

Safety and Soundness of Financial Intermediaries: Capital Requirements, Deposit Insurance, and Monetary Policy

More than two-thirds of the \$25 trillion of financial assets held in the United States is managed on behalf of investors by financial intermediaries, ranging from trusts, mutual funds, and mortgage pools to insurance companies, pension funds, and banks. Since the inception of financial markets in industrial economies, savers have entrusted much of their wealth to intermediaries that, in turn, finance the projects of investors. Because of their importance, governments have long regulated the activities of these intermediaries to ensure sound financial markets, a foundation of secure economic development. The form of this regulation has changed often over the centuries as intermediaries and financial markets have changed with economic conditions and the demands placed on them. Currently, regulators both here and abroad are considering reforms that not only might foster more efficient domestic financial markets but also might prepare the way for more equitable global markets.

The current discussions, like those past, engage views of financial markets that are often difficult to reconcile. Some, who believe that these markets potentially are relatively efficient, advocate minimal interference. Regulations that require more than the necessary disclosure of investments and risks might introduce burdens that exceed their benefits. Others, who believe that the prominence of intermediaries reflects the limits of savers' information, advocate regulations to insure the safety and soundness of intermediaries. At the very least, regulations may diminish the force of "credit cycles" and the threat of widespread insolvency among intermediaries.

The first section of this article considers the role of financial intermediaries within competitive financial markets wherein all investors view the prospects for each asset much the same. In these circumstances, the prices of assets and the allocation of resources do not depend greatly on the activities of intermediaries. Accordingly, the regulation of these intermediaries does not diminish the risks that fully informed investors

Richard W. Kopcke

Vice President and Economist, Federal Reserve Bank of Boston. Kathryn Cosgrove provided valuable research assistance.

are willing and able to assume. At worst, regulations such as mispriced deposit insurance or various taxes, which force intermediaries to price risk and returns differently than other investors, would influence the volume and form of intermediation, but they would little disturb the uniform pricing of assets and risks.

The second section reconsiders the role of financial intermediaries when not all investors are fully informed about the prospective returns on all assets. In this case, the activities of intermediaries can influence both the prices of assets and the volume of investment. Intermediaries that enjoy the confidence of savers foster more efficient financial markets by acquiring and managing proprietary information about assets that are not very familiar in public markets. Intermediaries' cost of funds rises with their leverage, in these circumstances, and this cost rises most slowly for those with the best reputations. If savers' confidence in intermediaries' investments varies with business conditions, financial institutions may be "fragile" and markets may be prone to occasional "crunches."

The third section discusses the role of regulation when not all investors are fully informed. When the cost of funds for intermediaries depends on savers' state of confidence, public policy can influence the risk premiums embedded in credit market yields by designing capital requirements, accounting rules, and liability insurance coverage in order to foster the prudent valuation of assets and the efficient flow of funds from savers to investors. Because the consequences of these regulations vary with economic conditions, the actions of regulators, like those of the monetary authority, may need to adjust with circumstances, so that they shift returns and risks during business cycles in ways that dampen, rather than exaggerate, attendant credit cycles. This section considers regulations that: (1) link intermediaries' requirements for capital to their investments in certain risky assets, (2) value intermediaries' assets according to prevailing prices of comparable assets, and (3) require intermediaries to undertake remedies promptly should their capital fall sufficiently to violate their requirements. Although these policies may tend to stabilize intermediaries, conserving the value of their capital when markets for their assets are liquid, these policies also can destabilize intermediaries and increase the risks inherent in investment when markets for their assets are illiquid.

The final section summarizes this article and discusses the consequences of regulation for monetary policy. At the very least, monetary policy must con-

sider the potential influence of regulations on the volume and timing of the flow of funds through financial markets in order to best attain its macroeconomic goals. Yet, regulation that affects the terms on which intermediaries are willing and able to make investments over the business cycle is a kind of monetary policy. If a common goal of both regulatory

The best regulation might be that which, taking into account the characteristics of financial markets, transmitted the actions of monetary policy with the fewest distortions and "head winds."

and monetary policy is to promote safe and sound financial markets, then the best regulation might be that which, taking into account the characteristics of financial markets, transmitted the actions of monetary policy with the fewest distortions and "head winds" through intermediaries to the decisions of savers and investors. These regulations, like monetary policy, might need to be sufficiently flexible to change with economic conditions.

I. Homogeneous Opinions and the Consequences of Regulation

Investors' demands for assets depend on their assessments of future returns on risky assets and their tolerances for bearing the risks inherent in these assets. If everyone possesses the same information about all assets and if everyone analyzes this information in similar ways, then all investors should assess the potential returns on all assets much the same. With this common understanding, all investors price the risks in every asset the same in competitive financial markets, despite any differences in their tolerances for bearing those risks. Securities or portfolios with certain returns are priced to yield the risk-free rate of interest. The expected yields for other portfolios exceed the risk-free rate to the degree the uncertainty in their returns cannot be reduced by diversification or hedging, because investors expect to be paid the market price for bearing risk (for example, Sharpe and

Alexander 1990). In these circumstances, savers and investors are indifferent about each intermediary's assumption of risk.

Regulations and taxes can introduce frictions that impede the uniform pricing of assets and of risks in this ideal model. Not all regulations entail such distortions, however. Conventions that require complete and timely financial statements from businesses and intermediaries, for example, tend to foster the uniform pricing of securities and risks. Furthermore, in the absence of other frictions, regulations that set standards for capital or leverage do not disturb the uniform pricing of assets even though these regulations may confine the investment strategies of financial intermediaries. But, risks and returns will not be priced uniformly when either investors or securities are taxed differently or "deposit insurance" premiums are not priced accurately. These differences, in conjunction with regulations fixing standards for the capital and leverage of financial intermediaries, cause financial intermediaries to value assets differently than other investors do, thereby fostering financial innovations, such as the use of derivatives, which allow the trading of risks and returns in ways that avoid the restrictions imposed by traditional regulations.

The Basic Role of Financial Intermediaries

Suppose that financial intermediation is frictionless, hampered by no special taxes, reserve requirements, proscriptions, or accounting inequities. If everyone is informed equally well about the potential returns on financial assets, then all financial intermediaries in competitive markets are essentially mutual funds that distinguish themselves by the additional options and services they offer their customers. Banks clear payments; insurers and pension plans write contingent claims; many write commitments to provide funds to their customers; all guarantee the principal and a fixed rate of return on some of their liabilities. Financial intermediaries also offer their customers investment services, not only by attending to the details of purchases, sales, and maintaining records but also by combining customers' funds so that all may invest in diversified portfolios of assets.

The expected yields on liabilities issued by financial intermediaries (including the implicit value of the services they offer their customers) should match the expected yields on portfolios of publicly traded securities bearing the same risk. Otherwise, customers would "unbundle" their purchases of financial services, favoring "low-balance" arrangements with

banks, insurers, and other intermediaries, in order to earn more competitive returns.¹ Traditional financial intermediaries, in principle, can be regarded as portfolios of services, each of which might be subcontracted to the most efficient suppliers, as long as the joint production of services yields negligible economies of scope (valuable externalities that vendors otherwise would be unable to capture).

Accounting conventions that dictate the way intermediaries report either their income or the value of their assets and liabilities, by themselves, alter neither the performance of investments nor the way fully

If everyone is informed equally well about the potential returns on financial assets, then all financial intermediaries in competitive markets are essentially mutual funds.

informed, like-minded investors assess these investments in competitive markets. Similarly, regulations that prevent financial intermediaries from holding particular assets or from issuing particular liabilities impose no significant tax on intermediaries. Consider an extreme restriction that requires a loan company to invest in only one type of asset, residential fixed-rate mortgages, for example. The expected returns on these mortgages compensate investors for the systematic risks inherent in these loans. To the loan company's shareholders, who are able to diversify their overall personal portfolios adequately, the title to the assets of the company is essentially as valuable as the mortgages themselves, and it is priced accordingly.

In the circumstances described above, financial intermediaries are not compelled to broaden their powers or engage in "financial innovations." Intermediaries might undertake these activities out of convenience, trading derivatives, for example, in order to fix

¹ Intermediaries might earn rents as a result of their efficiencies in managing funds or in providing other business services. Vendors increasingly are profiting from their comparative advantages by selling these services piecemeal. For example, some banks manage substantial custodial operations, some mutual funds and pension plans purchase administrative or insurance underwriting services for their pension, annuity, and employee benefit funds, and some investment advisors sell their services to funds sold by others.

the terms of future sales or reduce transactions costs by using one transaction to replace many. But, intermediaries cannot reduce their price of bearing risk through these strategies. Because the distribution of returns incorporated in all derivative contracts, which includes all liabilities of financial intermediaries, is defined by the distribution of returns on their underlying assets, fully informed investors price the risks inherent in all these derivatives according to the risks inherent in the underlying investments.

Risk and Leverage

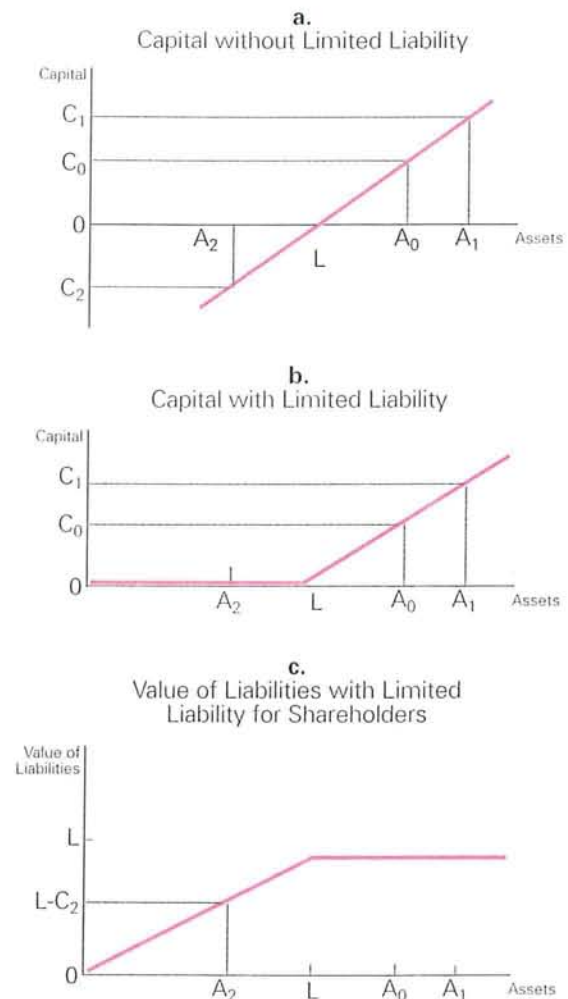
When everyone assesses the potential returns on each asset the same, the cost of funds for each financial intermediary depends on the risks inherent in its assets, not on the way it finances these assets. The returns required by an intermediary's shareholders and creditors vary with its leverage, because the division of these returns between shareholders and creditors also shifts with leverage. Nonetheless, the average cost of funds remains constant, other things equal, because those assuming more risk price it no differently than those shedding the risk.

If the liability of shareholders were not limited to their investment in an intermediary's stock or if intermediaries' investments in safe assets were at least as great as their debt, then shareholders would bear all of the risk inherent in the intermediary's assets. In these cases, the value of the intermediary's equity would change dollar-for-dollar with any change in the value of its assets (Figure 1a), while the value of the claims of its creditors would not change. For example, if the intermediary's assets of A_0 comprise liabilities to creditors of L and capital of C_0 , then as circumstances increase total assets to A_1 , the value of liabilities remains at L while capital increases to C_1 , and the value of equity also increases from C_0 to C_1 . Should the value of assets fall to A_2 , the capital of the intermediary and the value of its equity would fall to C_2 . If L exceeds the value of assets, shareholders would be obligated to pay creditors for this deficiency, $L - A$.

Because shareholders' liability is limited to their capital and intermediaries' investments in risky assets ordinarily exceed their capital, the previous example understates the risk borne by creditors and overstates that borne by shareholders. With the shield of limited liability (Figure 1b), shareholders' capital rises with the value of assets, but their position does not fall below zero when the value of assets fails to exceed creditors' claims against the intermediary. In this last

Figure 1

Capital With and Without Limited Liability

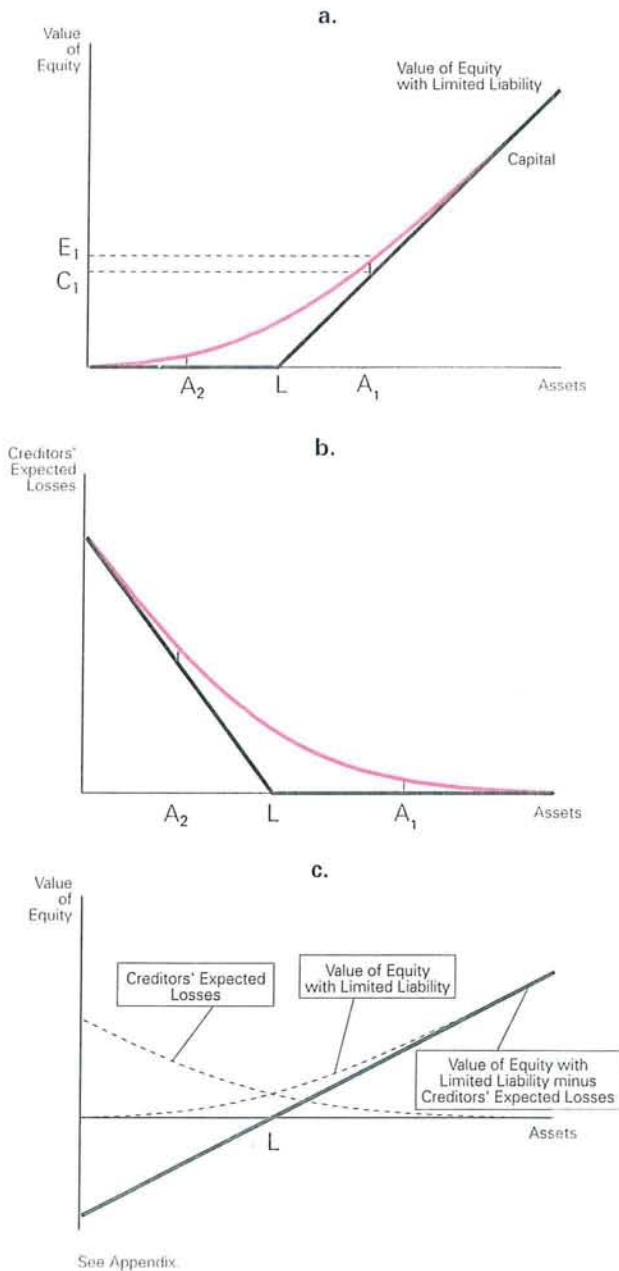


case, creditors would bear the losses as the value of their position falls with the value of the intermediary's assets (Figure 1c).

Limited liability confers both benefits and costs on shareholders. The benefit takes the form of a put option. The cost of this option is the premium that fully informed creditors require for accepting the risk entailed by this option. As the intermediary's assets approach L (Figure 2a), the value of this option to shareholders rises; the value of limited liability rises with the odds of insolvency. Accordingly, sharehold-

Figure 2

Value of Equity with Limited Liability



ers' equity—the sum of their capital and the value of their put option—exceeds zero, other things equal, even when the intermediary has little or no capital. As assets fall well below liabilities, the value of the shareholders' put option approaches $L - A$, because the failure of the intermediary essentially is a certainty.

Because the premium creditors require for accepting this put option equals the expected value of creditors' potential losses due to insolvency (Figure 2b), any benefit redounding to shareholders as a result of the shield of limited liability is offset exactly by the premium required by fully informed, like-minded creditors. The value of the shareholders' put option at A_1 (the vertical line in Figure 2a) equals the expected value of creditors' losses (the corresponding vertical line in 2b), and the value of the shareholders' put option at A_2 equals the expected value of creditors' losses in excess of $L - A_2$ (the vertical line in 2b). Accordingly, the value of equity, which is capital plus the value of the shareholders' put option less the premium the intermediary pays on behalf of creditors to compensate them for their expected losses, is identical to the value of the proprietors' stake in the absence of limited liability (Figures 2c and 1a). Shareholders' expected rate of return with the protection of limited liability, therefore, is the same as it would be without that protection. Similarly, the creditors' expected rate of return is the same in both examples. The weighted average of shareholders' and creditors' expected yields, consequently, remains equal to the expected return on assets.

In all cases, the cost of funds for intermediaries depends on investors' assessments of the returns on their assets, not their leverage. Investors essentially can tailor the leverage of an intermediary's investments to match their own tastes, but they cannot reshape the fundamental risks and returns inherent in the intermediary's assets (Modigliani and Miller 1958; Miller and Modigliani 1961). Although shareholders' expected returns rise when their intermediaries assume more risk, these greater returns compensate them no more generously than other investments. Consequently, investors who wish to bear more risk need not favor intermediaries that assume greater leverage; instead, these investors themselves may sell safe assets or borrow to purchase the shares of intermediaries in order to achieve the requisite risk. Likewise, investors who have relatively little taste for risk may purchase both the intermediary's debt and its equity to achieve their goals.

Voluntary Standards for Capital

In the frictionless circumstances examined above, the customers of financial intermediaries are indifferent about each intermediary's assumption of risk, but bankruptcy costs encourage the shareholders and managers of intermediaries to set minimum capital

requirements for themselves. When the capital of intermediaries becomes sufficiently low, the resolution of claims against their assets entails costs that reduce shareholders' and creditors' returns. Accordingly, intermediaries acting in the best interest of shareholders would maintain sufficient capital to ensure that bankruptcies are rare. These voluntary capital requirements ordinarily rise as intermediaries invest greater shares of their assets in risky securities.

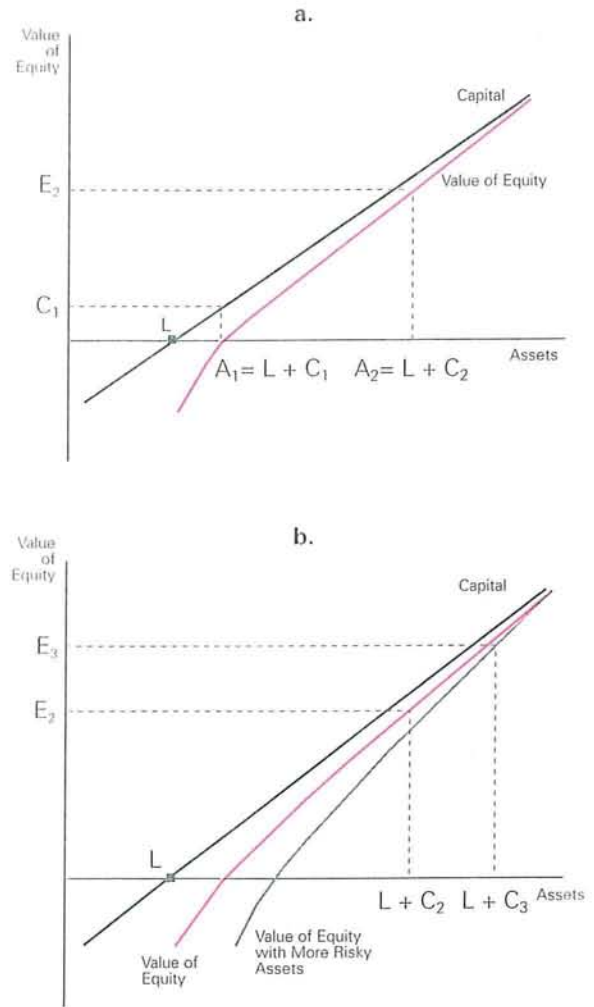
The cost of resolving claims when an intermediary becomes insolvent reduces the net returns from the intermediary's assets that can be divided between shareholders and creditors. Some of these costs are explicit, such as the fees of those who advise creditors and shareholders and the expense of negotiating claims. Regulators, moreover, may seize the assets of intermediaries that are nearly insolvent even though their capital is not exhausted.² Some costs are implicit, such as the interruption of careers or the diminished reputation of the owners and managers of insolvent intermediaries.

Because the threat of insolvency entails costs that are matched by no offsetting benefits, intermediaries would tend to manage their balance sheets to minimize the probability of insolvency. Inasmuch as fully informed creditors do not bear the expected costs arising from bankruptcies without receiving adequate compensation, the total risk premium that intermediaries incur on their liabilities is the sum of the premium entailed by shareholders' limited liability and the premium entailed by bankruptcy costs. The lower is an intermediary's capital, the greater are the probability of insolvency and the expected cost of insolvency (Figure 3a). If, for example, the value of an intermediary's assets is only A_1 , then the value of its equity would equal its capital, C_1 , in the absence of bankruptcy costs. But, in this illustration, expected bankruptcy costs are sufficiently great that the market value of the intermediary's equity is negligible—the premium for bankruptcy costs exhausts shareholders' returns. When capital is C_2 , the market value of equity also is nearly C_2 . Because both the probability of

² This policy of early intervention prevents the owners of intermediaries from increasing the value of their equity by assuming more risk once their capital becomes very low. Shareholders will not do so in this model principally because they may earn excess returns with no risk by adding more capital, as explained below. The assumption of more risk is most attractive when not all investors value the equity of the intermediary the same, as explained in section III.

Proposals that would impose penalties if intermediaries' losses in their trading portfolios exceeded some previously established "capital cushion" also would encourage intermediaries to set standards for their capital (Kupiec and O'Brien 1995).

Figure 3
Risk and the Value of Equity



bankruptcy and expected bankruptcy costs become negligible as capital increases, the premium for bankruptcy costs essentially becomes inconsequential, and the shareholders' expected rate of return is restored to the return they would earn on other equally risky investments.

Bankruptcy costs, therefore, encourage intermediaries to set and maintain minimum requirements for capital, requirements that increase with their investments in risky assets. In the previous illustration, if losses depress the intermediary's capital to C_1 , then by investing $C_2 - C_1$ in the intermediary, shareholders

increase their wealth by C_2 . This additional investment promises a return exceeding that available on other equally risky investments, an excess return equaling $C_1/(C_2 - C_1)$.³

This voluntary capital requirement rises as intermediaries invest a greater share of their portfolios in risky assets. Suppose C_2 represents the intermediary's minimum standard for capital for a specific mix of risky and riskless assets in its portfolio—with capital below C_2 , the value of its capital would be discounted too greatly in equity markets. Should the intermediary then place a greater share of its investments into risky assets, it would increase both its probability of insolvency and its expected bankruptcy costs at every value of C (Figure 3b). Accordingly, the value of its capital at C_2 would be discounted more greatly in equity markets, thereby requiring the intermediary to hold more capital than C_2 in order to maintain a relatively competitive rate of return for its shareholders.

Regulations limiting financial intermediaries' leverage and investments in risky assets do not affect the risks borne by their shareholders and creditors in competitive financial markets, because these regulations alter neither investors' perceptions of the risks and returns inherent in assets nor their ability to realize these risks and returns. Should regulations set capital requirements above intermediaries' voluntary standards, then those shareholders and creditors who wish to bear more risk may do so either by assuming greater leverage themselves or by shifting their other assets toward risky investments. More specific capital requirements that depend on intermediaries' investments in particular assets also entail no significant burdens. These requirements, other things equal, do not increase the intermediary's cost of funds, and, in this case too, shareholders could increase their own leverage and alter the composition of their other investments, if they so desired, in order to assume more risk than permitted by these capital requirements.

Liability Insurance and the Regulation of Capital and Assets

When the liabilities of intermediaries are insured, creditors no longer require risk premiums from intermediaries; instead, intermediaries pay these premiums to agencies guaranteeing intermediaries' debts. These insurance programs should not disrupt the efficient operation of competitive financial markets unless the premiums for insuring the liabilities of intermediaries are mispriced. A proper premium for

“deposit insurance” equals the expected value of creditors' potential losses due to a collapse of the value of the intermediary's assets—the premium creditors would require for the shareholders' put option if there were no deposit insurance (Merton 1977; Sharpe 1978; Buser, Chen, and Kane 1981; Kane 1995). This obligation may be covered by intermediaries' holding more capital, a fund held by the agency guaranteeing the liabilities, or an annual fee paid to the guarantor.⁴ Financial intermediaries are indifferent among these arrangements as long as each institution's expense in every case corresponds to its creditors' expected losses.⁵

Insurance programs should not disrupt the efficient operation of competitive financial markets unless the premiums for insuring the liabilities of intermediaries are mispriced.

Even if creditors could levy fair insurance premiums on their own, liability insurance can provide several economies to intermediaries and their customers. A guarantor can monitor intermediaries more economically than their many creditors. Moreover, because creditors holding long-term liabilities ordi-

³ In competitive markets, shareholders who invest $(C_2 - C_1)$ expect to receive assets whose value is the same. Here, by investing $(C_2 - C_1)$, they increase the value of their equity by C_2 , or C_1 more than offered by other investments.

⁴ Insurance funds are an additional capital cushion for insured intermediaries. The Federal Deposit Insurance Corporation maintains such a fund, but the states' guarantee covering policies issued by insurance companies is backed by a call against the capital and earnings of the insurance industry—the guaranty fund is invested in the capital of insurance companies. When the guarantor is a public agency some of this capital can be provided by taxpayers: Premiums that banks pay to the FDIC may be deducted from their taxable income and calls against insurers often may be declared as credits against state tax liabilities.

Although insurance rates for depository institutions nominally vary with their supervisors' rating of their risks, the effective premiums are set according to rules that might not be sufficiently flexible to represent properly each institution's expected losses (Spong 1994, pp. 117–8).

⁵ Intermediaries would be indifferent between holding more capital and accumulating a reserve held by its guarantors, provided each intermediary is credited with a competitive rate of return on its reserve (much like the structure of a cash-value life insurance policy). This is not the case for an undifferentiated fund, such as that of the FDIC.

narily must insure themselves against all future risks that an intermediary might assume, issuing these liabilities would be prohibitively expensive for those intermediaries that have no intention of assuming substantial risks in the future, unless intermediaries can insure this intention.⁶ Guarantors that levy flexible insurance premiums over the duration of long-term, fixed-rate liabilities give intermediaries the opportunity to issue such liabilities at appropriate rates of interest.

Liability insurance premiums need not be explicit. Guarantors may effectively exact a fair premium, for example, by holding a call option against intermediaries' assets (Kane 1986; Pennachi 1987): When the value of an intermediary's assets is sufficiently low relative to its liabilities, the guarantor may either impose formal agreements on its management or seize its assets. The implicit remuneration that guarantors receive in the form of this call option compensates them for their liability insurance. With the prompt enforcement of standards for the capital of intermediaries, guarantors would require no other insurance premium, because they seldom would experience underwriting losses, provided markets for intermediaries' assets and liabilities were efficient.

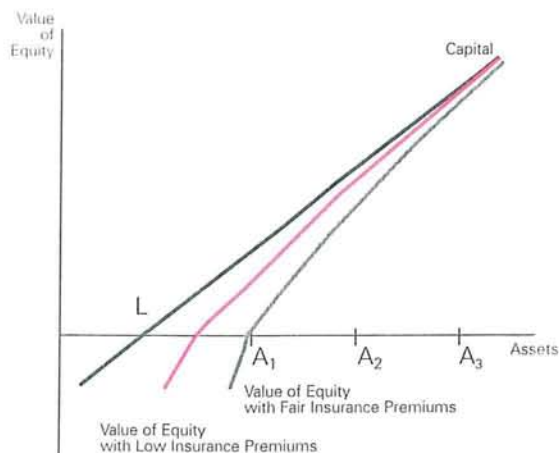
The mispricing of insurance for the value of intermediaries' liabilities essentially causes the price of bearing risk for the intermediary to diverge from the market price. If a guarantor were to assess premiums that were less than creditors' expected losses, the guarantor would artificially lower the price of bearing risk to intermediaries and their shareholders. This would be analogous to creditors' charging an intermediary a premium insufficient to cover their losses (Figure 2b). At a point such as A_1 , an insufficient insurance premium would not alter the value of the shareholders' put option, but it would reduce the amount shareholders effectively pay creditors for this option. In this case, the intermediary's shareholders would earn a rent which increases the value of their equity (Figure 4). This rent would be greatest when,

⁶ Even in this frictionless model, policies that require intermediaries to issue subordinated debt in order to establish a "capital cushion" sufficient to guarantee the claims of more senior creditors would impose too great a premium for this insurance. Intermediaries' cost of funds would rise as they finance more of their assets with longer-term, fixed-rate debt.

Liability insurance is not essential for intermediaries to issue longer-term liabilities. By issuing short-term liabilities and buying a longer-term interest-rate swap, agreeing to pay fixed and receive floating, an intermediary essentially can issue longer-term debt, while granting creditors the ability to adjust the yields on the intermediary's liabilities as necessary to correspond to its risks.

Figure 4

Effect of Liability Insurance on the Value of Equity



other things equal, capital is lowest for any given insurance premium (A_1 versus A_2). Accordingly, the line representing the value of equity would shift upward (to a degree that diminishes with the magnitude of capital), and, when the insurance premium is sufficiently low compared to bankruptcy costs, the value of equity could exceed the value of the intermediary's capital. To exploit this rent, intermediaries would increase both their insured liabilities and their holdings of risky assets per dollar of capital. If, for example, the intermediary wished to maintain capital of C_3 (point A_3) with fairly priced insurance, it might reduce its capital to C_2 (point A_2) if premiums were sufficiently cheap. Whereas low premiums encourage the taking of risks, excessive insurance premiums would discourage intermediaries from offering insured liabilities with yields as high as the risk-free rate of interest, thereby rendering these accounts unattractive to investors.

Taxes

Taxes interfere with the efficient operation of financial markets by altering investors' assessments of the effective returns and risks available on various investments. When investors or assets are not taxed the same, financial markets ordinarily fail to price risks and returns uniformly. Some taxes, such as

corporate income taxes or reserve requirements, impose extraordinary expenses on certain financial intermediaries. Unless these expenses are mitigated in other ways, the net burden of tax liabilities favors intermediaries organized as mutual funds over other financial intermediaries. Shareholders of intermediaries with the greatest tax burdens withdraw their equity from the holding of portfolios of assets in order to emphasize, instead, the provision of financial services, including the origination of securities.

Taxes interfere with the efficient operation of financial markets by altering investors' assessments of the effective returns and risks available on various investments.

Financial intermediaries pay both explicit and implicit taxes. The return to equity for intermediaries is generally taxed as corporate income, except for the returns to the equity in qualified mutual funds. Other taxes are less explicit; banks, for example, must invest some of their assets in reserves on which they earn no return, as dictated by reserve requirements against checkable deposits. Compliance with regulation also imposes "taxes" on intermediaries. These tax liabilities diminish an intermediary's net return on assets, which prevents it from offering competitive returns to its shareholders, provided fully informed creditors expect to receive a competitive rate of return on the intermediary's liabilities and these creditors receive no compensating benefits, such as lower personal income taxes on the income they derive from these liabilities (for example annuities, retirement accounts, or insurance policies). Rather than purchasing the shares of a taxed intermediary, savers would earn greater returns by purchasing a levered portfolio of assets matching that of the intermediary, thereby avoiding the need to pay the intermediary's taxes. Accordingly, the burden of these taxes tends to reduce the value of equity of intermediaries (the value of equity in Figure 4, for example, shifts down by an amount reflecting this tax burden at each value for capital).

Unless the burdens of intermediaries' taxes are offset by other considerations, the weight of these liabilities encourages banks, life insurance companies, and other intermediaries to recast their accounts as

shares in mutual funds that also offer other financial services. Bankers and insurers, for example, promote contracts invested in accounts separate from their general account, wherein creditors essentially become shareholders in mutual funds offered by these companies. Without resorting to the strategy of offering their customers mutual funds, intermediaries do derive some relief from the burden of corporate income taxation as a result of provisions in the personal income tax laws. People who hold permanent insurance policies, individual retirement accounts, and annuities generally pay no current taxes on the income that accrues on these investments, thereby relieving intermediaries from having to pay returns on these accounts that fully match the returns on alternative investments on which savers must pay current income taxes. Even with this concession, however, an insurance company selling tax-deferred annuities against its general account cannot offer its creditors and stockholders net returns matching those of a mutual fund that offers the same products because, other things equal, the insurance company's general account, unlike the mutual fund, incurs the added expense of a corporate income tax liability.

II. Heterogeneous Opinions

When investors are not informed equally well, or, for other reasons, investors do not agree about the potential returns on assets, the activities of financial intermediaries influence both the prices of assets and the volume of investment (Gurley and Shaw 1955, 1956, 1960; Tobin 1963; Carosso 1970; Baskin 1988). Financial intermediaries, in principle, foster efficient financial markets by acquiring and managing proprietary information about assets that are not very familiar to other investors. But the ability of intermediaries to cultivate and harvest the fruits of this knowledge depends on the confidence that others invest in the intermediaries themselves. An intermediary's cost of funds, in these circumstances, rises with its leverage, and this cost rises most slowly for those with the best reputations. Because confidence in intermediaries' investments tends to vary with business conditions, financial markets may be prone to credit cycles as the cost of funds rises and falls for intermediaries. If, during the course of these cycles, outsiders become especially skeptical of the value of intermediaries' investments, then this loss of confidence undermines the security of both intermediaries and financial markets.

Public and Proprietary Assets

Consider the simple case wherein financial markets comprise two types of asset. Assets of the first type attract many analysts; consequently, most investors often hold very similar assessments of the returns on these assets, and they tend to trade in broad, deep, and resilient public markets.⁷ The second type comprises assets that are not familiar to many investors; accordingly, opinions about these assets generally diverge, their markets are not dependable, and their prices can be very volatile. The valuation of these less familiar assets depends on the role of financial intermediaries, who expect to profit from their proprietary information by purchasing assets that, in their opinion, are valued too cheaply in public markets.⁸ Other investors may not value these assets very greatly because, for want of sufficient information, they may overestimate the risks inherent in these assets and, at times, they might underestimate potential returns.

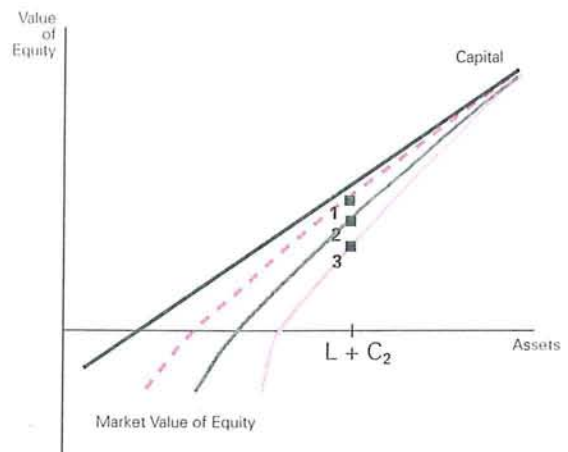
Loans from banks or finance companies, private placements, venture capital investments, and many over-the-counter securities are traditional examples of assets that do not enjoy a broad public following. A loan to a manufacturing company that has little access to public financial markets commits the lender to the company until the manufacturer may repay the loan with its own resources or offer securities to other lenders at attractive prices. Similarly, the lender may not be able to sell its loan to others without making substantial concessions, unless other investors also are familiar with the company and are at least as optimistic about its prospects. Without an informed lender, a prohibitively high cost of capital may confront the manufacturer; whereas a private arrangement, with a lender possessing proprietary information that is reinforced by frequent reports from the company, diligent oversight of the company, and some influence

⁷ Many listed securities may not trade in efficient markets. According to IBES, many equities fail to attract the consistent attention of very many analysts. The earnings-price ratios for stocks tend to be sufficiently high to entail a puzzlingly high cost of equity (Abel 1991). Corporations, especially those with the best ratings, seldom raise funds by issuing new equity (Myers and Majluf 1984), and the correspondence between investment spending and cash flow is surprisingly strong (Kopcke 1993). The volatility of assets' returns seems to be very sensitive to recent "surprises" (for example, GARCH models). Closed-end mutual funds frequently sell at significant, variable discounts from their net asset values. And, some contend that simple trading rules yield excess returns (for example each January buy the 10 stocks in Dow Jones Industrials that have the lowest price-earnings ratios).

⁸ This proprietary knowledge is not necessarily shared equally among all insiders and does not always entail a more accurate view (Simons and Cross 1991).

Figure 5

Effect of Misvaluation of Proprietary Assets on Equity



over the company's decisions when necessary may reduce the cost of funds considerably for the manufacturer, even after considering any administrative impositions entailed by the loan. In this respect financial intermediaries can promote both the efficiency of financial markets and capital formation by reducing the bid-ask spread on securities that are not very familiar to most investors.

Public Confidence and the Value of an Intermediary's Equity

The capacity of any intermediary to apply its proprietary information depends on other investors' confidence in the management of the intermediary. Suppose an intermediary acquires an asset whose risks appear greater to investors outside the intermediary than to specialists within the intermediary, so that the intermediary's private valuation exceeds the public valuation of the asset (Figure 5). Before the purchase of the asset, the value of the intermediary's equity in public markets corresponds to point 1 (matching point 2 in Figure 3). After the purchase of the asset, outside investors perceive that the intermediary has assumed more risk, so even if outsiders believed the intermediary were being compensated

fairly for its assumption of this additional risk, the line representing the value of equity shifts downward, reflecting the increased odds of bankruptcy. The value of equity in this case would fall to point 2. However, when the intermediary acquires the asset for a price exceeding its public valuation, outsiders also believe

The capacity of any intermediary to apply its proprietary information depends on other investors' confidence in the management of the intermediary.

that the intermediary is assuming this additional risk without receiving a sufficiently great expected return. Accordingly, the value of the intermediary's equity in public markets falls to point 3. Similarly, outside analysts who mark the intermediary's assets according to their valuation in public markets find that their measure of its capital falls by the distance between points 2 and 3, which represents the amount that the intermediary apparently overpaid for the asset.

Of course, the managers of the intermediary acquiring the asset take exception to these discounts. Because they believe the risk inherent in the asset is less than other investors believe it to be, and because they believe the asset's expected return is sufficient to compensate them for the asset's risk, in their opinion the dashed line representing the market value of equity should not fall as low as the line passing through point 2. In fact, to the degree the price they pay for the asset does not fully reflect their private valuation, the intermediary is earning a rent; therefore, in the opinion of its managers, the market value of its equity should be closer to, and may even exceed, that indicated by point 1.

The risk premium required of the intermediary by outsiders limits the ability of intermediaries to "arbitrage" the bid-ask spreads prevailing on securities that are not very familiar to most investors. The managers of financial intermediaries may proceed with their investments expecting that the resulting excess returns will compensate them for having to pay greater yields on their liabilities, but the need to cover

the higher cost of these liabilities, other things equal, warrants higher returns from their proprietary investments. Higher prices attract fewer takers. Furthermore, sufficiently large differences between the book value of an intermediary's assets and outside analysts' valuations of these assets threatens management's freedom to make its own decisions.

The value of equity does not necessarily fall for all intermediaries that purchase assets that are not familiar to other investors. Investors often accept the judgments of those intermediaries with a history of earning of attractive returns, those with strong reputations for making astute investments, for managing risky investments, and for not investing too greatly in illiquid assets. Managers deserving this confidence earn returns that, on average, exceed those available on other assets of similar risk that are traded in public markets. The value of equity for intermediaries with secure reputations tends to exceed their capital to the degree their shareholders anticipate that they will continue to earn rents.

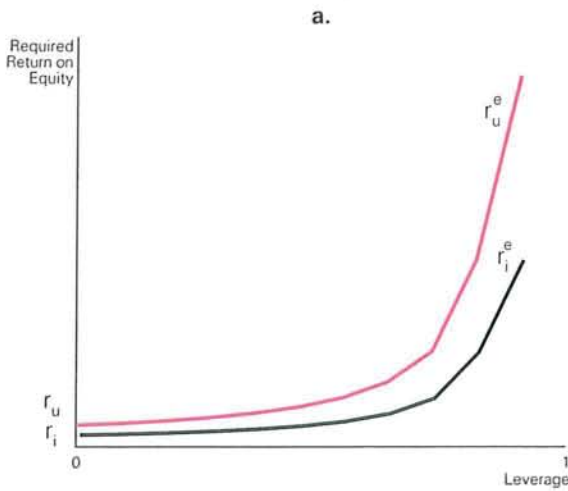
Leverage and the Cost of Funds

If shareholders are more confident or optimistic than creditors about the investments of a financial intermediary, the intermediary's cost of funds rises with its leverage, thereby inducing its management to set minimal standards for the intermediary's capital per dollar of risky assets. Other things equal, these voluntary capital requirements increase when investors become more wary of an intermediary's prospects or the difference between an intermediary's expected return on assets and its cost of funds diminishes. In these cases, management may meet its rising standards by acquiring more capital or by diminishing the share of its portfolio invested in proprietary assets, whichever course seems most economical.

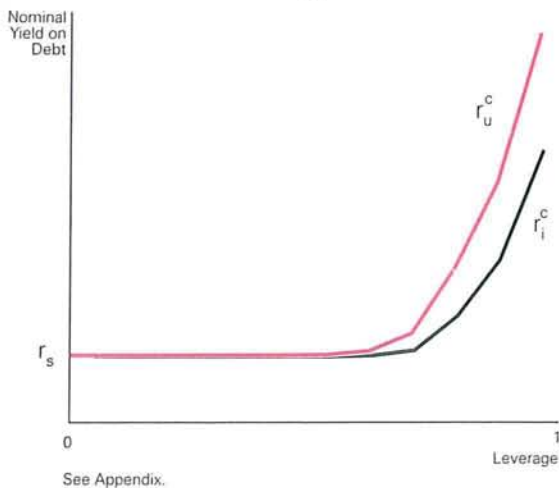
The cost of funds for intermediaries depends on marginal investors' views of their assets. Suppose investors are either informed or uninformed about the prospective return on an intermediary's assets. If the intermediary raises funds only from informed investors to finance a given portfolio of assets, its cost of funds is r_i regardless of its choice of leverage because the investors' assessments of the returns on this portfolio do not depend on the manner in which it is financed. Uninformed investors, on the other hand, require a greater return, r_u , because they anticipate more risk. For any given degree of leverage, uninformed investors require a greater return on both their debt and equity than do informed investors, but this

Figure 6

The Cost of Funds



b.

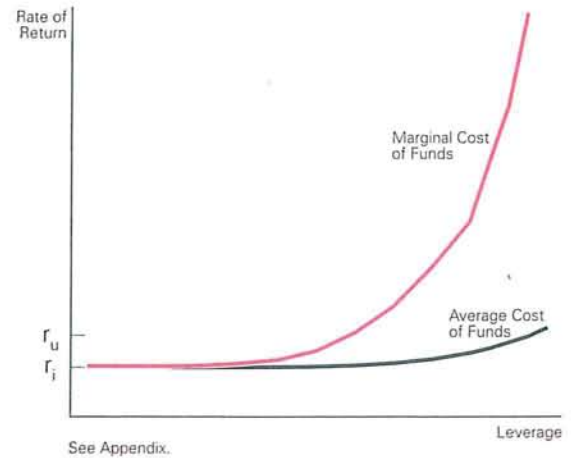


difference in required yields is greatest for equities (Figure 6).⁹

If an intermediary issues liabilities to uninformed as well as informed investors, informed investors would tend to own the equity of the intermediary, and uninformed investors would tend to own its debt. If the intermediary, after having exhausted the resources of informed investors, were to offer both debt and

Figure 7

Leverage and the Cost of Funds



equity to raise new funds, it would offer these securities at higher yields than formerly to attract uninformed investors. Informed investors would perceive the price of new debt and equity to be comparatively low, but equities would offer the better bargain. Accordingly, informed investors holding the debt of the intermediary would exchange their securities for equities, outbidding uninformed investors. After the available resources of informed investors were invested entirely in equities, the intermediary would achieve its lowest cost of funds by issuing only debt instruments to uninformed investors to raise more funds. In these circumstances, the intermediary's cost of funds rises as it expands and increases its leverage (Figure 7).¹⁰ Because each new dollar of debt raises the rate of interest that the intermediary pays on all of its debt, the marginal cost of these funds exceeds the average cost of funds. If the intermediary were to issue both new equity and debt to uninformed investors, its average cost of funds would rise abruptly, and, with this sale of equity, its marginal cost of funds, especially in the opinion of shareholders, would rise even more abruptly.¹¹

¹⁰ Once leverage becomes too great, the intermediary, in principle, might minimize its average cost of funds by issuing new equity, but doing so entails substantial capital losses for existing shareholders. Accordingly, the institution's voluntary standards for capital ought to limit leverage, in order to avoid the potential expense of having to issue new equity.

¹¹ The prices of both equity and debt in competitive markets would be set by the uninformed investors, who, in this case, would

Because investors' opinions of an intermediary's prospects generally span the spectrum of optimism, price-discriminating intermediaries minimize their cost of funds by issuing many different types of liabilities that offer many different blends of expected returns and risks. Their equity is held by the most optimistic investors, while preferred stock, debentures, notes, paper, investment contracts, deposits, and repurchase agreements are held by others who value an increasing degree of security. Retained cash flow (representing the implicit investment of funds by the most optimistic investors) and rights issues remain the least expensive source of funds (Duesenberry 1958; Myers 1984; Myers and Majluf 1984; Harris and Raviv 1991).

Bankruptcy costs reinforce the tendency for the cost of funds to rise with leverage, once leverage becomes sufficiently great. The markets for intermediaries' proprietary assets are not very liquid, especially when the primary specialists in these assets, as a result of their own financial duress, no longer are investing actively. Accordingly, when investors are not informed equally well about the assets acquired by financial intermediaries, the potential cost arising from the bankruptcy of an intermediary can greatly exceed those presented in section I, as a result of the new owners' need to manage unfamiliar proprietary assets or to sell these assets in illiquid markets to other wary investors. The expense of insuring creditors against this cost of bankruptcy becomes substantial after an intermediary's capital per dollar of risky assets falls sufficiently low, thereby raising the odds of bankruptcy. In this case, issuing new equity, even to relatively wary investors, is more economical than issuing new debt.¹²

Voluntary Standards for Capital

The optimal choice of leverage balances an intermediary's cost of funds against its assessment of the prospective return on its potential investments. For example, the management of an intermediary could expand its investments until its marginal return on assets equals its marginal cost of funds. Although managers might believe that outsiders impose too great a hurdle rate given the risks (as the managers perceive them) inherent in their assets, if the expected

marginal return on assets were less than the marginal cost of funds, the value of the intermediary's equity would diminish with any further expansion of its portfolio.

Those intermediaries with the best reputations and, therefore, the lowest cost of funds would be able to expand and to lever themselves the most. A good reputation reduces an intermediary's marginal cost of funds in two ways. First, investors require lower returns on the intermediary's liabilities. Second, as the intermediary expands, the least optimistic investors do not require returns very much greater than the most optimistic investors.

Suppose two intermediaries expect yields of 10 percent on their proprietary assets, and insiders require a constant average cost of funds of 4 percent, regardless of leverage. If these intermediaries could rely solely on insiders for their financing, their marginal cost of funds would be a constant 4 percent. The

The optimal choice of leverage balances an intermediary's cost of funds against its assessment of the prospective return on its potential investments.

ample investment opportunities for both, however, compel them to sell debt to outsiders. The good reputation of the first intermediary among outsiders allows it to raise \$10 million of debt at no premium over the yield required by insiders on their debt, \$20 million of debt at a premium of 1 percentage point, \$30 million at a premium of 2 percentage points, and so forth. The weaker reputation of the second allows it to raise \$10 million at no premium, \$20 million at a premium of 2 percentage points, and so forth. The marginal cost of funds for the first intermediary is 4 percent for the first \$10 million of debt that it issues. For the next \$10 million the marginal cost of funds rises to 6 percent: The second \$10 million not only costs a premium of 1 percentage point itself, but it also raises the premium on the first \$10 million from zero

¹² The intermediary could reduce the cost of raising new capital somewhat by issuing different classes of equity or other liabilities (such as subordinated debt) that might: (1) be recognized as capital by senior creditors and supervisors, and (2) offer new investors more security than common stock.

be the marginal investors. New equity sold at a discount sufficient to attract uninformed investors (especially when the reputation of the intermediary is questionable) would impose substantial losses on previous shareholders.

to 1 percentage point. The marginal cost of funds rises to 10 percent with \$40 million of debt: the last \$10 million requires a premium of 3 percentage points itself, and it raises the premium on the previous \$30 million by 1 percentage point, which adds another 3 percentage points to the cost of the last \$10 million. The second intermediary issues no more than \$20 million of debt; otherwise, its marginal cost of funds would exceed 10 percent. This intermediary can diminish, but not entirely avoid, the burden of its handicap by issuing different liabilities to different investors.¹³

An intermediary that suffers a loss of reputation may cope either by diminishing its investments in proprietary assets or by issuing new equity. The former is frequently the most economical course. If the marginal cost of debt is too expensive, equity is not likely to be a bargain, because a loss of confidence increases the cost of equity more than that of debt. If the intermediary sold those assets that are most familiar to outside investors, it would only increase its marginal cost of funds as the proportion of its liabilities backed by questionable proprietary assets increased. If, however, outsiders discounted the value of proprietary assets too greatly, so that selling these assets entailed substantial losses and the intermediary's capital were sufficiently low to raise the risk of bankruptcy, management would need to issue new equity.¹⁴

Financial Fragility, Credit Crunches, and Systemic Risk

The financial system becomes more fragile as public investors who formerly accepted intermediaries' valuations of their proprietary assets become skeptical of those valuations.¹⁵ Even the best investors ultimately suffer runs of bad luck wherein too many investments yield disappointing returns for too long, encouraging outsiders to question whether the returns are adequate for the risks inherent in these proprietary investments. Intermediaries that expect to earn greater rents by not paying their "full price" to obtain their proprietary investments, retain more "capital" for protection against the consequences of disappointing returns. A bad run would diminish, but not necessarily eliminate, the value of an intermediary's equity relative to that of its capital (the value of equity would tend to remain above point 1 in Figure 5). If the desire to meet or beat the competition causes an intermediary to bid full price for its proprietary assets, it retains less capital in the form of expected rents, putting the

value of its equity at greater risk should it experience a run of disappointing earnings (the value of equity could approach point 3 in Figure 5).¹⁶

A loss of confidence creates a credit crunch, as the cost of funds for affected financial intermediaries rises compared to yields prevailing in public markets.

A loss of confidence creates a credit crunch, as the cost of funds for affected financial intermediaries rises compared to yields prevailing in public markets.

When outsiders discount the value of an intermediary's proprietary assets, the value of its equity falls, as creditors require greater risk premiums. Intermediaries respond by reducing their leverage and their investments in assets for which managements' and outsiders' assessments diverge the most. In turn, the cost of funds rises sharply for businesses and consumers who depend on this intermediary for their financing (Gurley and Shaw 1955, 1956, 1960; Tobin

¹³ This example illustrates why differences between yields on private debt and Treasury debt might not indicate consistently the magnitude of credit crunches, and it suggests that changes in these differences may reflect more than changes in monetary policy. Suppose the cost of funds for the first intermediary rose to match that of the second intermediary owing to a sequence of disappointing earnings or growing fears of such disappointments. In this case, the intermediary would reduce its investments and diminish its leverage; yet, after this adjustment, the average cost of its debt in public markets would not rise, but fall—its average premium on debt drops from 3 to 2 percentage points. If a tighter monetary policy (higher safe rates of interest) accompanied the shift in confidence, the intermediary's yield on debt would fall less than indicated above or might even rise; nonetheless, any change in quality spreads would reflect the changing assessments of both insiders and outsiders. Ironically, the more skeptical outsiders become, the greater is the ensuing credit crunch, and the less quality spreads may rise as intermediaries reduce both their leverage and their investing in proprietary assets.

¹⁴ The value of shares should fall well before the public offering, as existing shareholders who anticipate this need to issue new equity and who hope to limit their losses might sell their shares to outsiders. Therefore, intermediaries' voluntary capital standards should become binding well before the need to issue equity to outsiders becomes very great.

¹⁵ The recent experiences of banks in Texas, New England, and Japan may illustrate such crunches (Furlong 1992; Peek and Rosengren 1995a; Bizer 1993; Bernanke and Lown 1991; Berger and Udell 1994; Hancock, Laing, and Wilcox 1995).

¹⁶ Those whose bids reflect their full valuation of an asset, "will, in the long run, be taken for a cleaning" (Capen, Clapp, and Campbell 1971). See also Thaler (1988).

1963; Bernanke and Gertler 1987). This crunch is most severe for intermediaries that hold the least capital per dollar of assets and those that retain less rent when purchasing proprietary assets. Intermediaries for which these resources are most ample are best able to adjust in a timely manner, perhaps postponing shrinking until their reputation is restored.

The rent embedded in the yields on intermediaries' proprietary investments can be considered a premium for insuring access to funds for their customers at reasonable terms. The need for this insurance is not compelling when public confidence in the management of financial intermediaries is strong. Accordingly, when all are optimistic, competitive pressures among intermediaries placing funds and customers seeking funds may diminish the writing of this insurance against credit crunches; borrowers want the best yield, and lenders want the volume. In these circumstances, any attenuation of public faith in intermediaries threatens a greater degree of financial fragility and more severe crunches (Sharpe 1990; Slovin, Shuska, and Polonchek 1993; Gibson 1995).

Systemic risk arises when the value of assets falls well short of expectations at many financial intermediaries at nearly the same time. Of course, the failure of one intermediary to meet its obligations may start a chain reaction if many intermediaries invest very greatly in each other's liabilities. But the ties need not be so explicit. For example, the failure of one bank might kindle duress at others if all had taken similar risks by investing a considerable proportion of their assets in loans to similar borrowers or similar industries. The potential for systemic risk increases when the need to establish strong reputations or accumulate capital encourages intermediaries to emulate winners, impelling all to report returns matching those of their most successful competitors. Systemic risk diminishes as intermediaries invest in more diverse assets and maintain adequate profit margins on their investments.

III. Heterogeneous Opinions and the Consequences of Regulation

According to the analysis of section I, when all investors assess the potential returns on all assets the same and when capital markets are competitive, regulations that govern the risks and leverage assumed by financial intermediaries are of little consequence unless they alter the net yields on assets through taxes, reserve requirements, or mispriced insurance fees. If,

however, investors are not equally well informed about the prospective returns on all assets, the terms on which financial intermediaries are able to issue their liabilities or acquire assets depend considerably on the regulations governing their financial structure.

Regulations that in some circumstances seem prudent and conservative do not necessarily promote safe and sound financial institutions or economic stability if, in other circumstances, they diminish the capacity of intermediaries to absorb financial shocks.

Regulations that in some circumstances seem prudent and conservative do not necessarily promote safe and sound financial institutions or economic stability if, in other circumstances, they diminish the capacity of intermediaries to absorb financial shocks.

Regulations such as capital requirements influence the cost of funds for intermediaries, and the burden of these requirements can vary substantially with outsiders' state of confidence. Although the conflation of fixed capital requirements with the marking of assets according to their market values promotes secure intermediaries when all investors possess the same information about intermediaries' assets, these policies can increase the volatility of intermediaries' cost of funds when outsiders are not informed fully about the prospects for intermediaries' proprietary assets. Because regulations affect the price of risk in financial markets and because this influence varies with economic conditions, the most promising regulatory policies seemingly would stabilize financial markets best by managing the price of risk in order to foster an appropriate flow of savings and investment, rather than by attempting to set absolute standards in order to judge the safety and soundness of intermediaries.

Capital Requirements

When investors are not informed equally well or, for other reasons, perceive the returns of intermediar-

ies' assets differently, the setting of minimum standards for the capital of intermediaries must balance the potential benefit of safer financial institutions against the cost of more expensive funds for those who rely on intermediaries for their financing.

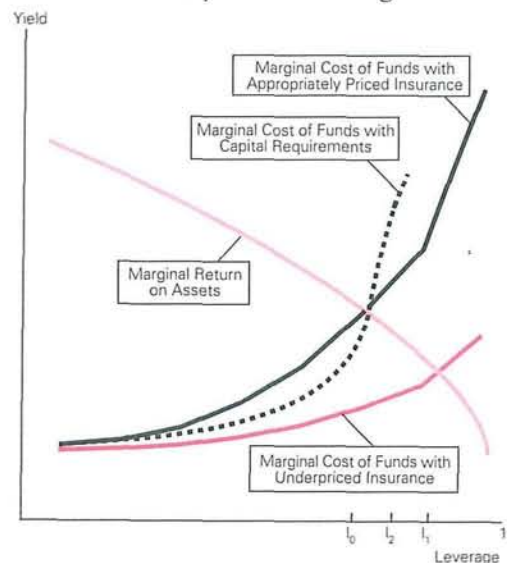
The potential benefits of regulating standards for capital are small unless creditors underestimate the risks assumed by financial intermediaries. If creditors require a premium that is too great, intermediaries restrict their purchases of assets more than necessary because of their greater cost of funds. Altering capital requirements alone would not alleviate such a credit crunch. If creditors require a premium that is too small for the risks they bear, intermediaries would expand more than otherwise. These circumstances may arise when creditors expect governments or others to indemnify them should their intermediary fail and when those who purportedly write this put option receive an insufficient premium from the intermediary to cover this liability. For example, if investors believed that the government regarded certain banks or insurance companies as too important to fail, then these institutions' uninsured creditors would not require adequate risk premiums of these intermediaries.

Capital requirements may limit the risks that intermediaries transfer to others, but, in principle, these requirements must be flexible if they are to substitute for fair risk premiums. Proper capital requirements should induce intermediaries to assume the degree of leverage that they would have assumed if creditors and their guarantors required properly priced risk premiums (Figure 8). Suppose that, in the opinion of fully informed investors who bear the full risk of their investments, the marginal cost of funds equals the marginal return on assets when an intermediary's leverage is l_0 . If, however, creditors do not require adequate risk premiums, the marginal cost of funds falls (the dashed line), and leverage rises to l_1 .

When capital requirements compel intermediaries to switch from debt to equity financing before they reach their voluntary standards for minimum capitalization, these requirements increase intermediaries' cost of funds substantially. Should regulators require that leverage not exceed l_2 , an intermediary's cost of funds would rise (the dotted line), thereby inducing it to maintain leverage nearer l_0 . The cost of funds rises sharply before reaching l_2 as the odds of having to raise more equity increase when l approaches l_2 . The more steeply the cost of funds rises near l_2 (due to the added expense of equity financing), the closer l_2 should be to l_1 in order to achieve leverage very near l_0 . The choice of l_2 presumes both that regulators

Figure 8

Capital Requirements, the Cost of Funds, and Optimal Leverage



understand that the appropriate leverage is l_0 and that they know how greatly the cost of funds rises with the switch from debt to equity financing. In order to maintain an appropriate flow of funds on proper terms, capital requirements should change as both the returns and risks inherent in an intermediary's proprietary investments change, as the "subsidy" implicit in the returns required by creditors changes, and as the "premium" for selling equity to outsiders changes.

Fixed capital requirements tend to exaggerate the credit cycles that arise as the opinions of outside investors vary from optimism to pessimism during business cycles (Blum and Hellwig 1995). At times when outsiders are particularly optimistic about the earnings of intermediaries, fixed capital requirements would entail a comparatively low cost of funds, encouraging intermediaries to expand comparatively rapidly when the prospects for the economy are attractive. At times when outsiders are particularly skeptical, requirements would impose a comparatively great cost of funds on intermediaries and their proprietary investments, thereby increasing the magnitude of credit crunches when the outlook deteriorates.

Adjusting capital requirements or the powers of intermediaries seems to be an awkward means of regulating intermediaries' risk. When savers are too

optimistic about the returns that will redound to intermediaries, greater minimum capital requirements might prevent insufficient risk premiums from inciting speculative booms. Perhaps requirements might be raised most for the "riskiest" assets, those riding the greatest bubbles. Conversely, capital requirements might be reduced when savers are too pessimistic. Yet, this policy depends on regulators' ability to recognize bubbles before others and to enforce new capital requirements. In any case, requiring intermediaries to raise more capital when outsiders are most willing to acquire their shares at high prices would seem to be a weak deterrent to speculative booms, and requiring less capital when savers are most concerned about the security of intermediaries' liabilities would seem to be a weak spur to confidence. The countercyclical adjustment of intermediaries' powers for making certain investments would pose similar problems.

Fixed capital requirements tend to exaggerate the credit cycles that arise as the opinions of outside investors vary from optimism to pessimism during business cycles.

To measure and control the risks of financial intermediaries, especially those of banks and insurance companies, regulations favor risk-based capital requirements (Spong 1994, pp. 70–82; Webb and Lilly 1994; Barth 1995; Cummins, Harrington, and Niehaus 1994). According to this policy, an intermediary holds capital in proportion to its investment in assets that are designated risky, but it might not hold capital in proportion to the risks that it assumed in its entire balance sheet (Grenadier and Hall 1995). These requirements, which currently dwell almost exclusively on credit risks, take into account neither any diversification of investments that might mitigate these risks nor any exposure to risks created by changing interest rates and other yields on assets.¹⁷ Safe balance sheets might be burdened with excessive capital requirements: A portfolio of assets offering a relative safe return might comprise a blend of risky assets with offsetting risks. Conversely, risky balance sheets might enjoy especially lenient capital requirements: A safe asset, such as a government bond, might be financed with short-term loans, thereby creating considerable

risk for the intermediary and its creditors. Risk-based capital requirements also entail an implicit tax, creating a kind of credit control, on those assets that are designated as risky, often the proprietary assets of intermediaries. This tax, which reflects the cost of equity financing, becomes especially burdensome during credit crunches. Accordingly, risk-based capital requirements encourage intermediaries to reduce their investments in these designated assets comparatively greatly during crunches, despite their success in controlling the risks in their balance sheets.

Accounting for Capital

The gravity of the tax implicit in capital requirements depends on the rules that govern how intermediaries measure their capital. If the managers of intermediaries are best informed about their proprietary assets for which markets too often are shallow or illiquid, marking all assets according to market prices undermines the efficient flow of funds in financial markets by supplanting the opinions of specialists with those of less informed investors. Market prices in these circumstances can be biased estimates of the values of proprietary assets.¹⁸ As the optimism of outsiders rises, prices of these assets may nearly meet or exceed proprietary valuations for a time, only to fall below proprietary valuations when this optimism subsequently ebbs. This potential volatility of outsiders' valuations for proprietary assets induces a commensurate volatility of intermediaries' capital with market accounting. Banks in Texas, New England, and Japan, for example, possessed more than adequate protection when the value of enterprises and real estate backing their assets was very great, but this capital eroded quickly when the prices of these assets collapsed.

Not only does a loss of confidence that reduces the value of capital in this manner raise the cost of funds for any given leverage (the dotted line in Figure 8 shifts up when leverage is near to or greater than l_2),

¹⁷ Banks and other intermediaries traditionally have pursued profits by "taking a view" of market trends or by "riding the yield curve." In the recent recovery, intermediaries invested a substantial share of their assets in longer-term Treasury securities in anticipation of falling interest rates. The risk in this strategy entailed no extra capital assessments; instead, to the extent intermediaries reduced their commitments to lower-grade bonds, mortgages, or equities, their capital requirements were diminished.

¹⁸ When no true prices are quoted in markets for assets, supervisors often resort to prices of comparable assets, prices derived from models, or book values of assets net of estimates of losses (due to default or workouts).

but, with market accounting, the loss of confidence also raises the cost of funds by increasing leverage (increasing l). When the prices of proprietary assets are particularly high, the cost of funds is comparatively low (l tends not to exceed l_2), encouraging intermediaries to issue more debt and expand their assets by offering comparatively attractive terms to those seeking funds. When the prices of proprietary assets "break," so does the capital of intermediaries (if l were near l_2 , it would rise above l_2), abruptly increasing the cost of funds.

Marking both assets and liabilities according to market values does not necessarily salvage market accounting, partly because ratios of capital to assets, however defined, are designed to measure neither the risks assumed by intermediaries nor their capacity for protecting creditors from losses (Merton 1995; Berger, Herring, and Szegö 1995). Insurance companies each holding \$10 million of 30-year mortgages financed by \$1 million of capital and \$9 million in cash value life insurance policies have the same capital ratios. But those companies that impose sufficient call premiums on policyholders who try to withdraw funds are protected better should interest rates rise unexpectedly. Similarly, companies that include sufficient call premiums in their mortgage loans are better insured against the risk of falling interest rates. Capital ratios measure neither the insurance embedded in intermediaries' portfolios nor the rate at which this insurance coverage might change with economic conditions.¹⁹

Alternative assessments of the "capital" of portfolios examine how their earnings and cash flows change with economic conditions. These sensitivity tests implicitly weigh the consequences of: (1) the options assumed by intermediaries, including those embedded in their assets and liabilities; (2) the mismatches in their books between long and short commitments at various maturities; (3) the correlation of returns among assets and liabilities; and (4) the possibility that the prices of some assets collapse and their maturities increase for want of dependable markets. These tests should be dynamic, incorporating managements' responses to changing conditions and covering intervals of time sufficiently long to encompass the full consequences of these changing conditions. Because the need for insurance arises precisely because investors are not all fully informed and markets are not dependable, these approaches might understate the risks that arise when the confidence of outsiders shifts, bringing surprisingly sharp changes in the prices of riskier assets while changing the customary covariances among their returns and perhaps those among

more liquid assets as well. Consequently, risk managers and supervisors should use the simulation model behind these tests to isolate an intermediary's bets—that is, to isolate those economic conditions that will threaten its solvency—so that they may assess its potential risk.²⁰

Prompt Enforcement of Capital Requirements

Current strategies for regulating financial institutions rest on the prompt enforcement of risk-based capital requirements.²¹ Policies for enforcing capital requirements that promote sound financial institutions in some circumstances might fail to do so in other circumstances. For example, the prompt enforcement of minimum capital requirements using market value accounting is a conservative policy when the markets for financial instruments are liquid. It also can be an efficient means of levying a fair liability insurance premium, as discussed in section I. Yet, the prompt enforcement of capital requirements tends to weaken intermediaries when outsiders are most skeptical of the returns on their proprietary assets and the prices of these assets understate their value significantly. Accordingly, the prompt enforcement of capital requirements also might not reduce the potential liabilities of agencies that guarantee the liabilities of intermediaries (Gilbert 1992).

If risky assets were priced efficiently, their prices would resemble random walks (Cootner 1964; Merton 1990). Tomorrow's news would be no more likely to

¹⁹ In the language of options, capital ratios do not convey the deltas, the gammas, or any of the other "Greeks" embedded in a balance sheet.

²⁰ Value-at-risk calculations essentially weight these events according to odds chosen by management. Even if the managements of all intermediaries assigned the same odds to the same events, supervisors might not agree with these assessments. A conservative policy, for example, might require that intermediaries adopt policies that keep their maximum losses for "reasonably likely" events below some minimum set by supervisors.

If intermediaries are portfolios of functions that differ mainly in the blends of functions they offer their customers, then level playing fields and efficient markets might require functional regulation that spans intermediaries. Even so, the risk in a portfolio is not a simple sum of the risks in its constituent functions. The auditing of risks described in this paragraph, therefore, requires more universal supervision.

²¹ Following a 1988 agreement on capital requirements among the United States and other developed economies and the Federal Deposit Insurance Corporation Improvement Act of 1991, the supervisory standards that apply to each bank depend on its regulators' rating of the adequacy of its capital (Spong 1994, pp. 70–82). In practice, however, regulators of banks appear to intervene earlier and with more discretion than the risk-based capital provisions of FDICIA would suggest (Peek and Rosengren 1995b; Jones and King 1995).

increase the value of these assets more than expected than to decrease their value more than expected. When intermediaries purchased these assets, prudent supervisors might require that they be marked according to their market values, because they would be no more due for redeeming gains after suffering substantial losses than they would be due for further substantial losses. A very conservative policy also might require that capital equal 100 percent of the value of proprietary assets so that creditors bear none of their risk (Friedman 1959; Tobin 1985; and Litan 1987). This need for 100 percent capital requirements diminishes if supervisors compel intermediaries to practice a form of portfolio insurance, responding promptly to any losses by raising new capital or by selling some risky assets (Fortune 1995). With such a policy of prompt enforcement, the more frequently risky assets are appraised and the less volatile are their prices, the less capital is required.

When shareholders regard raising new capital from outsiders to be very expensive, regulators have another reason to enforce promptly their standards for capital, including seizing the assets of intermediaries

The prompt enforcement of capital requirements is not necessarily a conservative policy when markets are not liquid.

that are nearly insolvent even though their capital is not exhausted. When an intermediary's capital is nearly depleted, shareholders may increase the value of their equity either by raising new capital or by assuming more risk, thereby increasing the value of the put option created by the shield of limited liability (Figure 2a). If creditors and guarantors do not raise their risk premiums promptly as shareholders assume more risk, then shareholders have little to lose by taking riskier investments, and they have much to gain should these investments produce high yields. When regulators seize the assets of the intermediary, they essentially are charging the shareholders a premium that covers the risk of the shareholders' taking such a strategy.

Nonetheless, the prompt enforcement of capital requirements is not necessarily a conservative policy when markets are not liquid. If proprietary assets are

not priced efficiently, their values may not follow random walks. When outsiders are most optimistic, the prices of these assets may nearly match or exceed informed valuations; when outsiders are most wary, their prices may fall well below these valuations. Therefore, the prices of these assets tend to revert to trends: Once a price falls below its proprietary valuation, the odds of its returning increase with time, while the odds of its falling further diminish. The prompt enforcement of capital requirements may even magnify the degree to which the prices of these assets diverge from trends. If, for example, an intermediary must sell proprietary assets in order to restore its ratio of capital to risky assets after the prices of these assets subside in the opinions of outsiders, then these prices will fall further in illiquid markets. After the prices of proprietary assets fall substantially, thereby increasing an intermediary's leverage, the chance of redeeming capital gains increases with time, while the chance of commensurate losses diminishes. Therefore, when the value of an intermediary's assets approaches that of its obligations and its liabilities are of sufficiently long duration, its expected losses due to insolvency may be low compared to the expected gains from retaining these assets (the divergence between points 1 and 3 in Figure 5 is especially great).

Suppose an intermediary attempts to maintain a ratio of capital to assets of 10 percent, while investing 40 percent of its assets in proprietary investments, 60 percent in safe assets. Because creditors believe the intermediary's liabilities are insured adequately, the yield on these accounts equals the yield on safe assets. The prices of proprietary investments follow a smoothed random walk: A below-average return on these assets creates no expectation of compensating above-average returns subsequently.²² When favorable earnings increase its capital per dollar of assets, the intermediary sells more accounts, investing the funds as required to maintain the 3:2 ratio between its safe and risky assets. When poor earnings reduce its capital per dollar of assets, the intermediary sells no new accounts and acquires no new risky debt. The capital of this intermediary approaches zero, on average, nearly twice every one hundred years (Figure 9a). When the intermediary practices portfolio insurance, selling risky assets as required in order to prevent the

²² This example uses a colored random walk with drift. The news that yields higher (or lower) than average returns in one year tends to yield higher (or lower) returns in subsequent years, albeit by an amount that diminishes with time. Despite these short-run cycles, in the long run the probability distribution of the value of an initial investment in the asset approaches a random walk.

Figure 9a

Capital Ratios When Prices of Assets Follow a Random Walk

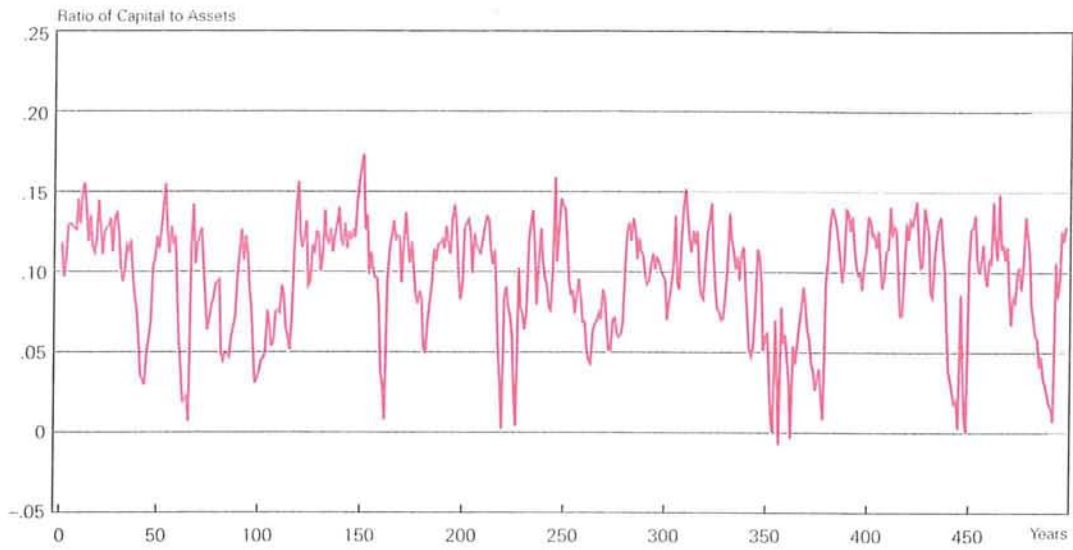


Figure 9b

*Capital Ratios When Prices of Assets Follow a Random Walk and
Capital Requirements Are Promptly Enforced*

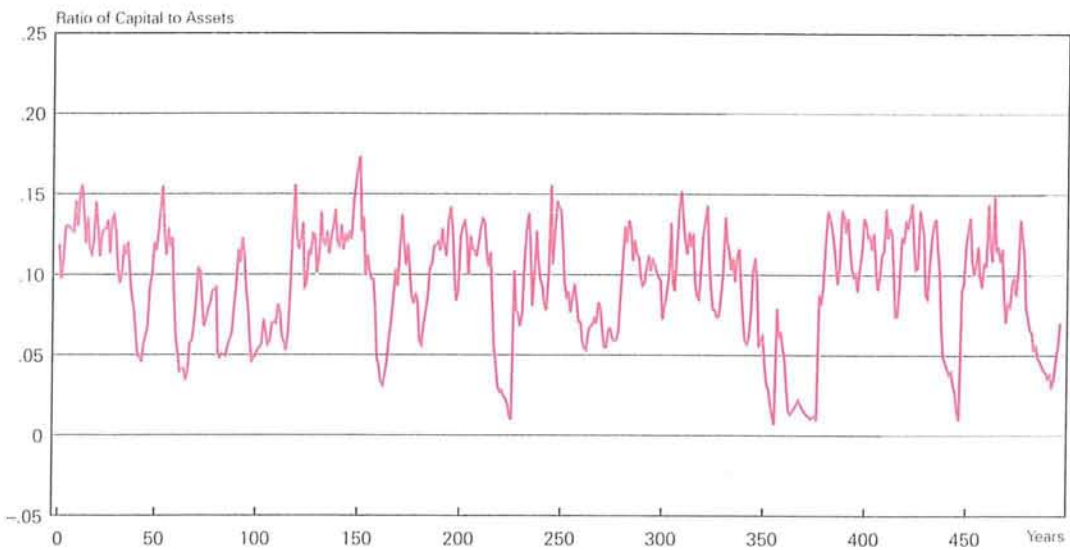


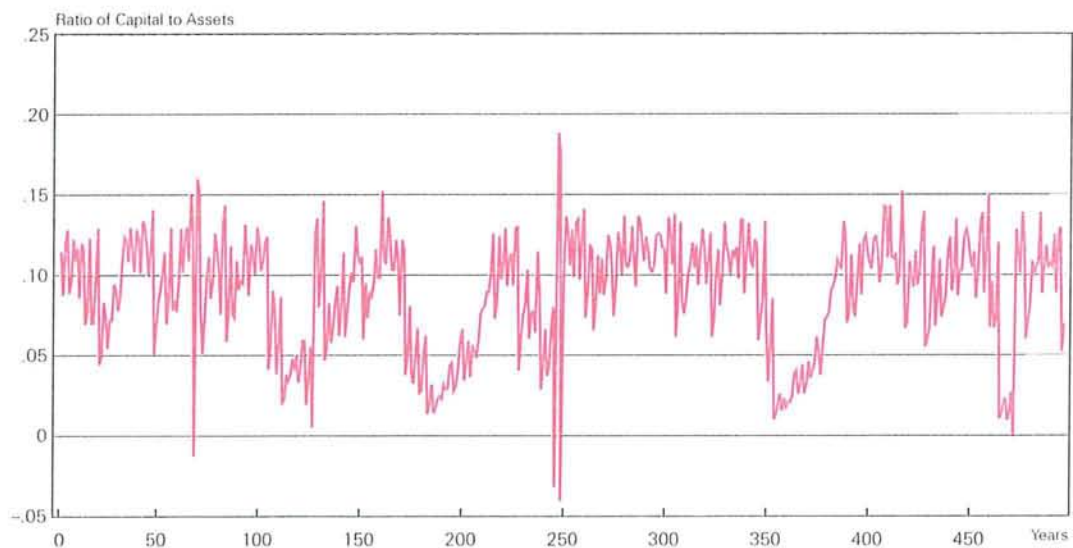
Figure 9c

Capital Ratios When Prices of Assets Revert to Trend



Figure 9d

*Capital Ratios When Prices of Assets Revert to Trend and
Capital Requirements Are Promptly Enforced*



See Appendix.

ratio of risky assets to capital from exceeding 4, then the intermediary's capital approaches zero less than once every century (Figure 9b).

Although the prompt enforcement of minimum capital standards makes intermediaries more secure when the prices of their assets follow random walks, this policy can undermine their security when their proprietary assets are not always liquid. If the values of proprietary assets tend to return to trend—a run of below-average returns increases the odds of earning above-average returns—the capital-to-asset ratio almost never approaches zero with the investment strategy described in the first simulation (compare Figure 9c to 9a), even though the annual volatility of the rate of return on proprietary assets is greater than in the first case. If, in this last instance, the intermediary practices portfolio insurance by selling some of its risky assets after their values decline and if the disposal of these assets temporarily reduces their prices by an additional 10 percent, then the intermediary's average capital-asset ratio (Figure 9d) falls and becomes more volatile. Consequently, the intermediary's capital approaches zero more frequently, about once every century, when it sells its risky assets at distressed prices in order to meet its capital requirements. Furthermore, this policy of promptly enforcing capital requirements induces a clear credit cycle: The lending capacity of the intermediary, as reflected in its capital per dollar of assets, falls further and remains depressed longer in this last case than it did in the former.

Supervision and Liability Insurance

Insuring the liabilities of financial intermediaries can make financial markets more efficient both by reducing the excessive risk premiums that outsiders might require of intermediaries and by diminishing the volatility of this premium over time. In order to achieve this efficiency, however, guarantors must make informed assessments of the risks entailed by intermediaries' commitments, so that each intermediary's insurance premium corresponds to its risks. To the degree the coverage of liability insurance is not complete—creditors bear some of the losses arising from insolvencies—or to the degree guarantors assess the values of proprietary assets the same as less-informed investors, then the cost of funds for financial intermediaries becomes more dependent on the outsiders' state of confidence.

Financial intermediaries would be superfluous if savers were expected to evaluate the assets of inter-

mediaries before purchasing their liabilities. Intermediaries can offer savers considerable economies of scale as their specialists divide the cost of their research and management among many savers. These economies would be lost if each saver then evaluated with "due diligence" the assets of intermediaries. But here too, savers can realize economies by relying on the expert opinions of analysts and supervisors who review the skills of intermediaries' specialists and the performance of their investments.

Neither analysts nor supervisors, however, are disinterested referees (Stigler 1971). Analysts must gain the confidence of their customers. Intermediaries can shun those they regard as unfair, thereby denying these analysts important information. Investors similarly will be reluctant to hire analysts who fail to anticipate and promote what seems to be the next best investment. The reputation of supervisors, as the name implies, rests on the reputation of the intermediaries they examine, which tends to restrain the vigor of supervisors' criticism and promote too much tolerance (Stewart 1991; Kane 1995).

Analysts, by disclosing their expert criticism, may foster a deeper and broader understanding of intermediaries' financial strategies among outside investors. Although this understanding may stabilize public confidence in intermediaries, it also may be fragile. When many banks, insurance companies, and finance companies profited from the commercial real estate boom during the 1980s, for example, many analysts applauded their strategies while questioning the acumen of those who did not invest in these assets. In the ensuing bust, analysts were very critical of those holding very many commercial mortgages or other investments backed by commercial real estate. In retrospect, both the accolades and the censures often were exaggerated.²³ The ability of analysts to build a durable foundation for the confidence of outside investors also is limited by analysts' limited access to intermediaries' proprietary information (Randall 1989).

Supervisors work in confidence, using their regulatory authority to enforce their standards. Although supervisors, in principle, can review the investments of intermediaries more intimately than analysts, practical limitations on their capacity for discovery encour-

²³ Analysts and rating agencies essentially impose their own risk-based "capital requirements." The less formal "questioning" of banks and insurance companies investing in low-grade or highly leveraged debt, commercial mortgages, derivatives, and certain equities generally preceded formal regulations. Today, a diminished reputation among analysts can augment the already considerable burden of formal capital requirements for intermediaries.

age supervisors also to rely on regulations confining the powers of intermediaries, in order to maintain safety and soundness (Buser, Chen, and Kane 1981).²⁴ Furthermore, supervisors, like the intermediaries they oversee, may be inclined to take bets. The dimensions of the past savings and loan crisis were known long before it made the headlines (Kopcke 1981; Carron 1982); yet, supervisors and government officials, who were aware of the problem and worried by its potential cost, have been accused of allowing the industry to grow despite its lack of capital in hopes that future profits would restore its health (Kane 1989).

Supervisors have relied on regulations in order to limit the risks borne by intermediaries because, even if guarantors were collecting adequate premiums for insuring their liabilities, frequent or very expensive failures would suggest that intermediaries were not sufficiently safe or sound to outside investors. With fair premiums, the guarantors' expected obligations

In order to make financial markets as efficient as possible, each intermediary's insurance premium ought to depend on the risks entailed by its commitments.

would equal their premium receipts, but these premiums would control neither the frequency of failures nor the amount of their expected losses. In other words, fair premiums fix the expected value of guarantors' losses at zero, but fair premiums by themselves do not control the variance of these losses. If guarantors were to report substantial losses, outsiders might question the ability of their guarantors to insure the value of their liabilities, thereby defeating the purpose of liability insurance. Furthermore, failures engender administrative costs, similar to bankruptcy costs, that tend to make insurance programs excessively expensive when insolvencies occur too frequently. In these circumstances, surviving intermediaries and their customers, who often bear a substantial share of these extraordinary costs, would benefit from regulations that limit each intermediary's ability to assume risk.

Adopting more extensive rules to limit intermediaries' powers is no longer a promising remedy. From the 1930s to the 1970s, regulations controlled

both the assets and liabilities that intermediaries might issue and the competition among intermediaries. To the degree regulations protected the rents of each intermediary, they fostered safe and sound financial institutions at the cost of hindering the flexibility and efficiency of financial markets. This lack of flexibility subsequently weakened intermediaries once high rates of inflation and high rates of interest reduced or eliminated their rents, compelling them to cultivate new opportunities for profit. Regulations setting greater standards for capital only impelled the decline of other regulations that limited the powers of intermediaries. As intermediaries evolved, supervisors increasingly have found themselves auditing risks rather than enforcing regulations that define intermediaries.

Liability insurance may be considered a performance contract between the supervisors and creditors of financial intermediaries: Supervisors not only assess the risk, but supervisors as guarantors also indemnify creditors against default, bearing the consequences of any mispricing of this insurance. In order to make financial markets as efficient as possible, each intermediary's insurance premium ought to depend on the risks entailed by its commitments. Creditors who value this service purchase insured liabilities, accepting the safe rate of interest. Intermediaries also would promote these insured liabilities if, in their opinion, outsiders generally require excessive risk premiums on their uninsured accounts. Although guarantors may not assess risks as optimistically as managers of intermediaries, their confidential audits may allow them to levy premiums lower than those required by most creditors, especially when outsiders are most skeptical of the value of intermediaries' assets.

For this liability insurance to be as efficient as possible, guarantors should be able to obtain funds on reasonable terms at times of financial distress. Guarantors, most likely, will require assistance at those times when their insured intermediaries are experiencing substantial losses, times when the threat of a severe credit crunch or systemic failure is great and even the most optimistic outside investors are most skeptical of the value of intermediaries' assets. On these occasions, guarantors essentially exercise claims against the capital of surviving intermediaries. Surviving intermediaries might avoid incurring this addi-

²⁴ Because surviving banks or insurance companies eventually are liable for paying some of the claims against insolvent intermediaries (a restoration of the insurance fund), insured intermediaries themselves benefit from supervision that limits these potential claims against their capital.

tional expense if the guarantor could obtain financing on favorable terms from a "lender of last resort," such as the government, or from healthy intermediaries possessing sufficient resources.²⁵

IV. Regulatory Policy and Monetary Policy

When financial markets are competitive and all investors assess the prospective returns on each asset similarly, regulation cannot make intermediaries safer or sounder, because all investors are able to tailor their risks to their tastes, and all are compensated uniformly for those risks that they assume. Regulations that set standards for intermediaries' leverage or that govern intermediaries' abilities to purchase assets or write liabilities should not influence the pricing of assets even though these regulations may limit the powers of many intermediaries. Similarly, accounting conventions that dictate the way intermediaries report either their income or the values of their assets and liabilities should not impede the efficient pricing of assets. These regulations and conventions alter neither investors' perception of the returns and risks offered by assets nor their ability to realize these returns and risks.

On the other hand, taxes—including income taxes, sterile reserve requirements, the cost of regulation, and improperly priced liability insurance—affect the pricing of assets by altering their net returns. Taxes reduce the efficiency of financial markets, and this, if anything, undermines the safety and soundness of savers' investments. Unless the burdens of intermediaries' taxes are offset by other considerations, these liabilities discourage traditional financial intermediation by prodding banks, life insurance companies, and other intermediaries to recast their liabilities as "mutual funds" that also offer certain financial services.

If investors assess the prospective returns on each asset differently, the prices of assets and the volume of investment depend on the policies that govern the activities of financial intermediaries. When not all investors are informed equally well, intermediaries can profit from their proprietary knowledge by raising money from wary savers to invest in deserving assets, thereby promising savers greater returns, other things equal, while reducing the cost of capital for investment projects. The ability of intermediaries to "arbitrage" financial markets in this manner ultimately rests on savers' confidence in their expertise. Because intermediaries' cost of funds rises and falls with this state of confidence, both the level and the volatility of

the cost of capital for investment projects depends on the perceived safety and soundness of financial intermediaries.

The lack of uniform information creates three problems: (1) the cost of funds for financial intermediaries might be too high, on average, for the risks inherent in their balance sheets; (2) the cost of funds also might be too volatile; and (3) policies that set risk premiums on behalf of outsiders might entail a cost of funds that is, on average, too low, thereby encouraging intermediaries to assume too much risk. Public policy has attempted to cope with these problems through regulation and liability insurance.

Efficiency might be promoted best when supervisors audit the risks assumed by intermediaries, taking into account as completely as possible their proprietary information, in order to levy reasonable premiums for insuring some of their liabilities. Insurance is most appropriate for basic liabilities that are backed to a substantial degree by assets that either are not familiar in public markets or can become illiquid—certain bank accounts, insurance policies, and pension plans. The enforcement of capital requirements alone does not necessarily promote efficiency by controlling the risks of intermediaries, because ratios of capital to assets describe neither the risks assumed by intermediaries nor their capacity for protecting creditors from losses. More revealing descriptions are provided by analyses that isolate those economic conditions that threaten the solvency of an intermediary. Liability insurance premiums would vary with these exposures.²⁶ This approach, in principle, would apply equally well to intermediaries that hold substantial portfolios of investments and to those that maintain only a small portfolio of assets compared to their other commitments and transactions. Intermediaries might pay a portion of these premiums by carrying more capital or by assuming hedges, but when these reme-

²⁵ At first blush, guarantees of bank accounts and insurance policies are backed by calls against the resources of the survivors—banks precommit, to a degree, in the form of the FDIC insurance fund, but eventually the survivors must restore the fund after it sustains substantial losses. The survivors, in turn, may transfer some of this burden to taxpayers (see footnote 4).

²⁶ If guarantors have no particular comparative advantage for assessing the likelihood that these threatening events will occur, their premiums should reflect the going price of hedging, for example, against a twist of the yield curve. By enforcing this universal hedging, intermediaries that successfully bet against a twist of the yield curve will not confuse their reward with pure profit. According to traditional theory, the rents of intermediaries are grounded in their unique knowledge of investment opportunities and their "arbitraging" market imperfections rather than their bets on economic events.

dies are excessively expensive, intermediaries retain the option of purchasing coverage from their “insurer of last resort.” When guarantors inevitably experience claims that exceed their reserves, they, in turn, must be able to obtain temporary funding at reasonable rates without raising questions about the safety and soundness of the accounts that they insure.

Regulatory policy affects not only the returns on intermediaries’ proprietary assets, but also the returns on assets that commonly trade in public markets. To the degree effective regulation promotes safer and sounder intermediaries by reducing both the average risk premium and the volatility of the risk premium required of their liabilities, it also tends to reduce the force of the credit cycle, thereby diminishing the gravity of some factors of risk common to all assets. Such a reduction of systematic risk would entail lower premiums for all assets.²⁷

This close relationship between regulatory policy and the cost of funds in financial markets runs parallel to that of monetary policy. Indeed, monetary policy and regulatory policy do not work independently of each other. When central banks change the terms on which they supply their liabilities, the resulting change in the supply of and demand for funds depends on the regulations governing the behavior of financial intermediaries. For example, Marriner Eccles, Governor and Chairman of the Federal Reserve during the 1930s, noted (Eccles 1951, pp. 266–67):

How can the Reserve System fulfill its responsibility of helping to maintain economic stability when the control of the nation’s banking system, through which it is supposed to work, is divided between state and federal authorities, and among federal authorities? . . . Or when the power of federal authorities to conduct bank examinations and issue regulations is divided among the FDIC, the Comptroller of the Currency, and the Federal Reserve Board, each of which has a different interest to be served by the examinations it conducts and the regulations it issues?

. . . Clearly, if the System is committed to a policy of monetary ease in times of depression, then bank-examination policies should follow a similar commitment. Or if the System is committed to a policy of credit stringency in order to curb an imminent inflation, then bank-examination policy should be brought in line with that same intention. Neither action was possible, however, so long as examinations were also devised by the FDIC and the Comptroller, whose personnel were disposed to follow the same policies regardless of prevailing economic conditions.

Eccles recommended, to little avail, that representatives of the FDIC, the Comptroller’s Office, and the

Federal Reserve agree to a joint bank-examination policy. More recently, critics have challenged regulators of banks and insurance companies for adopting standards that diminished the potency of monetary policy during the last recovery.

Just as the efficacy of monetary policy depends on regulatory policy, so regulatory policy is conditioned by monetary policy. For example, the variance of inflation versus the variance of capacity utilization in the economy depends on the rules guiding the monetary authority’s supply of base money (Fuhrer 1994). In turn, the volatility of returns on assets and the liquidity of intermediaries’ proprietary assets depend

The rules that best promote the safety and soundness of financial intermediaries cannot be established independently of the design of monetary policy.

not only on the size but also on the relative magnitudes of each of these variances, which are distinct elements of systematic risk (Ross 1976; Sharpe and Alexander 1990, Chapter 9). Furthermore, to the degree monetary policy attempts to control interest rates, the risks confronting intermediaries and their regulators would differ from those arising should policy attempt to control the growth of the stock of money or nominal gross domestic product, or those arising if monetary policy should attempt to manage the cost of capital or Tobin’s *q*. Monetary policy not only affects the means, variances, and covariances for assets, it also influences the degree to which the returns on assets or the values of assets tend to revert to trends. Consequently, the rules that best promote the safety and soundness of financial intermediaries cannot be established independently of the design of monetary policy.

Both monetary authorities and regulators essentially are in the business of writing “deposit insurance”—managing the price of risk and stabilizing economic performance, so that the values of investments generally fulfill reasonable expectations (Tobin

²⁷ Regulation, therefore, is a public good. As Albert Wojnilower has observed, banks are unique for having to pay for their deposit insurance.

1958, 1982). Both attempt to “insure” savers, investors, and productive activity against the consequences of economic “shocks.” Because regulations affect the price of risk in financial markets and because this influence varies with economic conditions, the actions of regulators, like those of the monetary authority, should be sufficiently flexible to adjust with economic conditions, in order to foster the prudent valuation of assets and the efficient flow of funds from savers to investors. Regulating the volume of intermediation by enforcing fixed standards for capital that are proportional to intermediaries’ investments in assets designated as risky, for instance, might undermine the stability of financial markets. At times, excessive confidence might entail an insufficient price of risk, thereby fostering speculative investment. When confidence subsequently subsides, the rising price of risk, reinforced by risk-based capital requirements grounded in market-value accounting, amplifies the credit cycle and increases the odds of a crunch. In these circumstances, regulatory and monetary policies would stabilize financial markets best by managing the price of risk so that it dampens cycles in economic activity.

Appendix

Figure 2

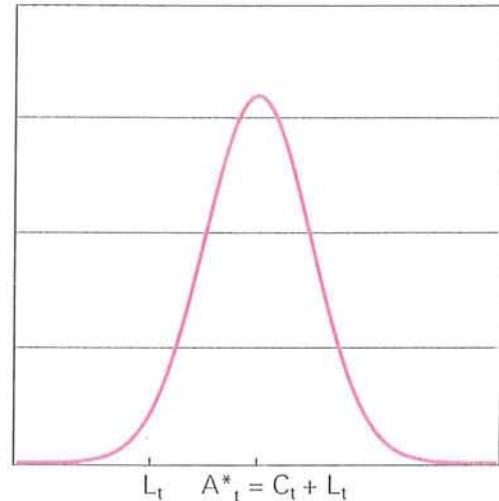
An intermediary finances a portion of its assets, A_0 , by issuing debt, L_0 . When the debt matures in t periods, the intermediary will owe its creditors $L_t = L_0 e^{rt}$. At that time, the capital of the intermediary will equal $A_t - L_t$. (r is the safe rate of interest. The following discussion explains the pricing of the risk premium.) Figure A1 shows the probability distribution for the value of assets t periods in the future. Taking into account the full range of values that are possible for A_t , the expected value of assets is A_t^* , and the expected value of capital is $A_t^* - L_t$. If shareholders’ liability to creditors were not limited, the expected value of their equity would equal that of capital.

Because shareholders’ liability is limited, the expected value of their equity is calculated only over the range of values for A_t that exceed L_t ; if A_t is lower than L_t , the value of equity is zero. The value of equity in this case equals the expected value of capital for the full range of A_t (as in the first case) plus the expected value of $L_t - A_t$ when capital is negative (the shaded region in the figure). Therefore, the value of the intermediary’s equity in this second case equals the sum of its capital and a put option with an “exercise price” of L_t , and payoff equal to $\max(0, L_t - A_t)$ at the “exercise date” t periods hence. (This combination of an equity stake and a put option is equivalent to a call option—the line in Figure 1b is the intrinsic value of a call.)

The value of this put option for shareholders is the

Figure A1

Probability Distribution for Value of Assets



expected value of $L_t - A_t$ when A_t is less than L_t . This expected value increases as $A_0 - L_0$ becomes smaller or as the variance of A increases; in both cases, the area of the tail of the probability distribution to the left of L_t becomes larger. If the distribution of A is normal, the variance of A per period is σ^2 , and $N[d]$ is the probability that a standard normal variable does not exceed d , then the value of this put option is (Sharpe and Alexander 1990, Chapter 18):

$$Put = L_0 * N[-d_2] - A_0 * N[-d_1], \text{ where}$$

$$d_1 = \frac{\ln(A_0/L_0) + (r + .5\sigma^2)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}.$$

The value of equity in panel a is the sum of capital and the value of this option. Because creditors assess the returns on assets the same as shareholders, the value of creditors’ expected losses in panel b equals the value of the put option derived above. Panel c shows the difference between the value of equity and the value of the option, which equals capital.

Figure 6

Informed investors believe the standard deviation of returns for the portfolio is σ_v , and they require a rate of return of r_i for financing these assets. Uninformed investors believe the standard deviation is greater, σ_u .

If informed investors held both the equity and the debt of the intermediary, the cost of funds would be r_v , regard-

less of leverage, l , the ratio of the intermediary's debt to its assets. In this case, the value of the put option entailed by leverage, $p(l|\sigma_i)$, is the same for both shareholders and creditors (see discussion of Figure 2). When the intermediary issues debt to uninformed investors, the value of the put option for creditors, $p(l|\sigma_u)$, exceeds that for shareholders. The premium required by creditors rises relative to that required by informed investors as leverage increases. Accordingly, the intermediary's cost of funds rises with leverage: $r(l) = r_i + [p(l|\sigma_u) - p(l|\sigma_i)]$.

Figure 7

The average cost of funds is that derived in Figure 6. The marginal cost of funds equals:

$$\frac{d(lr(l))}{dl} = r(l) + lr'(l).$$

Figure 9

Panel a: An intermediary holds risky and safe assets, financed by equity and "deposits." The expected return on risky assets, $E(r_t)$, is 10 percent annually; the standard deviation of this return, $\text{std}(\epsilon_t)$, is 6 percent annually; and the correlation coefficient between annual returns (a first-order Markov process) is 60 percent:

$$\begin{aligned} r_t &= .10 + \epsilon_t \\ \epsilon_t &= .6\epsilon_{t-1} + \eta_t \\ \eta_t &\sim N(0, .06^2(1 - .6^2)). \end{aligned}$$

The return on the intermediary's safe assets and the return that the intermediary pays on its deposits is 7 percent. The values of risky and safe assets increase according to their returns and any new investments in these assets, Δ^r and Δ^s ; likewise, the value of its deposits increases as a result of crediting interest and new inflows, Δ :

$$\begin{aligned} V_t^r &= V_{t-1}^r(1 + r_t) + \Delta_t^r \\ V_t^s &= V_{t-1}^s(1.07) + \Delta_t^s \\ L_t &= L_{t-1}(1.07) + \Delta_t. \end{aligned}$$

The capital of the intermediary, C , is the difference between the value of its assets and the value of its deposits, L . When its capital per dollar of assets the previous year exceeds its target of 10 percent, the intermediary issues new deposits; otherwise, Δ is zero. If the intermediary's risky assets are less than 4 times its capital, the intermediary purchases more risky assets in order to maintain the ratio

of 2 dollars of risky assets for every 3 dollars of safe assets; otherwise, Δ^r is zero:

$$\begin{aligned} \Delta_t &= \max([10C_{t-1} - (V_{t-1}^r + V_{t-1}^s)], 0) \\ \Delta_t^r &= \max([4C_t - V_{t-1}^r(1 + r_t)], 0) \\ \Delta_t^s &= \Delta_t - \Delta_t^r. \end{aligned}$$

When the intermediary's capital falls below 0.5 percent, it "fails," and its capital is restored to 10 percent. In the simulation shown in the graph, the intermediary fails 11 times, its mean capital-asset ratio is 9.5 percent, and the annual standard deviation of this ratio is 3.5 percent.

Panel b: The assumptions are the same as those for the previous panel, except that the intermediary sells risky assets in order to maintain only 4 dollars of risky assets per dollar of capital when this ratio exceeds 4:

$$\Delta_t^r = 4C_t = V_{t-1}^r(1 + r_t).$$

In the simulation shown in the graph, the intermediary fails 4 times, its mean capital-asset ratio is 9.1 percent, and the annual standard deviation of this ratio is 3.5 percent.

Panel c: The assumptions are the same as those for the first panel, except that the value of risky assets tends to revert to a trend:

$$\begin{aligned} trend_t &= V_0^r(1.1)^t \\ r_t &= .10 + \epsilon_t \\ \epsilon_t &= .6\epsilon_{t-1} - 2 \log(V_{t-1}^r - trend_{t-1}) + \eta_t \\ \eta_t &\sim N(0, .05^2(1 - .6^2)) \\ V_t^r &= V_{t-1}^r(1 + r_t). \end{aligned}$$

The standard deviation of annual returns behind the simulation shown in the graph is 7.5 percent. Yet, because of the tendency of the value of risky assets to revert to trend, the intermediary does not fail during this simulation, its mean capital-asset ratio is 10.3 percent, and the annual standard deviation of this ratio is 2.2 percent.

Panel d: The assumptions are the same as those for the previous panel, except that the intermediary sells risky assets in order to maintain only 4 dollars of risky assets per dollar of capital when this ratio exceeds 4, and this sale entails transactions costs equal to 10 percent of the value of the risky assets that are sold.

In this simulation, the intermediary fails 5 times, its mean capital-asset ratio is 9.1 percent, and the annual standard deviation of this ratio is 3.6 percent.

References

- Abel, Andrew B. 1991. "The Equity Premium Puzzle." Federal Reserve Bank of Philadelphia *Business Review*, September–October, pp. 3–14.
- Barth, Mike, 1995. "Trends in Life Risk-Based Capital Results." *National Association of Insurance Commissioners Research Quarterly*, vol. 1, October, pp. 50–5.
- Baskin, Jonathan Barron. 1988. "The Development of Corporate Financial Markets in Britain and the United States, 1600–1914: Overcoming Asymmetric Information." *Business History Review*, vol. 62, no. 2, summer, pp. 199–237.
- Berger, A. N. and G. F. Udell. 1994. "Did Risk-Based Capital Allocate Bank Credit and Cause a 'Credit Crunch' in the U.S.?" *Journal of Money Credit and Banking*, vol. 26, August, pp. 585–628.
- Berger, A. N., R. J. Herring and G. P. Szegö. 1995. "The Role of Capital in Financial Institutions." *Journal of Banking and Finance*, vol. 19, no. 3–4, June, pp. 393–430.
- Bernanke, B. and M. Gertler. 1987. "Banking and Macroeconomic Equilibrium." In W. Barnett and K. Singleton, eds., *New Approaches to Monetary Economics*. Cambridge, U.K.: Cambridge University Press.
- Bernanke, B. and C. Lown. 1991. "The Credit Crunch." *Brookings Papers on Economic Activity*, no. 2, pp. 205–48.
- Bizer, D. S. 1993. "Regulatory Discretion and the Credit Crunch." Working Paper, U.S. Securities and Exchange Commission, April.
- Blum, Jürg and Martin Hellwig. 1995. "The Macroeconomic Implications of Capital Adequacy Requirements for Banks." *European Economic Review*, vol. 39, pp. 739–49.
- Buser, S. A., A. H. Chen, and E. J. Kane. 1981. "Federal Deposit Insurance, Regulatory Policy and Optimal Bank Capital." *Journal of Finance*, vol. 36, March, pp. 51–60.
- Capen, E. C., R. V. Clapp, and W. M. Campbell. 1971. "Competitive Bidding in High-Risk Situations." *Journal of Petroleum Technology*, vol. 23, June, pp. 641–53.
- Carosso, Vincent P. 1970. *Investment Banking in America*. Cambridge MA: Harvard University Press.
- Carron, A. S. 1982. *The Plight of Thrift Institutions*. Washington, DC: The Brookings Institution.
- Cootner, Paul H., ed. 1964. *The Random Character of Stock Market Prices*. Cambridge, MA: MIT Press.
- Cummins, J. David, Scott E. Harrington, and G. Niehaus. 1994. "Risk-Based Capital Requirements for Property-Liability Insurers: A Financial Analysis." In E. Altman and I. Vanderhoof, eds., *The Financial Dynamics of the Insurance Industry*. Homewood, IL: Irwin Professional Publishers.
- Duesenberry, James S. 1958. *Business Cycles and Economic Growth*. New York: McGraw-Hill. Chapter 5, pp. 87–99.
- Eccles, Marriner S. 1951. *Beckoning Frontiers*. New York: Alfred A. Knopf.
- Fortune, Peter. 1995. "Stocks, Bonds, Options, Futures, and Portfolio Insurance: A Rose by Any Other Name" *New England Economic Review*, July/August, pp. 25–46.
- Friedman, Milton. 1959. *A Program for Monetary Stability*. Chicago, IL: University of Chicago Press.
- Fuhrer, Jeffrey C. 1994. "Optimal Monetary Policy in a Model of Overlapping Contracts." Federal Reserve Bank of Boston, Working paper 94–2, July.
- Furlong, F. 1992. "Capital Regulation and Bank Lending." Federal Reserve Bank of San Francisco, *Economic Review*, pp. 23–33.
- Gibson, M. S. 1995. "Can Bank Health Affect Investment? Evidence from Japan." *The Journal of Business*, vol. 68, no. 3, July, pp. 281–308.
- Gilbert, R. Alton. 1992. "The Effect of Legislating Prompt Corrective Action on the Bank Insurance Fund." Federal Reserve Bank of St. Louis *Review*, vol. 74, no. 4, July/August, pp. 3–22.
- Grenadier, Steven R. and Brian J. Hall. 1995. "Risk-Based Capital Standards and the Riskiness of Bank Portfolios: Credit and Factor Risks." National Bureau of Economic Research, Working Paper no. 5178, July.
- Gurley, John G. and Edward S. Shaw. 1955. "Financial Aspects of Economic Development." *The American Economic Review*, vol. 45, no. 4, September, pp. 515–38.
- . 1956. "Financial Intermediaries in the Saving-Investment Process." *Journal of Finance*, vol. 11, March pp. 257–76.
- . 1960. *Money in a Theory of Finance*. Washington, DC: The Brookings Institution.
- Hancock, D., A. J. Laing and J. A. Wilcox. 1995. "Bank Capital Shocks: Dynamic Effects on Securities, Loans, and Capital." *Journal of Banking and Finance*, vol. 19, no. 3–4, June, pp. 661–77.
- Harris, Milton and Artur Raviv. 1991. "The Theory of Capital Structure." *Journal of Finance*, vol. 46, March, pp. 297–355.
- Jones, David S. and Kathleen Kuester King. 1995. "The Implementation of Prompt Corrective Action: An Assessment." *Journal of Banking and Finance*, vol. 19, no. 3–4, June, pp. 491–510.
- Kane, E. J. 1986. "Appearance and Reality in Deposit Insurance: The Case for Reform." In Federal Home Loan Bank of San Francisco, *Journal of Banking and Finance*, vol. 10, June, pp. 175–88.
- . 1989. "Changing Incentives Facing Financial Service Regulators." *Journal of Financial Services Research*, vol. 2, September, pp. 263–72.
- . 1995. "Three Paradigms for the Role of Capitalization Requirements in Insured Financial Institutions." *Journal of Banking and Finance*, vol. 19, no. 3–4, June, pp. 393–430.
- Kopcke, Richard W. 1981. "The Condition of Massachusetts Savings Banks and California Savings and Loans." In Federal Reserve Bank of Boston, *The Future of the Thrift Industry*, Conference Series no. 24, pp. 1–31.
- . 1993. "The Determinants of Business Investment: Has Capital Spending Been Surprisingly Low?" *New England Economic Review*, January/February, pp. 3–31.
- Kupiec, Paul H. and James M. O'Brien. 1995. "A Pre-Commitment Approach to Capital Requirements for Market Risk." Division of Research and Statistics, Board of Governors of the Federal Reserve System, photocopy, April.
- Lintner, John. 1965. "The Valuation of Risky Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." *Review of Economics and Statistics*, February, pp. 13–37.
- Litan, Robert E. 1987. *What Should Banks Do?* Washington, DC: The Brookings Institution.
- Merton, Robert C. 1977. "An Application of Modern Option Pricing Theory." *Journal of Banking and Finance*, vol. 19, no. 3–4, June, pp. 431–60.
- . 1990. *Continuous Time Finance*. Cambridge MA: Blackwell Publishers.
- . 1995. "Financial Innovation and the Management and Regulation of Financial Institutions." *Journal of Banking and Finance*, vol. 19, no. 3–4, June, pp. 461–482.
- Miller, Merton H. and Franco Modigliani. 1961. "Dividend Policy, Growth, and the Valuation of Shares." *Journal of Business*, vol. 34, no. 3, October, pp. 411–33.
- Modigliani, Franco and Merton H. Miller. 1958. "The Cost of Capital, Corporation Finance, and the Theory of Investment." *The American Economic Review*, vol. 48, no. 3, June, pp. 261–97.
- Myers, Stewart C. 1984. "The Capital Structure Puzzle." *Journal of Finance*, vol. 39, no. 3, pp. 575–92.
- Myers, Stewart C. and N. S. Majluf. 1984. "Corporate Financing and Investment Decisions When Firms Have Information Investors Do Not Have." *Journal of Financial Economics*, vol. 13, no. 2, June, pp. 187–221.
- Peek, J. and E. Rosengren. 1995a. "Bank Regulation and the Credit Crunch." *Journal of Banking and Finance*, vol. 19, no. 3–4, June, pp. 679–92.
- . 1995b. "Prompt Corrective Action Legislation: Does It Make

- a Difference?" Federal Reserve Bank of Boston, photocopy, May.
- Pennachi, G. C. 1987. "A Re-examination of the Over- (or Under-) Pricing of Deposit Insurance." *Journal of Money, Credit and Banking*, vol. 19, August, pp. 340-60.
- Randall, Richard E. 1989. "Can the Market Evaluate Asset Quality Exposure in Banks?" *New England Economic Review*, July/August, pp. 3-24.
- Ross, Stephen A. 1976. "The Arbitrage Theory of Capital Asset Pricing." *Journal of Economic Theory*, vol. 13, no. 3, December, pp. 341-60.
- Sharpe, S. A. 1990. "Asymmetric Information, Bank Lending, and Implicit Contracts: A Stylized Model of Customer Relationships." *Journal of Finance*, vol. 49, March, pp. 1069-87.
- Sharpe, William F. 1978. "Bank Capital Adequacy, Deposit Insurance and Security Values." *Journal of Financial and Quantitative Analysis*, November, pp. 701-18.
- Sharpe, William F. and Gordon J. Alexander. 1990. *Investments*. Englewood Cliffs, NJ: Prentice Hall.
- Simons, Katerina and Stephen Cross. 1991. "Do Capital Markets Predict Problems in Large Commercial Banks?" *New England Economic Review*, May/June, pp. 51-6.
- Slovin, M. B., M. E. Shuska, and J. A. Polonchek. 1993. "The Value of Bank Durability: Borrowers as Bank Stakeholders." *Journal of Finance*, vol. 48, March, pp. 247-66.
- Spong, Kenneth. 1994. *Banking Regulation*. Kansas City: Federal Reserve Bank of Kansas City.
- Stewart, Richard E. 1991. "Discussion" of "Public Policy and Property-Liability Insurance," by Scott Harrington. In *The Financial Condition and Regulation of Insurance Companies*, Federal Reserve Bank of Boston Conference Series no. 35, pp. 276-81.
- Stigler, George J. 1971. "The Theory of Economic Regulation." *Bell Journal of Economics and Management Science*, vol. 2 (Spring), pp. 3-21.
- Thaler, Richard H. 1988. "Anomalies: The Winner's Curse." *Journal of Economic Perspectives*, vol. 2, winter, pp. 191-202.
- Tobin, James. 1958. "Liquidity Preference as Behavior Towards Risk." *Review of Economic Studies*, vol. 25, February, pp. 65-86.
- . 1963. "Commercial Banks as Creators of 'Money'." In Deane Carson, ed., *Banking and Monetary Studies*. Homewood IL: Richard D. Irwin Inc., pp. 408-19.
- . 1982. "Money and Finance in the Macroeconomic Process." *Journal of Money, Credit, and Banking*, vol. 14, no. 2, May, pp. 171-204.
- . 1985. "Financial Innovation and Deregulation in Perspective." *Bank of Japan Monetary and Economic Studies*, vol. 3, September, pp. 19-29.
- Webb, Bernard L. and Claude C. Lilly, III. 1994. *Raising the Safety Net: Risk-Based Capital for Life Insurance Companies*. Kansas City, MO: National Association of Insurance Commissioners.