, and age of building relative to new construction expressed in six dummy variables), type of mortgage (FHA or VA rather than conventional, expressed as dummy variables), property location (alleged redlined and other city neighborhoods compared to Suffolk County, expressed as dummy variables), year of transaction relative to 1951 (seven dummy variables), and the constant. Schafer also said that he included mortgage terms and the price of the property in the regression, but the coefficients were insignificant or of the "wrong sign."

An OLS regression was computed with the area-wide data, which yielded an R^2 of .16. With respect to areas, the coefficients indicate a statistically significant (at the .05 one-tail level) lower ratio of 5 percentage points for one of the three designated alleged redlined areas and lower ratios of from 2 to 6 percentage points for five of the six designated other (not redlined) neighborhoods. Significantly lower ratios also are shown for the age of buildings only between 10 and 29 years of about 2 percentage points. Thus the data are contrary to the hypothesis that lower appraisals characterize allegedly redlined areas or older properties.

Regressions also were computed for observations in allegedly redlined New York City neighborhoods, other New York City neighborhoods, and three suburban counties. The coefficients of the age of buildings dummy variables are significantly negative, but only in the other (nonredlined) New York City regression. The coefficients of the other variables either are insignificant or are similarly inconsistent with the hypothesis that appraisals are lower than purchase prices in the allegedly redlined areas.

A similar analysis was undertaken for 43 multifamily house mortgages. The coefficient for the alleged redlined areas dummy variable is positive at about the .10 level. Thus as Schafer concludes, "The analysis indicates that appraisal practices as reflected in granted loans do not indicate that lenders systematically under-appraise properties in areas that are alleged to the redlined." [p. 4-46]

Schafer [1978, Chapter 9] (Upstate New York). Regressions were run with data similar to those used in the New York areas. The number of observations on one-to-four family mortgages and R^2s from each of the regressions are as follows: Albany-Schenectady-Troy, 467 and .09; Buffalo, 310 and .16; Rochester, 177 and .22; and Syracuse, 319 and .13. The coefficients for the age of building variables are not significantly different from zero in the Albany-Schenectady-Troy and Buffalo regressions. Older houses average *higher* appraisal-to-selling price ratios in Rochester and Syracuse. The coefficients of the alleged redlined and the other city neighborhoods variables are not significantly different from zero in the Albany-Schenectady-Troy and Syracuse regressions. In Buffalo, one of four alleged redlined neighborhoods and one of seven other city neighborhoods averaged higher appraisal ratios of 4 and 8 percentage points; the other coefficients are not significant. In Rochester, one of three alleged redlined and one of three other city neighborhoods averaged lower appraisal ratios of 4.5 and 3 percentage points; the other coefficients are not significant. Including mortgage terms and the price of the house and running the regressions separately on observations from alleged redlined and other neighborhoods did not alter these conclusions. Thus, these data are inconsistent with the hypothesis that savings banks appraised at lower rates older properties or properties located in allegedly redlined areas.

Benston, Horsky and Weingartner [1978, Chapter 2] (Rochester, New York). As is described above (see terms charged to mortgagors), mortgages made over a three year period at almost all area institutions were sampled. The ratios of appraisals to purchase prices of properties were calculated for conventional, FHA and VA mortgages separately on

[48] In Appendix B, Schafer describes the survey and states that "the total sample size was 2,208 for the Bronx-Kings study area." [p. B-4] He also states that the data cover "either the last 15 years or the period for which the bank had 'complete' files, whichever was shorter." [p. B-3]

properties located in an allegedly redlined area and in a "control" suburb. The ratios for conventionals and VAs in both areas are almost exactly equal to one. The FHA ratios are significantly higher at 1.02, but almost exactly the same in each area. Because of the closeness of the means between areas, a multiple regression analysis was not undertaken.

King [1979B] (Miami, San Antonio, and Toledo). The data were gathered as described above (see mortgage terms). Two types of analyses were conducted. First, the applications rejected because of (stated) inadequate appraisal values were counted and categorized by the race of the applicant and the area of the property. King concludes: "It is evident from these figures that inadequate appraisal value is a relatively infrequent explanation for rejection. Moreover, relatively few of the rejected applications are from minorities, and there is no evidence that the applications are clustered geographically." [p. 11]

Second, OLS regressions were run, with the ratio of appraisal value to property price as the dependent variable. The independent variables include the type of mortgage (private or FHA-VA insured), the age of the property and its square, whether or not the borrower was black, Hispanic, other minority, female, and/or unmarried, the borrower's age and its square, the 1970 percentage in census tracts of blacks, Spanish-Americans, people below the poverty level, houses built before 1939, and owner-occupied houses, and dummy variables for the S&L association and (in Toledo) specified city neighborhoods. The sample sizes (with the percentages they represent of the total number before observations were omitted because of missing data in parentheses) are 2832 (75 percent) in Miami, 765 (53 percent) in San Antonio, and 1234 (69 percent) in Toledo. The means and standard deviations (in parentheses) of the ratios of appraisal value to property price are similar to those found by Benston, Horsky and Weingartner [1978], (the standard deviations are larger because outlyers were included), and are as follows: Miami, .99 (.06); San Antonio, 1.02 (.09); and Toledo, 1.02 (.07). The adjusted R^2s, at .04, .01 and .06, are quite low. Statistically significant variables (at the .05 one-tail level) related to possible discrimination are the following:

Miami – The relationships are contrary to those expected in that blacks average 3 percentage points higher appraisal ratios and the ratios decrease with the age of the house until 22 years, after which they increase. (The most significant variables are the savings and loan association dummies.)

San Antonio – The hypothesis that all coefficients are zero cannot be rejected at the .05 level.

Toledo – The relationships are contrary to those expected: census tracts with higher percentages of Spanish-Americans average higher appraisal ratios, older houses have higher ratios, 8 of the 29 city neighborhoods have higher ratios (2 at the .10 level) than the suburban areas of between 2 and 8 percentage points, and FHA-VA mortgage appraisal ratios average 5 percentage points lower than conventionals.

Thus all of the analyses yield findings that are contrary to the hypothesis that lower appraisals are associated with possibly discriminated-against people or areas.

Denials of Mortgage Applications

Black, Schweitzer and Mandell [1978] (Nationwide). A survey conducted by the Comptroller of the Currency and the FDIC provided data from 176 banks that chose to cooperate of 300 that were asked. Between September 1976 and February 1979, mortgage applicants at the participating banks completed a form that asked for their personal characteristics and mailed it to the FDIC. The banks later sent their forms that reported information about the mortgages, which were matched with the customers' forms. About half of each group could be matched (4895 in all). Missing data reduced the number to 3456. The authors state "There is no indication that banks systematically avoided returning forms that were matched with a group considered a priori as being most likely to suffer discrimination." [p. 187]

The rejection rate overall was 2.7 percent (138 loans), which the authors postulate may be due to prescreening by banks or real estate brokers, among other reasons. The data were analyzed with probit analysis, the dependent variable being equal to 1 for reject, 0 for accept. The independent variables, entered linearly, include loan terms (amount requested,

downpayment, loan origination fee, years to maturity, interest rate, monthly payment, and insurance status), economic variables (total income, net worth, monthly debt, years employed, self-employed, and age of house), and personal variables (male sex, black race, and age 55 years or older), plus the constant term. The dependent variables were regressed on the loan terms first (Model 1). Then the economic variables were added (Model 2), and then the personal variables (Model 3). In all three models the only statistically significant coefficients at the .05 one-tail level (and their signs) are downpayment (–), interest rate (+), self-employed (–) and age of house (+). In Model 3, coefficient of black race is negative but significant only at the .10 level. The authors conclude: "Note, however, that the summary statistics show a large improvement between Models 1 and 2. The change between Models 2 and 3 is not large. Therefore, although the racial variable is statistically significant at the 90 percent level of confidence, one must interpret its overall impact on the lending decision with some caution." [pp. 189, 191] One also should note that 16 black applicants were rejected and 142 were accepted. Since a probit analysis was employed, the estimated quantitative relationship between black race and the probability of denial cannot be determined from the coefficients presented.

Schafer [1978, Chapter 7] (New York City Area). The sample used was derived from Equal Housing Opportunity Lender forms which provide data on applicants for new conventional owner-occupied mortgages on one-to-four family houses. These forms were filed at and completed by 27 mutual savings banks in New York City and nearby counties, between May 1976 and October 1977. Of the 11,799 applications filed for these loans, 22 percent could not be used because of missing data that could not otherwise be obtained or estimated, leaving 9149 observations. Since he was aware of the effect of missing observations on the analysis, Schafer was careful in conducting many tests to determine whether the exclusion of data introduced biases, such as a relatively larger number of applications from black than white applicants, or from alleged redlined vs. other neighborhoods, and exclusion of applications by blacks with relatively different incomes than those whose applications were not excluded. Unfortunately, all of the test results are presented as comparisons of the sample with the total number of applications filed for *all* one-to-four family mortgages, which total includes applications for government-assisted mortgages, refinancing, nonowner-occupied houses, etc. These excluded applications comprise an additional 22 percent of the universe of 11,799 applications. Therefore, one cannot be sure that the sample is as representative as it seems.[49]

The applications analyzed were categorized as accepted as applied for (69 percent), accepted after modifications of terms (18 percent), withdrawn (4 percent), and denied, (9 percent). The probability of being in one group rather than in any of the other was estimated with OLS regressions, with the dependent variable coded 1 if the application was denied, 0 if it was accepted with or without modification or withdrawn.[50] The independent variables include the following: the applicant's financial characteristics (five dummy variables representing categories of income and wealth and two dummy variables for years at present occupation), loan characteristics (a dummy variable equalling one if the loan requested exceeds two times income and the requested loan-to-value ratio), neighborhood characteristics (percent of households with income $15,000+ in 1969, change in household income 1976 less 1969, change in population 1977 less 1960, and percent of housing built before 1940 – all by census tract), property locations (five New York City counties), race of applicant (black and other minority), percentage black population in census tract 1970, and the constant. The regressions are highly statistically significant.[51] The nonquestionable characteris-

[49] The tests conducted, however, are quite thorough and imaginative.

[50] Two other dependent variables, accepted with modification and withdrawn, were specified similarly. The findings are not summarized here because these events are not likely to be related to redlining practices, as is explained in the text above.

[51] Since the dependent variables is 0 or 1, the R^2 is of limited meaning. Multinomial logit estimates also were calculated, with essentially similar findings for the signs and significance of the variables' coefficients.

tics show up as one would expect (e.g., higher income applicants are less likely to be denied). Overall, 9 percent of the applications analyzed were denied.

The coefficients of the applicant's race variables, black and other minority, are positive and statistically significant.[52] They imply that the probability that an application for a mortgage was denied is greater by 6.6 percentage points for a black and 2.9 percentage points for an other minority person than a white. These findings were cross checked in several ways, most importantly by dividing the sample into black (552 observations), other minority (861 observations), and white (7736 observations). The regressions were rerun to determine whether the coefficients differed significantly. The regressions do, at the .01 level. So do several of the coefficients, indicating that low-income blacks have a higher probability of denial than low-income whites, more time on the job is a significantly positive factor for blacks but not for whites, and blacks have a much higher probability of denial when the loan requested exceeds two times their income. (None of the coefficients of the location variables were significant.) Schafer considers the possibility that these findings of apparent racial bias could be due to correlations of race with omitted variables, in particular socioeconomic factors, two-worker families and the applicant's poor credit rating. He rejects these explanations because he finds that income and wealth and two-worker applicants do not differ substantially by race, and poor credit rating is stated by the banks as a reason for denial more for whites than for blacks. Thus he calculates and concludes that "Blacks have a 13- to 22-percent chance of having their applications denied compared to the 9- to 21-percent chance for similarly selected whites [depending on the regression used for the calculations]. Applications from similarly situated other minorities, a group composed mostly of Hispanic and Asian families, have a 14-percent chance of having their applications denied." [p. 7-114]

Alleged area redlining was tested with the five New York City counties dummy variables (applications on suburban properties were coded zero). Only the coefficient of suburban NYC county (Richmond) of −.03 is significant. Since these are crude proxies for alleged redlining, regressions were run with 3336 observations from Bronx, Kings, and Queens counties. The regressions run for the entire sample were modified as follows. The five county dummy variables were replaced by 20 variables measuring specific neighborhood problems (six measures of housing code violation, four measures of vacancies, four measures of tax arrearages, two measures of welfare) and 10 neighborhood dummy variables (seven alleged redlined and three others). The only coefficient of the alleged and other neighborhood variables that is statistically significant is for an alleged redlined neighborhood (Park Slope). It indicates that applicants in this neighborhood are *less* likely to be denied than applicants in nonspecified, presumably favored neighborhoods by 8.9 percentage points. The coefficients of the percent black in census tract variables are not statistically significant, but the coefficients of the black and other minority variables are significant, and at +.04 and +.05 are similar to those described above. The coefficients of percent of housing built before 1940 variables also are significant, and indicate that an applicant for a mortgage on a house in a census tract where 50 percent of the houses were built before 1940 compared to one with no old houses would have a probability of denial that is 2 percentage points greater. Schafer concludes that while "the race of the applicant is crucial . . . geographic location, however, does not increase the likelihood that an application will be denied although there are some areas in which applications are more likely to be modified. In fact, if geography is a major consideration in lending decisions, it is probably used as a surrogate measure for actual risks of loss associated with the subject property because of the condition of its surroundings." [p. 7-112]

Schafer [1978, Chapters 11, 12] (Upstate New York). Multinomial logit estimates were used for analysis of data from the Albany-Schenectady-Troy SMSA, Buffalo, Rochester and Syracuse. The source of the data and method of checking for the effect of

[52] Denials as percentages of the total number of applicants are 12 percent for whites, 18 percent for blacks, and 12 percent for other minorities. The number of denials are 627 whites, 97 blacks, and 106 other minorities.

excluded observations are similar to those described above for Schafer's New York City analysis. The equations specified are similar to the Bronx, King, and Queens counties regressions, except that the 20 variables measuring specific neighborhood problems could not be included. The equations are statistically significant.

For the Albany-Schenectady-Troy SMSA 6173 applications were analyzed, 74 percent of the universe of 8322.[53] Eight percent of the applications were denied. With respect to race, there were 450 denials of whites (8 percent of their total), 20 of blacks (17 percent), and 19 of other minorities (9 percent). The coefficients of two of the eight neighborhoods alleged to be redlined are significant and positive, indicating that applicants for mortgages on these properties have a higher probability of denial than suburban residents.[54] The estimated probabilities are 81 and 73 percent compared to 10 percent for a similar average suburban application. The only other statistically significant property location coefficient is for the nonalleged-redlined City of Troy, for which denials are estimated to be 6 percent higher than a similar average suburban applicant.[55] The coefficients of the other variables of interest (race and areas with old houses) are not significant.

The Buffalo SMSA analysis used 7404 applications, 87 percent of the universe.[56] Eight percent of the applications analyzed are denials. In terms of race, there are 520 denials of whites (8 percent of their total), 45 of blacks (19 percent), and 24 of other minorities (7 percent). Six of the city areas have significant negative coefficients, indicating lower probabilities of denial in these city areas than in the suburbs. Of these, one is alleged to be redlined and three others are said to be redlined by some community organizations. The coefficient of the old house tract variable (percent of housing built before 1940) is significant and positive but has a very small effect on the probability of denial. The coefficient of the percent black census tract is not significant. Finally, black, but not other minorities, have a significantly greater probability of denial. Compared to similar average white applicants, the probability of denial is 12 percentage points greater.

The Rochester SMSA sample of 2951 applications is 84 percent of the universe.[57] Rochester mutual savings banks denied 3 percent of the applications. With respect to the applicant's race, 72 white applicants were denied (3 percent of their total), 6 blacks (10 percent), and 4 other minorities (4 percent). None of the city neighborhood dummy variables (alleged redlined and other) have significant coefficients, though the signs of all but one are negative, indicating some smaller probability of denial than applications for mortgages on suburban properties. The coefficient of the old house tract variable is significant and positive. The racial composition of a census tract is not significant. But the average black applicant was computed to have a significantly greater probability of denial of 9 percentage points compared to a similar white applicant.

The Syracuse sample of 2563 applications is 82 percent of the universe.[58] The mutual savings banks denied 6 percent of the applications. In terms of the applicant's race, 147 white applicants were denied (6 percent of their total), 5 blacks (14 percent), and 5 other minorities (7 percent). Neither of the two alleged redlined neighborhoods has statistically significant coefficients (though both are negative). Only a county area has a significant

[53] Tests for noninclusion bias included an additional 51 percent of the universe, comprised of definitionally excluded applications. Hence the apparent absence of noninclusion bias cannot be determined.

[54] One neighborhood (Hudson/Park) is in Albany. For the three alleged Albany neighborhoods there are 15 denied applications. The other neighborhood (Hillside) is in Troy. For the three alleged redlined neighborhoods in Troy there are five denied applications.

[55] Sixteen denied applications came from this area.

[56] Test for noninclusion bias include 3635 other applications in addition to the 1082 excluded because of incomplete information.

[57] As is discussed above, the tests presented for estimating noninclusion bias include an additional 2032 applications, 56 percent of the universe.

[58] The noninclusion bias analysis includes 2579 other applications in addition to the 609 that were excluded because of missing information.

positive coefficient. The coefficients of the age of housing and percentage black population are not statistically significant. But the coefficient of black is significant and positive, indicating that an average black applicant would have a 15 percent chance of denial compared to a 7 percent chance for a similar white applicant.

With respect to the upstate areas studied, Schafer concludes: "In general, objective lending criteria, such as applicant income, net wealth, and requested loan-to-value ratio, are major determinants in the lending decision in all four areas. The race of the applicant is also crucial in three of the four metropolitan areas (Buffalo, Rochester, and Syracuse). Property location in an alleged redlined neighborhood is a significant impediment to a favorable decision in only one metropolitan area (Albany-Schenectady-Troy)." [p. 12-155]

Evaluation of the Schafer Studies. These studies of five municipal areas are done with considerable care and imagination. The validity of the findings, though, are in doubt for the following reasons. First, though considerable effort was given to checking for noninclusion bias, the inclusion of a relatively large number of applications for mortgages not in the universe (e.g., FHA mortgages and mortgages on nonowner-occupied buildings) in the tests destroyed their usefulness.[59] (Nevertheless, the data used need not be biased with respect to the hypotheses tested.) Second, despite the large number of observations available, a validation sample was not used. Third, it is likely that many of the variables (such as the many measures of neighborhood quality and the applicant's income) are related to the variables of interest, property location and the applicant's race. Consequently, there is no way of determining the statistical significance of the coefficients. This problem is particularly acute for the New York City property location data. Fourth, the omitted variable problem may be particularly important to the measured relationship between the applicant's race and the probability of denial (as Schafer acknowledges in the quotation given in the introduction to this section in the text above). In particular, race may be a determinant of foreclosures, given an applicant's income, etc., if blacks are discriminated against in employment or are more likely to suffer from illness or marital problems and hence are more likely to default on their mortgages.[60] Should this be the case, society rather than lenders bears much, if not all, of the responsibility for the higher denial rates for black applicants reported. Fifth, the number of blacks whose applications were denied are small: 97 in the New York City area, 45 in Buffalo, 6 in Rochester and 5 in Syracuse. Based on these numbers, Schafer concludes: "The race of the applicant as opposed to the racial composition of the neighborhood surrounding the property, is a crucial factor in the lending decisions of all but one of the metropolitan areas . . . [This finding is] consistent with allegations of discrimination against black applicants." [p. 13-111]. In any event, "black" could be a proxy for other, risk-related variables and not a discriminator, as such, with reasoning similar to interpretations of the positive relationship between "black" and high defaults. Finally, because all the data were obtained from mutual savings banks, the alternative hypotheses that they discriminate against blacks or tend to favor blacks cannot be distinguished, if it is the case that the other variables used in the model are inadequate measures of the quality of the factor specified. For example, the quality of earnings may be lower for blacks because they are discriminated against in employment. But if real estate agents know that mutual savings banks (or the ones sampled which, it should be noted, were willing to give Schafer their data) tend to favor blacks, these banks will get a disproportionate number of applications (relative to other lenders). In this event, though the probability of a black being accepted is higher at the subject banks than at other lenders, the regression analysis will indicate the reverse.

[59] In total, over the five municipalities, applications excluded because of missing data are 20 percent of the universe (conventional mortgages on owner-occupied houses) and applications included in the tests that are definitionally not part of the universe are 38 percent of the universe.

[60] Barth, Cordes, and Yezer [1979] report a statistically significantly higher probability of defaults on FHA loans by blacks of 1.2 percentage points. (The overall average default is 1.5 percent.) As they state, this finding does not mean that blacks necessarily are poorer risks but that "black" may be associated with other, omitted variables that are positively related to defaults.

Warner and Ingram [1979] (Columbia, South Carolina). The data on conventional mortgages applied for were obtained from all four of the savings and loan associations and three of the four commercial banks with headquarters in the area. (One bank was excluded because it concentrated its conventional mortgage lending outside the area.) Over the period studied (1976 and 1977) all the 250 denied applications were analyzed and a randomly selected sample of 500 accepted applications was drawn from a population of about 4600. (The denial rate of 5.4 percent is lower than found in the New York mutual savings banks data. No mention is made by Warner and Ingram of modifications.) A validation sample was derived by selecting every other observation of each group.

A multiple discriminant model was used first to estimate only those factors that were considered to represent ordinary, nondiscriminating risk and return considerations (step I). Then the function was reestimated with a set of factors defined as discriminatory added to the first set (step II). As the authors explain: "While neither function may be a very effective model of the loan offer function, the key to the discrimination analysis rests in the fact that unless there is a significant improvement in discriminating power moving from Step I to Step II the discrimination variables representing particular categories of borrowers are eliminated as possible residual variables (with respect to the first discriminant function)." [p. 4]

The first (step I) discriminant function includes the following variables (listed in the order of the relative discriminating power estimated): applicant's credit rating, loan-to-value ratio requested, annual percentage (Regulation Z) interest rate, applicant's tenure in current occupation, applicant's total monthly payments-to-income ratio, applicant's occupation (percentage of income earned from sales commissions), term of mortgage applied for, and co-borrower's tenure in current occupation (0 if no co-borrower).[61] It is statistically significant at the .01 level. The additional, "discrimination" variables include the following (listed in the order of relative discrimination power estimated): applicant's age, neighborhood median family income in 1970, marital status (unmarried or separated = 1, married = 0), age of the dwelling, applicant's sex (1 for female or other than married couple applying jointly, 0 otherwise), applicant's race (1 for non-Caucasian, 0 otherwise), and co-applicant's income as a percentage of total income.[62] A comparison of the discriminating power of the step I and step II functions reveals no significant difference at the .01 level. (Quadratic discriminant functions also were computed, leading to the same conclusion.) Furthermore, the coefficients estimated were used to classify the validation sample. The step I linear model classified 68 percent correctly, as did the linear step II model which included the "discrimination" variables. The quadratic step I model classified 76 percent correctly, compared to 66 percent for the quadratic step II model. Thus, as the authors' conclude, "... there is no evidence of mortgage lending discrimination in the data." [p. 30]

King [1979B] (Miami, San Antonio, and Toledo). The data were obtained from registers of loan applications kept at 45 savings and loan associations for the months of September through November, 1978. The sample sizes are 2397 for Miami, 546 for San Antonio and 831 for Toledo. About half as many observations had to be omitted because of missing data in the San Antonio and Toledo samples and about a fourth as many in the Miami sample; however, a comparison of the means of some variables of the used and omitted samples indicates no evidence of bias. The dependent variable equals 0 if an application was accepted and 1 if it was rejected. Ordinary least squares and logit analyses were used, with little sub-

[61] The applicant's net worth was specified by the model but the data could not be obtained.

[62] Data limitations precluded inclusion of four discrimination variables specified: applicant's religion, applicant's national origin, public assistance income, and applicant's previous exercise of consumer protection rights. The following are the means of the "discrimination" variables in the accepted and rejected applications samples: age, 37 and 34 years; unmarried or separated, 11 and 12 percent; building age, 7 and 10 years; female or other than married, 21 and 11 percent; non-Caucasian, 11 and 20 percent; and co-applicant's income percentage, 9 and 8 percent.

stantive difference. The independent variables included the following: mortgage characteristics (FHA-VA and private mortgage insurance as dummy variables, and the ratio of the requested loan amount to appraisal value), borrower characteristics (the applicant's credit rating, ratio of monthly payment to the applicant's gross monthly income and the ratio squared, ratio of the purchase price of the house to the applicant's gross monthly income and the ratio squared, ratio of the requested mortgage loan to the applicant's net worth, ratio of applicants' existing monthly debt to their gross monthly income, the applicant's age and age squared, ratio of second income to total income of applicants, and dummy variables equaling 1 if the applicant is black, Hispanic, other minority, female, or unmarried), property characteristics (age of house and age squared), neighborhood characteristics (by census tracts, 1970 data – percent black, percent Spanish-American, percent of households having income below the poverty level, percent owner-occupied units, percent owner-occupied units built before 1939 and, for Toledo, 29 dummy variables designating defined neighborhoods), and dummy variables for each savings and loan association, less one.

The most important variables generally are those representing the mortgage characteristics, the borrowers' characteristics of bad credit rating, other debt to income, payments to income (except for San Antonio and some savings and loan dummy variables).

Because the applicant's credit rating variable was recorded only for declined applications, all accepted applications were considered to be from applicants with good credit ratings. But, since this coding may not be correct, King reports regressions including and excluding this variable. The statistically significant coefficients of the variables that may measure discrimination (e.g., black, Hispanic, other minority, female, unmarried, census tract black, Spanish-American, and units built before 1939) found are as follows:

Miami – The denial rate averaged 12 percent. Including bad credit rating (R^2 of .22), the average Hispanic applicant had a higher denial rate of 3 percentage points and census tracts with 50 percent more Spanish-Americans are associated with denial rates averaging 6 percentage points higher; excluding bad credit rating (R^2 of .11), the two variables were not changed much but blacks also averaged high denial rates of 7 percentage points (significant at the .10 level).

San Antonio – The denial rate averaged 5 percent. Including bad credit rating (R^2 of .30), the average Hispanic applicant had a higher denial rate of 3 percentage points, which increased to 5 percentage points when the bad credit rating variable was omitted (R^2 of .11).

Toledo – The denial rate averaged 7 percent. Including bad credit rating (R^2 of .23) the probability of denial declines until houses are 21 years of age and then increases, and 2 of the 29 city neighborhoods have lower denial rates of 22 and 19 percentage points; excluding bad credit rating (R^2 of .15), the age of house and neighborhood coefficients are largely unchanged and the average Hispanic applicant had a higher denial rate of 20 percentage points, but this finding is based on only five observations.

In summary, the findings show evidence of adverse selection only for Hispanic borrowers in Miami and San Antonio averaging about 3 percentage points higher rates of denial (relative to average rates of 12 and 5 percent). The data show no evidence of discrimination against black, other minorities, females, old, or unmarried applicants, applicants for mortgages on older houses or in neighborhoods occupied by blacks, Spanish-Americans, or in Toledo, city versus suburb.

Tyree and Yeager [1979, Chapter 10] (St. Louis). All 194 loans referred in 1978 to the St. Louis Savings Service Corporation, an organization established and financed by area saving and loan associations to consider "high risk" residential mortgage applications that previously were reviewed and rejected, were analyzed. Multiple discriminant analysis was employed to determine whether use of possible "discrimination" factors played a role in the corporation's rejection of 34 percent of the applications. These factors include location of the property, and the applicant's race, marital status, age, and sex as well as other factors, such as the price of the house and housing expense. The authors conclude: "The most important conclusion from this analysis is the insignificance of the entire model. The 18 factors, when considered as a group, provide no improvement over pure chance in determining the likelihood of an application being accepted or rejected. . . . The conclusion from this analysis is that decisions by the Savings Service Corporation are primarily influenced by other factors, and not by factors relating to discrimination, particularly redlining." [pp.

119-120] This finding is gratifying, but considering the purpose for which the Corporation was established, not surprising.

The Demand for Mortgages by Actual and Potential Home Buyers

Benston and Horsky [1979] (Rochester, New York). Surveys of present (1976) homeowners and buyers of houses within the previous three years were undertaken to determine the mortgage-related difficulties they encountered in selling and buying their homes and in obtaining home improvement loans. The experiences of people in the allegedly redlined area (identified by anti-redlining community group leaders, essentially as the central city) were contrasted with those of people in a control, suburban area. Based on a pilot study, 500 central city and 400 suburb homeowners were selected randomly for interviews. The interviews were conducted by a professional market research firm to reduce the possibility of bias. The homeowners were asked whether they had attempted to sell their homes within the last five years and/or currently were trying to sell their homes. Twelve percent of the central city owners (45 people) and 5 percent of the suburban owners (16 people) contacted said yes.[63] Of these, no potential buyer had inspected the homes of 36 percent of the central city owners and 13 percent of the suburban owners. The owners reported that, of those potential buyers who had inspected the house, a somewhat greater proportion of those in the central city than in the suburb said they encountered mortgage problems (28 vs. 21 percent). However, none of these problems was stated to be related to the area of the house.

Buyers of homes in both areas over the three years 1974 through 1976 were identified by sampling sales reported in the Rochester *Daily Record;* 260 people in the central city and 273 people in the suburb who had purchased homes for their own use were interviewed and asked about their experiences in obtaining financing. Mortgages were obtained by 92 percent of the central city buyers and 99 percent of the suburban buyers. All but 0.4 percent (one person) who wanted a mortgage did not get one; the balance said that they did not want a mortgage. Relatively more suburban buyers than central city buyers obtained a mortgage from a financial institution (99 vs. 87 percent). Of these, a mortgage was obtained from the first institution contacted by 84 percent of the central city and 89 percent of the suburban mortgagors. Most of the balance chose to use another institution. Mortgages were refused by a lending institution to 2 percent of the central city buyers (four people) and none of the suburban buyers. One of the four buyers said that the area of the home was the reason for refusal.

The buyers' reasons for obtaining conventional or FHA mortgages also were ascertained. (Conventionals were held by 29 percent of the central city and 62 percent of the suburban home buyers; FHAs were held by 55 percent of the central city and 18 percent of the suburban home buyers.) The principal reason given for obtaining FHA mortgages was lower downpayment and the principal reason for the choice of conventional mortgage was lower interest rate. The only reason that might indicate a forced choice, "only type available," was given for FHAs by the same percentage in each area (2 percent). Conventionals were said to be the only type available by 3 percent of the central city and 7 percent of the suburban home buyers. Finally, all but 3 percent of the central city and 2 percent of the suburban buyers said they were dissatisfied with the financing they obtained. Also no area-related problems with respect to home improvement loans were reported.

Tyree and Yeager [1979, Chapter 8] (St. Louis, Missouri). This study was based on interviews with leaders of neighborhood organizations and follow-ups of their allegations of redlining. All of the leaders of the 194 organizations listed by the city's Community Development Agency that were still in existence were contacted. Repeated attempts to obtain interviews resulted in 104 interviews. The interviews were standardized and controlled to minimize bias. The real estate practices of real estate lending institutions were said to have

[63] When adjusted for the total estimated number of selling attempts over the five-year period, no buyers inspected the house in 14 percent of the central city attempts and 2 percent of the suburban attempts.

a negative effect by 38 percent of the community leaders, and a positive or neutral effect by 58 percent (4 percent replied "don't know"). The agreement by community leaders who thought that lenders had a negative effect compared to those who said the institutions had a neutral or positive effect to the following series of statements provides insight into the basis for their belief. "An applicant who would be able to obtain financing on property outside the city of St. Louis would find financing for St. Louis property quite difficult or nearly impossible," 30 vs. 5 percent. "Interest terms in this neighborhood are less favorable than terms in other parts of the city," 38 vs. 16 percent, "and other parts of the county," 54 vs. 33 percent. "The general attitude of lenders regarding real estate financing in their neighborhood is discouraging," 46 vs. 14 percent, and "is less favorable than five years ago," 20 vs. 14 percent. When asked if they knew of any lending institutions that actively tried to get real estate loan business in the neighborhood during the last three years, "yes" was given by 41 percent of the "negative" leaders vs. 61 percent of the "positive and neutral" lenders.

The interviewers also asked questions about redlining. When asked whether they knew of "any specific cases of lending institutions not approving loan applications because of the location of the property," 41 percent of the community leaders who said that lending institutions have a negative effect replied "yes" compared to 18 percent of those who said the institutions have a positive or neutral effect. When asked "Do you know of any specific cases of lending institutions purposely discouraging applicants from buying in this neighborhood," yes was answered by 16 percent of the first (negative) group and 4 percent of the second group. When asked about the institutions' discouraging applications, 8 percent of the both groups said they knew of specific cases. In all instances where the respondent answered "yes" to these three questions, the interviewers asked for the number of instances and the names and addresses of the people involved. (One person expressed knowledge of 25 cases.) Repeated attempts were made to obtain this information. The researchers report: "In general, neighborhood association leaders were cooperative and attempted to assist in [the] search for redlined parties. Many discussed our search during their neighborhood organization meetings and went so far as to contact individuals who may have had difficulties in seeking financing." [p. 99] However, only seven alleged cases could be found. Two cases included people who could not be located; one was said to have been denied a mortgage five years earlier and one a year earlier. In four cases the people denied they had had a problem and in one case the problem appeared to be lack of creditworthiness because of the husband's low income, though the people got financing elsewhere and then divorced. (Details are provided in the study.) Thus little evidence of actual redlining in St. Louis was reported and none was documented.

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Discussion

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It is important to emphasize that the profitability of a particular approach to evaluating credit risk is not an appropriate test of whether the society, through its government, is justified in regulating the credit evaluation process. Private property is an aggregate of rights created by society, and society has always placed limits on its use. Similarly, society can add a requirement of equal treatment of similarly situated applicants as a constraint on the market. Such rules define the context within which business must be conducted. They can, and frequently do, alter the profitability of business. Society need only believe reasonably that the extra cost of doing business within the new constraints is less than the social benefits resulting from the fair and equal treatment of applicants.

In essence, the fair housing regulations require lenders to use objective measures of risk of loss for each application and prevent them from attributing the average behavior of some group to the individual. These rules are merely the reflection of an American ideal: each person should be judged on his or her *own* merits. In particular, fair housing laws prohibit discrimination on the basis of race, color, national origin, sex, marital status, age, receipt of income from public assistance programs, and good faith exercise of rights under the Consumer Protection Act. As a result, a black applicant for a mortgage must receive the same treatment and have the same chance of success as a white applicant who has the same income, net wealth, credit history and value of other objective measures of creditworthiness. Other regulations place restrictions on the use of neighborhood. For example, the Federal Home Loan Bank Board (FHLBB) prohibits "arbitrary decisions based on age or location of the dwelling."[1] Although the Community Reinvestment Act does not place direct constraints on the lending process, it requires the federal financial regulatory agencies to encourage lenders "to help meet the credit needs of the local communities in which they are chartered consistent with the safe and sound operation of such institutions."

It should be no surprise that these regulations might increase the costs of evaluating credit applications. Using the average risk of loss for various groups

[1] 12 CFR §531.8(c)(6), 43 *Federal Register* 22339 (May 25, 1978).

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of applicants is usually less expensive than researching each applicant's credit history.

The next section presents my comments on the Barth, Cordes and Yezer paper. The following section discusses the Benston literature survey.

Barth-Cordes-Yezer

The Barth-Cordes-Yezer paper's distinctions between a legal and economic definition of redlining are misleading. Any differences that do exist are considerably less than they suggest, especially regarding the anti-redlining regulations.

The most important way in which the Barth-Cordes-Yezer paper misleads its readers is the suggestion that the fair housing regulations require lenders to make loans that are unsafe. This follows from their economic definition of redlining: differential treatment of neighborhoods that does not correspond to differences in costs and risks. Increased costs due to a more individualized credit evaluation process should not be a part of the definition of redlining. It is not clear why the costs of processing and servicing should vary across mortgages that have equal risk of loss. Then, the major question turns on the implications of fair housing laws for the ability of lenders to use risk of loss. None of the fair housing regulations restrict a lender's ability to use risk of loss in deciding whether and on what terms to approve a mortgage application. These laws only require that lenders use objective measures of each application's risk of loss. Such measures must have a causal relationship with risk, and not just a correlation. In this sense, the laws can be credited with keeping economists honest; that is, requiring the models to be specified correctly. Anti-redlining laws even allow some aggregate neighborhood measures to be employed. For example, the FHLBB regulations only prohibit the *arbitrary* use of location. These conditional rules recognize the role of housing market externalities; for example, the condition of neighboring buildings is likely to affect the risk of loss on the property that is securing a mortgage.

Although the fair housing laws contain unconditional prohibitions on the use of race, sex and other personal characteristics, the anti-redlining laws can be read as asking for help in defining what is an unfair use of neighborhood factors. Here is a clear opportunity for economists to make a valuable contribution. Anti-redlining laws are begging for a workable definition of the "arbitrary" use of neighborhood. How can property externalities be reasonably used in the lending process? What should regulators do to determine what is arbitrary and what is not? What data are needed and what techniques are appropriate for its analysis? Lenders need to know what neighborhood factors are legitimate credit evaluation criteria and how they can incorporate them into an effective and legally defensible credit evaluation process.

It is relatively easy to delineate some neighborhood factors that cannot be utilized. These are the aggregate measures of the personal characteristics which the fair housing laws prohibit unconditionally. For example, the racial composition of a neighborhood is clearly prohibited. The laws tell lenders to find objective measures of risk which are reasonably related in a causal sense with risk of loss. Racial composition may be correlated with risk of loss but

society has correctly stated that any such relationship is spurious and not founded on a causal link. Economists can and should develop the causal relationships for use by lenders and regulators. A very likely candidate for a causal link with risk of loss is the incidence of housing code violations and vacant buildings. A useful study would be an assessment of the relative strengths of various measures of housing condition (e.g., census tract, census block, and adjacent property) as indicators of risk of loss in mortgage lending. The results would provide a firm foundation for defining the area impacted by housing market externalities.

It is also unfortunate that Barth, Cordes and Yezer misinterpret a clause of the Community Reinvestment Act that requires federal financial regulatory agencies to "assess the institution's record of meeting the credit needs of its entire community, including low- and moderate-income neighborhoods, consistent with the safe and sound operation of such institution" in reviewing applications for deposit facilities. The authors imply that this provision of the CRA might prevent lenders from using neighborhood income as a criterion. Their interpretation is uncalled for and unfounded. It is far more reasonable to read this section of the CRA as requiring lenders to participate in appropriate public programs to assist low-income neighborhoods. These programs would provide the risk adjustment necessary to make the ventures safe and sound for the lender. Thus, the statute would be consistent with economic reality.

Furthermore, Barth, Cordes and Yezer suggest that the economic but not the legal definition provides a standard against which lender behavior can be compared. I cannot agree. The law defines the boundaries of economic activity. Economic activity is not possible without some agreement about the procedures for conducting activity involving more than one party. This is the essence of law. In this case the law requires equal treatment of similarly situated applications. Economics has a role to play in defining the objective measures that need to be held constant to assess whether or not there is discrimination as defined by the law.

Barth, Cordes and Yezer also mislead the reader by incorrectly claiming that the law views redlining as occurring when local lenders export deposit funds. Many community organizations espouse this view, but it is not the law. The closest these groups have come to incorporating this view into the law is the Home Mortgage Disclosure Act of 1975, but it only requires disclosure of lending activity. It is only a source of data for use in evaluating whether lenders treat all neighborhoods equally. The problem is that the data are wholly inadequate for the task. Another problem is that economists, especially those working for regulatory agencies have not provided sufficiently strong backing for the appropriate data source: namely, detailed information on all serious mortgage inquiries. These data should be even more detailed than the information available under California and New York law. The Home Mortgage Disclosure Act of 1975 should be repealed and replaced with a law requiring the maintenance of detailed records on all serious inquiries about mortgages. Then, all parties will have access to data capable of answering the basic empirical question: Does discrimination occur and, if so, who are adversely affected?

In the area of methodology, I have several points on the Barth-Cordes-Yezer paper. First, a logit model is preferred to the OLS technique used because the logit has the appropriate functional form. This choice is not a matter to be resolved on the basis of sample size. Of course, the simultaneous equation model has less econometrical foundation in the logit formulation because there is no known way of introducing an error term into the logit function. It should be noted that under certain assumptions the binomial choice OLS coefficients can be transformed into consistent logit coefficients.

Second, the specification of the models is bothersome. The housing expenditure equation appears to be a confusing mixture of a consumption function and a hedonic price index. The maturity equation does not include the age of the borrower which would seem to be a relevant and important preference variable. Similarly, the loan-to-value equation excludes two relevant and important preference variables: net wealth and age of borrower.

Third, I believe that the authors misinterpret the coefficients of variables which are unconditionally prohibited as lending criteria. A positive and significant coefficient on such a variable (e.g., race) indicates that defaults are higher for this type of person but is not a defense against or a valid basis for objecting to regulations prohibiting discrimination. Instead, it is an indication that objective measures of default have been excluded from the model. In an appropriately specified default model, it should be unnecessary to brand an individual with the average behavior of a group.

Fourth, city characteristics are an inappropriate level of aggregation to study redlining. If lenders redline, they do it at the neighborhood level. In other words, redlining occurs, if at all, across neighborhoods within one metropolitan area and not across metropolitan areas. This is a serious weakness.

Finally, I believe that their discussion of a sample selection bias is incomplete. They argue that sample selection bias exists because the observed defaults are drawn from a population with an *ex ante* default which is less than a critical value. This is not true because lenders do not know the *ex ante* default probabilities; instead, lenders use estimates, or predicted values, of default probabilities. I believe this results in less efficient but not biased estimates when the dependent variable is *ex post*.

The Barth-Cordes-Yezer paper makes several valuable contributions:

First, it tests defenses against marginally discriminatory factors such as age of neighborhood. Community organizations argue that older neighborhoods are redlined, that is, receive less funds than other neighborhoods with equal risk of loss. Lenders have responded that such variations are spurious because neighborhood age is highly correlated with risk of loss. The Barth-Cordes-Yezer results indicate that this defense is invalid; they find that default is significantly less likely in older neighborhoods.

Second, it allays lenders' fears concerning the impact of fair housing laws. For example, any lender who may have relied on the age of the building or the racial composition of the neighborhood should not be concerned by their prohibition as lending factors; the Barth-Cordes-Yezer results indicate that they do not have a significant impact on default once other factors are taken into account.

In fact, other more objective measures of risk (e.g., the structural condition of the building and of nearby buildings) are even better and not subject to charges of discrimination.

Third, it contributes to the growing literature that provides a foundation for the development of a credit evaluation system to make lending decisions and to systematically adjust the terms (e.g., interest rate) for risk differentials. These models must be based on default models that exclude all variables that measure prohibited lending criteria.

Benston

Benston has tried to summarize the empirical literature available on the issue of redlining. This is a tremendous task requiring careful reading of many studies using widely different approaches. One valuable improvement would be a table summarizing the results of each study with respect to redlining; it is very difficult to assimilate these findings across the textual summary of the studies. Persons interested in literature reviews of these studies should also consult the excellent one by Thomas King of the Federal Home Loan Bank Board.

Benston asserts three conditions that studies of redlining must meet to have valid conclusions. He does not require each study to meet all three conditions. One of these conditions is plainly incorrect. He asserts that if the focus of the study is on the effects of redlining on consumers or neighborhoods, data from all mortgage lenders must be included. While this appears reasonable on its face, it is inconsistent with the requirements of fair housing laws. These laws do not require that on average a particular group of consumers such as blacks receive adequate mortgage funds. They require that no lender discriminate against them in the lending process. A lender that discriminates against a black applicant or some other protected group will not find a successful defense in the fact that another nondiscriminating lender granted that person a loan.

Bank specific studies are precisely the type necessary for regulators to make determinations relevant to the requirements of fair housing laws. Economists should assist them by developing pragmatic and sound methodological approaches. These analyses should also assist lenders by providing them with credit evaluation systems that are based on objective factors with causal links to risk of loss. The most difficult part of this challenge lies in developing a workable definition of redlining. Redlining based on the racial composition of the neighborhood or some other neighborhood aggregate measure of an individually protected status would have to pass the same standards as the discrimination against a member of one of these protected groups. However, redlining based on the age of the neighborhood or the geographic boundaries presents a more complex case. Yet even here, fair housing laws will probably be read as requiring lending rules based on a causal link between the variables and risk of loss for any areas within each lender's reasonable lending market. The definition of this market area is another place for economists to assist the lawyers.

It is true, however, that studies of the aggregate supply and demand for mortgages should include most if not all sources of mortgage funds. This does not, however, eliminate the usefulness of models based on aggregate data. In my

own study of three counties in New York City, I went to great lengths to point out the importance of interpreting my results as only applying to those institutions covered by the data set.[2]

In his discussion of default models, Benston argues that meaningful findings are only possible if the data were not prescreened by lenders. This is incorrect because, as I have already pointed out in my discussion of the Barth-Cordes-Yezer paper, lenders are making decisions on the basis of estimated and not the known probabilities of default. As a result, econometric procedures can provide valid estimates of the effect of variables on default. There is a similar, but unrelated issue that should be mentioned. In any econometric technique, the predictions weaken the further the situation is from the range of values of the independent variables available in the data used to estimate the model.

In discussing default studies, Benston concentrates on foreclosures. The wide variation in bank policies towards the institution of foreclosure proceedings suggests that delinquency may be a better measure of risk of loss. In my own studies the crude foreclosure and delinquency rates suggested that risk was higher in areas alleged to be redlined, but the multivariate analyses indicated that many factors other than location may be responsible for the higher default rates in these areas and that lenders can develop credit evaluation systems using information specific to the property and applicant without recourse to crude neighborhood-level rules of thumb.[3]

In discussing the studies of the lender decisions on applications for mortgages, Benston states that "all of the [se] studies found no evidence of differential denial rates related to" the property's location. This is incorrect. My own study of the Albany-Schenectady-Troy metropolitan area found strong evidence that two neighborhoods were redlined by savings banks.[4]

In his summary, he makes the further statement that "the weight of the evidence is contrary to the hypothesis that lenders discriminate against minority borrowers or areas by denying mortgage applications." This clearly incorrect statement could seriously mislead the reader and reveals a bias that runs through-

[2] Unfortunately, Benston's summary is written so that the reader may have the misunderstanding that this is his caveat while it is, in fact, my own. In addition, Benston states that my study of the quantity of mortgage money provided by reporting institutions (Chapter 5) found "no evidence of redlining." This is incorrect. The report concluded with respect to the analysis of Chapter 5 that "the community organizations may be incorrect about the existence of redlining in [the Central Brooklyn and Park Slope] neighborhoods, while they may be correct in their allegations concerning the South Bronx, Crown Heights, East Flatbush and Southeast Queens." (p. 5-78).

[3] My delinquency models include variables that identify whether or not the property is located in a neighborhood that is alleged to be redlined. Benston also points out that the borrower's race and the racial composition of the neighborhood were absent from my default models. The reasons are that the race of the borrower was not available (even though we sought it) from the banks' records and the racial composition is only available for 2 years of the 27-year period covered by the mortgages in the samples used to study default.

[4] In addition, the chances of modification of the requested terms prior to approval were significantly higher in the allegedly redlined Park Slope neighborhood in New York City.

out the literature review. Although the evidence indicates that redlining exists in only some metropolitan areas, the same studies find that minority applicants, especially blacks, are twice as likely to be denied a mortgage as are similarly situated white applicants. These findings are very statistically significant, and the differentials are large. And contrary to Benston's assertions, the studies are not beset by problems of multicollinearity and the models are specified so as to control for risk-related and other objective lending criteria.[5] These findings cannot be swept aside so easily. Lenders and society must address these findings honestly and forthrightly. We need to develop lending procedures and a lending officer training process that eliminates racial discrimination.

A bias against findings consistent with allegations of discrimination is evident to anyone familiar with the studies being reviewed. If the care that was devoted to identifying deficiencies in the studies with findings consistent with discrimination had also been devoted to the other studies, the latter would have been found to be seriously flawed relative to the former. For example, the Muth study of mortgage terms analyzes an obvious simultaneous equation system with an entirely inappropriate econometric tool. Another example is the differential insertion of the effect of potential multicollinearity. This criticism appears in the discussion of findings consistent with discrimination allegations whether or not it is appropriate. However, it is absent from other studies even though appropriate. The Warner-Ingram two-step procedure, for example, is entirely inappropriate and invalid in the presence of multicollinearity.

None of the research adequately deals with the question of whether lenders discriminate illegally in their response to initial inquiries, the prescreening process. Homeowner or borrower surveys shed no meaningful light on this issue. Some agency should conduct an audit study of this portion of the lending process. Such a study would have matched pairs of applicants that differ on only one characteristic such as race make inquiries of the same lender. Comparison of their respective treatment would be a significant addition to the literature. Among other things, such a study would assist financial regulatory agencies in deciding whether or not to make such audits a regular feature of their equal credit opportunity enforcement efforts.

[5] For example, Benston suggests that race may be a determinant of foreclosure. Of course, that could not be a causal relationship. In any case, the models he is criticizing at that point include a direct measure of the foreclosure rate as well as the delinquency rate.

Risk and Capital Adequacy in Banks

Sherman J. Maisel*

Financial markets have become more volatile and more competitive. The scopes of banks and bank holding companies have expanded. Management decisions have become more vital and more complex. Modern theories of risk and capital can aid bank decision-making. With a better understanding of potential trade-offs, banks may choose a desired level of risks with a minimum waste of capital. Unnecessary risks can be avoided.

Complaints are widespread that government regulations reduce productivity and raise costs of borrowing and lending. Bank regulations are specifically accused of reducing competition while giving birth to a plethora of wasteful nonprice competitive practices. Bankers' decisions are said to be warped as they shape their operations and lending to circumvent regulatory constraints. Risk-taking is artificially reduced even as capital is wasted.

Existing regulations and the bank examination system attempt to control capital, liquidity, diversification, and risks while promoting sound management. However, controls are based on tradition, industry norms, and subjective evaluations. How to measure risks and what is adequate capital have not been formulated in objective terms. The ratio of capital to assets has declined steadily. It is unclear whether this is due to market forces or to weaknesses in the regulatory system. In critical cases, problem banks have ignored regulatory constraints because suggestions for change could not be formulated in an enforceable manner.

Yet the need for some regulation is widely recognized. Without regulations, an undue percent of financial institutions are likely to take excessive risks. Because of the large amount of leverage, the difficulty of depositors' policing of risk levels, the high cost of information, and the number of small, uninformed depositors, an institution can profit by raising its risk ratio. Moral hazards are also high; it is hard to protect against conflicts of interest and self-dealing.

The introduction of federal deposit insurance was a major reform. It reduced fear among depositors, ended bank runs, and strengthened the stability of the economy. It also potentially increased competition and choice among borrowers and lenders by making entry easier. Depositors do not have to seek size to insure the safety of their claims.

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However, the existing system has several actual and potential flaws. Because insurance premiums are fixed and flat at all levels of risk or capital adequacy, bank managers and stockholders can profit by increasing their risks at the expense of the FDIC and uninsured depositors. As a result, to curtail excessive risks, detailed regulations and examinations are necessary. Many observers believe it would be more efficient to protect the public by greater use of the market and through insurance properly priced to reflect risks rather than through regulations. (Scott and Mayer, 1971; Barnett, 1976)

Another potential danger is the ambiguous position of uninsured depositors. Those in large banks have been insured *de facto*, while those in small banks have suffered losses. Moreover, since protection is not a matter of law, in critical periods all banks may become suspect. Unless changes are made, the future may witness major runs, together with all the problems that the deposit insurance is supposed to avoid. Even if such a point is not reached, fear may bring about concentration of funds in only a few large banks, causing critical problems for the smaller banks.

It is also claimed that the system penalized the well-managed bank. Poor managers are protected by the umbrella of the FDIC. Only in extreme situations will the stockholders and management be forced into bankruptcy. In most cases the FDIC helps bail them out of bad decisions. Many banks have been carried for long periods by the forebearance of the FDIC. When the economy was shaken in 1973 and 1974, a number of banks, including several large ones, turned out to have assumed excessive risks. The examination process did not protect the public against bad or unscrupulous managements.

The object of our study was to examine various implications of the modern theory of finance in order to compare their basic thrusts to the existing procedures of regulation with enforcement by examination. The theories contain a number of simplifying assumptions. What problems arise when they are applied to specific institutional problems?

On the whole, we believe that the regulatory process has not shifted rapidly enough to an emphasis on use of market information in place of detailed examination of individual loans and procedures. While adjustments must be made in application to individual cases because of lags, transactions costs, and poor information, the assumption that the market can solve most problems may well be a better starting point than the existing emphasis.

The primary risks are those of interest rate risk, mal-diversification, and moral hazard. Risks also arise from poor management. The question must be asked as to whether the current system has not established a pattern of subsidies to bad management with a resulting regulatory structure needed to keep the subsidies within bounds.

Our approach has been to emphasize the costs to the FDIC if banks become insolvent, on the assumption that deposit insurance has removed most of the original reasons for regulation. If depositors and borrowers can be guaranteed against loss, what do other regulations accomplish? Many seem to have arisen because entry into the banking market has been restricted because of a fear of competition. In contrast, if banks are required to maintain adequate capital or

are offered a choice of paying insurance penalties if their capital becomes inadequate, more use could be made of the competitive system.

Improvements can be made through a better understanding of how risks arise and how they can be measured. The modeling of risks shows that it is the entire portfolio, including its level of capital, that determines the danger of insolvency. A proper emphasis on the portfolio could bring about a reduction in specific constraints.

Measuring Adequate Capital

The use of a portfolio approach enables us to define capital adequacy. We would like to be able to measure adequate capital in a way that could be used by managers, insurers, and regulators. Such a task is not simple; if it were, no special studies would be needed. Our experience shows that modern theories of finance enable us to define and model capital adequacy. The measurement problem, while not easy, does not appear more difficult than those solved elsewhere. Applications of known techniques allow us to clarify many problems and to arrive at preliminary estimates of the magnitudes of some of the key parameters.

What constitutes adequate capital depends upon the amount of risk assumed by a firm. Capital is adequate either when it reduces risk of future insolvency to some predetermined level or when the premium paid by the bank to an insurer is "fair"; that is, it covers the expected losses of the insurer, given the risk and capital of the firm and the terms of insurance with respect to when insolvency will be determined and what losses will be paid.

Portfolio theory supplies the necessary tools for measuring the risks of insolvency. A bank selects a portfolio consisting of a variety of particular activities, including assets, liabilities, commitments, nonbalance-sheet operations, and net worth (capital and reserves). The expected changes in these activities, their rate of return, and the bank's capital policy give an expected end-of-period net worth. However, expectations are unlikely to be realized exactly. Because of economic events, total income (including changes in capital values) will exceed or fall short of expected levels. (Markowitz, 1959; Sharpe, 1964; Lintner, 1965; Mossin, 1966; Merton, 1974, 1977)

Measuring the risk of a portfolio requires a calculation of its expected end-of-period net worth and of the probable distribution of possible net worths around this level. The bank will become insolvent if events cause its income to be so negative as to more than offset its initial capital plus any contributions less any dividends paid during the period. Risk depends on both the probability of insolvency and the expected losses in case of such failure.

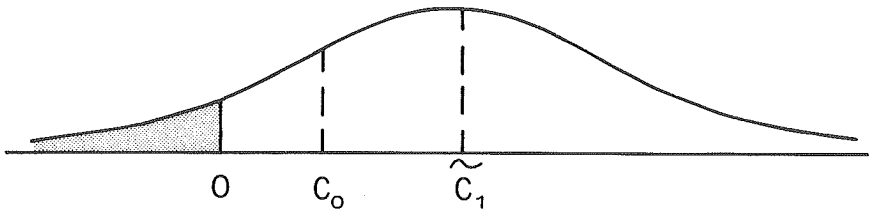
A Model of Insolvency

A bank is theoretically insolvent either (a) when its liquidity is so low that it cannot pay its debts, i.e., a negative cash flow cannot be met, or (b) when the market value of its liabilities exceeds that of its assets reduced by the costs of

bankruptcy. Because of gains and losses on intangibles not shown on a bank's books, the determination of insolvency is complex. Not infrequently, regulators delay bankruptcy procedures beyond the economic occurrence of insolvency. In an attempt to avoid the costs of liquidation, regulators close banks only with reluctance. In the interim, the FDIC or debenture-holders or noninsured depositors bear the cost of future potential losses.

Figure 1 diagrams this risk of insolvency. The bank's assets have a present value of A_0 and liabilities of L_0. Its net worth is $A_0 - L_0 = C_0$. Between the present and the next evaluations, events will cause unanticipated changes in the asset and liability values. The bank's expected value at the next evaluation is $\tilde{C}_1$. The difference between C_0 and $\tilde{C}_1$ is the expected return, $\tilde{R}_Z$, adjusted to correct for dividends or capital contributions. The total expected return, $\tilde{R}_Z$, depends on projected income, payments on liabilities, operating costs, loan losses, and the forward interest rate used to discount expected assets at the next evaluation.

Figure 1



The curve illustrated is the distribution function of $\tilde{R}_Z$ centered on the expected end-of-period net worth. To the left of the zero point in the diagram, net worth is negative, and the bank insolvent. The solid area under the curve indicates the probability of insolvency. To determine risk requires measuring the bank's initial net worth (C_0); the expected return in the period ($\tilde{R}_Z$); and the probability distribution or variance of the expected return [$\text{Var}(\tilde{R}_Z)$].

A Model of Variances

To measure risks, individual assets and liabilities can be grouped into a limited number of activities, such as consumer loans, real estate loans, bonds with three-year maturities, certificates of deposit. The banks' expected return and its variance depends on the weight of the individual activities, their expected returns, and their variances and co-variances. The returns on individual assets and liabilities will vary with movements in net yields and the rate of which the net yields are discounted.

The present expected value of an asset depends on three factors:

1. Its net yield. This will differ from its promised gross return by the amount of operating expenses and a provision for loss.

2. The rate at which net returns are translated into certainty equivalents (risk-free returns). This depends on the variance of the expected returns and their co-variance with the market.
3. The discount rate applied to the risk-free returns. This will vary with the time to maturity of the risk-free flow from the asset.

Changes in any of these items will cause the total return to differ from that originally expected. Predictions of risk require estimating possible changes in each of these factors: operating expenses and losses, to obtain an estimate of net yields; the market's discount for risk; and the risk-free interest rate.

For example, a mortgage may carry a face interest rate of 11 percent. The estimated risk-free return will be the 11 percent less allowances for each of these factors. Compared with government bonds, mortgages will have larger expenses and losses. The mortgage returns must be further discounted because they vary more than returns on risk-free securities. Finally, the value of their expected yield is reduced because risk-free long-term yields are higher and vary more than do short-term ones. On the average, these three forces may reduce the expected rate of return on a mortgage with a face yield of 11 percent by 250 basis points, or to 8.5 percent. The factors causing these reductions of promised returns compared to actual returns vary over time. Experience shows that, as a result, the average rate at which expected future mortgage cash flows are discounted will vary so that the 250 basis point reduction is merely the center of a range between 150 and 350 basis points. The expected return of an 11 percent mortgage over time has ranged from 7.25 percent to 9.5 percent around the average expected return of 8.5 percent.

In any period, the yield from an activity is its net cash flow plus the change in its capital value between the start and the end of the period. Changes in capital values, in turn, depend on how the discount factors move. Thus, in recent years, actual returns on mortgages have been as low as -3 percent, while in others they have been as high as 13 percent. The risk of an activity depends on the expected variance of such returns. [Var(r)].[1]

The expected return for the bank ($\tilde{R}_z$) is the sum of the present values of the positive and negative expected returns from each activity. A vector, Y_z, contains each activity's relative share of the next period's expected return. A covariance matrix is formed of the expected returns from each activity:

$$D = \mathrm{Cov}(r_{it}, r_{jt})$$

[1]A bank has a set of activities, "i" (K activities, with assets 1 . . . J and liabilities J + 1 . . . K). Each activity has an expected cash flow in the future: $\tilde{m}_{i1} \ldots \tilde{m}_{iT}$ for the years 1 . . . T. Each of these cash flows has an adjusted certainty equivalent market value in future years: $\tilde{F}_{i1} \ldots \tilde{F}_{iT}$. The present value, c, of activity i is the sum of these future market values each discounted by the market-wide discount factors expected to prevail. $c_i = \tilde{q}_1 \tilde{F}_{iT} + \tilde{q}_2 \tilde{F}_{i2} + \ldots \tilde{q}_T \tilde{F}_{iT}$ where $\tilde{q}_t = \frac{1}{\tilde{r}_{ft}}$ and $\tilde{r}_{ft}$ is a risk-free rate of return in period t. The actual return on an activity in a holding period will be: $\tilde{r}_{it} = m_{it} + \tilde{c}_{i,t+1} - c_{it}$ dependent on m_{it}, the cash flow actually received, plus the change in value of the activity which depends on $\tilde{r}$, the changes in $\tilde{F}_{it}$ and $\tilde{q}_1$, the future values of the certainty equivalent and the applicable discount rates for each. The risk in the activity [Var($\tilde{r}_{it}$)] depends on how the total return varies with events (Lanstein-Sharpe, 1978; Boquist, Racette, and Schlarbaum, 1975).

Given this co-variance matrix, the total expected variance of the bank's return is:

$$\text{Var}(\tilde{R}_Z) = Y_Z D Y_Z'$$

One of the major tasks of measuring capital adequacy is finding this expected variance. In thinking about the factors causing a bank's variance and risk, a useful background is the extensive literature based on portfolio theory and the Capital Asset Pricing Model (CAPM). This literature generally classified risks under three heads. Most important are market risks (also called systematic risks). These depend on those movements of the firm's returns which are correlated with movements of returns for the market portfolio (a combination of all securities, each in proportion to market value outstanding). Some of the bank's activities, such as defaults, shifts in operating expenses, and changes in the overall price of risk, are likely to react to the same events that cause movements in the value of the market portfolio. Depending on the particular set of activities the bank has chosen, the reaction of the bank's returns to these events may exceed or fall below those of the market as a whole.

In addition, however, because they may react in a unique manner to such factors as interest rates, foreign exchanges, localized depressions, or over-expansion in the real estate market, the returns of a bank may move quite differently from the overall market. Some movements lead to nonmarket, or nonsystematic, risks. These movements may be further subdivided into factors likely to cause banks as a group to move more or less together, leading to a second or extra-market co-variance or risk, and, thirdly, to specific risks unique to the individual bank.

Measuring Capital Adequacy in a Bank

There are four steps to estimating the capital adequacy in an individual bank.

1. The first step is to estimate the risk in each activity. This calls for a basic examination of how risks vary for each activity in which a bank might engage. Ideally, a complete co-variance matrix covering all of the pertinent activities under possible future conditions should be developed. This is not feasible. Our study estimated risks in approximately 10 separate activities. It seems likely that an optimum number of classes of activities for analysis would be between 15 and 20. When an activity encompasses assets with a wide spread in duration, it should be further subdivided by maturity.

2. The next task is to apply the estimated risk matrix to the activities the bank is expected to engage in between now and the next evaluation. Since total risk depends on the proportion of each activity to the total, the estimates of variance by function must be applied to assets aggregated into the desired classes. Each aggregate must be corrected for possible changes in size. Where the bank ends up depends on how it has been changing and where the economy goes. The matrix of expected returns and variances must be applied to the estimates of the average and end-of-period portfolios to obtain an expected income for the period, together with a distribution function for expected income.

3. The risk of insolvency depends on how the initial economic net worth of the bank may be altered by what happens to earnings. The initial capital is available to absorb potential losses. Thus, to measure risks, capital must be properly defined and estimated. Economic, rather than book or reported capital is required. Any exogenous (not dependent on income) capital changes must also be projected. Bank examiners have traditionally requested added capital if they believed it was weak. But they have not had proper measures of weakness.

4. Finally, the actual risk and measure of capital adequacy must be calculated. Several techniques are available for this purpose. Each uses a known relationship between initial net worth, expected income, and capital changes to give expected end-of-period net worth, together with the variance of this expected net worth.

Merton (1974, 1977) has shown that the pricing of deposit insurance as well as most other financial claims on a firm can be thought of as an application of generalized option pricing theory. This theory shows that the value of the fair insurance premium depends only on the risk-free interest rate, the value of the promises to pay, or liabilities at the date of next examination, the time until the examination, the current value of the firm's assets (the difference between the current value of its assets and liabilities being its net worth), and the variance rate per unit time for the logarithmic change in the value of assets. The fair insurance premium will differ depending on the distribution which expected events are thought to follow.

The second approach to measuring risk is through simulations. They enable one to relate the risk in particular portfolios either to a forecast of exogenous variables available from other sources or to a distribution of probable events based on past relationships.

A third approach models risk by use of regression techniques. It determines prediction rules for the systematic and residual risk experienced in the market for the bank's common stock. It aims to measure the predictive significance of a large number of variables as indicators of risk and, hence, as potential targets for management or regulation.

Finding the Risk in a Bank

A variety of risks face lenders at any time. The purpose of risk-management is to insure against unexpected developments which can cause insolvency. Basically, this is a classification problem. While the returns for a given loan depend on its proper underwriting, the risk and returns to a bank depend more on the relationship among activities than on individual loans. To manange risks, one must recognize the basic sources from which dangers spring. It is then necessary to estimate how much risk arises from each activity. Finally, the amount of variance in a bank's portfolio depends on the weight of each type of activity in the total.

A well-diversified portfolio of loans, even with high individual nonmarket risks, should return neither more nor less than a normal (corrected for market risk) profit. Their face interest rates should cover normal returns plus expected

operating costs and losses. Insolvency develops when firms fail to recognize this fact. By reaching for what seem like high promised returns, they either fail to diversify or accept too great a market risk. Typically, they neglect past events which they consider to be abnormal. An emphasis on individual loans misses the true dangers which arise from events affecting whole classes of assets and liabilities. Furthermore, because investors can diversify, nonmarket risks do not carry interest yields commensurate with their face yields. The measurement of risks should emphasize the need to examine broad classes of risks, and not individual loans. An improved classification system can call attention to the most critical areas and allow a better expenditure of effort.

1. Greatest is the risk of interest rate movements. When interest rates rise, banks must pay more for current liabilities. More significant, increases in the long end of the term structure raise discount factors for future promises to pay. The amount this will lower capital values depends on the duration of the portfolio (the present value of the future cash flows). Risk premiums may also increase, lowering capital values still further. The expected cash flow may become less favorable as assets are extended and liabilities lost or shortened.

If the interest rate risk is high, substantial adverse changes may cause insolvency. The degree of danger depends on the scheduled dates of cash flows from assets and liabilities and on the probable magnitude of shifts in the interest rate structure. It is the bank's net exposure, taking into account assets, liabilities, and capital, that determines its total interest rate risk. (Macaulay, 1938; Samuelson, 1943; Hicks, 1946; Grove, 1974).

2. Many discussions concentrate on loan loss or credit risk – the risk that loans will default or perform poorly. Variations in the default rate of typical banks around industry averages have not been large. However, occasionally an individual bank may depart considerably from the average. This potential must be estimated. Poor underwriting of individual loans can lead to above-normal losses, but errors of this kind are typically caught in time. Banks with above-average losses in one period tend to have a reduced probability of a second year of unanticipated losses. They regress back to the mean.

Banks whose loans carry high interest rates seem, as theory says they should, to charge enough to offset any added risk. One cannot assume that a well-diversified portfolio of loans whose individual risks appear high is either more or less profitable or risky than a similarly diversified portfolio of loans whose individual risks appear low. In a fairly competitive market, loans carry interest rates related to their true risks. A class of loans may stay out of line for several years and a bank may underestimate individual risks in attempting to compete, but such errors are not fatal. Studies of bank examinations seem to show that both lenders and examiners are able to recognize past mistakes.

3. Another risk is that operating margins may deteriorate. Margins depend on receipts from assets, on costs of funds, and on operating expenses. Banks may err in their liquidity management. When rates on current liabilities shift, movements may also occur in the amount and source of funds. A rise in market rates may be accompanied by unexpected surges in takedowns of commitments. In considering operating risks, attention must be paid to items not shown on the balance sheet. In addition to commitments, foreign exchange contracts, letters

of credit, and trust operations may be important. One fortunate fact with respect to operating risks is that, on the whole, a sudden deterioration is unlikely. Most situations cast shadows well in advance. Dangers arise primarily from failure to correct past trends.

4. Among banks as a whole, the greatest risks and most common cause of failure are due to fraud, either internal or external, and to insider abuse. Owners and managers alter the portfolio to enhance their personal investments or those of family and friends. There can also be defalcations by members of the staff; or the bank can be defrauded as a result of undue trust or inadequate investigation of borrowers.

5. The final and a very significant risk for most banks is a failure to diversify. This risk may arise from a concentration of long-term maturities and, therefore, excessive interest rate risks or from loans. Banks may concentrate loans in specific industries or in certain localities – small banks in single towns or neighborhoods; large banks assuming too many foreign risks – or they may lend to a related group of investors or companies, or indulge in excessive short-term borrowing.

The idea of diversification to reduce risks is well recognized. Federal statutes and regulations restrict the size of loans to a firm or individual in relation to the bank's capital. While such rules are useful in guaranteeing a minimum, they fail to insure an adequate degree of diversification.

Nondiversification arises when a group of loans or investments are likely to react in the same way to outside forces. While concentration to a single borrower can be important, other factors can also dominate nondiversification. Thus, a portfolio of long-term bonds is not diversified even though it contains hundreds or even thousands of different borrowers. Loans to 100 real estate investment trusts have only slightly increased diversification over a portfolio of 50 REITs. For certain purposes, the entire net balance of loans made abroad may constitute a single risk. The effectiveness of diversification depends on selecting loans or activities where the correlation among the activities is either negative or slight.

Bank regulators have traditionally considered risks of illiquidity to be critical. We do not treat such risks as a separate factor. A liquidity risk is either (a) another name for interest rate risk or (b) included in operating risks. This latter risk arises from the danger of high transactions costs or interest penalties when parts of a portfolio must be shifted to others because of negative cash flows.

These costs exclude losses which may have been incurred because interest rates rose in the past. Liquidation problems relate not to the maturity dates of an asset, but to shiftability. Commercial loans, even when due, may not be shiftable. Foreign loans are another example where liquidity can evaporate. Liquidation costs depend on the state of the economy; they rise rapidly in periods when markets are under pressure. Contrary to usual treatment, liquidity risks may vary greatly even among items with identical maturities.

Several of these risks are related to the size of banks. Dangers of nondiversification and of insolvency due to fraud or insider abuse diminish as the size of a bank grows. Such risks are less likely to be as significant a part of the total, and

therefore to cause insolvency, in larger organizations. The U.S. National Bank of San Diego is the exception that proves the rule; but this case also proves the need for logic in recognizing what is meant by diversification, in contrast to efforts merely to enforce narrowly conceived regulations.

Our regulatory system does not seem to have faced up to the differences which size makes on operations and risks. The largest 250 banks, with over $500 million of assets in each, hold over 60 percent of bank assets. The smallest 10,000 banks hold only about 10 percent of all assets. For the larger banks, a much greater share of assets, liabilities, and decisions will be market-dominated. Dependence on particular situations and localities is far less likely.

Among the smaller banks, moral hazard remains a critical issue. If this could be reduced to a negligible factor, risks in banking could be treated far more like insurance problems elsewhere. No one expects fire losses to be zero; yet the problem is handled efficiently through insurance with minimum regulation. A key question is whether, with a proper recognition of what is involved, auditing or other processes could be depended on to reduce the risks of moral hazard and mal-diversification to acceptable and insurable levels. To date, regulations have done a poor job of clarifying major risks and reducing them to a minimum. They have not been designed to correct the most pressing problems.

Some Estimates of Risk

The first step in estimating risks, as indicated by the previous discussion, is to measure the expected variance in the returns to an individual bank, given its selection of assets and liabilities. Ideally, this estimate should be made by applying a co-variance matrix for classes of assets to a bank's individual portfolio.

In our study of bank risks, a great deal of effort was devoted to attempts to measure the variance of specific activities. The greatest success was found in the study of interest rate risks. Because interest rate risks are closely related to movements in the risk-free interest rate and because such rates are set in a well-functioning market, it is not too difficult to measure the probability of movements in the risk-free rate applicable to assets with varying durations and maturities (cf. McCulloch, 1978b). With estimates of how movements of specific assets and liabilities of a bank relate to those in the government bond market, it is possible to estimate the interest rate risk of a bank as a whole (Maisel and Jacobson, 1978).

The data on credit and operating risks, while not as extensive, seem adequate for many purposes. These data consist of time series of loan losses and operating income changes for banks as a whole, and of similar information for large banks and bank holding companies. In addition, extensive data are available on the levels and year-to-year changes in total loan losses and operating income for each bank since 1970. These were analyzed through studies of the year-to-year movements of the cross-section of all individual banks.

Information on the risks of mal-diversification and of moral hazards is far harder to obtain. There are records of the number of banks which have become insolvent for these and related reasons. The actual numbers are small. Moreover, these events occurred under a regime of regulations and detailed bank examina-

tions. They give little indication of what would happen under a system of freer choices and minimal regulations. However, some measures for these risks can be obtained through simulations and examinations of related problems in other industries.

Another sphere in which information is minimal is on the co-variances among risks. Here, however, data on a number of activities indicate that while an assumption of complete correlation among risks is conservative, it probably does not greatly distort the situation; that is, the co-variance term can be ignored.

As a result, we conclude that currently the exact measurement of risks is not possible. However, the theories and available empirical estimates can show orders of magnitude and can pinpoint critical problems. Many types of risks can be quantified. The procedures point toward methods of reducing the remaining areas of uncertainty. With more detailed data from individual banks, the reliability of such estimates could be rapidly improved.

Interest Rate Risks

When interest rates move, banks are affected in at least four ways.

1. Their cash flows alter as the rate at which commitments are taken down changes, assets are paid off more or less rapidly, and deposit liabilities shift.
2. The interest rates paid and received on liabilities and assets tied to market rates move with those rates.
3. The term structure of interest rates shifts. If the term structure moves up, the value of future promises to pay becomes less.
4. The discounts for risk may widen. These changes will have the same effect as movements in the risk-free rate.

We have tried to measure interest rate risks by two separate methods. The first calculates the probable variance in the risk-free rate of assets and liabilities at maturities from 3 months to 30 years. These estimates are based on the listing of actual month-to-month movements of government securities between 1951 and 1977. (McCulloch, 1975) These variances are combined into a weighted total variance depending on the duration of the activities conducted by typical banks.

The second technique calculates the interest rate elasticity of net worth of specific institutions. Potential changes in capital values are estimated from econometric models of past lending and borrowing. Possible movements in interest rates are based on maximum past shifts in the term structure.

The first column in Table 1 shows the percent changes from the end of one year to the next in the value of a government security with an average duration of three years. (Through three years there are only minor differences in the variance of pure discount instruments and notes of the same maturity. As maturity increases, the effect of semi-annual interest payments and, therefore of differences in duration, alters the relationship between the two instruments.) Three years has been roughly the duration of the assets in a typical bank. The table shows a maximum year-to-year change of 5¾ percent. For assets with a six-year duration, the maximum change is about 8½ percent. The year-to-year variance increases regularly with duration. For the first three years, the rate of

increase is rapid; it then continues to rise, but at a decreasing rate.

The final row in the column shows the variance of the log of the change in the value of the asset with a three-year duration, assuming that the price depends only on movements in the risk-free rate. Because of changes in the discount for risk, the total variance of the actual assets in a bank would be somewhat greater.

The assumption is frequently made, as in the Black-Scholes option pricing model, that changes in value due to interest rate movements follow a log-normal distribution. McCulloch and others have argued that the distribution of the prices of interest-bearing securities is far more fat-tailed or leptokurtic. To reflect this fact, McCulloch has developed an option pricing formula based on a log-symmetric stable distribution (McCulloch, 1978a). The distribution assumes a greater probability of extreme events. The application of the more fat-tailed distribution greatly increases the estimated risk from interest rate changes. Thus, McCulloch shows that for a 20-year par bond, the risk that the price will change by 10 percent or more during a year is estimated to be covered by a fair insurance premium of 0.06 percent if a log-normal distribution is used, compared to a premium of 1.17 percent under the log-symmetric stable distribution which he has fitted to past interest rate changes.

Studies by Morrison (1977) and Nadauld (1977) show how much the interest rate elasticity of a financial institution depends on the structure of activities in which it engages. Thus Morrison models a wholesale bank which has only business loans, demand deposits, certificates of deposit, and equity capital. For banks with this structure, a 100 basis point increase in interest rates will lower net worth by only about 0.4 percent. In contrast, Nadauld (1979) shows that for a typical savings and loan association with assets concentrated in long-term mortgages, a change in interest rates of about 100 basis points (with an average change of 250 basis points for the first three years and 80 basis points thereafter) will cause its net worth to drop by 40 percent, or 100 times as much as that of an institution with fairly well-balanced short-term assets and liabilities.

Credit Risks

Tables 1 and 2 contain information on net loan losses and changes in net loan losses as a percentage of net earning assets. Examination of individual banks shows that the assumption that both loan losses and operating income will continue at the rate of the previous year is a good one. Banks determine their expected income on the basis of choices of assets and operations. Because of a slight tendency of banks to regress back toward the mean, that is a conservative assumption.

The risk of insolvency then depends, as illustrated in Figure 1, on the probability distribution of the outcomes of operations around this expected level. The distribution function can be estimated from both time series and cross-sectional information.

The middle column of Table 1 shows the year-to-year changes in net loan losses as a percent of net earning assets for all banks. The signs have been reversed, so that negative signs throughout the table indicate a loss in asset values.

TABLE 1

Time Series of Percent Changes in Capital Value of Bank Net Earning Assets from:

Year	Changes in Interest Rates for Treasury Notes with 3-Year Duration	Changes in Net Loan Losses (signs reversed)	Changes in Operating Income before Losses and Taxes
1966	−3.12%	−0.024%	0.109%
1967	−0.24	0.004	−0.079
1968	−0.03	0.018	0.074
1969	−5.76	−0.015	0.212
1970	5.19	−0.097	−0.022
1971	1.02	0.003	−0.231
1972	−1.77	0.062	−0.091
1973	−2.54	−0.022	0.086
1974	−1.94	−0.095	0.100
1975	−0.22	−0.157	0.079
1976	3.99	−0.017	0.030
Var (log of asset value)	.0008626	.0000039	.0000090

Source: U.S. Treasury, FDIC

The bottom row shows the variance of the logs of the asset value of the average bank due to unanticipated changes in loan losses.

Table 2 contains more detailed information on loan losses as a percent of net earning assets (NEA) for the year 1975. This is the post-war year with the greatest unanticipated loan losses and is close to the maximum in absolute levels. The top two sections of the table show the distribution of banks by losses as a percent of NEA in this year of high losses. The average U.S. bank had net losses of only 0.09 percent. Of over 14,000 banks, 572 had losses exceeding 1 percent of their NEA. Thirty-three banks had losses over 4 percent, including six with losses over 6.0 percent. Excluded from these data are the additional 13 banks which were declared insolvent during the year.

The bottom part of the table shows half of a distribution of banks by the increase in their loan losses as a percentage of net earning assets between 1974 and 1975. Only about 5 percent of banks sustained unexpected losses as high as 0.6 percent of their earning assets. Slightly over 1 percent of banks saw their losses increase by 1 percent or more of NEA.

On the other hand, a high level of losses with low capital can lead to disaster. In 1975 loan losses equaled 50 percent or more of book equity for 28 banks. Since losses are first met from reserves and then from operating income, the number of banks requiring capital to offset loan losses would be somewhat less.

The log-normal variance of the change in net asset values due to the year-to-year movements in losses is shown in the final column. In this year of maximum change, this cross-sectional estimate results in a risk estimate about four times

TABLE 2

Net Loan Losses as a Percent of Net Earning Assets

I. For Banks at Percentile of All Banks:

	1	5	50	95	99
In 1975	0	0	0.09%	0.82%	2.21%

II. Number and Percent of Banks Whose Loan Losses as a Percent of Net Earnings Were:

Class of Banks by Net Earning Assets ($ millions)	1.0 to 1.99%		2.0 to 3.99%		4.0 to 5.99%		6.0 + %	
	No.	%	No.	%	No.	%	No.	%
> 500	14	6.9%	3	1.5%	0	0	0	0
50-500	75	4.2	13	0.7	3	0.2%	1	0.1%
10-49	215	3.1	67	1.0	12	0.2	2	*
< 10	110	2.1	42	0.8	12	0.2	3	0.1%
All banks	414	2.9	125	0.9	27	0.2	6	*

III. For Banks at Percentile of All Banks:

	Median	75	90	95	99	Var log (1+Δ)
Change from 1974 to 1975	0.04	0.17	0.38	0.62	1.17	.000016

*less than 0.05%

Source: FDIC call reports.

as large as does the time-series estimate of variance from credit risks. However, two adjustments might be made in these estimates. The first would be to add a factor to account for the fact that the variance is calculated around the actual rather than the expected loss level. The second would account for the fact that here, too, a more leptokurtic distribution appears to fit the data better than a normal one. The effect of applying such corrections would raise estimated risks somewhat, but they would probably remain well below those estimated for interest rate movements.

Measuring the Risks of Operating Losses

Tables 1 and 3 contain information on the amount and unanticipated changes in operating income before loan losses and taxes as a percent of net earning assets. The third column of Table 1 shows the year-to-year changes for banks as a whole. The largest negative change was that from 1970 to 1971, with a magnitude of 0.23 percent. This was larger than any drop in values due to a

change in credit losses. The movements in expected asset values resulting from changes over time in the operating results of an average bank are more than twice as large as those accounted for by loan losses, but they are still small.

The cross-sectional data in Table 3 show that losses from operations are somewhat less likely to occur than sizable loan losses. In 1975 only 169 banks sustained operating losses of over 1 percent, compared to the 572 banks with loan losses of this magnitude. Furthermore, operating losses were almost entirely concentrated among the smallest banks.

The tables show that there is some, although far from complete, correlation between losses from these two sources. While, on the average, for banks as a whole loan losses and operating losses frequently moved in opposite directions, this was less true for individual banks. Thus, the poorest 1 percent of banks had a negative income of 1.5 percent from operations, while the bottom percentile had total losses of 2.7 percent from operations and loan losses combined. The combined losses exceeded 18 percent of equity for banks in the bottom 1 per-

TABLE 3

Operating Income as a Percent of Net Earning Assets

I. For Banks at Percentile of All Banks:

% NEA	1	5	50	95	99
Income before Loan Losses	−1.5%	0.4%	1.5%	2.8%	3.7%
Income after Loan Losses	−2.7	−0.3	1.3	2.7	3.6
% Book Equity					
Income after Loan Losses	−18.9	−2.0	13.4	24.2	30.1

II. Number and Percent of Banks Whose Operating Losses as a Percent of Net Earning Assets Were:

Class of Banks by Net Earning Assets ($ millions)	1.0 to 1.99%		2.0 to 2.99%		3.0 to 3.99%		4.0 + %	
	No.	%	No.	%	No.	%	No.	%
> 500	0	0	0	0	0	0	0	0
50-500	2	0.1%	0	0	0	0	0	0
10-49	20	0.3	7	0.1%	5	0.1%	4	0.1%
< 10	56	1.1	35	0.7	22	0.4	18	0.3
All Banks	78	0.6	42	0.3	27	0.2	22	0.2

III. For Banks at Percentile of All Banks:

Change from 1970 to 1971	1	5	10	25	Median	Var log (1+Δ)
	−2.31	−0.75	−0.39	−0.11	+0.002	.000039

Source: FDIC Call Reports

cent. There were 36 banks whose losses from both sources exceeded 50 percent of their book net worth.

The final part of Table 3 shows cross-sectional data on the decrease in operating income as a percent of NEA from 1970 to 1971, the year of the largest negative change in this category. One percent of banks saw their operating income drop by 2.3 percent or more. This was a much greater change than was experienced by the banks with the most negative movement in loan losses. On the other hand, changes in operating income can be larger without doing as much harm because many banks move from a sizable amount of earnings to small negative ones, whereas losses almost always move from an initial negative number to a larger one. The variances in the value of assets from changes in operations are somewhat larger than for loan losses but, again, if unanticipated losses from operations followed a log-normal distribution, they would not cause much concern.

Tables 1 to 3 seem to indicate that interest rate risk needs to be watched most diligently. Normal year-to-year movements in loan losses and operations do not add much to total risk. The dangers in this sphere seem to be concentrated in problems of mal-diversification and moral hazard.

Measuring Net Worth

In the measurement of risk and capital adequacy, most attention has been paid to measurement of possible losses in income. Yet the measurement of current and projected net worth should play a role as or even more significant than that of possible losses. Furthermore, the difficulties of measuring net worth are as great, or even greater.

A key factor in total risk is the real or economic value of a bank's capital and those nonincome forces which will cause it to differ at the next evaluation. Because many gains or losses in the value of assets and liabilities are taken into the books only over time rather than when they occur, and because many intangibles are never recorded, the economic value of capital often varies greatly from that shown on a bank's books.

How great the difference is between book and economic value can be seen if we are willing to assume that the value of a bank's stock in the market reflects its true economic value. In the years 1950 through 1975, the market value of the net worth of the approximately 25 banks and bank holding companies carried in the Standard & Poor's Bank Stock Index averaged about 135 percent of their book value. In individual years, the ratio of net worth in the market to book for all of these banks ranged from 1.87 in the highest year to 0.94. Year-to-year changes in this ratio exceeded 40 percent at times. When market-to-book ratios for individual banks are examined by years, an even wider range is found. We have examined the market-to-book ratios for the years 1971-73 for each of 135 banks; they ranged from 2.8 for the bank with the highest ratio to 0.6 for that of the lowest, around a median of 1.2.

Capital accounts in banks consist of equity capital, surplus, undivided profits, reserves for contingencies, and other capital reserves. True economic

capital may differ from this total because: (1) gains or losses on assets from interest rate movements are not recorded; (2) liabilities may be overstated when Regulation Q forbids payment of market interest rates; (3) the value of information, customer relations, and good will may be considerable; (4) reserves for loan losses may not be accurate; (5) the value in use or in liquidation of fixed assets varies; (6) commitments for future loans or foreign exchange purchases and sales may have a positive or negative value; (7) other reserves, such as those for contingencies and deferred taxes, may increase real net worth.

How can real net worth be measured? To some, the answer is simple: Use the market's estimate of value, as in the ratios discussed above. They argue that since the market is efficient, no one can arrive at a better estimate.

But this is far from a satisfactory solution. Usable market estimates would not number even 250 out of a total of over 14,000 banks (although those with fair or better markets hold a majority of all assets). Furthermore, while the market may be efficient in projecting its own future estimate of net worth, this may differ from actual values. The market swings widely in its estimates. It must consider earnings far into the future, not the resources available for payments on a given day.

While efficient in the narrow sense, the market's record of projections, both on an individual and an aggregate basis, is not good. If the market's estimates were accepted, the amount of capital would fluctuate widely. This could affect lending decisions and output. Even if public policy increased the risks assumed by the FDIC to some degree, it might be good policy to smooth the swings in order to discourage pro-cyclical lending. Finally, because it is so heavily influenced by government regulations and actions, there is no reason to expect the market to be estimating the true market values desirable for public policy as against the value of regulations to the individual owners.

Lacking a single simple source of estimates of net worth, must we fall back on book value? Not necessarily. It may be possible to arrive at better estimates than book through valuations of the components of the balance sheet, using market-related data. (Cf. Nadauld, 1979.) Thus, few problems are encountered in a direct estimate of the values of securities. Similarly, it is possible to estimate gains or losses from interest movements in loans and similar accounts from movements in the market rates. Estimates are also available of the expected average net returns from different types of deposits. These expected returns from deposits as well as earnings or losses from other intangibles may be capitalized by the use of rates based either on current market rates or some average of past market rates.

Would such *ad hoc* procedures improve on use of either stock prices or book? The answer seems to be yes. Since capital enters into the risk calculations in a nonlinear form, even minor improvements in estimates may be important in certain critical ranges.

In the same way, some adjustment for expected growth in a portfolio relative to net worth may also be worthwhile. Although the record of sophisticated attempts to project individual balance sheets is not good, in a dynamic situation rough approximations of the future are likely to be better than an assumption of no change.

The Optimum Level of Capital

Capital is risk-offsetting because it can cover losses. It can bridge negative cash flows and pay off creditors. It also earns returns, but does not require cash payments or engender interest-rate risk. Yet banking history reflects a steady decline in the ratio of capital to assets. Why has this occurred? Why has leverage – the ratio of borrowed money to capital – steadily increased?

Financial theory offers two conflicting answers. One emphasizes the advantages to stockholders of increasing leverage, advantages to be gained because of the tax and regulatory system. While, in theory, arbitrage among investors and lenders should wipe out any profits from leverage, this probably does not happen under existing condtions.

In contrast, traditional theory posits a falling cost curve until leverage reaches some optimum point. It pays to reduce the capital ratio until that point is reached. If leverage continues to expand among banks, this indicates that the market judgment is that leverage has not reached an optimum.

In this latter view, failure to pick the optimum point of capital reduces welfare through a waste of scarce resources. On the other hand, if leverage has expanded primarily because it is subsidized by the government, then regulations which prevent it from expanding as far as the market wants do not create a social loss. While neither view can be proved, many believe that bank capital may be far lower now than it would be in a completely free, competitive market. In banking, unlike other industries where excess capital and fixed assets are wasted, most capital is lent out. There are no obvious advantages to substituting one form of liquid capital for another, in contrast to whatever ratio a free market would select.

Estimating Risk in Prototype Banks

While the data on individual classes of risks are not complete, they can be used to estimate how the need for capital or, alternatively, the cost of insurance compares for banks which take greater or fewer risks in their portfolios. Table 4 is constructed to indicate how risks vary among prototype banks. In the table, Bank A selects the safest portfolio – that with the lowest duration or interest rate risk, whose loan losses vary the least, and whose operating income is most stable. Bank B represents an average bank in all dimensions. Bank C is assumed to be willing to take the greatest risks among banks.

In Section I of the table, the estimates of risk are based on time series information. The interest rate risk for Bank A is equal to the variance in the log of the price of a 2-year government note between 1965 and 1976. For Bank B and Bank C, the variances are those for 3-year and 5-year governments respectively. These maturities have been selected to represent typical average maturities found in banks whose assets have low, average, and high durations. It is assumed that movements in governments will reflect movements in the returns for all assets even though, as pointed out previously, interest rate movements cause some additional losses.

TABLE 4

Example of Risks and Fair Insurance Premia

	Bank A	Bank B	Bank C
		Section I	
Interest Rate Risk	.0006539	.0008627	.0021111
Credit Risk	.0000003	.0000039	.0000251
Operating Risk	.0000011	.0000090	.0000523
Sum of Variances	.0006553	.0008756	.0021885
		Fair Insurance Premia per $ of Liabilities	
5% Capital/NEA	.000221	.000512	.003293
10% Capital/NEA	.0000001	.000001	.000204
		Section II	
Interest Rate Risk	.0006539	.0008627	.0021111
Credit Risk	.0000090	.0000165	.0000185
Operating Risk	.0000298	.0000320	.0000683
Sum of Variances	.0006927	.0009112	.0021979
		Fair Insurance Premia per $ of Liabilities	
5% Capital/NEA	.000263	.000567	.003339
10% Capital/NEA	.0000002	.000002	.000211
		Section II	
		Fair Insurance Premia Interest Risk Based on McCulloch	
5% Capital/NEA	.0047*	.0065*	.0090*
10% Capital/NEA	.0028	.0039*	.0054

*Interpolated

Source: See text. Fair insurance premia for Sections I and II based on Table 1, Merton, *Journal of Banking and Finance, 1* (1977), pp. 3-11.

The variances of asset values arising from credit risks (loan losses) and operating risks are based on the experience of large banks and bank holding companies between 1965 and 1976. The data are taken from the variances of the year-to-year movements in 68 of this country's largest banks. The estimate for Bank A is based on the average of the two banks with the lowest variance. Bank B uses the average of all banks in the country, and Bank C that for the two with the largest variances in this period. The variances from the three risks are added together, excluding any correction for co-variances.

The prototype banks in Section II use the same estimate of interest rate risk as in Section I. However, the estimates for credit and operating risks are based on cross-sectional data. The variances are based on the logs of changes in asset values arising from loan losses of individual banks between 1974 and 1975,

and changes in operating income before loan losses and taxes between 1970 and 1971. These are the years of maximum changes in the postwar period. Bank A uses banks with over $500 million in assets; Bank B uses the data for all banks, and Bank C uses data for banks under $10 million in assets, which have the greatest variance.

We are interested in seeing how risks – fair insurance premia – vary with these types of banks. Merton has shown that the risk of a bank varies with the variance in its asset values and its capital asset ratio (Merton, 1977). Under a set of simplifying assumptions, he has calculated the fair premia for banks with different degrees of variance and capital.

The second part of Sections I and II shows estimates of risk (fair insurance premia) based on Merton's table, and the variances estimated in the upper part of each section. Several points stand out. As shown also in Table 1, the interest rate risk far exceeds credit and operating risks. In fact, among these prototypes, interest rate risk accounts for 95 percent or more of the total.

The amount of capital compared to assets or liabilities is extremely important in determining total risk. Given the type of variances shown for the prototype banks, insolvency is very unlikely if a bank starts the year with a true economic net worth of 10 percent of net earning assets. On the other hand, with capital of 5 percent or less, the chances of insolvency are not negligible. Furthermore, the smaller the capital, the more does the type of risks assumed take on significance. Some banks may have risks 5 to 10 times as great as the average bank. Moreover, these differences are sufficiently large so that banks may appreciably increase their profitability by taking excess risks.

In the techniques used here, how the credit and operating risks are calculated makes little difference. However, an examination of the underlying data indicates that, just as with interest rate movements, the actual changes may not follow a normal distribution. Especially among smaller banks, outlyers in the negative direction exceed normal expectations. If possibilities of fraud and insider abuse were added, the risks from these and other factors would also be somewhat greater than shown in the table.

Some idea of the rapidity with which risks can rise if account is taken of these other factors is shown in Section III. This presents an estimate of the fair insurance premia required if one believes that a log-symmetric stable distribution rather than a log-normal distribution ought to be fitted to project possible future movements in yields. According to McCulloch's tables, the estimated risk of failure with a capital-to-net earning asset ratio of 5 percent is 10 to 30 times as great as under an assumption of a normal distribution.

The amount of risk will also exceed that shown for the banks in Sections I and II if other distributions are used for credit and operating risks, and if adjustments are made for mal-diversification and for moral hazard. Unfortunately, we do not have estimates of how much these will raise the possible variances. It does not seem likely, however, that they will increase so much as to make these other hazards equal interest rate risk.

While we cannot check the accuracy of the data from information about past insolvencies, they appear to be consistent with past events. Actual failures

occur primarily among small banks and among banks with high moral hazards not caught by auditors or the examination system. The critical question is whether the present complex system of regulation is necessary to perform this task, or whether alternative systems of measuring the risks and insuring properly could arrive at a more efficient technique for insuring against large numbers of insolvencies and a threatened breakdown in the banking system.

Fair Insurance Premia

A flaw in the present system lies in the fact that banks may find it profitable to increase their risks, since there is only slight relationship between risks and their costs of insurance. This can lead to a constant losing battle by regulators to force specific banks to reduce their risks. Many observers have argued that charging deposit insurance premiums which vary with actual risk is a necessary starting point in solving many regulatory problems. (Barnett, 1976; Scott-Mayer, 1971).

Our studies indicate that some system of variable rates should be feasible. Banks could be divided into 5 or 10 risk classes dependent on their ratio of economic net worth to their assets and the activities in which they are engaged. By using their recent history of earnings and losses, together with the duration of their current activities and their diversification, the detailed examination of individual loans and procedures could be minimized or abolished. Adjustments in rating and charges could be made retrospectively to guard against major shifts in operations.

The number of failures might rise somewhat, but most observers would be willing to trade some losses to poor managers for a greater freedom for the majority. If those taking greater risks were charged for their choices, or if they were required to maintain higher capital as a cushion, the public would be better off.

The actual dangers to our system do not lie in an increased rate of failures of small- or medium-sized banks. Dangers arise primarily from a failure to consider the overall risks in the portfolios of large banks and from inadequate capital. If, to fight inflation or for other reasons, the fluctuations in interest rates continue to grow in intensity, a failure to recognize how these and similar movements impact on portfolios and how they can be guarded against could be expensive for the nation.

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Capital Requirements for Entry into Property and Liability Underwriting: An Empirical Examination

J. D. Hammond and Arnold F. Shapiro*

Regulation of insurers has focused primarily on insurer solidity.[1] The concern for solidity centers on safe capitalization requirements for insurers, premium rate adequacy, and investment controls. Although current regulatory concerns frequently address issues of pricing equity and new approaches to risk classification, solidity remains the principal consideration.

Capital adequacy, a key solidity requisite, has generally been addressed from a context of rules-of-thumb and general conservatism. Questions of capital adequacy are relatively complex and analysis of risk theory and finance has been difficult to translate into statutes and difficult for insurance commissioners to incorporate into regulatory practice. Rule-of-thumb analysis, therefore, has held considerable appeal for insurance commissioners.

In recent years, research into the capital adequacy of established insurers has expanded considerably. Aside from the long-standing conceptual contributions of risk theory, advances were stimulated greatly by the linking of portfolio theory to the risk and return analysis of different lines of insurance.[2] The most thorough explanation is the work of Bachman, who employed the optimization features of the portfolio model to estimate minimum capital requirements

[1] Most dimensions of insurance regulation are concerned with insurer solvency. However, solidity is a broader, although less precise, term than solvency and implies a higher standard of surveillance and concern than just solvency alone. The term was first used in the European literature and its acceptance into the U.S. literature on insurer regulation has resulted largely from the writings of Spencer L. Kimball. See, Spencer L. Kimball, "The Purpose of Insurance Regulation: A Preliminary Inquiry in the Theory of Insurance Law." *Minnesota Law Review*, March 1961, especially pp. 478-486.

[2] See J. Robert Ferrari, "A Theoretical Portfolio Selection Approach for Insuring Property and Liability Lines," *Proceedings of the Casualty Actuarial Society*, 1967, pp. 33-54. So far as we can tell, Ferrari was the first to apply the Markowitz portfolio analysis in an insurance underwriting context.

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associated with optimal combinations of insurance lines, grouped in such a way as to minimize the variance or risk of the entire underwriting portfolio.[3] The National Association of Insurance Commissioners has also been active in developing and refining its "Early Warning System," a series of financial tests designed to identify insurers with questionable solidity. Our own work has also explored the application of portfolio theory towards the estimation of capital required for conduct of the underwriting function.[4] Empirical research dealing with the capital required for entry into the various lines of insurance, however, has been sparse.

The purpose of the present paper is to examine empirically the entry capital for nonlife insurers required to conduct the insurance underwriting function, to estimate differences in underwriting risk among insurance lines which can be associated with entry level underwriting activity, and to develop information which enhances the ability of regulators to assess entry risk.[5] The paper first discusses the significance of the entry topic and summarizes current capital requirement statutes. Then, industry-wide data are employed to prepare estimates of the underwriting risk at entry for the interval of the study, 1972-1975. Lines which were consistently of high risk are identified and estimates are made of the maximum ratios of premium volume to capital which can safely be accommodated in each line of insurance. Finally, suggestions are made for improvement of entry capital requirement statutes.

Entry Capital Requirements[6]

Most of the statutes specifying entry capital requirements are straightforward, simply indicating an absolute amount to be met as a condition for licensure. Most were almost certainly formed judgmentally without reference to

[3] James E. Bachman, *Capitalization Requirements for Multiple Line Property-Liability Companies,* Huebner Foundation Monograph No. 6., (Homewood, Illinois: Richard D. Irwin Co., 1978). The bibliography of the monograph provides a thorough listing of publications dealing with insurer financial analysis and also with its links to portfolio theory.

[4] J.D. Hammond and Ned Shilling, "Some Relationships of Portfolio Theory to the Regulation of Insurer Solidity," *Journal of Risk and Insurance,* September 1978; also reprinted by the American Bar Foundation as *Research Contributions of the American Bar Foundation,* 1978, No. 2. Also, a part of the National Science Foundation Study on which the current paper is based examined underwriting capital needs in an empirical, portfolio theory context. Technical Report NSF Grant Apr75-16550 A01, *The Regulation of Insurer Solidity through Capital and Surplus Requirements.* One of the difficulties in application of the theory to underwriting portfolios is that variances of lines of insurance do not remain constant as premium volume changes.

[5] Established insurers generally face a different and probably more stable set of risks than new insurers. The beneficial pooling effects of large numbers are more likely to be present, the expense drain of start-up costs has disappeared, market niches and identities are apt to be present, with survival implying at least some ability to withstand competitive and perhaps regulatory constraints.

[6] Unless otherwise noted, the word capital is used throughout the study to denote both capital and surplus. We are grateful to the National Association of Independent Insurers for supplying a summary of the capital requirement laws of all states. The compilation is complete into 1976.

any formal research techniques. The capital requirements of New York State were enacted in 1939 and have not been appreciably altered since.[7] A recently proposed revision would simply double the requirements of the existing New York law.

Entry capital requirements also reflect some balance between concern over insurer solidity and the marketplace benefits associated with ease of entry. The emphasis is not uniform across states, however. The Insurance Department of Illinois, for example, described the problem:

> The minimum capital and surplus requirements were substantially increased to their present levels in 1971. It is doubtful legislation to require additional capital and surplus . . . One of our major concerns and responsibilities is to encourage competition among insurers. Such competition is largely dependent upon ease of entry into the Illinois market. Excessive or unreasonable statutory capital and surplus requirements would, in the long run, stifle that competition by discouraging the growth of new companies in Illinois.[8]

Illinois requirements for underwriting on a multiple-line basis amount to $1,000,000 of capital and surplus. On the other hand, those of New York specify approximately $6,000,000. Nonetheless, the New York Department states that:

> It is now practically impossible for a new company financed on the minimum basis (required by law) to maintain adequate financial strength and to write sufficient volume to absorb the necessary overhead expenses and leave an underwriting margin after losses. The low amounts presently required by law have permitted the formation of companies which have encountered considerable difficulty in maintaining proper financial strength to meet their commitments.[9]

No more is required to illustrate the varying philosophies among states concerning entry capital requirements.

Market Importance of Entry

In the last 10 years, 390 new property and liability insurers have been formed. The details are shown in Table 1.

Of the 390 new formations, 321 were stock insurers which attracted a total of $709,367,000 from investors.[10]

[7] Insight did not extend to the generally presumed effects of underwriting diversification. To underwrite all lines of property and liability insurance, simply requires, under New York law, the sum of the capital required for each individual line of insurance. That is not true, however, of all statutes.

[8] State of Illinois Department of Insurance, *Financial Regulation of Illinois,* December 1977, p. 49.

[9] Memorandum of the New York State Insurance Department, February 14, 1977.

[10] Estimates of the aggregate capital of the remaining 69 insurers are not conveniently available. Some of these could have been sizable, however, because of the formation of some relatively large physicians' cooperatives in response to market shortages of medical malpractice insurance in the mid-1970s. During this same interval, a few of the large mutual life insurers also established property-liability subsidiaries, contributing substantial amounts of capital in the process.

TABLE 1

Number of New Property and Liability Insurers: 1969 to 1978

Year	Number of New Companies
1969	15
1970	32
1971	34
1972	63
1973	58
1974	35
1975	25
1976	46
1977	38
1978	44
	390

Source: *Best's Review, Property/Casualty Edition,* March 1979, p. 10.

Although the number of new insurers formed in the past 10 years provides an idea of entry magnitude, some important details are obscured. That interval includes the formation of some very important entrants. The Prudential Property and Casualty Insurance Company was incorporated in 1972 and held an initial capital of $1,000,000 and contributed surplus of $4,000,000. Capital was raised to $2,500,000 in 1973 and in 1974, the parent organization contributed $44,000,000 more to surplus. By the end of 1976, its net premium volume was over $300,000,000. The Metropolitan Property and Liability Insurance Company was also formed in 1972, with a paid-in capital of $2,000,000 and contributed surplus of $8,000,000. Its premium volume was $116,000,000 at the end of 1976. Both insurers received over $200,000,000 in surplus contributions in 1976 from their parents. Other insurers also formed new subsidiaries during the 1970s.[11]

Physicians also formed their own medical malpractice insurers during the 1970s. The Medical Insurance Exchange of California, for example, was formed in 1975 with an initial capital of $500,000. At the end of that year, its net premiums written totaled over $5,000,000.[12]

While the entry of large mutual life insurers and medical associations into the property and liability insurance business may be viewed in some sense as unusual and nonrecurring events, it does indicate the impact upon the supply of insurance which new entrants can have. Moreover, the formation of important new insurers continues. The recent formation of the New York Insurance Exchange, although comprised of individual underwriting syndicates, had to meet the entry capital requirements of New York law.[13] It is viewed by many ob-

[11] *Best's Insurance Reports, Property and Casualty Edition,* 1977, p. 985.

[12] *Ibid.*, p. 532B.

[13] In general, the exchange would be free of traditional forms of rate regulation if its business were confined to larger commercial account business.

servers as a potentially large competitive force in both the domestic and international insurance markets. Other states are also considering appropriate statutes to permit establishment of such insurance exchanges. Also, a relatively recent Colorado statute was designed to facilitate the formation of "captive" insurers.[14] Any change in U.S. tax laws which would permit premiums to such captives to be wholly deductible would almost certainly spur legislative review of capital requirement statutes.[15]

Assessment of current price or supply problems in some areas of insurance may again direct attention towards new entry as a market response. Products liability and insurance coverages for municipalities are two current examples.[16,17]

Summary of Existing Statutes

Statutes affecting entry do not focus exclusively on capital. Insurers may be required to deposit securities with the state, specify plans for conducting business, or certify that management is free of association with insurer failures within the past five years. Nonetheless, the most common statutory requirement and probably the most important from a solidity viewpoint is the condition for licensure that each new insurer possess and maintain prescribed amounts of capital and surplus. The requirements are sometimes so low as to constitute only a nominal barrier to entry and provide little support for the solidity objective. In other instances, the prescribed capital amounts are more formidable.[18]

[14] In this context, a captive insurer is a wholly owned subsidiary of a non-insurance parent firm. The principal and frequently sole purpose of the captive is to insure some or all of the risks of the parent firm. Most captives are domiciled in Bermuda where entry capital requirements are quite modest. Observers estimate that about 700 to 800 such captives are domiciled in Bermuda.

[15] The interest in ease of entry would likely dominate discussions of safety because the insurers' policyholder is a corporate parent and not a member of the public. Legislation can take on several concerns, however, and one is a possible requirement for captives to write at least some "public" insurance, in which case concerns again focus on solidity.

[16] Because underwriting returns in most lines of insurance are cyclical, an adequate insurance supply is almost certain to deteriorate. If the deterioration is severe, and if the line of insurance is major, corrective legislative and/or market forces usually appear.

[17] For instance, Werner Pfennigstorf of the American Bar Foundation observes that municipalities frequently experience difficulty in obtaining insurance coverage and suggests the development of a mutual insurance organization by municipalities as a possible solution. Capital requirements for entry would again be prominent along with the concerns of balance between solidity and ease of entry. Werner P. Pfennigstorf, "Insurance Mutuals: A Solution to Municipal Risks Coverage," *Risk Management,* September 1978, pp. 12-21.

[18] See Allen L. Mayerson, "Enduring the Solvency of Property and Liability Insurance Companies," *Insurance, Government, and Social Policies,* Herbert S. Denenberg and Spencer L. Kimball, eds. (Homewood, Illinois: Richard D. Irwin Co., 1969), pp. 151-160. Mayerson generally believed capital requirements to be inadequate. See, also, P.L. Joskow, "Cartels, Competition, and Regulation in the Property-Liability Insurance Industry," *The Bell Journal of Economics and Management Science*, Autumn, 1973, pp. 388-391. Joskow generally assesses all entry barriers to be low, including capital requirements. The only exception is the relatively higher promotional costs of new direct writers which are incurred to establish product recognition.

Existing statutes typically specify amounts for both initial capital and initial surplus. The majority of states permit a surplus less than the initial minimum after an insurer has operated for a period of time, five years being common. For example, the California statute requires an initial capital and surplus of $200,000 each for entry into fire insurance. After five years, surplus can be $100,000. The lowered requirement suggests that expenses of established insurers can be met out of operating income and that increasing size (to the extent associated with increasing age of the insurer) may provide greater stability in underwriting experience.

Statutes typically differentiate capital requirements by line of insurance and according to the legal form of insurer. Since mutual insurers issue no capital stock, they are generally expected to begin with more surplus than stock insurers. The typical requirement is to specify that the initial surplus of mutual insurers equal the combined amount of capital and surplus for stock insurers. The same stipulation generally holds for reciprocal and Lloyds' organizations. The vast majority of statutes indicate capital requirements for each separate line of insurance (e.g., fire) or for general groupings of insurance lines such as "property" or "casualty." Those insurers which wish the authority to write any or all forms of nonlife coverages must meet the requirement set by the law for "multiple-line" insurance.

Property vs. Casualty Requirements.

Many statutes do not show insurance lines in detail but rather merge fire and allied coverages into the single designation of "property and liability" coverages and miscellaneous casualty lines into "casualty." Differences in capital requirements for different lines or line groupings presumably reflect regulatory judgments about the relative riskiness of insurance lines: if one line requires more capital than another, a judgment has been made that it is more risky. The most consistent distinctions are between the capital required for writing casualty and that required for writing property (or similarly for writing liability or writing fire). They are shown in Table 2.

The majority of statutes make no distinction between the capital requirements for property or casualty even though lines in the latter category include such troublesome coverages as products liability and professional malpractice. The volatility of these coverages, however, may be too recent to be reflected in existing laws. Only one statute, however, implies that casualty lines are less risky (i.e., require less capital) than property lines and several view casualty lines as riskier than property coverages.

Statutes frequently identify fidelity or surety bonding for separate capital requirements. Statutes sometimes alter casualty capital requirements depending on whether or not surety bonds are to be written. If they are, as part of the casualty license, additional capital is sometimes required. Table 3 summarizes these distinctions by contrasting, as in Table 2, fidelity and surety requirements relative to capital required for transacting a property insurance business.

TABLE 2

Casualty Capital Requirements as a Percentage of Property Capital Requirements

Percentage	Number of States[19]
0.50	1
1.00	24
1.14	1
1.30	1
1.33	5
1.42	1
1.50	5
1.67	1
2.00	2

Source: Compiled from National Association of Independent Insurers Summary.

TABLE 3

Fidelity or Surety Requirements as a Percentage of Property Capital Requirements

Percentage	Number of Statutes[20]
0.50	1
1.00	17
1.14	1
1.25	7
1.33	2
1.42	3
1.50	1
1.67	1
2.33	1
2.40	1
2.50	2

Source: Computed from N.A.I.I. Summary.

[19] The wording of some statutes makes it difficult to determine capital differentiation based on "property" or "casualty" or "fire" or "liability." Totals, therefore, amount to less than 50. These statutes are omitted from the tabulation.

[20] See footnote 19.

In general, fidelity and surety lines require about the same capital as casualty, although some states require more and some require less.

Multiple-Line Requirements.

An interesting and important dimension of capital requirement statutes is the extent to which the diversification effects of multiple-line operation are recognized. If risk is reduced through the writing of several lines of insurance instead of only one, then the capital required for writing several lines should be less than the sum of all individual-line capital requirements. Nearly all statutes reflect presumed diversification benefits, but to varying degrees. Table 4 shows multiple-line requirements as a percentage of the sum of individual-line capital requirements; the lower the percentage, the greater is the recognition of the presumed benefit of underwriting diversification.

Table 5 shows the absolute requirements for multiple-line licensure.

A plurality of states require about one-third the capital for multiple-line activity compared to the aggregate of individual-line requirements. The highest requirement for multiple-line licensure is approximately $6,000,000, while the lowest is $300,000.

TABLE 4

Multiple-Line Capital Requirements as a Percentage of the Sums of Capital Requirements for Individual Lines[21]

Percent of Individual Total	Number of States
less than 10	1
10-19	3
20-29	3
30-39	13
40-49	2
50-59	5
60-69	4
70-79	1
80-89	3
90-99	0
100	4

Source: Compiled from N.A.I.I. Summary.

[21] See footnote 19.

TABLE 5

Capital Requirements for Multiple-Line Licensure

Requirements (000 omitted)	Number of States
$0- 499	3
500- 999	10
1,000-1,499	14
1,500-1,999	8
2,000 and over	3

Source: Compiled from N.A.I.I. Summary.

Judgmental Statutes.

Vermont and Wisconsin allow capital requirements to be set partly at the discretion of the insurance commissioner. These statutes, particularly the Wisconsin law, warrant elaboration.

(1) *Vermont Statute.* The Vermont law for stock insurers reads as follows:

> To qualify for authority to transact the business of insurance, a stock insurer shall possess and thereafter maintain unimpaired paid-in capital of not less than $250,000 and, when first so authorized, shall possess free surplus of not less than $150,000.
>
> *The Commissioner may prescribe additional surplus* if it appears to him that the kind of insurance to be transacted so requires. (emphasis supplied)[22]

The commissioner has the same discretion with respect to mutual insurers.

(2) *Wisconsin Statute.* The Wisconsin statute is more elaborate and requires the proposed insurer to file a business plan with the commissioner as well as allowing the commissioner discretion with respect to initial capital requirements. It reads as follows:

> (1) The commissioner shall specify the minimum capital for a stock corporation or the minimum permanent surplus for a non-assessable mutual being organized under this chapter. It shall be sufficient, in accordance with sound business practice, to provide for the needs of the proposed business, but in no case except a segregated account bearing no risks that are not assumed by the corporation's general account shall it be less than $200,000, nor shall it be more than $2,000,000. In specifying the amount, the commissioner shall take into account all the information in the business plan, the projection supplied under Section 611.13(2)(k), the general economic situation, the reinsurance market available to the proposed corporation, and any other factors relevant to its needs for capital and surplus.

[22] Quote taken from compilation of statutes by National Association of Independent Insurers.

> (2) A corporation organized under this chapter shall have an initial expendable surplus, after payment of all organizational expenses of at least 50% of the minimum capital or minimum permanent surplus specified under sub. (1), or such smaller percentage as the commissioner specifies.[23]

The Wisconsin law goes on to point out the purpose of the statute governing initial capital and surplus requirements.

> The "minimum capital" (for stock corporations) and "minimum permanent surplus" (for mutuals) are intended to provide solidity at the time a new corporation is launched, and for its formative period. The amount needed depends on what the new company intends to do, and it has to be fixed on the basis of the information given to the commissioner at the time of incorporation. It is specified under Section 611.19[24]

The Wisconsin law is similar to the German Insurance Law which calls for new insurance firms to submit a "Geschaftsplan" (business plan) which is obliged to set forth the purpose and organization of the insurer, the territory of its proposed operations, and in particular must state the facts and data intended to show that its future obligations can be continuously met.[25] The business plan specified in the Wisconsin laws is defined to include: the geographical area in which business is to be done in the first five years; types of insurance to be written in the first five years; the proposed marketing methods; to the extent requested by the commissioner, the proposed methods for the establishment of premium rates; and a projection of the anticipated operating results of the insurer at the end of the first five years of operation, based on reasonable assumptions of loss experience, premiums, and other income, operating expenses, and acquisition costs.

Statutory Reference to Premium Volume.

Although the Wisconsin statute allows the Commissioner to consider premium volume by implication (as part of the business plan) in determining capital requirements, the vast majority of statutes prescribe capital requirements only as fixed amounts and without reference to premium volume. The New Mexico law however, is an exception. It requires a fixed amount of capital for the initial authorization to conduct business. Subsequent to authorization, insurers with multiple-line authority must meet additional minimum requirements based upon annual premium volume. The capital-premium volume relationships are specified as follows:

Premium Volume	*Capital*
$ 0 – 10,000,000	$300,000
10 – 25,000,000	$450,000
over 25,000,000	$675,000

[23] Wisconsin Insurance Laws, Section 611.19.
[24] Wisconsin Insurancé Laws, Section 623.11.
[25] Wisconsin Insurance Laws, Section 611.13(2)(k).

The requirements are in addition to the $300,000 for initial authorization which is required for any line designation. Insurance writing less than multiple-line portfolios must meet similar requirements.[26]

Capital Requirements for Entry: Summary and Comment:

Statutes governing capital requirements for new insurers are diverse and amounts of capital required for a given line of insurance vary widely. Statutes differ on whether to differentiate requirements by line of insurance and the extent to which risk diversification is recognized varies widely. Most statutes do not relate capital requirements to premium volume. This diversity reflects, at the least, different judgments on matters of underwriting risk and solidity regulation. It may also reflect a lack of adequate information for the legislative process. The Wisconsin statute in particular places a considerable burden upon regulatory judgment.

Estimates of Underwriting Risk Relevant to Entry

A study for the National Association of Insurance Commissioners held that potential problem insurers could be screened out in part by the establishment of adequate capital and surplus requirements for new insurers.[27] That analysis also identified underwriting losses as a major cause of insolvencies in the past decade, with most of the insolvencies involving smaller insurers.[28] A more recent study by Munch and Smallwood similarly suggests that insolvent insurers are below average size.[29] Their analysis also showed that insolvencies tended to be more common among firms writing automobile insurance and less common among firms writing only commercial lines. Their most robust finding was that insolvencies occur more frequently under inexperienced management.[30]

Data and Methodology

Sample Characteristics: Our analysis rests upon the analysis of underwriting data for nearly the complete universe of property and liability insurers operating

[26] This requirement is similar to the Great Britain Companies Act of 1967 which also relates minimum capital to premium income. If premium income does not exceed £250,000, required capital is £50,000. If premium volume is between £250,000 and £2,500,000, 20 percent of premium income must be held as capital. For premium volume in excess of £2,500,000, capital must be £500,000 plus 10 percent of premium volume in excess of £2,500,000.

[27] McKinsey & Company, "Strengthening the Surveillance System, Final Report to the NAIC," April 1974, as reprinted in the *NAIC Proceedings*, Volume II, 1974, p. 234.

[28] *Ibid*, p. 253.

[29] Patricia Munch and Dennis Smallwood, "Solvency Regulation in the Property/Casualty Insurance Industry," Paper presented at the National Bureau of Economic Research Conference on Public Regulation, Washington, D.C., December 15-17, 1977, p. 42.

[30] *Ibid*, p. 43. New companies, of course, are more likely than established firms to have inexperienced management.

in each line of insurance over the 1972-1975 interval.[31] Specifically, for each line of insurance the study data consist of (1) net premiums earned, (2) net premiums written, and (3) losses and expenses incurred. The number of insurers analyzed for each year, beginning with 1972, was: 979, 998, 1,003, and 1,000. Individual underwriting results in a line of insurance were omitted if annual net premiums written were less than $1,000 or if the experience produced a negative loss or expense ratio. The exclusion of results based on less than $1,000 of premiums was chosen to eliminate a small number of insurers with unusually small retentions and which introduced a source of variability into the data inconsistent with the aims of the study. A negative loss or expense ratio reflects unusual reinsurance transactions and again injects data variation not a part of study objectives. The data do not differentiate on the basis of the legal form of insurers.

Entry Risk Measurement: Capital required for underwriting is directly related to the level of risk associated with the activity undertaken. Underwriting risk, in turn, is directly affected by fluctuations in claim frequency and severity, competition, economic conditions, insurer size,[32] access to the reinsurance market, and any regulatory constraints which might be present. The study of underwriting risk for new insurers is a difficult task which is complicated by the absence of an operating history.

One approach to the study of new insurer capital needs would be to trace the experience of a cohort of new entrants in each line of insurance over a period of time. The problems of changing economic conditions, competition, regulatory philosophies,[33] changing insurer size, and differences in insurance lines entered,[34] make such an approach difficult. Moreover, shifts in societal attitudes can quickly affect both claim frequency and severity. This appears to have been true in various liability lines, particularly products and medical malpractice. These are all familiar problems in time series analysis. Therefore, an industry cross-sectional approach to analysis of the data was chosen, where small premium volumes of existing insurers were used to estimate the underwriting risk for new insurers.[35]

[31] The data were prepared on tape by A.M. Best and Company for the research purposes of the study.

[32] The pooling or large number effects commonly associated with size tend to reduce year-to-year variation in those events which are poolable, such as random fluctuations in the collective value of claims. It does not have the potential to pool out variation resulting from social change, competition, regulatory constraints and the like.

[33] Successive commissioners in a given state may pursue different regulatory philosophies, and differences among commissioners may also exist at any point in time.

[34] Some lines of insurance are not commonly represented in the many cohorts of entrants.

[35] A time-series analysis of the problem, utilizing only the experience of new insurers, would still be helpful. Our approach is not in lieu of that but represents a more convenient starting point for an unresearched area. Observations of the growth patterns for new insurers point strongly to the presence of small premium volume, at least in the first year of operation and sometimes longer. Exceptions have been among physicians' cooperatives entering the medical malpractice line and insurers formed by large corporate parents and provided with an initially large capital, sometimes augmented by transfers soon after formation, and large enough to support a premium volume beyond that usually associated with new insurers.

By including 1972, a year of record underwriting profits, and 1975, a year of record underwriting losses, a focus was provided on well-defined conditions of strong interest to insurance regulators. The nature of underwriting risk under those conditions is described, so that they may serve as guidelines should they again prevail.

The empirical approach is also contrained by the form in which data are conveniently available. Claims and expense data for each line of insurance are reported directly to insurance commissioners on the expense exhibit, a prescribed regulatory form. Data on the actual distribution of individual claim amounts are available only from internal records of insurers and may not be available at all.[36] Therefore, claims and expense data reported on the Insurance Expense Exhibit were employed. These data can easily be reduced to two values widely used in the analysis of underwriting gains and losses. They are:

(1) Loss Ratio: The ratio of losses and loss adjustment expenses incurred to net premiums earned.

(2) Expense Ratio: The ratio of underwriting (nonclaim) expenses incurred to net premiums written.

It is standard practice to add the loss and expense ratios to produce a single measure of underwriting performance known simply as the combined ratio.[37]

For the purpose of this study, underwriting return is measured by the complement of the combined ratio, i.e., 1 − (loss ratio + expense ratio) and risk is measured by the standard deviation of this function. The analysis revolves about the development of the standard deviation of returns to a particular line of insurance across specified size subsets of insurers.

Insurance line designations are those which are required for the Insurance Expense Exhibit. The lines are:

1. Fire
2. Allied Lines
3. Farm
4. Homeowners Multiple-peril
5. Commercial Multiple-peril
6. Ocean Marine
7. Inland Marine
8. Earthquake
9. Group Accident and Health
10. Other Accident and Health

[36] Statutory accounting requirements govern much of the way in which data are maintained and may discourage the transcription and retention of data in alternate forms.

[37] Statutory accounting is a mixture of cash and accrual accounting. Prepaid expenses are not allowed as an asset. Where premium volume is expanding, underwriting gains are slightly understated by the statutory system. Combining the loss and expense ratio is a shorthand approach to estimating underwriting results, taking prepaid expenses into consideration. A combined ratio of 100 percent, for example, means that the underwriting functions (ignoring possible investment gains or losses) essentially broke even.

11. Workers Compensation
12. Liability Other than Auto
13. Private Passenger Auto Liability
14. Commercial Auto Liability
15. Private Passenger Auto Physical Damage
16. Commercial Auto Physical Damage
17. Aircraft
18. Fidelity
19. Surety
20. Glass
21. Burglary and Theft
22. Boiler and Machinery
23. Credit
24. International
25. Reinsurance
26. Miscellaneous
27. All or Total
28. Medical Malpractice[38]

Diverse coverages, such as accounts receivable insurance, mobile home insurance, extra expense insurance, "floater" contracts, and countless others are all submerged among the categories listed above. Therefore, a particular line designation is not necessarily homogeneous across insurers because the offering of such coverages is not consistent across all insurers. Thus, a "line" of insurance may consist of several related coverages.

The cross-sectional measure of risk serves as a good estimate of the underwriting variability for small premium volumes under certain ideal condtions:

(1) The content of a line of insurance is essentially the same for all insurers writing that line. For example, nonautomobile liability written by insurer A encompasses the same period and coverages as for insurer B, C, D, E, etc.[39]
(2) All insurers in a given line have essentially the same underwriting objectives. Variation in underwriting results across insurers represents random departures from a consistent set of objectives and expectations.
(3) Each insurer faces the same regulatory constraints where underwriting variations across insurers are independent of regional differences that may reflect different regulatory patterns.

Insurers may, of course, exhibit different underwriting objectives, attempt to appeal to different markets, write diverse coverages, and operate under vary-

[38] Medical malpractice was added to the Expense Exhibit as a separate line in 1975. Prior to that, it was a part of Liability Other than Auto.

[39] The line "liability other than auto", for example, is identified by the expense exhibit as a separate line. However, it encompasses several different liability lines including products liability and, until 1975, medical malpractice.

ing regulatory constraints. Unfortunately, the nature of available data does not permit consistent identification of such differences among insurers. The results of the analysis, therefore, can approximate underwriting risk and related values but not measure it precisely.[40]

Underwriting Risk Differences among Lines: The Empirical Evidence

The data base of the present study permits direct cross-sectional observations of underwriting risk differences among lines of insurance and among any desired size strata of insurers.

New insurers typically begin operations in one or only a few lines of insurance and premium volume, particularly for a single line, frequently remains below $500,000 for the first year of operation.[41] Accordingly, the data which follow include annual retained premium volumes in each insurance line up to $500,000. The size classifications constructed for such analysis are:

$ 1,000 – $ 99,999
100,000 – 499,999

By presenting underwriting risk differences only for small size classifications, the possible effects of size from the inclusion of larger volumes is greatly reduced.[42] Tables 6 through 9 array underwriting risk differences among lines of insurance for each of the years 1972 through 1975; those lines with lowest risk values begin each array for each year.

This section attempts to identify from the underwriting risk array of Tables 6 through 9 those lines which presented high levels of underwriting risk in each of the four years. The identification problem is somewhat analagous to that of legislators or regulators confronting the same problem. If a line is in fact low risk but is misclassified as high risk, the error is not in conflict with the solvency or solidity regulatory objective. To classify a line as low risk, however, when it is not, does conflict with that objective. Identification, therefore, focuses only on the high-risk classification. Those lines with the highest risk values for the two lowest size classifications are identified for each year. Any such lines are then surveyed for consistency of the high-risk classification across the four year interval.

[40] Some insurers do not even maintain detailed accounts of claim experience for coverages not identified on the expense exhibit. However, if the study were conducted for only the business written within a particular state, the problem of varying regulatory patterns would not exist. It would be relatively easy for state departments of insurance to undertake.

[41] Observation of the total premium volumes of a sample of 80 new insurers generally confirms that premium volume usually remains below $500,000 through the first year of operation and frequently through the first two years. Where volume is in excess of that, it appears to be clearly associated with capital contributions from a parent corporation.

[42] The study data consistently show decreasing risk values to be associated with increasing size classifications. The complete set of data is not shown here but is available from the authors upon request. A paper on underwriting-size effects is being prepared separately.

TABLE 6

1972 Variability of Combined Ratios of Insurance Lines: Arrayed by Standard Deviation: Number of Companies Shown in Parentheses

Net Premium Volume			
$1,000 – 99,999		$100,000 – 499,999	
1. Earthquake	0.0000 (0)	Earthquake	0.0000 (0)
2. Glass	0.2520 (288)	Burglary and Theft	0.1510 (72)
3. Group A & H	0.3250 (45)	Glass	0.1550 (47)
4. Commercial Mult. Peril	0.3580 (159)	Farm	0.1830 (8)
5. Allied Lines	0.3660 (199)	Fire	0.2180 (211)
6. Pvt. Pass. Auto. Phys. Dmge.	0.3800 (70)	Homeowners Mult. Peril	0.2200 (145)
7. Credit	0.3810 (47)	Pvt. Pass. Auto. Phys. Dmge.	0.2270 (129)
8. Farm	0.4000 (11)	Inland Marine	0.2290 (167)
9. Burglary and Theft	0.4140 (277)	Commercial Auto. Phys. Dmge.	0.2290 (145)
10. Ocean Marine	0.4220 (55)	Allied Lines	0.2390 (211)
11. Commercial Auto. Phys. Dmge.	0.4330 (176)	Fidelty	0.2650 (27)
12. Fire	0.4400 (102)	Air	0.2770 (26)
13. Other Accident and Health	0.4750 (66)	Credit	0.3110 (27)
14. Homeowners Mult. Peril	0.6450 (72)	Other Accident and Health	0.3230 (45)
15. Workers Comp.	0.8230 (60)	Commercial Mult. Peril	0.3310 (113)
16. Inland Marine	0.8270 (284)	Commercial Auto. Liab.	0.3390 (125)
17. Air	0.8370 (54)	Group A and H	0.4300 (38)
18. Fidelity	0.9770 (104)	Ocean Marine	0.4650 (39)
19. Boiler and Machinery	1.1590 (58)	Liab. Other Than Auto.	0.4730 (177)
20. Liab.	1.6070 (95)	Workers Comp.	0.4790 (88)
21. Liab. Other Than Auto.	2.5890 (177)	Pvt. Pass. Auto. Liab.	0.6060 (77)
22. Pvt. Pass. Auto. Liab.	2.6890 (51)	Boiler and Machinery	0.6770 (13)
23. Surety	5.6310 (73)	Surety	1.4150 (58)
24. All Lines	0.9660 (27)	All Lines	0.3450 (69)

TABLE 7

1973 Variability of Combined Ratios of Insurance Lines: Arrayed by Standard Deviation: Number of Companies Shown in Parentheses

	Net Premium Volume			
	$1,000 – 99,999		$100,000 – 499,999	
1.	Group A & H	0.1800 (40)	Burglary and Theft	0.1830 (79)
2.	Credit	0.2450 (42)	Other Accident and Health	0.1970 (39)
3.	Glass	0.3100 (298)	Glass	0.2100 (43)
4.	Commercial Multi. Peril	0.3900 (147)	Boiler and Machinery	0.2270 (16)
5.	Inland Marine	0.4010 (271)	Farm	0.2290 (52)
6.	Commercial Auto. Phys. Dmge.	0.4560 (178)	Pvt. Pass. Auto. Phys. Dmge.	0.2310 (128)
7.	Pvt. Pass. Auto. Phys. Dmge.	0.5330 (77)	Allied Lines	0.2470 (211)
8.	Fire	0.5840 (107)	Homeowners Multi. Peril	0.2480 (142)
9.	Burglary and Theft	0.6210 (264)	Commercial Multi. Peril	0.2620 (133)
10.	Liab. Other Than Auto	0.6270 (166)	Inland Marine	0.2660 (195)
11.	Commercial Auto. Liab.	0.6540 (100)	Workers Comp.	0.2730 (84)
12.	Other Accident and Health	0.6770 (64)	Commercial Auto. Phys. Dmge.	0.2970 (155)
13.	Farm	0.7150 (90)	Pvt. Pass. Auto. Liab.	0.3160 (74)
14.	Allied Lines	0.7490 (205)	Credit	0.3580 (17)
15.	Earthquake	0.7840 (60)	Fidelity	0.3870 (30)
16.	Surety	0.8460 (76)	Commercial Auto. Liab.	0.3910 (143)
17.	Ocean Marine	0.8850 (70)	Liab. Other Than Auto.	0.4140 (179)
18.	Fidelity	0.9000 (97)	Air	0.4280 (41)
19.	Homeowners Multi. Peril	0.9130 (92)	Group A and H	0.4350 (41)
20.	Workers Comp.	1.1220 (70)	Earthquake	0.4540 (23)
21.	Air	1.2560 (58)	Ocean Marine	0.5150 (42)
22.	Pvt. Pass. Auto. Liab.	1.3120 (64)	Surety	0.9730 (57)
23.	Boiler and Machinery	2.4770 (49)	Fire	3.5660 (226)
24.	All Lines	0.6350 (22)	All Lines	5.4380 (56)

TABLE 8

1974 Variability of Combined Ratios of Insurance Lines: Arrayed by Standard Deviation: Number of Companies Shown in Parentheses

Net Premium Volume			
$1,000 – 99,999		$100,000 – 499,999	
1. Glass	0.2800 (301)	Group A and H	0.1590 (41)
2. Earthquake	0.3760 (60)	Glass	0.1770 (37)
3. Other Accident and Health	0.4100 (65)	Other Accident and Health	0.2160 (43)
4. Ocean Marine	0.4670 (65)	Earthquake	0.2320 (28)
5. Pvt. Pass. Auto. Phys. Dmge.	0.4980 (87)	Pvt. Pass. Auto. Phys. Dmge.	0.2790 (130)
6. Burglary and Theft	0.5910 (270)	Burglary and Theft	0.2960 (81)
7. Allied Lines	0.6010 (216)	Commercial Multi. Peril	0.2980 (126)
8. Farm	0.6500 (82)	Fire	0.2990 (224)
9. Fire	0.6700 (116)	Farm	0.3040 (61)
10. Air	0.7740 (48)	Commercial Auto. Phys. Dmge.	0.3140 (148)
11. Commercial Multi. Peril	0.7830 (149)	Allied Lines	0.3380 (214)
12. Fidelity	0.8370 (109)	Inland Marine	0.3580 (192)
13. Surety	0.9760 (86)	Homeowners Multi. Peril	0.3620 (135)
14. Commercial Auto. Liab.	1.0730 (121)	Ocean Marine	0.4570 (61)
15. Commercial Auto. Phys. Dmge.	1.0930 (193)	Boiler and Machinery	0.4640 (22)
16. Pvt. Pass. Auto. Liab.	1.1540 (70)	Fidelity	0.4800 (32)
17. Group A and H	1.1960 (46)	Workers Comp.	0.4910 (72)
18. Inland Marine	1.2810 (257)	Pvt. Pass. Auto. Liab.	0.4910 (73)
19. Homeowners Multi. Peril	1.4330 (101)	Commercial Auto. Liab.	0.5210 (142)
20. Credit	2.3000 (42)	Liability Other Than Auto	0.5900 (186)
21. Workers Comp.	2.3670 (88)	Air	0.8260 (46)
22. Boiler and Machinery	2.4910 (53)	Surety	0.9080 (62)
23. Liability Other Than Auto	13.6530 (167)	Credit	0.9200 (24)
24. All Lines	2.5980 (17)	All Lines	0.3150 (61)

TABLE 9

1975 Variability of Combined Ratios of Insurance Lines: Arrayed by Standard Deviation: Number of Companies Shown in Parentheses

	Net Premium Volume			
	$1,000 – 99,999		$100,000 – 499,999	
1.	Earthquake	0.2770 (70)	Glass	0.1870 (35)
2.	Glass	0.3320 (286)	Farm	0.2920 (63)
3.	Credit	0.3800 (34)	Fire	0.2970 (215)
4.	Fidelity	0.4520 (99)	Earthquake	0.2970 (25)
5.	Allied Lines	0.4700 (209)	Commercial Auto. Phys. Dmge.	0.3130 (157)
6.	Homeowners Multi. Peril	0.5070 (87)	Other Accident and Health	0.3150 (40)
7.	Farm	0.5440 (86)	Pvt. Pass. Auto. Phys. Dmge.	0.3200 (135)
8.	Commercial Auto. Liab.	0.5600 (106)	Allied Lines	0.3310 (213)
9.	Burlary and Theft	0.6120 (268)	Boiler and Machinery	0.3320 (26)
10.	Pvt. Pass. Auto. Phys. Dmge.	0.6160 (74)	Homeowners Multi. Peril	0.3490 (135)
11.	Group A and H	0.7740 (46)	Burglary and Theft	0.4080 (78)
12.	Liability Other Than Auto	0.8060 (167)	Inland Marine	0.4190 (186)
13.	Air	0.8560 (44)	Commercial Auto. Liab.	0.4630 (134)
14.	Commercial Auto. Phys. Dmge.	0.8690 (187)	Group A and H	0.4770 (36)
15.	Inland Marine	0.8770 (244)	Air	0.5410 (57)
16.	Pvt. Pass. Auto. Liab.	0.8780 (47)	Liability Other Than Auto.	0.5530 (168)
17.	Commercial Multi. Peril	1.0530 (112)	Ocean Marine	0.5530 (52)
18.	Surety	1.1000 (86)	Pvt. Pass. Auto. Liab.	0.6360 (84)
19.	Fire	1.1300 (115)	Workers Comp.	0.6830 (76)
20.	Ocean Marine	1.2900 (55)	Fidelity	0.7240 (42)
21.	Other Accident and Health	1.3050 (70)	Surety	0.8000 (50)
22.	Boiler and Macheriny	1.6360 (53)	Medical Malpractice	0.8100 (33)
23.	Medical Malpractice	5.3900 (22)	Credit	0.8820 (24)
24.	Workers Comp.	9.3000 (60)	Commercial Multi Peril	1.2430 (151)
25.	All Lines	0.3400 (10)	All Lines	0.9730 (69)

There are 24 principal lines of insurance identified on the expense exhibit.[43] The eight lines exhibiting the highest underwriting risk values were classified as high or possibly high risk, depending upon whether they appear among the top eight in both of the size categories. Specifically, the judgmental criteria used for such identification were as follows:

(1) If a line is among the eight most risky lines in both of the size classifications, it is classified as high risk.
(2) If a line is among the eight most risky lines in either of the smallest size classifications, it is classified as possibly high risk.

The classification of a line as either high risk or possibly high risk in a given year may not be significant. Assume, for example, that in any given year each line has an equal opportunity to fall within the high-risk category. Under that condition, the probability that a line would be in the high-risk grouping would be 1/9 or 0.111. The probability that a line would be in the possibly high-risk category is 4/9 or 0.444[44] The appearance of any line in a single year as high risk or possibly high risk need not, therefore, be surprising.

The classifications, of course, apply only to the years under observation. Table 10 identifies those lines judged as high risk or possibly high risk.

If a line remained in the high-risk classification over the entire four-year interval, that would offer improved affirmation of its high-risk status. Also, if a line appeared as either high risk or possibly high risk in each of the four years, that too would be further affirmation of its high-risk potential. These kinds of observations are summarized in Table. 11.

As indicated previously, if it is assumed that each line has an equal chance of being identified as high or possibly high risk in a given year, the probability is relatively high that it will occupy one of these classifications. Should it remain in either of those groupings for every year of the study, however, it would lend considerable credence to the hypothesis that a given line is, in fact, risky. Again, assume that the underwriting risk value of a given line is a random variable, independent and identically distributed with equal probability of being in any risk category. Under these conditions, the chance that a particular line will remain in the high-risk category over the four years is $(1/9)^4$ or 0.00015; for three of the four years $32/9^4$ or 0.0049; and for two of the four years $384/9^4$ or 0.05853.[45] Similarly, the probability of being in either but not both, the high-

[43] International, miscellaneous, and reinsurance are not included in the presentation. Although they are a part of the data, they do not represent well-defined loss exposures and have little, if any, relevance to capital statutes dealing with entry.

[44] The probability of falling into the high-risk grouping is 1/3 for each of the two small-size categories, so that the probability of the joint occurrence is 1/3 x 1/3 = 1/9. The probability of falling in only the possibly high-risk grouping is 2/9 + 2/9 − 0 = 4/9.

[45] The probability that a line will be a high-risk line for n of the four years is:

$$\binom{4}{n} \left(\frac{1}{9}\right)^n \left(\frac{8}{9}\right)^{4-n}$$

TABLE 10

Lines Developing High Cross-Sectional Risk Values: 1972-1975

1972		1973		1974		1975	
High Risk	Possibly High Risk	High Risk	Possibly High Risk	High Risk	Possibly High Risk	High Risk	Possibly High Risk
–Surety	–Fidelity	–Air	–Boiler and Machinery	–Liability Other Than Automobile	–Boiler and Machinery	–Workers Compensation	–Boiler and Machinery
–Private Passenger Automobile Liability	–Air	–Ocean Marine	–Private Passenger Automobile	–Workers Compensation	–Homeowners	–Medical Malpractice	–Other Accident and Health
–Liability Other Than Automobile	–Inland Marine	–Surety	–Workers Compensation	–Credit	–Inland Marine	–Ocean Marine	–Fire
–Commercial Automobile Liability	–Workers Compensation		–Homeowners	–Private Passenter Automobile Liability	–Group Accident and Health	–Surety	–Private Passenger Automobile Liability
–Boiler and Machinery	–Ocean Marine		–Fidelity		–Fidelity	–Commercial Multiple Peril	–Credit
	–Group Accident and Health		–Commercial Automobile Liability		–Commercial Automobile Liability		
			–Liability Other Than Automobile		–Air		
			–Group Accident and Health		–Surety		
			–Earthquake				
			–Fire				

TABLE 11

High Risk Classification Consistency Across
1972-1975 Interval for Small Premium Volumes

Number of Years Appearing as High Risk				Number of Years Appearing as Either High Risk or Possibly High Risk			
ONE	TWO	THREE	FOUR	ONE	TWO	THREE	FOUR
–Commercial Automobile Liability –Boiler and Machinery –Air –Credit –Medical Malpractice –Commercial Multiple Peril	–Private Passenger Automobile Liability –Liability Other Than Automobile –Ocean Marine –Workers Compensation	–Surety	–	–Earthquake –Medical Malpractice –Commercial Multiple Peril –Other Accident and Health	–Inland Marine –Fire –Credit –Homeowners Multiple Peril	–Fidelity –Air –Ocean Marine –Group Accident and Health –Boiler and Machinery –Commercial Automobile Liability –Liability Other Than Automobile	–Workers Compensation –Private Passenger Automobile Liability –Surety

isk and the possibly high-risk classification in all four years is 0.0951 and in hree of the four years is 0.2024.[46]

Three lines appeared in either the high- or possibly high-risk categories over he four years: workers compensation, private passenger auto liability, and surety. While no line appeared as high risk for four years, surety appeared for hree, thereby strongly suggesting it to be, in fact, high risk. Private passenger uto liability, liability other than auto, workers compensation, and ocean marine ppeared as high risk for two years.[47]

Risk classification was also performed for premium volume up $1,000,000 by adding a third size class of $500,000 – $999,999. The number of lines identified as high- or possibly high-risk was fewer. However, surety again continued in one of these categories in at least one of the three size groupings in each of the four years. Similarly, liability other than auto continued for three years.

Cross-sectional risk values for small premium volumes provide a basis for developing hypotheses and supplementing regulatory judgment regarding initial capital requirements among lines. The data may be especially useful to Wisconsin-type statutes which allow regulatory discretion in establishment of initial capital amounts and for revisions of statutes specifying fixed capital amounts for entry into various insurance lines.

While the classification scheme for determining high-risk and potentially high-risk classes may also be used to identify low-risk counterparts, it is important to note again the consequences of misclassification error. If a line is classified as high risk when it is not, the consequence is over-capitalization, at least initially. On the other hand, misclassification of a line as low risk could lead to insolvency. Until more data are available, prudence is required in the identification of low-risk lines from the study data.

Some lines did appear to be low risk, using the same classification system as before. Glass appeared in the low-risk classification in each of the four years and private passenger automobile physical damage appeared as low risk in three of the four years. Other lines did not develop such consistency. The high-risk classifications of Tables 10 and 11 suggest that the highest capital requirements for entry should be for surety and perhaps for private passenger automobile liability, liability other than automobile (principally products and malpractice), ocean marine, and workers compensation. These lines developed the most consistent high-risk patterns.[48]

[46] The probability that a line will be in either, but not both, the high-risk and the possibly high-risk classifications in n of the four years is:

$$\sum\sum_{n_1 + n_2 = n} \frac{4!}{n_1!\, n_2!\, (4 - n_1 - n_2)!} \left(\frac{1}{9}\right)^{n_1} \left(\frac{4}{9}\right)^{n_2} \left(\frac{4}{9}\right)^{4 - n_1 - n_2}$$

[47] Liability other than auto would almost certainly have appeared as high risk for three years had not the medical malpractice component of the line been separately identified for the last year, 1975. The latter appeared as high risk for that year.

[48] The experience of the liability other than auto line may change given it no longer includes medical malpractice. It does encompass products liability, however, and that generally remains as a troublesome line.

As noted, automobile physical damage produced lower risk patterns than automobile liability. Statutes specifying entry capital requirements, however, frequently make no such distinction. Statutes do, however, frequently require high capital for entry into the surety lines, a requirement consistent with the empirical observations shown here. Since medical malpractice was identified as a separate line only in 1975, it could have been separately identified only once. Its 1975 risk value and the situation leading to price and supply problems strongly suggest that classification as a high-risk line would be reasonable.

Low-risk lines tend to be those with relatively low catastrophe potential. Both the glass and automobile physical damage risks, for example, are characterized by a well-defined and relatively low maximum loss per insured unit and a relatively small chance of a single occurrence effecting large numbers of exposures simultaneously. On the other hand, risky lines tend to have a higher catastrophic potential. Surety contracts cover diverse loss exposures and aggregate claims can be unpredictable and large. Changing socio-economic conditions and attitudes have elevated the large-loss potential of all liability lines. It is not surprising that private passenger automobile liability and liability other than automobile fall into high-risk groupings (with medical malpractice as well).[49] The workers compensation risk is beset with similar pressures, higher medical care costs and income payments increased by inflationary pressures. Ocean marine is also characterized by a large maximum loss potential.

Capital and Premium Volume

Statutory capital requirements typically make no reference to new insurer premium volumes. Yet, the adequacy of any capital amount can be judged only in reference to the premium volume which may be associated with it. Premiums are approximately the expected value of future losses and expenses and if actual underwriting results always coincided with those expected, there would be no need for a financial cushion to absorb fluctuations in underwriting experience. In the context of underwriting, capital is equivalent to a financial buffer.

The presumed stabilizing effects of large premium volumes suggest that new insurers, to remain at a given level of safety, would be constrained to a smaller ratio of premiums to capital than larger firms. The ratio is not only conceptually important but also continues as one of the key guidelines used by regulators in assessing solvency. Over the years, a premiums-to-capital ratio of 2.0 has been commonly used rule-of-thumb in judging the capital adequacy of all nonlife insurers.[50] The ratio, however, has usually been applied and spoken of without reference to insurer size or to differences in the mix of underwriting portfolio.

[49] The finding is consistent with the Munch and Smallwood findings that insolvency tended to be greatest among firms writing automobile insurance. Munch and Smallwood, p. 42.

[50] The 2.0 ratio is usually referred to as the "Kenney Rule": that an insurer's premium volume should not normally exceed 200 percent of its capital and surplus. The Early Warning System of the National Association of Insurance Commissions prescribes 3.0 as an upper limit but still without direct reference to size or business mix.

The study data can be employed to estimate maximum ratios of premiums to capital for each line of insurance and for any size classification of insurers. The most straight-forward estimation can be made from a standard statistical formulation resting upon the assumption of normality in the underlying data, in this case, the distribution of the combined loss-and-expense ratio. Specifically:

$$C = P(Z \cdot \sigma_X + X - 1)$$

where: C = capital
X = expected combined ratio
P = estimated premium volume
σ_X = estimated standard deviation of expected combined ratio
Z = value from a normal distribution associated with a selected probability of ruin value.

The formulation was employed in this context a decade ago by Hofflander.[51] His study provided a major empirical insight into the relationship between monoline underwriting variability and maximum ratios of premium to capital.

For purposes of illustration, it is assumed that the highest probability of ruin acceptable to regulators is 0.001 ($Z = 3.09$). For example, if the data for a given line indicate an average combined ratio of 0.99 with a standard deviation of 0.05, the maximum premiums-to-surplus ratio for that line would be estimated as follows:

$$C = 100\,(3.09 \times 0.05 - 0.01)$$

C = \$14.45 for every \$100 of premiums or an estimated permissible ratio of 6.92.

In the above illustration, the combination of profitable and reasonably stable underwriting results produced a relatively high ratio of premiums to surplus.

Table 12 shows the maximum premiums to capital ratios that an insurer could have written, under the assumptions noted, in only one line of insurance and not have exceeded a ruin probability of 0.001. The values, therefore, do not reflect possible balancing effects from writing more than a single line. Only in the values shown for all lines combined is there any indication of the direction and extent of possible diversification effects.

Size difference observations from Table 12 are confined to the two smallest premium volume classes (\$1,000 to \$99,999 and \$100,000 to \$499,999) and to

[51] Alfred E. Hofflander, "Minimum Capital and Surplus Requirements for Multiple Line Insurance Companies: A New Approach," *Insurance, Government, and Social Policy: Studies in Insurance Regulations,* edited by Spencer L. Kimball and Herbert S. Denenberg, S.S. Huebner Foundation for Insurance Education (Homewood, Illinois: Richard D. Irwin Co., 1969). See pp. 80-88 in particular. Hofflander, however, did not attempt to differentiate the ratios on the basis of different size classifications. His work did draw attention to the problem of using arbitrary ratios to assess insurer solidity and capital adequacy.

TABLE 12

Maximum Premiums-to-Capital Ratios for Monoline Underwriting and Selected Line Groupings; For Small Premium Volume and All Insurers Combined, 1972-1975

Line	1972			1973			1974			1975		
	$1,000-99,999	$100,000-499,999	All	$1,000-99,999	$100,000-499,999	All	$1,000-99,999	$100,000-499,999	All	$1,000-99,999	$100,000-499,999	All
1. Fire	0.79	1.84	8.68	0.55	0.09	0.61	0.46	1.06	2.73	0.28	1.11	2.65
2. Allied Lines	1.12	2.23	5.25	0.46	1.86	3.57	0.53	1.00	1.73	0.71	1.06	2.15
3. Farm	0.80	2.35	3.10	0.44	1.41	2.09	0.44	0.94	1.31	0.55	0.96	1.49
4. Homeowners Peril	0.48	1.57	5.29	0.33	1.28	4.79	0.20	0.78	2.07	0.55	0.80	2.37
5. Com. Mult. Peril	1.14	1.17	6.60	0.97	1.63	5.04	0.42	1.24	2.58	0.31	0.26	1.80
6. Ocean Marine	0.84	0.69	2.57	0.34	0.59	2.15	0.73	0.66	1.99	0.24	0.51	1.40
7. Inland Marine	0.41	1.68	2.47	0.94	1.49	3.26	0.25	0.94	1.96	0.36	0.77	2.12
8. Earthquake	NA	NA	NA	0.48	1.03	0.86	1.48	3.57	4.39	2.97	2.21	5.78
9. Group A & H	1.04	0.76	3.05	1.91	0.72	2.72	0.26	2.21	3.00	0.40	0.66	2.57
10. Other A & H	0.66	1.12	2.77	0.47	1.99	2.41	0.76	1.74	2.08	0.25	1.05	1.82
11. Workers Comp.	0.37	0.69	3.35	0.27	1.28	3.13	0.13	0.62	2.41	0.03	0.45	1.41
12. Liab. Other Than Auto	0.12	0.71	1.09	0.52	0.78	1.32	0.02	0.52	0.43	0.40	0.56	1.02
13. Pvt. Pas. Auto. Liab.	0.11	0.49	3.43	0.22	0.93	3.32	0.26	0.59	2.90	0.33	0.46	2.74
14. Com. Auto. Liab.	0.20	1.03	1.91	0.47	0.80	1.97	0.28	0.61	1.58	0.56	0.67	1.49

15. Pvt. Pas. Auto. P.D.	0.80	1.59	6.93	0.59	1.36	4.01	0.59	1.07	2.01	0.43	0.81	2.03
16. Com. Auto. P.D.	0.78	1.70	4.15	0.72	1.10	3.27	0.29	1.01	1.76	0.36	0.96	1.81
17. Air	0.38	1.21	1.63	0.22	0.64	0.81	0.35	0.33	0.78	0.34	0.49	0.76
18. Fidelity	0.32	1.55	1.81	0.35	0.92	1.63	0.37	0.65	1.24	0.72	0.42	0.92
19. Surety	0.06	0.22	0.69	0.37	0.32	1.35	0.33	0.34	0.66	0.29	0.38	0.64
20. Glass	1.41	2.35	2.04	1.09	1.64	1.85	1.09	1.62	1.69	0.90	1.52	1.32
21. Burg. & Theft	0.88	4.04	3.79	0.54	2.62	2.50	0.56	1.19	1.77	0.52	0.81	1.53
22. Boiler & Mach.	0.24	0.50	1.73	0.13	1.81	1.38	0.12	0.68	1.14	0.19	0.97	1.60
23. Credit	0.88	1.10	0.54	1.32	0.85	0.16	0.13	0.30	0.16	0.96	0.35	0.59
24. Med. Malpractice	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05	0.36	0.55
25. All	0.31	0.97	7.20	0.46	0.06	2.68	0.12	0.92	3.20	0.78	0.30	3.15
26. 1+2	1.03	1.86	12.14	0.54	0.10	0.89	0.41	1.19	3.11	0.24	1.06	3.06
27. 1+2+3+4	0.46	1.39	10.90	0.42	0.08	1.29	0.47	0.87	2.84	0.20	0.80	2.95
28. 13+15	0.24	0.95	5.51	0.30	1.07	4.18	0.32	0.94	2.90	0.31	0.91	2.33
29. 14+16	0.21	1.03	2.52	0.67	0.89	2.57	0.42	0.62	1.95	0.54	0.75	1.89
30. 13+14+15+16	0.13	1.14	5.07	0.39	0.98	4.22	0.79	0.87	3.38	0.25	0.76	2.49
31. 1+2+3+4+22	0.46	1.39	10.90	0.42	0.08	1.30	0.47	0.87	2.86	0.20	0.80	2.97
32. 1+2+3+4+12	0.12	0.93	3.57	0.45	0.08	1.32	0.27	0.52	1.76	0.23	0.71	2.28
33. 1+2+3+4+5	0.47	1.31	13.93	0.46	0.08	1.54	0.38	0.84	3.20	0.21	0.71	3.23
34. 11+12+13+14	0.06	0.47	2.64	0.45	0.88	3.22	0.53	0.59	2.41	0.49	0.90	2.38

facilitate comparisons with other insurers, the ratio value calculated from the results of all insurers combined. Size effects are readily apparent. The underwriting experience at small premium volumes consistently develops maximum ratios below those calculated from the experience of all insurers combined. Volumes in excess of $500,000 are consistent with the pattern shown.

Table 12 also shows maximum ratios of premiums to capital for certain selected but standard groupings of insurance lines. The values shown were calculated on the basis of the previously noted assumptions reflecting a ruin probability of 0.001. The data base is the same as for all previous tables and charts.

The premium to capital values are generally consistent with the underwriting variability patterns noted previously. The general decline in the maximum ratios over the 1972-1975 interval reflect the contrast between the profitable and unprofitable years of 1972 and 1975. While it has always been conceptually clear that low combined ratios coupled with stable underwriting can permit premiums-to-capital ratios in excess of those under contrary positions, the extent and magnitude of such differences had not always been clear. Table 12 helps to estimate such differences.[52]

The underwriting experience underlying the small premium volume classifications typically develops maximum ratios well below the 3.0 NAIC Early Warning Value and also the more conservative 2.0 Kenney rule.[53] Private Passenger Auto Liability, Surety, and Liability Other Than Auto developed the lowest ratios at small volumes.

Thus, for insurers just entering a new line of insurance, there would appear to be few if any lines which could accommodate rapid premium growth without commensurate increases in surplus. For example, if the statutory capital requirement for entering private passenger auto liability were $500,000, premium volumes in excess of that amount might raise ruin levels beyond those which regulators were willing to tolerate. A firm which, for example, expected to write $500,000 in private auto liability premiums might reasonably be expected to maintain a capital of at least $500,000 or perhaps considerably more to absorb underwriting fluctuations (assuming that a ruin assumption of 0.001 is reasonable). One of the interesting judgments to be made from the data of Table 12 is the apparent continued relevance of the so-called Kenney rule to the monoline underwriting activities of small insurers. The traditional "two to one" rule may even be optimistic when applied to small premium volumes on a monoline basis, a situation more likely to exist with new insurers than with established ones. Even more dramatic limitations on premium volume or increased capital might be expected of insurers entering the nonautomobile liability field, surety, fidelity and other lines capable of tolerating only modest ratios of premium to capital.

[52] For purposes of comparison, premiums-to-capital ratios were calculated for several size groupings. Consistently similar size effects were observed throughout. Only with credit insurance was higher volume associated with a lower ratio; underwriting variability at higher volumes was relatively high. The line is very cyclical and highly subject to business conditions.

[53] Conversely, the values resulting from the experience at large volumes developed ratios consistently in excess of the 3.0 value. In 1972, a year of record underwriting profit, larger volumes frequently developed values in excess of 2.0 and 3.0 norms.

Insurers entering more than one line at a time might benefit from diversification and experience a more stable underwriting result. Although the cross-sectional data of 1972 through 1975 cannot be used to forecast accurately the underwriting experience of individual insurers, some insights into possible diversification effects can be observed for the permissible premiums-to-capital ratios associated with the line groupings of line 31 through line 39.[54]

The grouped data from Table 12 do not permit clear identification of diversification effects because of the presence of size or pooling effects. Insurers with more than one line of insurance, to remain in the smallest size category, will have small premium volumes in each line thereby injecting a possible increase in variability to go along with the possible decrease associated with diversification. The automobile lines (13, 14, 15 and 16) are grouped to form line 35 which produces a higher premiums-to-capital ratio than for the separate auto liability lines, but lower than for the physical damage lines – a kind of leveling effect. Similar effects appear for other combinations of lines. It is not possible, however, to measure the extent in which such effects are produced by diversification.

Summary and Conclusions

The principal problem in setting capital requirements for entrants is that new insurers have no operating history. Underwriting results, management philosophy, and the impact of economic conditions on capital must be assessed on the basis of collective and not individual underwriting experience. Collective results, however, are usually known only on an aggregate basis, thereby obscuring patterns and variations of relevance to regulatory assessments about capital needs.

The cross-sectional measure of risk employed in this analysis measures the variation in underwriting results across essentially all insurers operating in each line of insurance from 1972 through 1975. It is suggestive of the regulatory uncertainty surrounding the specification of capital for new insurers. Lines which develop highly variable underwriting results produce a greater degree of regulatory uncertainty about operating results than those which do not. It is not unreasonable to think that entry of an insurer into such lines requires more capital than entry into lines or classes of business where uncertainty is less.

Possible Regulatory Applications

The data on underwriting variability should help reduce regulatory uncertainty surrounding capital requirement specifications for new insurers. The most important insights into underwriting risk assessment center upon apparent size-effect problems for new insurers and differences in risk among lines.[55]

[54] Technically, the extent to which an underwriting portfolio or more than one line of insurance produces a more stable underwriting experience depends upon the intercorrelations of underwriting results among insurance lines. The information required to study such relationships is best developed from time series on individual firms. See Bachman, *Capitalization.*

[55] These statements by themselves are not startling. Regulatory statutes, guidelines, and regulations, however, frequently do not recognize these points.

Size. Small premium volumes are clearly associated with high underwriting risk. While the study data do not provide conclusive evidence that the smaller premium volume of a given insurer will produce more variation than higher volumes, they strongly suggest it. The evidence supports the notion that small insurers cannot, from a given capital base, write as much insurance as their larger competitors and still maintain the same level of safety.

The information developed thus provides a reasonable basis for regulatory interest in insurer expectations and market realities about premium volume growth in relation to capital.

Risk Difference among Lines. Existing statutory capital requirements for entry frequently specify different amounts for different lines of insurance. The information developed in the study supports such differential requirements and helps to identify lines of highest risk and therefore likely to require the highest amounts of capital.

For small premium volumes, the lines which exhibited the greatest cross-sectional risk were workers compensation, private passenger automobile liability, and surety. These lines exhibited relatively high variability in each of the four years under review. Lines developing high variability values in three of the four years were: fidelity, air, ocean marine, group accident and health, boiler and machinery, commercial automobile liability, and liability other than auto (the latter including medical malpractice in all of the study years except 1975 as well as product liability).

Changes in Statutes

The study interval is particularly interesting since it included a year of record low combined ratios (1972) as well as a year of record highs (1975). The data generally support regulatory and legislative judgment which implied some lines as risky (e.g., surety, liability), thus requiring the greatest amount of capital for entry.

The smaller premium volumes generally linked with new insurers appear sufficiently associated with high underwriting risk to warrant conservative ratios of premiums to surplus. The Kenney "two-to-one" rule appears optimistic when applied to small premium volumes on a monoline basis.

Nearly all statutes specify a fixed amount of capital for entry into a line or class of insurance. Yet, solvency does not depend on the absolute amount of capital but on the premium volume in relation to capital. The expected premium volume of new insurers, however, is affected by management philosophy, competition, profit, and market growth potential, conditions which may change from one year to the next. These in turn may vary from one line to the next. A statute which imposes only a fixed amount of capital cannot accommodate the different risks associated with different ratios of premiums to capital.

The Wisconsin statute, however, by allowing regulatory discretion in the establishment of entry capital amounts and by requiring premium growth plans from prospective insurers (as part of the business plan), can deal with premiums and capital together. The administration of such a statute is in turn facilitated

by studies of underwriting risk and their continued development over time. It is hoped that the analysis and information generated here will encourage the adoption of statutes modeled after the Wisconsin Code and the continued updating and possible refinement of the data.

Discussion

Robert C. Merton*

The two papers to be discussed, "Risk and Capital Adequacy in Banks" by Sherman Maisel and "Capital Requirements for Entry into Property and Liability Underwriting: An Empirical Examination" by J.D. Hammond and Arnold Shapiro, have much in common. Each paper is a summary of a larger study. Both papers examine concern over the effects of regulation on competition among intermediaries. The regulatory aspect that both focus on is the use of quantitative methods in the establishment of appropriate capital requirements. In measuring risk for the purposes of establishing capital requirements, both papers subscribe to the "portfolio approach" although the specific methodology employed in each paper is somewhat different. Thus, I begin with some general points which apply to the topics and approaches of both papers and leave for the end specific points about each paper.

To put the analysis in these papers in perspective, it is useful to review briefly why adequate capital is an important objective for the regulation of financial intermediaries. Even the most elementary and abstract analysis of an economic system would lead one to expect a widespread demand among individuals for financial instruments which are functionally equivalent to bank deposits and insurance. If they did not exist, then such contracts would have to be invented, and hence, it is not necessary to dwell on why they exist. However, in a somewhat less elementary analysis, it can also be shown that the efficiency with which these contracts perform their function is inversely related to their default risk. The loss in efficiency from default risk is caused by significant increases in both information and transactions costs. For example, the holder of a bank deposit which is known to be free of default risk requires little, if any, other information to understand the properties of the financial instrument he holds. However, once there is a possibility of default, then at a minimum, the holder of the deposit must assess the probability of default and in the event of default, the range of possible amounts that he might recover. Of course, to make such an assessment requires data about the type and size of other liabilities of the bank; the assets held by the bank and their risk; the operating expenses of the bank; and the quality of its management. In addition, these data would have to be analyzed to estimate the relevant probability distribution. Moreover, because

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conditions within the bank change over time, such analyses would be required frequently. In effect, the depositor must become a security analyst.

Even if independent firms evolved to provide such analytical services, the depositor would still be left with the problem of evaluating the evaluators. And in any event, prudence would dictate that he diversify by spreading his deposits among many banks. Given the profile of a typical individual who uses bank deposits and the typical amounts involved per person, the aggregated information and transactions costs caused by significant default risk are substantial. Along the same lines, there is a serious loss in efficiency from default risk on insurance contracts. While to some extent there is also a loss in efficiency from default risk on general goods and services provided to individuals, the case of financial intermediaries is special because to receive the services of an intermediary one must become a liability-holder of the firm for the duration of the services and because the aggregate amount of such "customer" liabilities is a significant fraction of the total value of the firm. Therefore, "customer" liabilities of intermediaries differ from the general liabilities of firms in that resources should be spent to ensure that these customer liabilities are virtually default-free.

To ensure that these obligations to customers are met will in general require a third party to set rules for performance by the intermediaries and to provide surveillance to ensure compliance. It may also require that the third party guarantee the customer liabilities. While it is not essential that this party be a government agency, it is important that the capability and willingness of the third party to meet its obligations be virtually beyond question. Otherwise, a fourth party might be required to ensure the performance of the third one; and a fifth for the fourth; and so on. The resulting "layering" of surveillance and other costs are likely to be inefficient. Further, in the absence of detailed information and analysis, customers (e.g., depositors) may well use the size of the guarantor as a selector for greater safety. This tendency could make it difficult to maintain a competitive structure within which the private sector could provide these services at minimum cost. Of course, lack of competition will still be a problem if a government agency provides this "third party" service. That is, if a government agency provides the service, then the usual market forces which tend to enforce efficient operations on the part of private enterprises will be missing. If the government agency also insures the liabilities (as with deposit insurance), then the absence of a market makes the determination of economically sound insurance premiums especially difficult. Whether or not these services should be provided by the private sector or government agencies is far from a resolved issue in theory. However, as a practical matter, government agencies are deeply involved in these activities, and at least, for large scale intermediation such as in the banking system, the view that they should be is not without foundation.

If a government agency such as the Federal Deposit Insurance Corporation does perform this function, then the information and diversification costs of individual depositors are eliminated. Of course, this does not eliminate all such costs since the agency must incur the costs of monitoring the performance of the intermediaries. While common sense suggests that regulations be set so as to keep these costs to a minimum, there are constraints on the form that these

regulations can take. For example, the cost to FDIC ensuring that deposit obligations are met could be minimized by simply requiring that all member banks hold all their assets in short-term, marketable U.S. government securities. While this solution has at times been suggested, it would clearly eliminate the other important functional role for banks which is to make loans to businesses and individuals. The social cost of eliminating this service would most likely exceed the benefit of reduced costs to FDIC. Thus, the regulations should be chosen so as to minimize the costs of insolvency subject to the constraint that the regulations do not significantly impair the intermediaries' capabilities to perform their functional roles.

While "insolvency" has been defined in a variety of ways, the definition used by Maisel (with some slight modification) is an appropriate one for the purpose of regulation. In the Maisel paper, insolvency of an intermediary is said to occur "when the market value of its liabilities exceeds that of its assets reduced by the costs of bankruptcy." It should be noted that "liabilities" as used by Maisel refer to " 'customer' liabilities" (as I have described them) and not the general liabilities of the intermediary which would include equity. While I applaud his emphasis on "market" rather than "book" values for determining insolvency, his definition has a technical difficulty because the limited-liability feature of equity implies that the *market* value of equity (and hence, net worth) cannot be negative. However, if his definition is modified to read "when the value of its liabilities (to consumers), *computed by assuming that the terms of such obligations would be fully met,* exceeds the market value of its assets reduced by the costs of bankruptcy," then net worth, defined as the difference between the value of assets and the value of liabilities computed in this way, can be negative. Under this definition, negative net worth implies insolvency, and its probability is represented by the shaded area of the probability distribution for net worth as illustrated in Figure 1 of the Maisel paper.

The risk of insolvency will depend upon the volatilities of the intermediary's assets, liabilities, and operating costs. It will also depend upon the frequency with which the intermediary is evaluated by the regulators, and on the amount of capital or assurance money provided by the equityholders of the intermediary. Regulatory restrictions can be imposed on all of these items to reduce the risk of insolvency. However, as discussed earlier, there are limits to the restrictions which can be placed on the volatility of either assets or liabilities without significantly interfering with the functions served by the intermediary. It is for this reason that both papers focus on the establishment of adequate capital requirements. In the case of the insurance industry examined by Hammond and Shapiro, the capital adequacy requirement is indeed the central device for protecting policyholders. For the banking industry where most deposits are insured, the central protection is of course deposit insurance. However, the capital requirement is the central device for protecting the insurer of those deposits (e.g., FDIC or FSLIC). The insurance premium charged by FDIC is also an important control at least in principle. That is, banks with smaller amounts of capital or riskier assets could be charged a higher premium. However, as Maisel points out, FDIC charges all banks the same insurance rate independent of their risk, and therefore, under current practices, this second control is not very effective.

The appropriate capital requirement to meet a specified level of insolvency risk will depend upon the volatility of both the intermediary's assets and its liabilities. Both papers fall short of a complete analysis in this respect because Maisel only studies the volatility of the assets and Hammond and Shapiro only study the volatility of the liabilities and operating costs. However, both papers do stress that it is the riskiness of the portfolio (of assets or liabilities) which is important for establishing capital requirements. While this approach will come as no surprise to students of modern portfolio theory, it is in sharp contrast to the traditional treatment of risk in regulation where the practice is to set risk limits on each individual component of the (asset or liability) portfolio held by the intermediary. As the authors of both papers point out, this traditional approach explicitly neglects the important role diversification plays in the reduction of risk. The analyses presented in the Hammond and Shapiro paper provide empirical evidence of the important benefits from diversification across multiple lines of insurance. Further evidence of the importance of diversification can be found in parallel studies on the regulation of money-management fiduciaries and revisions of the "Prudent Man" rules. And indeed, recent guidelines for ERISA-type pension accounts suggest a move away from the traditional view of setting risk standards for each investment in the account and a move toward replacing these standards with ones applied to the account as a whole.

In both papers, the authors chose to measure risk by variance (or equivalently, standard deviation). This choice raises two questions: Should one use "total" risk or only its "systematic" component as the appropriate measure? If "total" risk is the correct measure, does the variance adequately measure it? In his paper, Maisel discusses both questions and I agree with his answers. On the first, because both papers are concerned with measuring default risk, total risk is the proper measure as has been shown elsewhere.[1] On the second, the answer is less clear. If the dynamics of asset and liability value changes are such that they can reasonably be modeled by diffusion processes, then the variance rate will be an adequate statistic. However, if these dynamics involve radical changes in value over a short period of time, then variance will not be sufficient, and more complex measures such as those associated with either stable or Poisson-directed distributions may be required. While the empirical resolution of this question would be important prior to the implementation of either paper's quantitative methods as a formal part of the regulatory process, the qualitative indications for regulatory change as suggested by either paper would be largely unaffected.

I now turn to the specifics of each paper beginning with Maisel's.

Research in finance theory has produced a number of important quantitative tools for analyzing risk and evaluating insurance premiums. These quantitative methods have been subjected to empirical verification and many have be-

[1] See, for example, R.C. Merton, 1974, "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance* 29, pp. 449-70 and 1977, "An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees," *Journal of Banking and Finance* 1, pp. 3-11.

come standard operating tools in the (private sector) financial community. I am strongly in agreement with Maisel's central theme that these tools should be employed within the bank regulation and examination system to provide more objective evaluations. Indeed, because government agencies such as FDIC and FSLIC do not have a competitive market providing price data on their type of insurance premiums and because they do not have publicly traded share prices to indicate how the market perceives these agencies' performance, the use of these quantitative tools for making objective evaluations may be more important for these agencies than they would be for a corresponding private-sector firm.

Although the issues raised and analyses presented by Maisel are confined to the banking system and deposit insurance, his contribution has added significance because much of what he has done can be applied with minor modification to other areas of public-sector guarantees. Two such areas of particular importance are government loan guarantees and government guarantees of private pension obligations. Both areas promise to be topics for much future discussion, and the role of quantitative methods in making objective evaluations of the costs and benefits will be at least as important in these areas as it is for the banking system.

The Maisel paper covers most of the important issues. He recognizes that the establishment of "adequate" capital requirements cannot be undertaken without a simultaneous analysis of bank asset risks and the schedule of insurance premiums charged by FDIC. In his section titled "Measuring Capital Adequacy in a Bank," he correctly stresses the importance of using "economic, rather than book or reported capital" in assessing the risk of insolvency. He underscores the empirical significance of this point in the section titled "Measuring Net Worth" where he describes the historically large discrepancies between the market and book values of net worth for large banks. I agree with the conditions he describes for "capital to be adequate" in that section although I would replace his description of a "fair" insurance premium as one that ". . . covers the expected losses of the insurer . . ." with ". . . compensates fully the insurer in terms of ex-ante expected return for the risks borne. . .". The reason for this suggested change is that some of the risk borne by the insurer may be market-related or systematic risk in which case the insurer should be compensated by an expected return in excess of the risk-free rate, and therefore, the premium should cover more than expected losses. It should also be mentioned that the probability of insolvency is not a sufficient measure of the risk of insolvency because it does not capture the magnitudes of the losses in the event that insolvency occurs.

In his analysis of bank asset risk (in "Finding the Risk in a Bank"), Maisel lays out the various categories of risk and their relative importance. By emphasizing broad risk classes, he incorporates the effects of diversification and correctly points out that the important risks are the nondiversifiable ones such as interest rate risk. He also points out the importance of taking into account "off-balance-sheet" liabilities such as credit lines and "stand-by" agreements to purchase mortgages in evaluating the bank's risk position. Since these liabilities are essentially option-type financial contracts, the powerful tools developed in finance theory for pricing options could be especially useful in their evaluation.

In discussing moral hazard risks, Professor Maisel states that "Among banks as a whole, the greatest risks and most common cause of failure are due to fraud, either internal or external, and to insider abuse." As one might expect, these moral hazard risks are more important among smaller banks, and therefore, they may not represent a serious threat to the banking system as a whole. Moreover, while it would be naive not to provide safeguards against such abuses, these abuses often violate the criminal code, and therefore, vigorous enforcement of this code may possibly provide the best protection. However, there is another, far more important, moral hazard problem which Professor Maisel discusses in the section titled "Fair Insurance Premia." Namely, by insuring the deposits, FDIC "induces" the banks to pursue more risky investment strategies. Maisel describes the problem in terms of the current system as "A flaw in the present system lies in the fact that banks may find it profitable to increase their risks, since there is only a slight relationship between risks and their costs of insurance. This can lead to a constant losing battle by regulators to force specific banks to reduce their risks."

To solve this problem, Maisel indicates that a system of variable rates would be feasible. While variable rates based upon differences in risk among banks is preferable to a uniform rate, variable rates alone will not solve the problem. If the rate is set on the basis of an *ex ante* assessment of the bank's risk, then there is still an incentive for the bank to "cheat" by following *ex post*, a more risky investment strategy. To deal with this issue, Maisel suggests that "Adjustments in ratings and charges could be made retrospectively to guard against major shifts in operations." The effectiveness of this method is of course an empirical issue, and it will certainly depend upon the frequency and care with which FDIC monitors the risk position of each bank. However, my belief is that such adjustments will not be adequate. Given the level of premiums currently charged by FDIC, even with some adjustment, the "cost" to a bank from pursuing a riskier investment strategy appears small. Indeed, if a bank "wins" on these riskier investments, then it would probably be more than happy to pay the additional assessment. If it "loses," then how does FDIC collect? While a definitive solution to this problem has not as yet been presented, one possible avenue for exploration would be to replace (or at least supplement) the current practice of annual charges with a large "front-end" entry fee for membership in FDIC. As I have shown elsewhere,[2] this type of charge will reduce (and under some conditions, eliminate) the "FDIC-induced" incentives for a bank to pursue a riskier investment strategy. Of course, like larger initial capital requirements, such charges would make entry into the banking industry more costly, and therefore, may have a negative effect on competition.

In summary, the Maisel paper does not resolve all the theoretical problems involved in bank regulation and deposit insurance. There certainly remain many practical difficulties in developing the "standardized" methods of evaluation and the necessary supporting data to implement the procedures recommended. How-

[2] See R.C. Merton, 1978, "On the Cost of Deposit Insurance When There Are Surveillance Costs," *Journal of Business* 51, pp. 439-452 and especially pages 447-450.

ever, these problems and difficulties can be solved, and I firmly believe that the lines suggested by Maisel are in the right direction toward a vastly improved system.

The Hammond and Shapiro paper on insurance regulation is more narrow in focus than the Maisel paper. Specifically, they concentrate on entry capital requirements for nonlife insurance companies, and their principal contribution is to provide empirical estimates of differences in risks among various insurance lines and to demonstrate the benefits of diversification in multiple-line activities. Their quantitative analyses permit an evaluation of the current "rule-of-thumb" practices in setting entry capital and suggest directions for change in entry capital requirement statutes. In their analysis of the appropriate entry capital requirement, they consider only the underwriting and operating expense risks and not the risks associated with the assets held by the insurance company. For many of the same reasons given in footnote five of their paper, it would appear that the risks of the assets held by fledgling insurance companies should be an integral part of the determination of entry capital. In particular, the relatively small size of new insurance companies' asset bases may make them especially vulnerable to significant risks from insufficient asset diversification.

On the whole, the empirical analysis presented is comprehensive and statistically proper. The use of a combined time series and cross-section analysis of the data is especially to be applauded. However, I have some concern with the use of the combined ratio for the purposes here even though it is the standard practice to use it as the measure of underwriting performance. For example, the authors find that smaller (and therefore, presumably newer) insurance companies have a much larger standard deviation of underwriting performance than do larger (and therefore, presumably more established) companies. It seems to this reader that it would be useful for regulatory purposes to know whether this higher variation was principally due to the expense ratio or the loss ratio. If it were the expense ratio, then do these results suggest greater variation in management skills available to the smaller companies? Or do they suggest that new companies tend to enter into the "tougher" part of the market where expenses are more uncertain? Or are these differences principally the result of accounting "biases" which differentially affect smaller, newer, or faster growing insurance companies but which tell us very little about the relative risks of default between small and large companies? If it were the loss ratio, then do these results suggest that the premiums charged by smaller firms are more variable? Or is it that smaller companies attract riskier customers even within the same insurance line?

By separating the two ratios, the authors can verify that a principal source of greater risk to smaller companies is the lack of diversification among customers within a product line. It is well known that for independent customers of about the same size, the variation in the loss experience should be roughly proportional to one-over-the square root of the number of customers. There is no strong reason to expect that expense ratios should similarly benefit from such customer diversification, and indeed, the expense ratio might even increase.

These comments and questions should not be interpreted as a negative report on the paper. Many of these questions may be answered in their cited

larger study or in the works of others. It is also clear that some of the data required to answer these questions may not be available. Moreover, the use of the combined ratio causes fewer problems for the purpose of distinguishing risk differences among insurance lines, and the analysis presented should be helpful to insurance regulators. However, on the specific regulatory issue of entry capital requirements, an expanded analysis of the risk characteristics of smaller insurance companies would seem to be in order.

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