Monetary Policy and Consumer Expenditures: The Historical Evidence

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I. Introduction

The Quantity Theory and the Keynesian Income-Expenditure Theory approaches have both sought to explain aggregate demand and the price level. However, the income-expenditure analysis went further in claiming a wider range of dependable implications about the broad outlines of the composition of aggregate demand in addition to aggregate demand itself. In fact, the traditional income-expenditure analysis of aggregate demand mainly derived from the analysis of private and public decisions about the uses to which current income and expenditures are put.

Past differences in the intended scopes of the two leading general approaches to maero-phenomena explain some of the difficulty in comparing their performances. It also suggests why many of the economists who analyze business conditions and prepare business forecasts who have recently come to accept the Quantity Theory view that the stock of money is an important determinant of short-

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period fluctuations in aggregate demand have also been troubled because they have found it either difficult or impossible to make the Quantity Theory apparatus yield as wide a range of implications

TABLES and CHARTS

about the details of the economy as they had been accustomed to obtaining when applying the income-expenditure framework. It has not been enough to repeat that the Quantity Theory was never designed to predict short-period relationships among GNP components, or that a narrow range of good predictions is preferable to a wide range of poor ones.

The Quantity Theory in its current state seeks to explain a more limited range of economic phenomena than many alternative hypotheses, which ought not dull the lustre of its performance in predicting nominal aggregate income or the price level, neither easy nor trivial tasks. Widening the range of implications of the effects of monetary change would, however, enhance the usefulness of the stock of money as a predictor of short-period economic change, including whether there are dependable links between money and specific expenditures. If dependable associations between money and specific expenditures do exist, they may suggest some elements of the process by which the economy adjusts to a change in the stock of money to add to our rather meager tested knowledge of the channels through which monetary policy affects the economy. No doubt these and related concerns were some of the motivating factors in organizing this conference.

II. Summary

The main purpose of this paper is to help provide the conference with some of the evidence about the empirical association between monetary policy and both the aggregate of consumer (or household, as distinct from government or business) spending and some of its principal components, including expenditures for residential housing construction. The paper first updates some of the regressions done in the original Friedman-Meiselman study[1] on the relationship between money and consumer demand and improves on these estimates for the 1952-1969 period mainly by the use of the Almon lag technique. The most important finding is that there is a strong association between monetary policy, evaluated as changes in either of two

[1]Milton Friedman and David Meiselman, "The Relative Stability of Monetary Velocity and the Investment Multiplier in the U.S., 1897-1958," in *Stabilization Policies*, A Series of Research Studies prepared for the Commission on Money and Credit (New Jersey: Prentice Hall, 1963).

measures of the stock of money for the monetary base on the one hand, and both consumer spending and GNP on the other. The evidence strongly supports the view that monetary change affects aggregate demand principally by altering household spending rather than business investment expenditures for plant and equipment which the Keynesian analysis presumes are the link between monetary actions and the spending response of the private sector. The links between money and consumer outlays are more dependable, the lags are shorter, and the magnitude of effect greater than between money and plant and equipment spending. The paper then reports on other experiments with disaggregating the main components of household spending and of GNP and reports some interesting regularities which are suggestive of the adjustment process.

One of the most intriguing regularities is that the more durable the class of expenditures the shorter the lag and, correspondingly, the less durable the class of expenditures the longer the lag. A change in the stock of money first leads to a relatively large increase in expenditures for housing construction, then expenditures for consumer durables, then consumer non-durables, and lastly consumer services. This suggests that the total response of consumer outlays to monetary change is a composite of two conceptually separable responses which operate with different lags, that money first influences expenditures for the stock of household capital and that money later affects outlays on the flow of consumption services.

The earlier response of household tangible capital may be thought of as resulting from a set of substitution, or balance sheet, responses to a corresponding change in cash balances. If the stock of money is increased so that individuals initially hold a larger proportion of their assets in the form of cash than they desire under existing alternatives, people will tend to substitute cash for other forms of wealth. A substitution between money and household tangible capital may take place directly; new cash is "spent" to acquire more housing or automobiles, thereby increasing the demand for their stocks. Alternatively, the substitution chain may be a longer one, with money initially exchanged for intangible wealth such as credit instruments, thereby affecting interest rates or credit market conditions, which in turn tends to alter outlays for consumption capital. We cannot yet effectively discriminate between these two classes of hypotheses, but whichever route money takes in influencing spending for consumption capital the resulting change in household wealth and permanent income may then be the source of later changes in outlays

on the flow of consumption services, an income rather than substitution effect. This may explain why the lag of service component of personal consumption expenditures is significantly longer and more sustained than other components of household spending. (Alternatively, the change in demand for consumption services may be related to the corresponding change in the flow of services yielded by the altered stock of household capital, and the two may turn out to be essentially complementary household demands.)

This view of the linkages between monetary change and consumer outlays suggests that many of the apparent differences between the quantity theory and the income-expenditure theory with respect to the adjustment process may hinge critically on definitions of the variables involved. For example, these results indicate, as the Keynesian analysis has asserted, that investment expenditures of the first private outlays for goods and services that respond to monetary policy, but that the empirically relevant investment expenditures are for household rather than business capital, housing more than plant, and consumer durables more than equipment. Similarly, the length and shape of the lag for services suggests that money affects consumption by altering income, but that the relevant measure of income is permanent rather than measured income and that the relevant measure of consumption is the flow of consumption services rather than what statisticians have come to measure as Personal Consumption Expenditures. In other words, these results suggest that when the variables are properly defined and measured, there may well be great merit to the empirical presumption of the income-expenditure analysis that the chain of causation resulting from monetary change may indeed be from money to capital goods to income to consumption. We intend to pursue this line of analysis in future research.

The shape of the lag as well as the length of the lag also tends to be related to durability. The expenditure response of housing construction expenditures, and to a lesser degree of consumer durables, tends to over-shoot. The more durable the expenditures the earlier and the greater the over-shooting, and thereby the greater the tendency for cycles to result from variations in the rate of change of money. Housing expenditures react quickly to monetary change, reach a maximum with a lag of two quarters, and then decline for the next three quarters. The decline virtually offsets all of the initial increase, leaving essentially no permanent impact on housing construction expenditures.

These patterns indicate that variations in the rate of change of money have contributed to instability and to cycles in the level of expenditures for housing construction and for consumer durables. They suggest that stable monetary growth would help to reduce the instability of these important components of aggregate demand, variations in which tend to make up such a large share of short period fluctuations in private spending.

Because of the evidence we present about the strong association between money and consumer spending, we also tested whether a change in monetary policy leads to a corresponding change in consumer spending or the other way around. The paper reports some interesting and impressive results of attempting to resolve the long standing chicken-egg problem. It concludes that a change in the stock of money (or the monetary base) is followed by a change in consumer spending or total GNP, *but not the reverse.* As is generally the case in the use of timing evidence to adduce causality, this evidence is highly suggestive of the direction of effect but is not conclusive by itself. The paper concludes with a section relating some of these findings to recent analysis of the relationship between monetary policy and consumption and emphasizes the roles of the scale variable, the real rate of interest, and the expected rate of price change.

III a. The Original Friedman-Meiselman Results, 1897-1958.

A starting point for the presentation of our findings is the Friedman-Meiselman paper which was completed somewhat more than 10 years ago. This study not only achieved much notoriety--plus an academic promotion for its junior author--but one of its major and unintended results was a set of regressions evaluating the relationship between the stock of money and personal expenditures using annual data for the period 1897-1958 and quarterly data for the period from the end of World War II through 1958. Separate business cycle periods as well as the long period as a whole were analyzed with annual data. The quarterly data were analyzed for the immediate postwar period as a whole. These regressions were a by-product of a research effort which initially sought to test the relative abilities of simple versions of the income--expenditure theory and the quantity theory to predict aggregate income, not the relationship between the stock of money and consumer spending. Friedman and Meiselman initially posed the research problem in terms of statistical tests to determine whether autonomous

expenditures, which the income-expenditure theory asserts is a controlling factor in determining aggregate demand, predicts income better than the stock of money. Using criteria and tests that have become part of the controversy the paper initiated, Friedman and Meiselman settled on personal consumption expenditures as the induced component of income, and for autonomous expenditures, they used the sum of gross private domestic investment, the government deficit on income and product account, and net exports. They also defined money to include currency in the hands of the public plus both commercial bank demand and time deposits, M_2. Although many of the controversies the study raised need not concern or detour us here, some of the findings provide us with evidence of the relationship between money and consumption.

The study concluded, "There is throughout . . . a close and consistent relation between the stock of money and consumption and income, and between year-to-year changes in the stock of money and in consumption or income. . . . These statements hold both for the annual data available for a 62-year period and for the quarterly data available for the period after World War II."

Because personal consumption expenditures are such a large proportion of total income it was not surprising that the empirical relationship between money and income would tend to apply as well to the relationship between money and consumption outlays. What was surprising indeed was that not only was there a close relationship between the stock of money and consumption, one that was typically better than the relationship between autonomous expenditures and consumption as Friedman and Meiselman measured the variables, but also that there was generally a somewhat higher correlation between the stock of money and personal consumption expenditures than there was between money and total income! These results puzzled Friedman and Meiselman as well as many others who reviewed the study.[2] Except for the cycle periods that included World War II, this was typically the case for both annual data and quarterly data, for both nominal and real values, for both contemporaneous and lagged relations, and for both level figures and first differences.

[2]For example, see Harry Johnson, "Monetary Theory and Policy," *American Economic Review* (June, 1962).

A summary of some of the Friedman and Meiselman results are in Tables 1, 2, and 3.[3] Table 1 and Table 2 show some of the principal statistical results summarized above. Table 1 contains the correlation coefficients (r) and regression equations between the level of nominal consumption expenditures and the level of the nominal stock of money (M_2) for the 14 different periods examined. Table 2 shows the correlation coefficients between first differences of the two series for these periods as well as the correlation coefficients between first differences of aggregate income and first differences of the stock of money.

Using quarterly data for the 1946-1958 period as a whole, Friedman and Meiselman also attempted to examine the relationship between consumption and both concurrent and earlier values of money. The correlations were high throughout but adding lagged values of money contributed little. The high degree of multicollinearity among the reported lagged values of money meant that it was difficult to observe the separate effects of individual lags. In addition, both consumption and money were also highly trend dominated. Thus, although the correlation coefficients were extremely high, the regression coefficients were very unstable and typically did not differ significantly from zero.

Friedman and Meiselman then sought to avoid some of these problems by a set of multiple regressions in which first differences of current and lagged values of money were used to explain first differences of personal consumption expenditures. Correlation coefficents dropped sharply and regression coefficients again tended to be both unstable and statistically insignificant.

[3]Although Friedman and Meiselman discuss the results of correlations between first differences in the original study, they neglected to present these correlations. However, they did so in "Reply to Donald Hester," *Review of Economics and Statistics,* Nov. 1964, Table 1, p. 375. Part of this table is reproduced above as Table 2. Some of the data have been revised since these tests were originally conducted. In a recent study William Poole and Elinda Kornblith reestimated these regressions using the revised series. They reported that the revisions were minor and the statistical findings were little affected by the revision. (See their paper, "The Friedman-Meiselman C. M. C. Paper: New Evidence on a Seven-Year Old Controversy," presented at the Detroit Meetings of the Econometric Society, December 1970. See also, David Meiselman, "The Stock of Money or Autonomous Expenditures as Predictors of Aggregate Income: Some Recent Evidence," *Business Economics,* Summer 1968, for a partial replication of post-1968 data of the Friedman-Meiselman tests and a comparison of these results with a similar replication using measures proposed by A. Ando and F. Modigliani.)

TABLE 1[4]

SIMPLE REGRESSION EQUATIONS BETWEEN NOMINAL CONSUMPTION AND SYNCHRONOUS VALUES OF THE NOMINAL STOCK OF MONEY (M_2)

Period	Constant Term	Regression Coefficient of M	r
Annual Figures			
1897-1958	7.812	1.315	.985
1897-1908	3.190	1.635	.996
1903-1913	.533	1.900	.997
1908-1921	1.427	1.810	.995
1913-1920	-.123	1.875	.991
1920-1929	15.303	1.357	.968
1921-1933	.337	1.663	.897
1929-1939	-9.432	1.527	.912
1933-1938	7.278	1.303	.991
1938-1953	-2.434	1.262	.958
1939-1948	17.438	.976	.963
1948-1957	-140.039	2.230	.990
1929-1958	-1.198	1.351	.974
Quarterly Figures			
1945_{III} - 1958_{IV}	-175.088	2.422	.985

[4]Friedman and Meiselman, "The Relative Stability . . .," Table II-2, p. 226.

TABLE 2[5]

CORRELATIONS BETWEEN FIRST DIFFERENCES OF SYNCHRONOUS VARIABLES IN NOMINAL TERMS

Period	$\Delta C\ \Delta M_2$	$\Delta Y\ \Delta M_2$
Annually		
1898-1958	.696	.576
1898-1908	.868	.863
1903-1913	.907	.803
1908-1921	.872	.782
1913-1920	.728	.534
1920-1929	.693	.627
1921-1933	.820	.786
1930-1939	.890	.884
1933-1938	.879	.832
1938-1953	.353	.180
1939-1948	.163	-.177
1948-1957	.434	.256
1930-1958	.627	.543
Quarterly		
1946_{II} - 1958_{IV}	.229	.148

[5]Friedman and Meiselman, "Reply to Donald Hester," Table 1, p. 375.

TABLE 3[6]

REGRESSION EQUATIONS BETWEEN FIRST DIFFERENCES OF CONSUMPTION AND FIRST DIFFERENCES OF THE STOCK OF MONEY FOR THE SAME AND EARLIER QUARTERS QUARTERLY FIGURES, 1945_{III} - 1958_{IV}

Constant Term	Regression Coefficient of (and Its Standard Error)						
	M_t	M_{t-1}	M_{t-2}	M_{t-3}	M_{t-4}	M_{t-5}	R
11.193	.889	—	—	—	—	—	.297
	(.397)	—	—	—	—	—	
10.620	.405	.706	—	—	—	—	.359
	(.502)	(.457)	—	—	—	—	
10.695	.420	.777	-.115	—	—	—	.360
	(.510)	(.546)	(.472)	—	—	—	
10.590	.409	.694	-.309	.321	—	—	.373
	(.513)	(.560)	(.545)	(.444)	—	—	
10.567	.382	.713	-.339	.267	.098	—	.374
	(.533)	(.573)	(.568)	(.517)	(.469)	—	
10.494	.420	.650	-.315	.194	.002	.192	.377
	(.548)	(.602)	(.577)	(.577)	(.539)	(.513)	

[6] Friedman and Meiselman, "The Relative Stability . . .," Table II-7, p. 239.

IIIb. Experiments with Updating the Friedman-Meiselman Study

Experiments with updating the Friedman-Meiselman tests are presented in Table 4 through Table 9. Table 4 shows the regression equations between the level of nominal personal consumption expenditures and either nominal M_1 (currency plus demand deposits), or nominal M_{2N} (M_1 plus commercial bank time deposits less charge certificates of deposit) for four peak-to-peak cycles between the third quarter of 1953 and the fourth quarter of 1969 as well as for the period as a whole. The correlation coefficients are close to unity except for the 1957_3 - 1960_2 cycle. For M_1 there is some evidence of cycle-to-cycle changes in the relationship between money and personal consumption expenditures and a clock-wise rotation of the regression line as the negative constant term moved closer to zero and the positive slope coefficient declined from a value of 5.58 for the 1953_3 - 1957_3 cycle to a value of 3.44 for the 1966_4 - 1969_4 cycle.

The same general relationships hold between personal consumption expenditures and M_{2N} except that the rotation of the regression line took place during the 1950's, but not during the two cycles of the 1960's. The regression coefficients are essentially identical for both the 1960_2 - 1966_4 and 1966_4 - 1969_4 periods and both constant terms are close to or are essentially zero. The regression equations for the 1960's are also close to the peak-to-peak cycle values found in the Friedman-Meiselman study using yearly data.

However, with both personal consumption expenditures and the stock of money series highly trend dominated the correlation coefficients are biased toward unity and the residuals are highly autocorrelated, as evidenced by the uniformly low Durbin-Watson statistics. When first differences are regressed (see Table 5) the Durbin-Watson statistics for the two 1960's cycles show essentially no autocorrelation of the residuals but the correlation coefficient falls sharply in all cases, in many cases falling to zero. The regression lines also rotate in a clock-wise direction in successive periods.

Much the same picture as revealed in these regressions and the earlier Friedman-Meiselman regressions is seen when current and lagged values of money are regressed on personal consumption expenditures using level figures as well as first differences for quarterly observations over the 1952-1969 period. (See Table 6 and Table 7 for regressions of level figures with C_t as the dependent

TABLE 4

SIMPLE REGRESSION EQUATIONS OF NOMINAL PERSONAL CONSUMPTION EXPENDITURES ON CONTEMPORANEOUS NOMINAL M_1 OR M_{2N}, 1953_3 - 1969_4 AND FOUR INTRAPERIOD PEAK - TO - PEAK CYCLES (QUARTERLY, SEASONALLY ADJUSTED DATA)

	M_1				
	$53_3 - 57_3$	$57_3 - 60_2$	$60_2 - 66_4$	$66_4 - 69_4$	$53_3 - 69_4$
Constant	-490.980 (-9.21)	-318.276 (-2.59)	-341.858 (-31.83)	-119.059 (-4.92)	-376.830 (-25.77)
Regression Coefficient	5.582 (14.00)	4.422 (5.04)	4.726 (67.98)	3.444 (26.87)	4.851 (51.33)
R^2	0.92	0.69	0.99	0.98	0.98
D–W	0.24	0.36	1.07	1.00	0.08
	M_{2N}				
	$53_3 - 57_3$	$57_3 - 60_2$	$60_2 - 66_4$	$66_4 - 69_4$	$53_3 - 69_4$
Constant	-251.851 (-10.06)	-88.884 (-1.29)	10.004 (2.34)	0.434 (0.01)	-22.971 (-4.54)
Regression Coefficient	2.770 (20.25)	1.915 (5.66)	1.477 (88.86)	1.489 (17.16)	1.572 (79.65)
R^2	0.96	0.74	0.99	0.96	0.99
D–W	0.32	0.30	0.99	0.64	0.13

Note: t-values in parentheses

variable and current and lagged values of M_1 and M_{2N} as independent variables respectively. Table 8 and Table 9 present the corresponding first difference calculations.) For level figures all regressions have coefficients of multiple determination (R^2) close to unity and Durbin-Watson statistics close to zero, again showing strong evidence for positive autocorrelation of residuals. Essentially all the regression coefficients are both unstable and do not differ significantly from zero, reflecting multicollinearity and other statistical malaises. When first differences are used there is a marked reduction in the degree of positive serial correlation of the residuals as evidenced by the improvements of all the Durbin-Watson statistics, which move close to a value of 2.00. With the exception of contemporaneous changes in M_1, the regression coefficients remain unstable and are statistically insignificant.

Evidence of the multicollinearity problem can be seen in Tables 10, 11, and 12. These tables contain the simple correlation coefficients between first differences of lagged, concurrent, and leading nominal values of M_1, M_{2N}, and the monetary base, B, on the one hand, and on the other hand personal consumption expenditures (C) and its major components. These comprise consumer durables (D), consumer non-durables (N), and services (S) as well as expenditures for residential housing construction (H), GNP (Y), and several combinations of these expenditures.

With respect to C, the highest correlation for M_1 occurs when money comes two quarters earlier, when M_{2N} comes three quarters earlier, and when the monetary base comes one quarter earlier. However, for each monetary measure differences in adjacent quarters tend to be relatively small as they do for money coming four to five quarters earlier than C to one or two quarters later than C.

There is another interesting timing characteristic of Tables 10, 11, and 12 that shows up more clearly in results discussed later in the paper. The highest correlation between each of the three measures of monetary change and the spending component shown in the three tables tends to have the shortest lag for housing, perhaps the most durable item in the household budget, a somewhat longer lag for consumer durables, the next most durable item in the household budget, a still longer lag for non-durables, and the longest lag for the service component of personal consumption expenditures.

TABLE 5

REGRESSION EQUATIONS OF FIRST DIFFERENCES IN NOMINAL PERSONAL CONSUMPTION EXPENDITURES ON FIRST DIFFERENCES IN NOMINAL M_1 OR NOMINAL M_{2N}, 1953_3 - 1969_4 AND FOUR INTRAPERIOD PEAK-TO-PEAK CYCLES (QUARTERLY, SEASONALLY ADJUSTED DATA)

	ΔM_1				
	$53_3 - 57_3$	$57_3 - 60_2$	$60_2 - 66_4$	$66_4 - 69_4$	$53_3 - 69_4$
Constant	2.288	3.598	4.136	7.215	3.356
	(3.91)	(5.35)	(4.55)	(3.17)	(6.78)
Regression	1.741	0.867	1.418	0.866	1.878
Coefficient	(2.00)	(1.46)	(2.17)	(1.05)	(6.15)
R^2	0.16	0.09	0.12	0.01	0.36
D–W	0.95	1.21	2.18	2.07	1.78
	ΔM_{2N}				
	$53_3 - 57_3$	$57_3 - 60_2$	$60_2 - 66_4$	$66_4 - 69_4$	$53_3 - 69_4$
Constant	2.072	3.756	2.293	9.385	3.075
	(1.72)	(4.11)	(1.57)	(4.01)	(4.92)
Regression	0.848	0.105	0.880	-0.007	0.740
Coefficient	(0.96)	(0.26)	(2.50)	(-0.02)	(4.87)
R^2	-0.01	-0.09	0.17	-0.09	0.26
D–W	0.83	1.24	2.32	1.82	1.50

Note: t-values in parentheses

TABLE 6

REGRESSION EQUATIONS OF NOMINAL PERSONAL CONSUMPTION EXPENDITURES ON THE NOMINAL STOCK OF MONEY (M_1) FOR THE SAME AND SUCCESSIVELY EARLIER QUARTERS, 1953_3 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

Constant	M_{1_t}	$M_{1_{t-1}}$	$M_{1_{t-2}}$	$M_{1_{t-3}}$	$M_{1_{t-4}}$	$M_{1_{t-5}}$	R^2	D–W
-376.830	4.851	—	—	—	—	—	.98	0.08
(-25.77)	(51.33)	—	—	—	—	—		
-386.877	2.626	2.307	—	—	—	—	.98	0.07
(-21.98)	(1.22)	(1.03)	—	—	—	—		
-407.321	7.055	-9.874	7.914	—	—	—	.98	0.15
(-22.12)	(2.69)	(-1.99)	(2.73)	—	—	—		
-426.631	4.983	-3.170	-2.648	6.083	—	—	.98	0.12
(-20.54)	(1.78)	(-0.53)	(-0.43)	(1.95)	—	—		
-443.295	4.565	-4.177	2.732	-3.152	5.415	—	.98	0.13
(-19.33)	(1.63)	(-0.70)	(0.40)	(-0.52)	(1.78)	—		
-463.784	4.254	-4.003	1.160	2.774	-4.256	5.617	.98	0.16
(-20.12)	(1.64)	(-0.72)	(0.18)	(0.44)	(-0.76)	(2.00)		

Note: t-values in parentheses

TABLE 7

REGRESSION EQUATIONS OF NOMINAL PERSONAL CONSUMPTION EXPENDITURES ON THE NOMINAL STOCK OF MONEY (M_{2N}) FOR THE SAME AND SUCCESSIVELY EARLIER QUARTERS, 1953_3 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

Constant	M_{2N_t}	$M_{2N_{t-1}}$	$M_{2N_{t-2}}$	$M_{2N_{t-3}}$	$M_{2N_{t-4}}$	$M_{2N_{t-5}}$	R^2	D–W
-22.971	1.572	—	—	—	—	—	.99	0.13
(-4.54)	(79.65)	—	—	—	—	—		
-26.059	0.583	1.015	—	—	—	—	.99	0.11
(-4.71)	(0.87)	(1.47)	—	—	—	—		
-30.856	2.092	-2.916	2.455	—	—	—	.99	0.13
(-5.21)	(2.22)	(-1.56)	(2.26)	—	—	—		
-36.620	1.505	-1.053	-0.448	1.664	—	—	.99	0.10
(-5.80)	(1.61)	(-0.50)	(-0.19)	(1.39)	—	—		
-36.677	1.494	-1.429	0.780	-0.296	1.128	—	.98	0.11
(-3.52)	(1.10)	(-0.46)	(0.20)	(-0.08)	(0.66)	—		
-42.360	1.623	-1.719	0.387	1.428	-1.523	1.518	.98	0.14
(-3.86)	(1.28)	(-0.59)	(0.11)	(0.38)	(-0.47)	(0.93)		

Note: t-values in parentheses

TABLE 8

REGRESSION EQUATIONS OF FIRST DIFFERENCES OF NOMINAL PERSONAL CONSUMPTION EXPENDITURES ON FIRST DIFFERENCES OF THE NOMINAL STOCK OF MONEY (M_1) FOR THE SAME AND SUCCESSIVELY EARLIER QUARTERS, 1953_3 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

Constant	$\Delta M1_t$	$\Delta M1_{t-1}$	$\Delta M1_{t-2}$	$\Delta M1_{t-3}$	$\Delta M1_{t-4}$	$\Delta M1_{t-5}$	R^2	D-W
3.356	1.878	—	—	—	—	—	.36	1.78
(6.78)	(6.15)	—	—	—	—	—		
3.030	0.896	1.264	—	—	—	—	.42	1.95
(6.22)	(1.93)	(2.72)	—	—	—	—		
2.522	1.338	-0.396	1.682	—	—	—	.52	2.38
(5.47)	(3.07)	(-0.66)	(3.85)	—	—	—		
2.221	1.254	-0.051	0.591	1.113	—	—	.56	2.46
(4.88)	(3.00)	(-0.09)	(1.00)	(2.61)	—	—		
2.125	1.219	-0.050	0.696	0.735	0.402	—	.56	2.44
(4.55)	(2.91)	(-0.08)	(1.16)	(1.25)	(0.93)	—		
2.187	1.248	-0.052	0.709	0.653	0.673	-0.296	.56	2.45
(4.57)	(2.95)	(-0.09)	(1.17)	(1.08)	(1.14)	(-0.67)		

Note: t-values in parentheses

TABLE 9

REGRESSION EQUATIONS OF FIRST DIFFERENCES OF NOMINAL PERSONAL CONSUMPTION EXPENDITURES ON FIRST DIFFERENCES OF THE NOMINAL STOCK OF MONEY (M_{2N}) FOR THE SAME AND SUCCESSIVELY EARLIER QUARTERS, 1953_3 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

Constant	ΔM_{2N_t}	$\Delta M_{2N_{t-1}}$	$\Delta M_{2N_{t-2}}$	$\Delta M_{2N_{t-3}}$	$\Delta M_{2N_{t-4}}$	$\Delta M_{2N_{t-5}}$	R^2	D-W
3.075	0.740	–	–	–	–	–	.26	1.50
(4.92)	(4.87)	–	–	–	–	–		
2.576	-0.006	0.893	–	–	–	–	.36	1.74
(4.31)	(-0.02)	(3.41)	–	–	–	–		
1.791	0.328	-0.274	1.066	–	–	–	.51	2.36
(3.22)	(1.36)	(-0.77)	(4.37)	–	–	–		
1.391	0.182	0.167	0.020	0.884	–	–	.58	2.42
(2.66)	(0.80)	(0.48)	(0.05)	(3.53)	–	–		
1.323	0.127	0.197	0.086	0.629	0.238	–	.58	2.40
(2.50)	(0.54)	(0.56)	(0.23)	(1.67)	(0.91)	–		
1.372	0.152	0.215	0.104	0.547	0.473	-0.238	.58	2.43
(2.57)	(0.64)	(0.61)	(0.27)	(1.40)	(1.23)	(-0.84)		

Note: t-values in parentheses

TABLE 10

SIMPLE CORRELATION COEFFICIENTS BETWEEN FIRST DIFFERENCES OF LAGGED AND LEADING VALUES OF NOMINAL M_1 (CURRENCY PLUS DEMAND DEPOSITS ADJUSTED) AND FIRST DIFFERENCES OF NOMINAL GNP, NOMINAL CONSUMER SPENDING, AND SOME PRINCIPAL COMPONENTS, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	C	D	N	S	H	C+H	Y
$M_{1_{t+4}}$	.341	.012	.288	.573	-.057	.300	.251
$M_{1_{t+3}}$	.311	.008	.212	.597	-.055	.272	.331
$M_{1_{t+2}}$	.496	.215	.345	.639	.129	.496	.378
$M_{1_{t+1}}$	.583	.353	.405	.599	.376	.646	.498
M_{1_t}	.603	.345	.449	.608	.492**	.698**	.645
$M_{1_{t-1}}$	.628	.355**	.475	.629	.376	.688	.663**
$M_{1_{t-2}}$	.629**	.342	.499	.617	.102	.612	.643
$M_{1_{t-3}}$	.603	.221	.527**	.685**	-.161	.514	.527
$M_{1_{t-4}}$	.520	.172	.409	.683	-.347	.385	.377
$M_{1_{t-5}}$	.346	-.016	.282	.639	-.245	.252	.228
$M_{1_{t-6}}$	.208	-.108	.181	.518	-.078	.171	.137
$M_{1_{t-7}}$	.215	-.050	.195	.431	-.040	.188	.156
$M_{1_{t-8}}$	.227	.012	.190	.378	-.154	.167	.158

C = personal consumption expenditures
D = consumer durables
N = consumer non-durables
S = consumer services
H = housing construction expenditures
**Denotes highest correlation

TABLE 11

SIMPLE CORRELATION COEFFICIENTS BETWEEN FIRST DIFFERENCES OF LAGGED AND LEADING VALUES OF NOMINAL M_{2N} (M_1 PLUS COMMERCIAL BANK TIME DEPOSITS LESS LARGE CD'S) AND FIRST DIFFERENCES OF NOMINAL GNP, NOMINAL CONSUMER SPENDING, AND SOME PRINCIPAL COMPONENTS, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	C	D	N	S	H	C+H	Y
$M_{2N_{t+4}}$	.355	.015	.356	.561	-.222	.267	.340
$M_{2N_{t+3}}$	.406	.113	.321	.564	-.228	.312	.388
$M_{2N_{t+2}}$	.445	.179	.326	.572	-.013	.409	.372
$M_{2N_{t+1}}$	.481	.248	.341	.552	.196	.502	.418
M_{2N_t}	.522	.276	.380	.575	.429**	.605	.552
$M_{2N_{t-1}}$	.619	.311	.485	.657	.378	.681	.684
$M_{2N_{t-2}}$	.705	.324**	.578	.757	.171	.702**	.737**
$M_{2N_{t-3}}$	.745**	.323	.611**	.830	-.040	.680	.703
$M_{2N_{t-4}}$	.694	.306	.515	.841	-.141	.604	.604
$M_{2N_{t-5}}$	.578	.133	.458	.843**	-.102	.507	.496
$M_{2N_{t-6}}$	.498	.087	.387	.779	-.005	.460	.443
$M_{2N_{t-7}}$	.496	.101	.384	.755	-.001	.459	.469
$M_{2N_{t-8}}$	.529	.129	.422	.757	-.136	.452	.438

C = personal consumption expenditures
D = consumer durables
N = consumer non-durables
S = consumer services
H = housing construction expenditures
**Denotes highest correlation

TABLE 12

SIMPLE CORRELATION COEFFICIENTS BETWEEN FIRST DIFFERENCES OF LAGGED AND LEADING VALUES OF NOMINAL B (MONETARY BASE) AND FIRST DIFFERENCES OF NOMINAL GNP, NOMINAL CONSUMER SPENDING, AND SOME PRINCIPAL COMPONENTS, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	C	D	N	S	H	C+H	Y
B_{t+4}	.385	-.022	.365	.646	-.086	.332	.416
B_{t+3}	.552	.195	.461	.670	-.087	.487	.503
B_{t+2}	.561	.257	.395	.696	.043	.533	.480
B_{t+1}	.511	.209	.388	.632	.156	.518	.481
B_t	.595	.264	.496	.641	.276**	.629	.571
B_{t-1}	.657**	.394**	.492	.630	.221	.671**	.685**
B_{t-2}	.605	.245	.484	.717	.076	.583	.650
B_{t-3}	.633	.263	.515**	.726	-.061	.570	.544
B_{t-4}	.580	.209	.454	.738**	-.149	.496	.485
B_{t-5}	.488	.116	.397	.693	-.110	.422	.363
B_{t-6}	.410	.069	.301	.670	-.010	.377	.365
B_{t-7}	.410	.074	.333	.618	.005	.382	.364
B_{t-8}	.435	.163	.307	.594	-.067	.385	.379

C = personal consumption expenditures
D = consumer durables
N = consumer non-durables
S = consumer services
H = housing construction expenditures
**Denotes highest correlation

IIIc. Experiments with the Almon Lag Procedure on the Impact of Money on Household Spending and Its Major Components

These and other statistical problems led us to experiment with the use of the Almon lag procedure to estimate distributed lag relationships between first differences of monetary change and first differences of consumption outlays and its major components or of GNP and some of its major components. The findings reported here use a 4th degree interpolating polynomial. We experimented with other orders of the polynomial, but the results were relatively insensitive. We settled on the 4th degree polynomial, in part, to compare our results with the Andersen-Jordan equations which also use the 4th degree polynomial.[7] The polynomial was constrained to zero at (t + 1) and (t - n), where n is the length of the lag. We also experimented with unconstrained regressions as well as single-ended constraints at (t + 1) and (t - n) separately, but those results, too, differed little from the constrained ones. Impressive results of distributed lag relationships between monetary change and change in household spending are found in Tables 13, 14, and 15, all of which have five quarters of lag.

We experimented with alternative periods of lag for each set of variables reported in this paper. We settled on the best lag on the basis of whether adding additional periods of lag altered the regression coefficients and whether the regression coefficients of additional periods of lag were statistically significant. We initially experimented with up to eight quarters of lag. It turned out that in most cases, and for all three monetary variables we examined, the best distributed lag spanned contemporaneous through five consecutive earlier quarters. In several cases, however, notably in the case of the service component of personal consumption expenditures, still longer lags appeared best. For services we experimented with distributed lags of up to 12 quarters and found that the best lags were either 9 or 10 quarters. Reported in Table 16 are estimates of lags where it appeared to us that the best relations involve periods of lag greater than five quarters. In the distributed lag estimations involving first differences of M_1 as the independent variable and personal consumption expenditures as the dependent

[7] For an account of some of the implications for several major GNP components of the Andersen-Jordan model see Leonall C. Andersen, "Money and Economic Forecasting," *Business Economics*, September 1969.

variable, the best lag pattern is found when there are six rather than five quarters of lag. These results are also reported in Table 16.

These tables have interesting properties when all of the variables are reported with the same period of lag. They facilitate a convenient comparison of the effects of money on major classes of spending and their components. The tables contain much information about the response of aggregate expenditures to monetary aggregates, the response of important components of the aggregate expenditures to money, as well as the contribution of the components to the change in aggregate demand itself. The tables have not yet been subjected to a complete analysis, and we report only a preliminary reading. Because it appears that the general response of different spending components is similar for each of the three monetary aggregates, we shall discuss Table 13 which analyzes the effects of M_1 only. The principal difference among the 3 monetary aggregates appears to be a tendency for slightly longer lags with M_{2N}. We intend to make a more systematic and rigorous analysis of these and related results in later research.

Table 13 contains the distributed lag regression equations between (1) first differences of nominal GNP, nominal consumer spending and housing and (2) the first differences of the nominal stock of the M_1 definition of money. (Tables 14 and 15 use M_{2N} and the monetary base respectively as independent variables.)

To illustrate the use of the table, consider the effects of a once-for-all unit change in M_1 on GNP. To do so, read down the column. It shows that an increase in M_1 of \$1 billion leads to an increase in GNP of \$1.388 billion in the same quarter. The regression coefficient of 1.388 is highly significant and has a t-value of 3.58. In addition, the effects of a once-for-all increase in the quantity of money continue for several quarters more. One quarter later, the first difference of GNP will increase by \$1.681 billion more. Two quarters later the first difference of GNP will increase again, but at a decreasing amount (\$1.315 billion), and so forth. The entire effect will be exhausted after a lag of three additional quarters. Four and five quarters after the initial increase in the stock of money, there is essentially no further impact on aggregate GNP. Considering the total effect over the period as a whole, the \$1 billion increase in M_1 leads to an increase of \$4.892 billion in the level of GNP. For some indication of relative scale, this is approximately 0.87 percent of the mean value of GNP for this period of \$560.9 billion.

These statistical results also indicate that GNP responds quickly to monetary change, that the response tends to accelerate for one

TABLE 13

DISTRIBUTED LAG REGRESSION EQUATIONS OF FIRST DIFFERENCES OF NOMINAL GNP, NOMINAL CONSUMER SPENDING, AND SOME PRINCIPAL COMPONENTS ON FIRST DIFFERENCES OF THE NOMINAL STOCK OF MONEY (M_1=CURRENCY PLUS DEMAND DEPOSITS ADJUSTED) FOR THE SAME AND 5 EARLIER QUARTERS, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	Pers. Cons. Exp. Total	Total	Durables			Non-Dur.	Serv.	Housing	C+H	Y
			Auto	Furn.	Other					
M_{1_t}	0.620 (2.94)	0.186 (1.27)	0.088 (0.66)	0.059 (1.59)	0.049 (2.17)	0.173 (1.42)	0.260 (4.58)	0.395 (5.86)	1.015 (4.64)	1.388 (3.58)
$M_{1_{t-1}}$	0.732 (5.76)	0.288 (3.24)	0.162 (2.02)	0.096 (4.28)	0.034 (2.48)	0.257 (3.48)	0.187 (5.46)	0.291 (7.17)	1.023 (7.76)	1.681 (7.19)
$M_{1_{t-2}}$	0.612 (3.64)	0.259 (2.21)	0.162 (1.53)	0.089 (3.01)	0.003 (0.15)	0.264 (2.71)	0.088 (1.95)	0.019 (0.35)	0.631 (3.61)	1.315 (4.25)
$M_{1_{t-3}}$	0.441 (2.68)	0.114 (0.99)	0.080 (0.77)	0.041 (1.41)	-0.016 (-0.89)	0.215 (2.25)	0.112 (2.52)	-0.202 (-3.84)	0.239 (1.40)	0.669 (2.21)
$M_{1_{t-4}}$	0.305 (2.30)	-0.075 (-0.81)	-0.043 (-0.51)	-0.025 (-1.08)	-0.012 (-0.85)	0.134 (1.74)	0.246 (6.88)	-0.261 (-6.16)	0.044 (0.32)	0.066 (0.27)
$M_{1_{t-5}}$	0.193 (0.87)	-0.177 (-1.13)	-0.116 (-0.83)	-0.062 (-1.58)	0.003 (0.13)	0.051 (0.39)	0.319 (5.30)	-0.157 (-2.20)	0.036 (0.15)	-0.227 (-0.55)
Sum	2.903 (8.31)	0.595 (2.44)	0.333 (1.52)	0.198 (3.21)	0.061 (1.62)	1.094 (5.40)	1.214 (12.87)	0.084 (0.75)	2.987 (8.24)	4.892 (7.61)
Constant	2.092 (4.30)	0.181 (0.53)	0.036 (0.12)	0.089 (1.04)	0.058 (1.11)	0.746 (2.64)	1.164 (8.87)	0.085 (0.54)	2.176 (4.31)	3.032 (3.39)
Mean Dep. Var.	354.6	51.8	22.6	22.1	7.2	162.8	140.0	23.9	378.5	560.9
Sum/Mean(%)	0.82	1.15	1.48	0.90	0.84	0.67	0.87	0.35	0.79	0.87
R^2	0.52	0.13	0.03	0.23	0.05	0.31	0.70	0.46	0.56	0.53
SE	2.45	1.71	1.54	0.43	0.26	1.42	0.66	0.78	2.54	4.51
D-W	2.21	2.44	2.47	2.28	2.71	2.39	0.94	1.54	2.16	1.36

TABLE 14

DISTRIBUTED LAG REGRESSION EQUATIONS OF FIRST DIFFERENCES OF NOMINAL GNP, NOMINAL CONSUMER SPENDING, AND SOME PRINCIPAL COMPONENTS ON FIRST DIFFERENCES OF THE NOMINAL STOCK OF MONEY ($M_{2N} = M_1$ PLUS COMMERCIAL BANK TIME DEPOSITS LESS LARGE CD'S) FOR THE SAME AND 5 EARLIER QUARTERS, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	Pers. Cons. Exp. Total	Total	Durables			Non-Dur.	Serv.	Housing	C+H	Y
			Auto	Furn.	Other					
M_{2N_t}	0.023 (0.23)	0.008 (0.11)	-0.024 (-0.36)	0.003 (0.17)	0.033 (3.05)	-0.020 (-0.34)	0.034 (1.53)	0.167 (4.49)	0.190 (1.73)	0.140 (0.77)
$M_{2N_{t-1}}$	0.202 (3.15)	0.092 (1.90)	0.040 (0.94)	0.039 (3.29)	0.015 (2.10)	0.078 (2.03)	0.033 (2.26)	0.147 (6.10)	0.349 (4.92)	0.589 (4.97)
$M_{2N_{t-2}}$	0.351 (3.84)	0.140 (2.03)	0.090 (1.47)	0.058 (3.48)	-0.010 (-0.97)	0.162 (2.98)	0.049 (2.36)	0.044 (1.28)	0.395 (3.91)	0.845 (5.02)
$M_{2N_{t-3}}$	0.370 (4.46)	0.105 (1.68)	0.076 (1.37)	0.042 (2.75)	-0.016 (-1.76)	0.167 (3.38)	0.097 (5.15)	-0.063 (-2.04)	0.306 (3.34)	0.695 (4.54)
$M_{2N_{t-4}}$	0.250 (3.74)	0.005 (0.11)	0.006 (0.14)	-0.002 (-0.21)	-0.001 (-0.13)	0.090 (2.27)	0.154 (10.09)	-0.121 (-4.84)	0.128 (1.74)	0.214 (1.74)
$M_{2N_{t-5}}$	0.070 (0.59)	-0.078 (-0.87)	-0.058 (-0.73)	-0.038 (-1.76)	0.017 (1.34)	-0.007 (-0.10)	0.155 (5.74)	-0.102 (-2.28)	-0.031 (-0.24)	-0.235 (-1.07)
Sum	1.266 (9.26)	0.272 (2.64)	0.131 (1.42)	0.101 (4.03)	0.039 (2.58)	0.470 (5.77)	0.523 (16.77)	0.071 (1.38)	1.337 (8.84)	2.249 (8.91)
Constant	1.365 (2.69)	-0.014 (-0.04)	-0.009 (-0.02)	-0.013 (-0.14)	0.008 (0.14)	0.486 (1.61)	0.893 (7.73)	-0.059 (-0.31)	1.306 (2.33)	1.390 (1.48)
Mean Dep. Var.	354.6	51.8	22.6	22.1	7.2	162.8	140.0	23.9	378.5	560.9
Sum/Mean (%)	0.36	0.52	0.58	0.46	0.54	0.29	0.37	0.30	0.35	0.40
R^2	0.57	0.10	0.01	0.26	0.12	0.35	0.81	0.35	0.55	0.58
SE	2.31	1.74	1.56	0.42	0.25	1.38	0.53	0.87	2.55	4.26
D-W	2.40	2.32	2.40	2.31	2.78	2.52	1.40	1.21	2.08	1.46

Note: t-values in parentheses

TABLE 15

DISTRIBUTED LAG REGRESSION EQUATIONS OF FIRST DIFFERENCES OF NOMINAL GNP, NOMINAL CONSUMER SPENDING, AND SOME PRINCIPAL COMPONENTS ON FIRST DIFFERENCES OF THE MONETARY BASE FOR THE SAME AND 5 EARLIER QUARTERS, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	Pers. Cons. Exp. Total	Total	Durables			Non-Dur.	Serv.	Housing	C+H	Y
			Auto	Furn.	Other					
B_t	1.461 (1.89)	0.662 (1.22)	0.180 (0.37)	0.281 (2.08)	0.235 (2.91)	0.581 (1.30)	0.218 (1.04)	1.210 (4.19)	2.672 (3.20)	3.488 (2.53)
B_{t-1}	2.274 (4.17)	1.051 (2.73)	0.538 (1.55)	0.387 (4.06)	0.144 (2.52)	0.847 (2.68)	0.376 (2.54)	1.050 (5.14)	3.324 (5.64)	6.202 (6.37)
B_{t-2}	2.306 (3.57)	0.934 (2.05)	0.637 (1.56)	0.306 (2.71)	-0.019 (-0.28)	0.830 (2.22)	0.542 (3.10)	0.270 (1.12)	2.576 (3.69)	6.179 (5.36)
B_{t-3}	1.653 (2.68)	0.341 (0.78)	0.333 (0.85)	0.088 (0.81)	-0.104 (-1.62)	0.602 (1.68)	0.709 (4.24)	-0.549 (-2.38)	1.104 (1.66)	3.188 (2.90)
B_{t-4}	0.642 (1.15)	-0.430 (-1.10)	-0.221 (-0.62)	-0.159 (-1.64)	-0.070 (-1.20)	0.277 (0.86)	0.794 (5.26)	-0.996 (-4.79)	-0.355 (-0.59)	-1.276 (-1.28)
B_{t-5}	-0.171 (-0.20)	-0.818 (-1.38)	-0.579 (-1.08)	-0.265 (-1.80)	0.021 (0.24)	0.011 (0.02)	0.636 (2.79)	-0.836 (-2.65)	-1.007 (-1.11)	-3.989 (-2.65)
Sum	8.164 (8.58)	1.740 (2.59)	0.888 (1.47)	0.638 (3.83)	0.206 (2.08)	3.148 (5.71)	3.276 (12.69)	0.149 (0.42)	8.314 (8.09)	13.793 (8.12)
Constant	1.652 (3.18)	0.066 (0.18)	0.010 (0.03)	0.024 (0.27)	0.034 (0.63)	0.552 (1.83)	1.034 (7.34)	0.116 (0.60)	1.768 (3.15)	2.259 (2.44)
Mean Dep. Var.	354.6	51.8	22.6	22.1	7.2	162.8	140.0	23.9	378.5	560.9
Sum/Mean(%)	2.30	3.36	3.94	2.89	2.85	1.93	2.34	0.62	2.20	2.46
R^2	0.52	0.11	0.02	0.24	0.10	0.31	0.70	0.27	0.52	0.56
SE	2.45	1.72	1.55	0.43	0.26	1.42	0.66	0.92	2.64	4.37
D–W	2.14	2.36	2.41	2.27	2.79	2.38	0.95	1.19	1.88	1.40

Note: *t-values in parentheses*

TABLE 16

DISTRIBUTED LAG RELATIONS WHERE THE BEST PERIOD OF LAG IS GREATER THAN (t-5), 1952_1-1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	A	B	C	D
M_t	0.123 (3.88)	0.015 (1.26)	0.282 (2.33)	0.513 (2.96)
M_{t-1}	0.179 (5.47)	0.031 (2.42)	0.420 (3.27)	0.741 (5.86)
M_{t-2}	0.193 (7.88)	0.047 (4.63)	0.464 (4.99)	0.733 (5.99)
M_{t-3}	0.182 (7.30)	0.060 (6.09)	0.451 (5.26)	0.555 (3.64)
M_{t-4}	0.160 (5.26)	0.071 (5.82)	0.411 (3.58)	0.288 (2.41)
M_{t-5}	0.136 (4.47)	0.077 (5.99)	0.365 (2.83)	0.028 (0.20)
M_{t-6}	0.115 (4.31)	0.078 (7.08)	0.325 (2.85)	-0.110 (-0.58)
M_{t-7}	0.098 (3.20)	0.074 (7.77)	0.294 (3.23)	— —
M_{t-8}	0.079 (1.98)	0.064 (5.09)	0.266 (2.44)	— —
M_{t-9}	0.051 (1.39)	0.048 (2.91)	0.225 (1.55)	— —
M_{t-10}	— —	0.026 (1.82)	0.148 (1.12)	— —
Sum	1.32 (11.13)	0.592 (18.57)	3.652 (12.44)	2.747 (7.52)
Constant	1.077 (7.28)	0.773 (7.23)	0.922 (6.42)	2.244 (4.52)
Mean Dep. Var.	140.0	140.0	140.0	354.6
Sum/Mean(%)	0.94	0.42	2.61	0.77
R^2	0.68	0.85	0.72	0.52
S-E	0.68	0.47	0.64	2.44
D-W	0.92	1.75	0.96	2.20

Note: t-values in parentheses

A: M is M_1, Dependent Variable is Services

B: M is M_{2N}, Dependent Variable is Services

C: M is B, Dependent Variables is Services

D: M is M_1, Dependent Variable is Personal Consumption Expenditures

quarter for M_1 and two quarters for M_{2N}. The total impact of monetary change on the level of GNP reaches a maximum in three to four quarters. 90% of the total effect of first differences in M_1 on the level of GNP is achieved after two quarters. Reflecting the somewhat longer lead of M_{2N} over GNP, 70% of the effect of first differences in M_{2N} is reached after two quarters. The final effect is essentially achieved after three quarters, although GNP does rise in the fourth quarter before falling in the fifth quarter of lag. A similar analysis can easily be made of each component of GNP.

Personal consumption expenditures, its principal components, and housing can also be analyzed in the same way. A $1 billion increase in M_1 leads to an increase in personal consumption expenditures of $.620 billion in the same quarter, $.732 billion more a quarter later, and so forth, with the total effect on the level of personal consumption expenditures summing to $2.903 billion, or 0.82 percent of their mean value of $354.6 billion for the period. These figures suggest that personal consumption expenditures tend to be relatively less responsive than gross national product when considering *total or cumulative* effects. Note also that the coefficient for concurrent personal consumption expenditures of 0.620 relative to the sum of the coefficients of 2.903 suggests that only about 20 percent of the total effect of monetary change on C takes place during the same quarter. Similarly, almost 25 percent of the total effect takes place one quarter later, its peak effect, and roughly 20 percent of the total effect is two quarters later, approximately 15 percent three quarters later, and so forth. All regression coefficients for the synchronous and the first four quarters of lagged changes in M_1 are highly significant and the coefficient of multiple determination (R^2) is 0.52, especially impressive for a regression using first differences of quarterly and seasonally adjusted data. The Durbin-Watson statistic of 2.21 indicates essentially no serial correlation of the residuals.

These regressions are of first differences of the original data and the regression coefficients should be interpreted carefully to avoid confounding levels, first differences and second differences. To evaluate the impact of monetary *change* on the *level* of the dependent variable, note that a positive regression coefficient means an acceleration of the rate of change from the level in the previous period, a zero coefficient means no change in the rate of change of the level of the dependent variable, and a negative coefficient means a retardation (deceleration) of the rate of change of the level of the dependent variable. When using multiple regression coefficients to

analyze distributed lags, the peak acceleration takes place when the regression coefficient is a maximum. The cumulative impact of the initial disturbance is a maximum when the regression coefficient is essentially zero. For example, according to the regression coefficients reported in Table 13, a once-for-all increase in M_1 of $1.0 billion leads to an increase of GNP of $1.388 billion in the same quarter. In the next quarter, the disturbance has led to a further increment of $1.681 billion more in the rate of increase in GNP, so that one quarter after the monetary increase GNP is rising at the accelerating rate of $3.069 billion more than would have been the case without the monetary change. The still further increase of $1.315 billion in the next quarter means the GNP is then rising at the rate of $4.384 billion, but that the rate of increase is slowing down. These results indicate that the peak acceleration of GNP takes place with a one-quarter lag, and that the cumulative impact of monetary change on the level of GNP is a maximum when the lag is four quarters. Some of the cumulative changes can be seen more clearly in Table 17 which is derived from Table 13. Note finally that the negative coefficient for (t + 5) means that there is a mild tendency for GNP to overshoot in responding to monetary change.

Chart I shows actual values of quarterly changes in personal consumption expenditures and changes predicted from the regressions fitted to the 1952_1 - 1969_4 period. In addition it shows the results of using the estimated coefficients to predict the four quarters of 1970. Chart II shows similar values for the first differences in M_1 and first differences in the sum of personal consumption expenditures plus housing, one measure of total household spending on both consumption and investment goods. In both charts predicted values tend to track actual values except for some of the erratic quarter-to-quarter changes in actual values. The close fit includes the major cycles in the data, cycles which correspond to overall business cycle expansions and contractions, as one would anticipate given the high correlations and the absence of serial correlation of the residuals.

Because the coefficients of a set of components sum to the coefficient of the aggregate of the components, another set of comparisons is also possible with the use of this table. For example, the coefficient of GNP in each period can be interpreted as the marginal total of the individual components that sum to GNP. Thus, we can see that the coefficient for synchronous personal consumption expenditures is approximately 45 percent of the coefficient of GNP. This indicates that 45 percent of the change in aggregate demand

CHART I

ACTUAL AND ESTIMATED FIRST DIFFERENCES IN NOMINAL PERSONAL CONSUMPTION EXPENDITURES

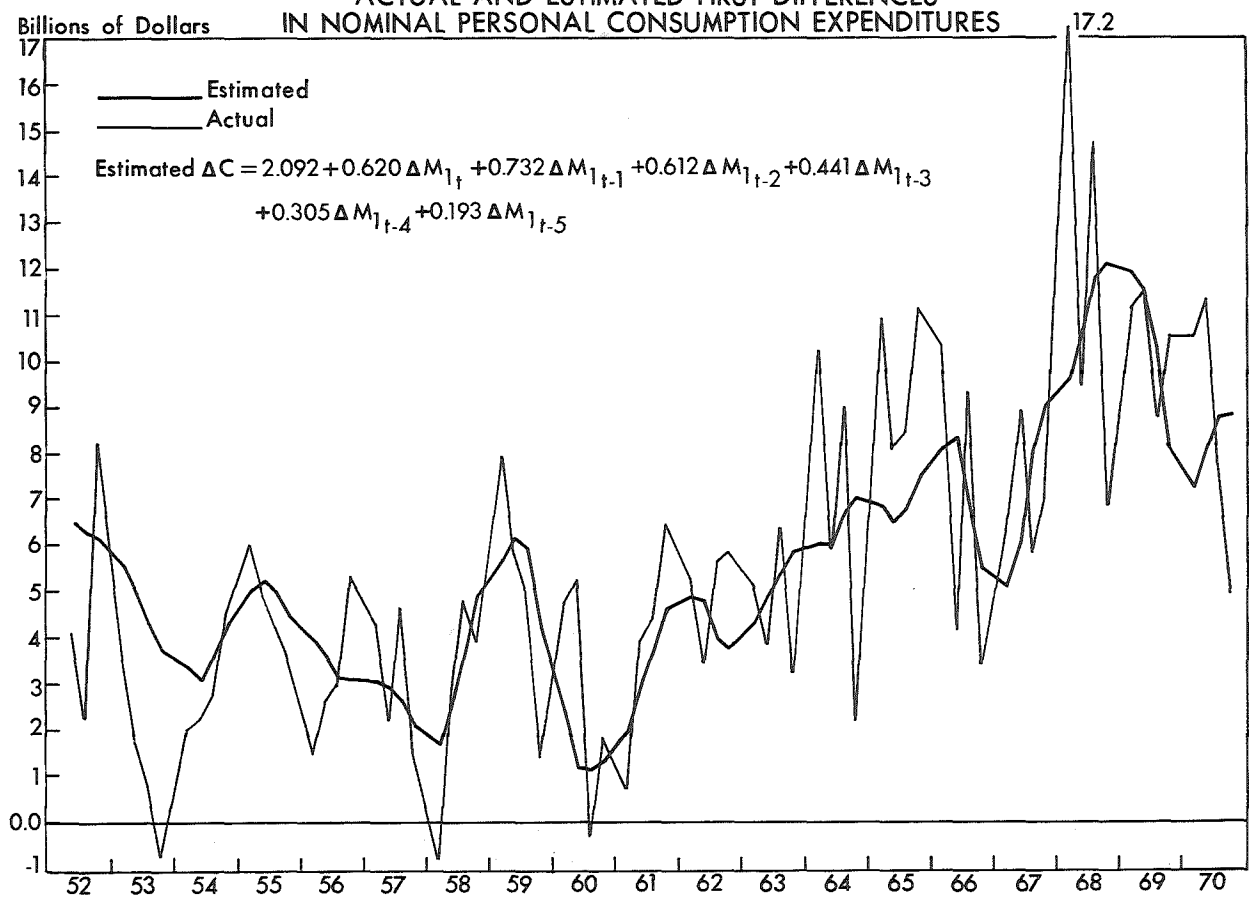
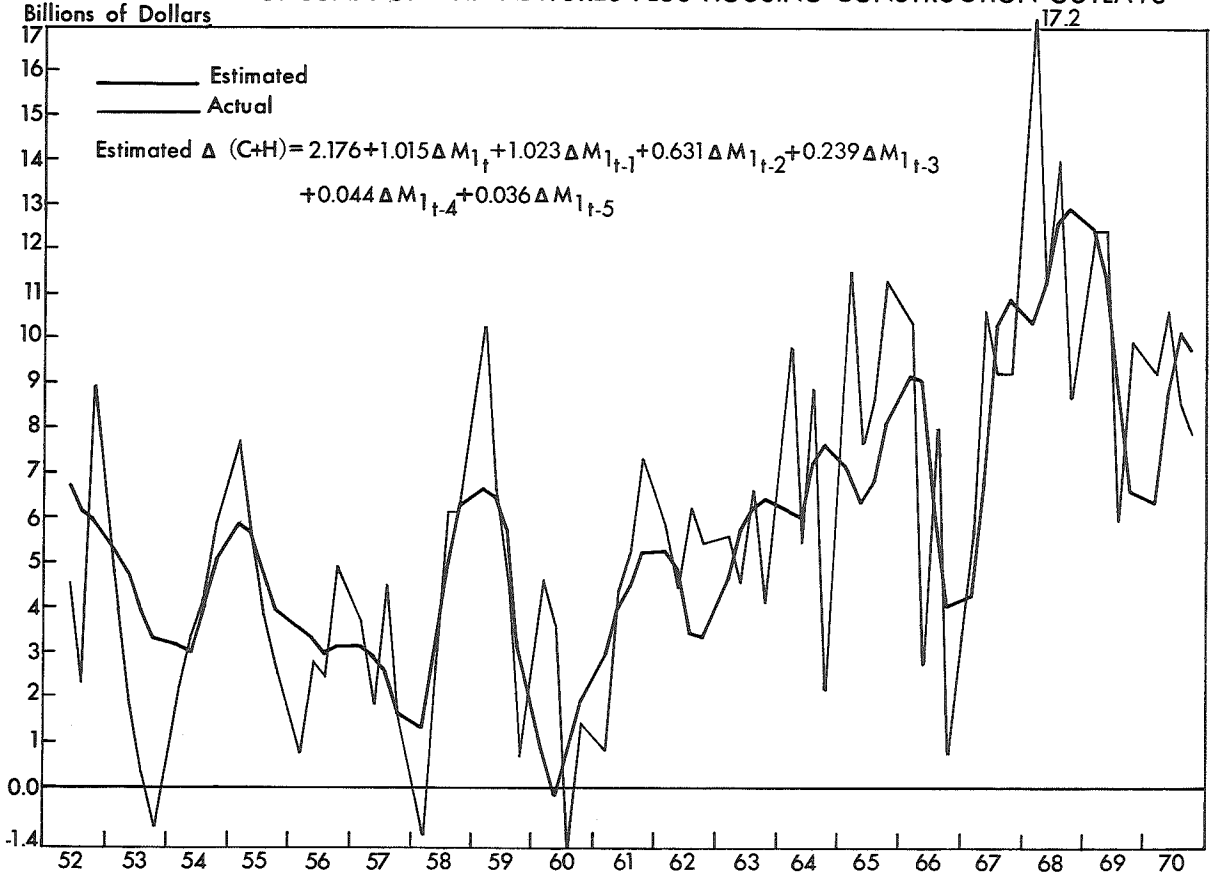


CHART II

ACTUAL AND ESTIMATED FIRST DIFFERENCES IN NOMINAL PERSONAL CONSUMPTION EXPENDITURES PLUS HOUSING CONSTRUCTION OUTLAYS



brought about by a change in the stock of money will come from personal consumption expenditures. The proportions of the components of personal consumption expenditures will be given by the relative weights of their separate coefficients. Thus, a $1 increase in M_1 will cause expenditures for services to increase by 26¢ in the same quarter, or approximately 18.5 percent of the total change in GNP in that quarter and 41 percent of the change in personal consumption expenditures, attributed to a concurrent increase in the stock of money. Similarly, the sum of the coefficients for each of the components taken separately can also be interpreted as a marginal total summed vertically. Thus, the sum of the coefficients for GNP can be interpreted as the grand total of all the cells.

Expressing the sum as a percent of the mean level value within the 1952_1 - 1969_4 period suggests the responsiveness or sensitivity of each component to monetary change. This procedure is analogous to deflating the sum of the coefficients for each component by its own mean in order to correct for scale differences. Thus, even though the sum of the coefficients for personal consumption expenditures is 2.9, several times greater than that for the durables component of .595, when deflated by their respective means it turns out that expenditures for consumer durables are relatively more responsive to changes in the stock of money than is the aggregate of personal consumption expenditures. For the moment, holding aside questions about the statistical significance of the sum for the automobile component of consumer durables, if we use this index as a reflection of the responsiveness of the component to monetary change, it can easily be seen that the 1.48 percent for the automobile component of durables is substantially greater than the 0.90 percent for the furniture component. Indeed, the sum of the coefficients for automobiles is larger relative to its own mean than any of the other components contained in Table 13. Of other GNP components that we have estimated thus far, it turns out that only the plant and equipment component of gross private domestic investment is more responsive to changes in M_1, than automobiles, and but slightly so. (The sum of its coefficients is 1.51 percent of its mean.)

IIId. Money and Housing Construction Expenditures

The responsiveness of expenditures for residential construction, H, to changes in M_1 is one of the most interesting aspects of Table 13 and Table 17. Monetary policy has a relatively great impact on

housing expenditures in same quarter. The coefficient of 0.395 indicates that when M_1 increases by one dollar, housing expenditures in the same quarter increase by 39.5¢, which is about 28% of the synchronous change in GNP explained by the change in M_1. One quarter later, housing expenditures expand to 68.6¢ for each dollar increase in M_1, or 29.1¢ more than in the quarter before. One quarter later, the effect of the once-for-all change in the stock of money on the flow of housing construction expenditures is essentially a maximum of 70.5¢ for each dollar increase in M_1. By the third quarter housing construction expenditures fall by 20¢. In the fourth quarter they continue to fall. By the fifth quarter the cumulative effect is essentially zero, and housing construction expenditures have returned to the level that existed before the once-for-all change in M_1. Housing construction expenditures are affected only temporarily, but the temporary change in housing construction does tend to alter the stock of housing permanently.

The pattern of lags for housing suggests several elements of the adjustment process to monetary change, including an apparent tendency for over-shooting which may help to generate cycles in housing construction expenditures, especially in the context of variable rates of monetary change. If the demand for housing is related to interest rates, as is generally conceded, the initial increase in the stock of money, by lowering interest rates, quickly causes a sharp increase in housing construction expenditures. However, once the effects of monetary change result in an increase in aggregate demand, interest rates start to rise, moderating the increase in demand. As GNP rises further, there is a tendency for interest rates to continue rising and to over-shoot, ending up higher than before the monetary expansion. The resulting tendency for a housing retardation may also be strengthened by resources being bid away from housing construction by the expansion of other GNP components which respond to monetary change with longer lags. These may be some of the damping mechanisms for both housing and consumer durables, as well as for the economy as a whole. (Note that the lag patterns for consumer durables suggest a response generally similar to housing but somewhat weaker and slower.) The U.S. financial structure and regulation would appear to accentuate these tendencies.

IIIe. Experiments with the Almon Lag Procedure on the Impact of Money on GNP and Its Major Components

Table 18 supplements Table 13 and contains a similar analysis for several other GNP components. Perhaps the most interesting are plant and equipment expenditures and state and local government purchases. Changes in plant and equipment expenditures respond to changes in M_1 with a lag of one quarter and with the peak effect at (t-2). As noted above, the total impact relative to the mean of plant and equipment expenditures for the 17-year period as a whole is the greatest among the GNP components we have analyzed thus far. It also turns out that changes in state and local government purchases are responsive to changes in M_1, both synchronously and with a lag of one quarter. According to these estimates federal government purchases of goods and services on income and product account are essentially unrelated to monetary change, including changes in the monetary base.

IIIf. Does Money "Cause" Consumption or Vice Versa?

The long-standing question often raised whenever it is demonstrated that there is an empirical association between money and spending is whether the change in money is followed by, or "causes," the change in income or consumption or whether the change in income or consumption resulting from some non-monetary disturbance is followed by, or "causes," the change in money. To help resolve this question, at least with respect to the findings we have presented, we turn to some experiments with distributed lag relations between changes in the money supply and alternative combinations of lagged and leading values of changes in personal consumption expenditures in order to help shed some light on the chicken-egg problem. We performed similar experiments with changes in GNP as the independent variable and the results are generally similar to the ones we report here.

These tables show results of trying to predict either M_1, M_{2N}, or the monetary base from information about changes in personal consumption expenditures, rather than the other way around. Consider some of the results in Table 21 where first differences in M_1 are the dependent variable. When values of first differences of personal consumption expenditures extending from one quarter before the first difference of M_1, to four quarters before, are used to predict changes

TABLE 17

IMPACT OF A ONCE-FOR-ALL CHANGE IN M_1 ON LEVELS OF EXPENDITURES FOR NOMINAL GNP, NOMINAL CONSUMER SPENDING AND SOME PRINCIPAL COMPONENTS

	Personal Consumption Expenditures							Housing	C+H	GNP
	Total	Durables				Non-Dur.	Serv.			
		Total	Auto	Furn.	Other					
Same Quarter	0.620	0.186	0.088	0.059	0.049	0.173	0.260	0.395	1.015	1.388
1 Qtr. Later	1.352	0.474	0.250	0.155	0.083	0.430	0.447	0.686	2.038	3.069
2 Qtrs. Later	1.964	0.733	0.412	0.244	0.086	0.694	0.535	0.705	2.669	4.384
3 Qtrs. Later	2.405	0.847	0.492	0.285	0.070	0.909	0.647	0.503	2.908	5.053
4 Qtrs. Later	2.710	0.772	0.449	0.260	0.058	1.043	0.893	0.242	2.952	5.119
5 Qtrs. Later	2.903	0.595	0.333	0.198	0.061	1.094	1.212	0.085	2.988	4.892

Note: The values in this table are derived from Table 13 and are cumulations of the changes in expenditures per quarter from the initial change in M_1 to the quarter noted.

TABLE 18

DISTRIBUTED LAG REGRESSION EQUATIONS OF FIRST DIFFERENCES OF NOMINAL GNP AND SOME PRINCIPAL COMPONENTS ON FIRST DIFFERENCES OF THE NOMINAL STOCK OF MONEY (M_1 = CURRENCY PLUS DEMAND DEPOSITS ADJUSTED) FOR THE SAME AND 5 EARLIER QUARTERS, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	GNP	Plant and Equip. Total	Equip.	Plant	Govt. Purch. Total	Federal Purch.	State Local Purch.
M_{1_t}	1.388 (3.58)	-0.022 (-0.19)	0.015 (0.16)	-0.036 (-0.60)	0.277 (1.53)	0.138 (0.91)	0.138 (2.17)
$M_{1_{t-1}}$	1.681 (7.19)	0.183 (2.62)	0.147 (2.61)	0.037 (1.03)	0.238 (2.18)	0.102 (1.12)	0.135 (3.52)
$M_{1_{t-2}}$	1.315 (4.25)	0.338 (3.65)	0.231 (3.09)	0.108 (2.25)	0.134 (0.93)	0.039 (0.32)	0.096 (1.88)
$M_{1_{t-3}}$	0.669 (2.21)	0.312 (3.43)	0.193 (2.64)	0.118 (2.52)	0.100 (0.71)	0.024 (0.20)	0.076 (1.53)
$M_{1_{t-4}}$	0.066 (0.27)	0.116 (1.59)	0.053 (0.90)	0.062 (1.66)	0.153 (1.35)	0.066 (0.69)	0.087 (2.17)
$M_{1_{t-5}}$	-0.227 (-0.55)	-0.089 (-0.72)	-0.079 (-0.80)	-0.010 (-0.17)	0.192 (1.00)	0.102 (0.64)	0.090 (1.34)
Sum	4.892 (7.61)	0.838 (4.35)	0.560 (3.61)	0.278 (2.81)	1.095 (3.65)	0.472 (1.88)	0.623 (5.90)
Constant	3.032 (3.39)	0.027 (0.10)	0.008 (0.04)	0.018 (0.13)	0.828 (1.98)	0.235 (0.67)	0.593 (4.04)
Mean Dep. Var. Sum/Mean(%)	560.9 0.87	55.6 1.51	35.5 1.58	20.1 1.38	117.9 0.93	63.5 0.74	54.4 1.14
R^2 SE D–W	0.53 4.51 1.36	0.27 1.35 1.72	0.20 1.09 1.94	0.12 0.70 2.46	0.13 2.10 0.88	0.01 1.76 1.01	0.33 0.74 1.07

Note: t-values in parentheses

TABLE 19

DISTRIBUTED LAG REGRESSION EQUATIONS OF FIRST DIFFERENCES OF NOMINAL GNP AND SOME PRINCIPAL COMPONENTS ON FIRST DIFFERENCES OF THE NOMINAL STOCK OF MONEY (M_{2N}=M_1 PLUS COMMERCIAL BANK TIME DEPOSITS LESS LARGE CD'S) FOR THE SAME AND 5 EARLIER QUARTERS, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	GNP	Plant And Equip. Total	Equip.	Plant	Govt. Purch. Total	Federal Purch.	State Local Purch.
M_{2N_t}	0.140 (0.77)	-0.066 (-1.09)	-0.036 (-0.77)	-0.030 (-0.98)	0.106 (1.29)	0.062 (0.84)	0.044 (1.73)
$M_{2N_{t-1}}$	0.589 (4.97)	0.037 (0.94)	0.029 (0.94)	0.008 (0.39)	0.130 (2.43)	0.067 (1.41)	0.062 (3.77)
$M_{2N_{t-2}}$	0.845 (5.02)	0.140 (2.52)	0.094 (2.14)	0.047 (1.66)	0.119 (1.57)	0.052 (0.77)	0.067 (2.84)
$M_{2N_{t-3}}$	0.695 (4.54)	0.157 (3.10)	0.104 (2.62)	0.053 (2.06)	0.102 (1.49)	0.038 (0.62)	0.064 (3.00)
$M_{2N_{t-4}}$	0.214 (1.74)	0.078 (1.91)	0.055 (1.72)	0.023 (1.09)	0.088 (1.59)	0.032 (0.65)	0.056 (3.23)
$M_{2N_{t-5}}$	-0.235 (-1.07)	-0.025 (-0.34)	-0.010 (-0.18)	-0.015 (-0.41)	0.065 (0.66)	0.027 (0.31)	0.038 (1.22)
Sum	2.249 (8.91)	0.321 (3.85)	0.235 (3.59)	0.085 (2.00)	0.610 (5.37)	0.278 (2.74)	0.332 (9.38)
Constant	1.390 (1.48)	-0.040 (-0.13)	-0.100 (-0.41)	0.060 (0.38)	0.133 (0.32)	-0.114 (-0.30)	0.247 (1.89)
Mean Dep. Var.	560.9	55.6	35.5	20.1	117.9	63.5	54.4
Sum/Mean(%)	0.36	0.58	0.66	0.42	0.52	0.44	0.61
R^2	0.58	0.21	0.17	0.06	0.28	0.07	0.56
S–E	4.26	1.41	1.11	0.72	1.92	1.71	0.60
D–W	1.46	1.62	1.91	2.31	1.05	1.09	1.51

Note: t-values in parentheses

in M_1, it can be seen that first differences of personal consumption expenditures with lags of one and two quarters are statistically significant, suggesting that changes in consumption lead to later changes in the stock of money. When synchronous changes in consumption are added, they too are statistically significant, but changes in consumption lagged two quarters lose significance. As we add values of changes in personal consumption expenditures coming *after* the first difference of M_1, the leading values are also significant with the peak coefficient at the lead of one quarter. In addition, the coefficients tend to be stable. Throughout, changes in consumption lagged one quarter remain statistically significant, suggesting that there is at least a one quarter feedback from consumption to money. However, taken as a whole these results suggest that the *main* direction of effect is from money to consumption. Although there is some feedback from consumption to M_1 with a lag of one quarter that does show up in Table 21, the same coefficient is not statistically significant for M_{2N} or the monetary base. Perhaps of greater importance for the controversy, this feedback does not show up in similar experiments we performed with first differences of lagged and leading values of GNP.

IV. Money and the Demand for Consumer Durables

The evidence of this study differs from the traditional interpretation of the income-expenditure theory. That theory implies that money affects consumption indirectly through changes in business investment. Additions to the stock of money increase the level of investment spending by lowering the rate of interest. The increase in investment then leads to an increase in the current income of the consumer which induces him to spend more on consumption goods. The sequence of causality thus implies that changes in investment precede changes in consumption.[8] However, this sequence is not consistent with the evidence discussed earlier in this paper. The evidence indicates that some components of consumption, consumer durables in particular, respond more quickly to monetary changes than business investment.

[8]Housing is an interesting special case. In the national income accounts it is treated as investment and thus we can assume it is sensitive to changes in the rate of interest. Yet housing decisions are made by households and it may be similar to consumption. The discussion which follows indicates that housing has properties similar to consumer durables and may be affected directly by changes in money.

TABLE 20

DISTRIBUTED LAG REGRESSION EQUATIONS OF FIRST DIFFERENCES OF NOMINAL GNP AND SOME PRINCIPAL COMPONENTS ON FIRST DIFFERENCES OF THE NOMINAL MONETARY BASE FOR THE SAME AND 5 EARLIER QUARTERS, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

	GNP	Plant And Equip. Total	Equip.	Plant	Govt. Purch. Total	Federal Purch.	State Local Purch.
B_t	3.488 (2.53)	-0.572 (-1.33)	-0.308 (-0.90)	-0.250 (-1.12)	1.234 (2.06)	0.848 (1.60)	0.386 (1.87)
B_{t-1}	6.202 (6.37)	0.486 (1.60)	0.441 (1.82)	0.052 (0.33)	1.390 (3.29)	0.872 (2.33)	0.518 (3.56)
B_{t-2}	6.179 (5.36)	1.404 (3.90)	1.030 (3.60)	0.370 (1.98)	0.994 (1.99)	0.510 (1.16)	0.484 (2.81)
B_{t-3}	3.188 (2.90)	1.316 (3.82)	0.884 (3.23)	0.423 (2.36)	0.447 (0.94)	0.089 (0.21)	0.358 (2.18)
B_{t-4}	-1.276 (-1.28)	0.266 (0.86)	0.076 (0.31)	0.182 (1.13)	0.022 (0.05)	-0.182 (-0.48)	0.204 (1.37)
B_{t-5}	-3.989 (-2.65)	-0.793 (-1.69)	-0.673 (-1.80)	-0.120 (-0.49)	-0.134 (-0.20)	-0.205 (-0.36)	0.071 (0.32)
Sum	13.793 (8.12)	2.106 (3.96)	1.450 (3.44)	0.657 (2.38)	3.952 (5.36)	1.931 (2.96)	2.022 (7.96)
Constant	2.259 (2.44)	0.009 (10.03)	-0.024 (-0.10)	0.032 (0.22)	0.256 (0.64)	-0.118 (-0.33)	0.373 (2.69)
Mean	560.9	55.6	35.5	20.1	117.9	63.5	54.4
Sum/Mean(%)	2.30	3.79	4.08	3.27	3.35	3.04	3.71
R^2	0.56	0.26	0.21	0.08	0.29	0.10	0.48
S–E	4.37	1.37	1.08	0.71	1.90	1.67	0.65
D–W	1.40	1.63	1.90	2.35	1.08	1.16	1.23

Note: t-values in parentheses

Some recent modifications of the traditional income-expenditures theory may help to explain this result.[9] Expenditures on consumer durables are separated from the other components of consumption and assumed to be a function not only of the scale variable, disposable income, but also of the rate of interest. In this respect consumer durables are similar to business investment. Thus an increase in the money stock lowers the rate of interest and stimulates both more capital equipment spending by businesses and more durable goods spending by households.

Empirical investigations relating to these channels have been made. These investigations have attempted to isolate the impact of changes in the rate of interest on the demand for consumer durables and the demand for investment goods. Their results indicate, however, that consumer durables respond to changes in the interest rate with a considerably longer lag than business investment. Consumer durables respond to changes in the Moody Aaa rate of interest with a lag of from four to six quarters.[10] Investment goods, on the other hand, respond to changes in this rate with a lag of about two quarters.[11] If we accept these lags we would expect investment to respond more quickly to changes in money than consumer durables, but this is inconsistent with our results. Our results indicate that the peak response to a change in money is shorter for consumer durables than it is for plant and equipment. Table 13 illustrates that for consumer durables the peak response to a change in M_1 occurs in the quarter following the change. Table 18 shows that for plant and equipment it occurs two quarters after the change in money, which incidentally is the same lag obtained by those who look at interest rates. In addition, if we consider housing to be a consumer durable, the lag for durables becomes even shorter. Hence, the discrepancy between our results for durables and the results of other studies relating money to spending through the rate of interest indicates that there may be

[9]For example, see Michael Hamburger, "Interest Rates and the Demand for Consumer Durable Goods," *American Economic Review,* LVII (December, 1967), 1132-53.

[10]See Hamburger, *op. cit.,* and Simpson, "Properties of the Demand for Consumer Durables," unpublished Ph. D. dissertation, Department of Economics, University of Chicago, 1970. Both studies estimate quarterly demand functions for durables and indicate a peak lag for automobiles with respect to changes in the Moody Aaa rate of four quarters and a peak lag for rest of the durables, furniture and other, of six quarters.

[11]See Z. Griliches and N. Wallace, "The Determinants of Investment Revisited," *International Economic Review* (September, 1965), 311-29.

additional routes through which changes in money affect household spending.

Recent developments in the area of intertemporal models of consumer behavior suggest additional channels through which money may affect consumption, and these additional channels may help reconcile the discrepancy.[12] In this type of model the consumer is viewed as making decisions which maximize his utility or satisfaciton over a number of time periods. These decisions are subject to a scale or budget constraint variable which is wealth, both human and non-human. One important implication of this class of models is that the consumer's optimal flow of consumption services over time will be relatively stable even when he expects his income to fluctuate greatly. Moreover, he can purchase these services directly or he can purchase their source, i.e., he can buy a consumer durable or a house.

According to these models, a change in money affects three types of economic variables which in turn affect the demand for goods and services. They are the scale variable, the real rate of interest, and the anticipated rate of price change. In the first place, changes in the money stock may result in unexpected changes in the scale variable or wealth.[13] To begin with, the money stock itself is a component of the community's wealth, and an increase in the money stock not immediately followed by a proportionate change in the price level increases the community's wealth. Probably more important, though, is the impact of a change in the stock of money on the price of financial assets and hence wealth held in the form of bonds and

[12]Early contributions were made by Friedman in his *A Theory of the Consumption Function* (Princeton, N.J.: Princeton University Press, 1957) and by Ando and Modigliani in "The 'Life Cycle' Hypothesis of Saving," *American Economic Review* LIII (March, 1963), 55-84. More recent contributions have been made by Motley, "The Consumer's Demand for Money: A Neoclassical Approach," *Journal of Political Economy,* LXXVII (October, 1969), 817-26; Simpson, *op. cit.;* Telser and Graves, "Constrained Maximization of an Infinite Dimensional Quadratic Form With An Application to the Theory of the Demand for Consumer Durable Goods," Center for Mathematical Studies in Business and Economics, Report No. 6842, University of Chicago, 1968; and Wright, "Some Evidence of the Interest Elasticity of Consumption," *Econometria,* XXV (September, 1967), 850-55.

[13]See H. G. Johnson, "Inside Money, Outside Money, Wealth and Welfare in Monetary Theory," *Journal of Money, Credit and Banking,* I (February, 1969), 30-46; Patinkin, "Money and Wealth: A Review Article," *Journal of Economic Literature,* I (December, 1969), 1140-59.

stocks.[14] An increase in the money stock may increase the price of both and correspondingly increase consumer spending with a short lag. This link between money and spending through fluctuations in the bond and stock market is increasingly being emphasized by economists and business analysts.

Unexpected changes in the budget constraint may have a differential impact on spending decisions. One model implies that the more durable the item in question, *ceteris paribus,* the greater the impact of an unexpected change in wealth on demand.[15] If we reflect on the matter for a moment, this implication seems reasonable. Recall that people wish to maintain a steady flow of consumption services over time. Hence, an increase in consumption resulting from an increase in wealth is likely to be spread out over several time periods. This can be accomplished easily by purchasing a consumer durable. In fact, the more durable the good the longer its service flow will be sustained. As a consequence, we may expect the most durable goods to be affected first by a change in the money stock and less durable goods affected later. This, in fact, is what Tables 13-15 of our paper suggest. We have found the most durable component of household spending, housing, to be the first affected by a change in money; the peak impact occurs in the same quarter as the change in M_1. Next to be affected is consumer durables, with a peak lag of one quarter. This is followed by nondurables, with a lag of two quarters; and the last component to be affected is services, with a peak lag of five quarters.[16]

[14]The relationship between money, interest rates and consumption has been labelled "Keynes' Second Psychological Law of Consumption" by Leijonhufvud. See Axel Leijonhufvud, *On Keynesian Economics and the Economics of Keynes* (New York: Oxford University Press, 1968) 191-98. The FRB-MIT model assumes money affects consumption through changes in the market value of financial assets, but with a relatively long lag. See Ando and Modigliani, "Econometric Analysis of Stabilization Policies," *American Economic Review,* LIX (May, 1969), 296-314.

[15]See Simpson, *op. cit.* pp. 18-20.

[16]A similar relative lag structure for housing and durables is obtained for interest rate changes by Simpson, *op. cit.,* pp. 46-70. However, the actual lag in each case, is longer than the lags we obtained in this study. Simpson finds housing to have a peak lag of three quarters, automobiles a peak lag of four quarters, and the rest of consumer durables to have a lag of six quarters. He also finds the intensity of response to changes in the rate of interest is directly related to durability. Housing is most responsive, automobiles are next most responsive, and the rest of durables are least responsive.

The two other types of variables affected by money and likely to affect consumer behavior are the real rate of interest and the anticipated rate of inflation. The relationship between money, interest rates and spending on consumer durables is discussed above in connection with the updated income-expenditures theory. One intertemporal model implies that the impact of a change in the rate of interest on spending, *ceteris paribus,* is directly related to durability.[17] Hence, here once again we have reason to expect a link between monetary changes and spending on durable goods. It should be noted that the inverse relationship between spending and the rate of interest is in terms of the real rate of interest, i.e., the effects of inflation expectations on the nominal rate of interest are eliminated.

Changes in the money stock may also affect the anticipated rate of price change. An increase in the anticipated rate of price change will induce people to substitute consumer durables and other goods whose price appreciates with the level of prices for cash balances and other assets fixed in nominal terms. Increases in the expected rate of inflation will increase the nominal rate of interest, but will have the opposite affect on consumer spending as a change in the real rate. An increase in the expected rate of price change will increase the nominal interest rate and increase the demand for consumer goods whereas an increase in the real rate of interest will lower the demand for consumer goods.

On the basis of the available evidence, we would expect both the real interest rate effect and the price expectations effect to work on consumer spending with a lengthy lag. Some empirical studies of the demand for consumer durables discussed earlier indicate an interest rate lag of from one to one-and-one-half years. Moreover, the impact of money on prices and of prices on expectations probably takes equally long, if not longer, to materialize. However, the empirical results of this study imply a relatively short lag between changes in money and changes in consumer spending, and hence interest rate and price expectations effects do not seem to carry much of the load.

[17] See Simpson, *op. cit.*, pp. 37-39.

TABLE 21

EXPERIMENTS WITH DISTRIBUTED LAG RELATIONS BETWEEN THE NOMINAL STOCK OF MONEY (M_1=CURRENCY PLUS DEMAND DEPOSITS ADJUSTED) AND ALTERNATIVE COMBINATIONS OF LAGGED AND LEADING NOMINAL PERSONAL CONSUMPTION EXPENDITURES, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

C_{t-4}	-0.030 (-0.80)	-0.041 (-1.28)	-0.049 (-1.84)	-0.050 (-2.33)	-0.047 (-2.64)	-0.044 (-2.97)	—	—	—	—
C_{t-3}	-0.035 (-1.16)	-0.034 (-1.69)	-0.031 (-1.87)	-0.033 (-2.11)	-0.035 (-2.31)	-0.036 (-2.48)	-0.029 (-1.60)	—	—	—
C_{t-2}	0.074 (2.58)	0.031 (1.09)	0.023 (1.04)	0.015 (0.94)	0.005 (0.40)	-0.001 (-0.13)	-0.009 (-0.58)	0.020 (0.94)	—	—
C_{t-1}	0.189 (4.90)	0.121 (6.20)	0.084 (3.88)	0.066 (3.36)	0.050 (3.15)	0.039 (3.19)	0.030 (2.48)	0.037 (2.30)	0.058 (2.27)	—
C_t	—	0.153 (4.75)	0.121 (7.44)	0.099 (6.58)	0.083 (5.33)	0.072 (5.15)	0.066 (4.18)	0.049 (3.26)	0.060 (3.83)	0.071 (2.38)
C_{t+1}	—	—	0.103 (3.86)	0.101 (6.61)	0.094 (8.20)	0.087 (7.25)	0.084 (5.34)	0.058 (3.02)	0.049 (2.42)	0.070 (3.88)
C_{t+2}	—	—	—	0.067 (3.15)	0.080 (5.44)	0.082 (7.92)	0.079 (6.74)	0.061 (4.06)	0.046 (2.26)	0.056 (2.16)
C_{t+3}	—	—	—	—	0.046 (2.58)	0.059 (4.20)	0.054 (3.65)	0.055 (3.61)	0.053 (3.49)	0.054 (3.00)
C_{t+4}	—	—	—	—	—	0.027 (1.85)	0.021 (1.20)	0.036 (1.73)	0.051 (2.05)	0.052 (1.79)
Sum	0.198 (5.09)	0.231 (6.30)	0.250 (7.09)	0.264 (7.78)	0.275 (8.40)	0.284 (8.80)	0.296 (9.02)	0.316 (9.66)	0.318 (10.00)	0.303 (9.60)
Constant	0.069 (0.31)	-0.127 (-0.60)	-0.250 (-1.22)	-0.346 (-1.74)	-0.421 (-2.19)	-0.477 (-2.51)	-0.519 (-2.65)	-0.606 (-3.07)	-0.614 (-3.17)	-0.545 (-2.79)
R^2	0.37	0.47	0.53	0.57	0.60	0.62	0.59	0.58	0.58	0.56
S–E	0.90	0.82	0.78	0.74	0.71	0.70	0.72	0.73	0.73	0.75
D–W	0.86	0.96	1.04	1.08	1.11	1.10	1.01	0.95	0.99	1.03

Note: t-values in parentheses

TABLE 22

EXPERIMENTS WITH DISTRIBUTED LAG RELATIONS BETWEEN THE NOMINAL STOCK OF MONEY (M_{2N}=M_1 PLUS COMMERCIAL BANK TIME DEPOSITS LESS LARGE CD'S) AND ALTERNATIVE COMBINATIONS OF LAGGED AND LEADING NOMINAL PERSONAL CONSUMPTION EXPENDITURES, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

C_{t-4}	-0.000 (-0.00)	0.004 (0.05)	0.016 (0.24)	0.010 (0.19)	0.005 (0.12)	-0.012 (-0.37)	– –	– –	– –	– –
C_{t-3}	0.053 (0.76)	0.020 (0.40)	0.006 (0.15)	0.001 (0.03)	-0.007 (-0.19)	-0.022 (-0.68)	0.021 (0.54)	– –	– –	– –
C_{t-2}	0.172 (2.55)	0.090 (1.28)	0.033 (0.61)	0.014 (0.36)	-0.005 (-0.16)	-0.015 (-0.63)	0.011 (0.32)	0.046 (1.01)	– –	– –
C_{t-1}	0.237 (2.63)	0.186 (3.88)	0.108 (2.03)	0.062 (1.30)	0.026 (0.71)	0.013 (0.47)	0.008 (0.29)	0.031 (0.92)	0.078 (1.46)	– –
C_t	– –	0.211 (2.66)	0.193 (4.83)	0.135 (3.66)	0.085 (2.33)	0.061 (1.98)	0.032 (0.94)	0.024 (0.76)	0.049 (1.48)	0.070 (1.14)
C_{t+1}	– –	– –	0.203 (3.07)	0.195 (5.18)	0.154 (5.70)	0.120 (4.50)	0.086 (2.55)	0.059 (1.48)	0.040 (0.94)	0.067 (1.81)
C_{t+2}	– –	– –	– –	0.179 (3.41)	0.199 (5.73)	0.172 (7.50)	0.153 (6.08)	0.132 (4.22)	0.100 (2.35)	0.107 (2.01)
C_{t+3}	– –	– –	– –	– –	0.170 (4.08)	0.192 (6.17)	0.199 (6.24)	0.202 (6.37)	0.198 (6.26)	0.197 (5.34)
C_{t+4}	– –	– –	– –	– –	– –	0.148 (4.57)	0.172 (4.52)	0.196 (4.45)	0.228 (4.40)	0.233 (3.93)
Sum	0.462 (5.07)	0.512 (5.69)	0.559 (6.43)	0.596 (7.17)	0.629 (8.14)	0.657 (9.16)	0.681 (9.67)	0.689 (10.10)	0.692 (10.46)	0.674 (10.42)
Constant	0.750 (1.42)	0.453 (0.87)	0.159 (0.32)	-0.089 (-0.18)	-0.321 (-0.71)	-0.520 (-1.23)	-0.621 (-1.48)	-0.662 (-1.60)	-0.678 (-1.68)	-0.594 (-1.48)
R^2	0.27	0.33	0.40	0.46	0.54	0.61	0.61	0.62	0.62	0.62
S–E	2.10	2.02	1.92	1.81	1.68	1.55	1.54	1.53	1.52	1.53
D–W	0.51	0.58	0.64	0.69	0.72	0.76	0.74	0.76	0.79	0.82

Note: t-values in parentheses

TABLE 23

EXPERIMENTS WITH DISTRIBUTED LAG RELATIONS BETWEEN THE NOMINAL MONETARY BASE AND ALTERNATIVE COMBINATIONS OF LAGGED AND LEADING NOMINAL PERSONAL CONSUMPTION EXPENDITURES, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

C_{t-4}	-0.012 (-0.98)	-0.005 (-0.44)	0.001 (0.10)	-0.002 (-0.28)	-0.002 (-0.40)	-0.003 (-0.62)	— —	— —	— —	— —
C_{t-3}	0.022 (2.20)	0.006 (0.84)	0.001 (0.17)	0.001 (0.14)	0.000 (0.00)	-0.001 (-0.19)	0.006 (1.03)	— —	— —	— —
C_{t-2}	0.041 (4.26)	0.022 (2.21)	0.007 (0.95)	0.008 (1.42)	0.006 (1.37)	0.004 (1.15)	0.008 (1.62)	0.008 (1.08)	— —	— —
C_{t-1}	0.026 (1.98)	0.033 (4.84)	0.020 (2.69)	0.017 (2.44)	0.013 (2.37)	0.011 (2.56)	0.010 (2.40)	0.011 (2.12)	0.013 (1.52)	— —
C_t	— —	0.029 (2.55)	0.033 (5.89)	0.025 (4.72)	0.020 (3.66)	0.017 (3.52)	0.012 (2.27)	0.014 (2.72)	0.016 (3.09)	0.028 (2.85)
C_{t+1}	— —	— —	0.033 (3.57)	0.028 (5.26)	0.024 (6.03)	0.021 (5.10)	0.016 (2.93)	0.017 (2.61)	0.017 (2.54)	0.021 (3.63)
C_{t+2}	— —	— —	— —	0.022 (2.92)	0.024 (4.61)	0.022 (6.24)	0.019 (4.86)	0.020 (3.97)	0.019 (2.79)	0.014 (1.63)
C_{t+3}	— —	— —	— —	— —	0.017 (2.67)	0.020 (4.02)	0.021 (4.12)	0.021 (4.14)	0.021 (4.11)	0.018 (3.00)
C_{t+4}	— —	— —	— —	— —	— —	0.012 (2.41)	0.016 (2.68)	0.016 (2.32)	0.018 (2.12)	0.023 (2.48)
Sum	0.077 (5.86)	0.086 (6.63)	0.095 (7.81)	0.098 (8.26)	0.102 (8.79)	0.104 (9.25)	0.109 (9.78)	0.106 (9.77)	0.105 (9.80)	0.104 (10.09)
Constant	0.052 (0.68)	0.002 (0.02)	-0.053 (-0.76)	-0.078 (-1.13)	-0.101 (-1.49)	-0.120 (-1.81)	-0.138 (-2.09)	-0.130 (-1.97)	-0.123 (-1.88)	-0.118 (-1.85)
R^2	0.36	0.41	0.50	0.53	0.56	0.58	0.58	0.58	0.58	0.58
S—E	0.30	0.29	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.24
D—W	1.03	1.24	1.34	1.46	1.53	1.58	1.55	1.60	1.60	1.60

Note: t-values in parentheses

TABLE 24

EXPERIMENTS WITH DISTRIBUTED LAG RELATIONS BETWEEN THE NOMINAL STOCK OF MONEY (M_1=CURRENCY PLUS DEMAND DEPOSITS ADJUSTED) AND ALTERNATIVE COMBINATIONS OF LAGGED AND LEADING GNP, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

Y_{t-4}	0.006 (0.25)	0.015 (0.92)	0.008 (0.66)	-0.002 (-0.25)	-0.011 (-1.53)	-0.015 (-2.41)	— —	— —	— —	— —
Y_{t-3}	-0.007 (-0.41)	-0.009 (-0.99)	-0.003 (-0.39)	-0.003 (-0.48)	-0.006 (-1.00)	-0.008 (-1.36)	-0.009 (-1.22)	— —	— —	— —
Y_{t-2}	0.024 (1.45)	-0.004 (-0.27)	-0.001 (-0.16)	0.004 (0.62)	0.007 (1.43)	0.008 (1.75)	0.004 (0.64)	0.001 (0.08)	— —	— —
Y_{t-1}	0.068 (3.15)	0.042 (4.55)	0.022 (2.35)	0.020 (2.63)	0.024 (3.86)	0.026 (5.12)	0.024 (4.70)	0.020 (3.10)	0.018 (1.73)	— —
Y_t	— —	0.079 (4.80)	0.056 (7.69)	0.040 (6.64)	0.038 (6.17)	0.039 (6.78)	0.039 (6.31)	0.039 (6.44)	0.039 (6.05)	0.047 (3.57)
Y_{t+1}	— —	— —	0.066 (5.53)	0.055 (8.42)	0.045 (9.08)	0.043 (8.42)	0.045 (7.21)	0.047 (6.26)	0.048 (5.72)	0.054 (7.18)
Y_{t+2}	— —	— —	— —	0.049 (5.60)	0.043 (6.83)	0.038 (8.09)	0.039 (7.68)	0.041 (6.76)	0.042 (4.99)	0.041 (3.49)
Y_{t+3}	— —	— —	— —	— —	0.029 (4.01)	0.026 (4.22)	0.024 (3.72)	0.023 (3.50)	0.023 (3.51)	0.021 (2.76)
Y_{t+4}	— —	— —	— —	— —	— —	0.011 (1.74)	0.007 (0.97)	0.003 (0.38)	0.002 (0.20)	0.005 (0.37)
Sum	0.091 (3.95)	0.123 (5.71)	0.147 (7.33)	0.163 (8.74)	0.168 (9.14)	0.169 (9.03)	0.173 (9.33)	0.174 (9.56)	0.173 (9.72)	0.167 (9.65)
Constant	0.353 (1.57)	0.069 (0.33)	-0.149 (-0.77)	-0.294 (-1.64)	-0.348 (-1.96)	-0.357 (-1.98)	-0.385 (-2.14)	-0.391 (-2.19)	-0.381 (-2.17)	-0.335 (-1.93)
R^2	.21	.39	.51	.60	.62	.62	.61	.61	.61	.60
S–E	1.00	.88	.79	.71	.70	.70	.71	.70	.70	.71
D–W	.76	.86	1.04	1.04	1.03	1.03	1.02	1.01	1.02	1.02

Note: t-values in parentheses

TABLE 25

EXPERIMENTS WITH DISTRIBUTED LAG RELATIONS BETWEEN THE NOMINAL STOCK OF MONEY (M_{2N}=M_1 PLUS COMMERCIAL BANK TIME DEPOSITS LESS LARGE CD'S) AND ALTERNATIVE COMBINATIONS OF LAGGED AND LEADING GNP, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

Y_{t-4}	0.044 (0.90)	0.074 (1.90)	0.073 (2.66)	0.046 (2.35)	0.017 (1.16)	-0.001 (-0.09)	— —	— —	— —	— —
Y_{t-3}	0.035 (0.95)	0.016 (0.75)	0.024 (1.44)	0.023 (1.59)	0.012 (0.94)	0.002 (0.19)	0.005 (0.37)	— —	— —	— —
Y_{t-2}	0.057 (1.53)	-0.003 (-0.08)	-0.015 (-0.72)	-0.001 (-0.04)	0.009 (0.91)	0.013 (1.34)	0.015 (1.15)	0.008 (0.46)	— —	— —
Y_{t-1}	0.086 (1.80)	0.062 (2.92)	0.015 (0.71)	0.010 (0.62)	0.021 (1.66)	0.030 (2.91)	0.030 (2.97)	0.028 (2.17)	0.020 (0.94)	— —
Y_t	— —	0.132 (3.43)	0.100 (6.08)	0.059 (4.45)	0.049 (3.89)	0.052 (4.48)	0.050 (4.04)	0.053 (4.38)	0.054 (4.14)	0.065 (2.49)
Y_{t+1}	— —	— —	0.149 (5.48)	0.119 (8.27)	0.086 (8.29)	0.074 (7.13)	0.072 (5.79)	0.078 (5.09)	0.084 (4.93)	0.090 (5.98)
Y_{t+2}	— —	— —	— —	0.129 (6.75)	0.112 (8.52)	0.090 (9.39)	0.089 (8.79)	0.093 (7.64)	0.099 (5.85)	0.095 (4.11)
Y_{t+3}	— —	— —	— —	— —	0.097 (6.53)	0.091 (7.28)	0.091 (7.12)	0.091 (6.97)	0.091 (6.98)	0.088 (5.90)
Y_{t+4}	— —	— —	— —	— —	— —	0.065 (5.20)	0.067 (4.59)	0.063 (3.61)	0.058 (2.66)	0.063 (2.38)
Sum	0.222 (4.36)	0.282 (5.61)	0.346 (7.58)	0.386 (9.47)	0.405 (10.59)	0.418 (11.03)	0.420 (11.30)	0.414 (11.33)	0.406 (11.35)	0.401 (11.61)
Constant	1.303 (2.62)	0.779 (1.60)	0.203 (0.46)	-0.174 (-0.44)	-0.372 (-1.01)	-0.496 (-1.36)	-0.516 (-1.43)	-0.466 (-1.30)	-0.402 (-1.13)	-0.361 (-1.04)
R^2	0.20	0.31	0.47	0.60	0.65	0.67	0.67	0.67	0.67	0.67
S–E	2.22	2.05	1.79	1.56	1.45	1.42	1.42	1.42	1.42	1.42
D–W	0.52	0.66	0.76	0.80	0.81	0.86	0.85	0.86	0.84	0.85

Note: t-values in parentheses

TABLE 26

EXPERIMENTS WITH DISTRIBUTED LAG RELATIONS BETWEEN THE NOMINAL MONETARY BASE AND ALTERNATIVE COMBINATIONS OF LAGGED AND LEADING GNP, 1952_1 - 1969_4 (QUARTERLY, SEASONALLY ADJUSTED DATA)

Y_{t-4}	0.007 (1.05)	0.011 (2.01)	0.012 (2.93)	0.007 (2.54)	0.003 (1.36)	0.001 (0.48)	– –	– –	– –	– –
Y_{t-3}	0.007 (1.25)	0.004 (1.42)	0.005 (2.23)	0.005 (2.41)	0.004 (1.82)	0.003 (1.30)	0.003 (1.09)	– –	– –	– –
Y_{t-2}	0.010 (1.93)	0.002 (0.44)	-0.0001 (-0.03)	0.002 (1.20)	0.004 (2.56)	0.005 (3.06)	0.005 (2.40)	0.004 (1.22)	– –	– –
Y_{t-1}	0.015 (2.11)	0.011 (3.40)	0.004 (1.22)	0.004 (1.43)	0.006 (2.84)	0.007 (4.20)	0.007 (4.42)	0.007 (3.37)	0.006 (1.64)	– –
Y_t	– –	0.019 (3.40)	0.015 (6.30)	0.009 (4.69)	0.009 (4.24)	0.009 (4.84)	0.009 (4.55)	0.010 (5.08)	0.011 (5.01)	0.013 (2.92)
Y_{t+1}	– –	– –	0.021 (5.40)	0.016 (7.62)	0.012 (7.20)	0.011 (6.29)	0.011 (5.25)	0.012 (4.77)	0.014 (4.75)	0.016 (6.07)
Y_{t+2}	– –	– –	– –	0.017 (5.98)	0.014 (6.59)	0.011 (7.10)	0.011 (6.74)	0.012 (5.99)	0.013 (4.68)	0.013 (3.38)
Y_{t+3}	– –	– –	– –	– –	0.011 (4.75)	0.010 (4.86)	0.010 (4.78)	0.010 (4.67)	0.010 (4.65)	0.010 (3.83)
Y_{t+4}	– –	– –	– –	– –	– –	0.006 (3.14)	0.007 (2.78)	0.006 (2.07)	0.005 (1.42)	0.006 (1.28)
Sum	0.039 (5.30)	0.048 (6.52)	0.057 (8.61)	0.062 (10.07)	0.063 (10.27)	0.064 (10.20)	0.064 (10.32)	0.062 (10.10)	0.059 (9.84)	0.057 (9.75)
Constant	0.127 (1.76)	0.053 (0.75)	-0.032 (-0.50)	-0.078 (-1.32)	-0.093 (-1.56)	-0.101 (-1.66)	-0.098 (-1.63)	-0.083 (-1.38)	-0.064 (-1.07)	-0.047 (-0.80)
R^2	0.28	0.37	0.52	0.61	0.62	0.61	0.61	0.61	0.60	0.59
S–E	0.32	0.30	0.26	0.24	0.23	0.24	0.24	0.24	0.24	0.24
D–W	1.04	1.28	1.45	1.58	1.67	1.65	1.65	1.65	1.61	1.57

Note: t-values in parentheses

DISCUSSION

DONALD J. DALY

My comment on the Meiselman-Simpson paper is really the second discussion of this paper. Franco Modigliani has already commented on it in discussing the differences between using the reduced form and the structural relations in the F.M.P. model in his epilogue.

The research strategy in this paper continues to emphasize a few basic relations that are considered important, rather than the specification and estimation of a complete system of simultaneous relations.

This paper by Meiselman and Simpson extends the earlier classic and controversial paper by Friedman and Meiselman[1] in three ways. First, it updates some of the regressions in the original study by adding 11 more years of quarterly data. I would say that the updating does not seem to modify the general nature of the results to any significant degree, although the tone on the size of the regression results does seem to be more cautious. This is particularly apparent on pages 240 and 242 of this study, which are more cautious than page 186 of the Friedman-Meiselman study, even though the statistical results for the first differences in the postwar quarterly data are very similar.

[1]Milton Friedman and David Meiselman, "The Relative Stability of Monetary Velocity and the Investment Multiplier in the U.S., 1897-1958," in *Stabilization Policies,* A Series of Research Studies prepared for the Commission on Money and Credit, New Jersey, Prentice Hall, 1963.

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A second modification from the earlier study is the use of the Almon distributed lag method. This provides additional information and perspective on the speed of response of the various expenditure flows studied to an earlier change in monetary policy (as defined in terms of the rate of change in the money supply.) This is a useful additional step, especially because the speed of response and the duration of the outside lag is an important issue in the scope for discretionary monetary policy in relation to the short-term business cycle.

The third step in the paper is to move toward a significant degree of disaggregation. The initial Friedman-Meiselman paper had emphasized the levels and first differences in total comsumption. The current Meiselman-Simpson paper moves toward a much lower level of disaggregation (durables in total, and broken down into automobiles, furniture and other; non-durables; services; housing; total consumption and housing combined; total consumption and total income). This is without doubt the most important step in the paper, as it moves to the level of study that a majority of the profession prefers both as part of most approaches to economic forecasting, and in the theory and testing of macro models for stabilization policy. This is the area most in need of further discussion in my opinion, and most of my remarks will relate to this area.

Before discussing the evidence of monetary response at the more disaggregated level, I would like to make a couple of side comments. One minor point is just to note with surprise that the paper by Friedman, "A Theoretical Framework for Monetary Analysis,"[2] was not referred to.

A further interesting point is to note how well the regression estimates for total consumption and for total consumption plus housing correspond to the actual data in Charts 1 and 2 (based on

TABLES

[2] *JPE*, March-April 1970, pp. 193-238.

TABLE 1

FAMILY DWELLING AND MORTGAGE ON FAMILY DWELLING, BY NET WORTH AND LIFE CYCLE GROUP SEVEN CANADIAN CITIES, 1962 (PERCENTAGES)

	Family Dwelling	Total Net Worth	Mortgage on Family Dwelling
Net Worth			
-$500 or more	-	100.0	-
-$1 to -$500	7.3	100.0	-
0	-	100.0	-
$ 1-$ 999	17.8	100.0	18.0
$ 1,000-$ 4,499	45.5	100.0	31.6
$ 4,500-$ 7,499	79.0	100.0	46.0
$ 7,500-$ 9,999	82.1	100.0	34.8
$10,000-$14,999	75.2	100.0	19.8
$15,000-$24,999	73.5	100.0	15.8
$25,000-$49,999	56.6	100.0	10.4
$50,000 or more	21.4	100.0	2.3
All Households	48.8		13.5
Selected Life Cycle Group			
Young, Married			
No Children	56.2	100.0	30.6
Pre-school Age Children	64.2	100.0	30.0
School Age Children	54.6	100.0	23.6
Teenage Children	70.3	100.0	30.8
Number in Household, Head under 50 Years			
One	37.1	100.0	2.1
Two	55.3	100.0	22.7
Three or Four	60.1	100.0	22.3
Five to Seven	52.1	100.0	19.8
Eight or more	88.3	100.0	16.7

Source: J. V. Poapst, "Consumer Survey," Appendix A in Royal Commission on Banking and Finance, *Appendix Volume*, Ottawa, The Queen's Printer, 1965, Tables 6 and 8, pp. 13 and 15.

TABLE 2

DISTRIBUTION OF HOUSEHOLDS WITHIN AGE GROUPS, BY RATIO OF ANNUAL DEBT AMORTIZATION PAYMENTS TO TOTAL INCOME SEVEN CANADIAN CITIES, 1962 (PERCENTAGES)

Ratio of Annual Debt Amortization Payments to Total Income	Age of Household Head					
	29 years and under	30-39	40-49	50-64	65 years and over	All Households
	Total Annual Debt Amortization, Including Mortgage Payments					
No income or negative income with payments	-	1.1	1.6	3.8	1.6	1.8
No payments	47.9	36.7	43.8	57.7	82.3	49.5
Up to 9.99%	16.0	16.1	19.0	13.5	9.3	15.5
10 to 19.99	20.9	28.1	23.7	15.9	4.2	20.8
20 to 29.99	7.4	11.5	7.8	5.5	2.1	7.6
30% and over	7.8	6.5	4.0	3.7	0.5	4.8
Total	100.0	100.0	100.0	100.0	100.0	100.0
	Annual Home Mortgage Payments					
No income or negative income with mortgage payments	-	1.1	1.6	3.8	1.6	1.8
No payments	84.0	55.6	57.5	70.7	86.9	66.6
Up to 9.99%	1.4	10.3	15.3	7.4	5.7	9.2
10 to 19.99	9.9	24.3	19.8	12.9	5.3	16.6
20 to 29.99	1.4	7.2	3.8	3.6	-	4.0
30% and over	3.2	1.5	2.0	1.8	0.5	1.8
Total	100.0	100.0	100.0	100.0	100.0	100.0
	Annual Instalment Debt Amortization Payments					
No income or negative income with amortization payments	-	1.1	1.6	3.8	1.6	1.8
No payments	58.3	67.2	74.7	80.4	92.7	73.5
Up to 9.99%	16.7	15.3	13.0	7.6	4.6	12.0
10 to 19.99	17.4	11.9	7.8	5.4	-	8.9
20% and over	7.7	4.5	3.0	2.9	1.1	3.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: J. V. Poapst, *op. cit.*, Tables 84, 86 and 88, pp. 62, 64 and 66.

results in Table 13). In a way one should expect that a regression line of a dependent variable would fit the actual data fairly well over the period on which the regression results were based. However, r^2s of 0.52 and 0.56 on first differences of consumer spending and consumer spending plus housing are quite respectable, especially in a model using only six quarters of currency plus demand deposits as the independent variable. It might be noted that the simulation tests of large scale econometric models (such as the Brookings model, the Wharton School model, and the Department of Commerce model) did not correspond well to all periods in the historical experience. All three tended to drift off the actual path during the 1957-1964 period, the most pronounced cyclical departures from potential output of the post-war period.[3] Charts 1 and 2 suggest that a much simpler model seems to have reproduced the first differences over this period fairly well.

The balance of my remarks will deal with the main differences in degree of response to monetary changes among the main expenditure categories. The *General Theory* emphasized the role of changes in interest rates (determined by the equilibrium in the money market between the monetary stock and the liquidity preference theory of the demand for the stock of money) on the marginal efficiency of investment of the business firm. The effects of interest rates on consumption and savings out of a given level of income were played down. The early studies of the sensitivity of business investment to interest rates tended to suggest a very limited response in this area, however. If one stayed with this simple Keynesian type model, this evidence tended to suggest that stabilization policy would have to put primary emphasis on fiscal policy or on selective credit controls to be effective.

An interesting result in the Meiselman-Simpson study is that changes in the money stock have an influence on *all* the components of consumer expenditure, on housing, and on government purchases, and the impact on consumer expenditures occurs earlier than on plant and equipment expenditures. One could even argue that the monetary impact on plant and equipment was indirect through the

[3]Bert Hickman, ed., *Econometric Models of Cyclical Behavior,* NBER Conference Volume, forthcoming; especially, Michael K. Evans, Yvel Haitovsky and George I. Treyz, "An Analysis of the Forecasting Properties of U.S. Econometric Models," and Ronald L. Cooper, "The Predictive Performance of Quarterly Econometric Models in the United States." The same lack of correspondence shows up in the charts in the Ando-Modigliani paper, "Econometric Analysis of Stabilization Policies," *AER*, May 1969, pp. 296-314. It is not clear that the present version of this model performs any better for this key period.

effects of monetary changes in housing and consumer expenditure, rather than direct.

The evidence in the paper on the influence of changes in the monetary stock (with similar results for a number of definitions of money) on housing and on various categories of consumer expenditure suggests several channels by which monetary changes operate. The last few pages of the paper suggest three - the scale variable or wealth effect, the real rate of interest, and the anticipated rate of price change. However, although these three channels are distinguished, the ideas are not systematically related to the differences in response between the various expenditure areas. They do relate the durability of the expenditure flow to changes in wealth, interest rates and expected price change. The range of data covered in their paper is too limited, however, to throw any real light on the impact of monetary change through these three lines of influence or on the areas of expenditure flow. The exclusive reliance of correlations of time series data is suggestive, as is the emphasis on the role of durability, as a relevant factor in the timing and extent of change in expenditure flow to a prior change in the money stock.

I would like to draw on some data and discussion of Canadian material that seem relevant to some of these key results in the Meiselman-Simpson study. This material will emphasize the life cycle status of families and the implications for spending, borrowing, and debt servicing. The emphasis goes along the same direction as the Dolde-Tobin paper for this conference, and Tom Juster's comments of yesterday morning.

The first point I would like to make is the key importance of owner-occupied housing and the related mortgage (or mortgages) on the net worth of the family. Table 1 shows the data for a sample of households in seven Canadian cities, and although it is no longer recent data, it illustrates the key role of the family dwelling in the net worth of the household. The family dwelling amounts to 49 percent of the net worth for all families, the mortgage about 14 percent. Both the family dwelling and the mortgage are relatively *even more important* for the young married couple, and for those families with children with the head under 50. For many families, the decisions on the family house and its financing are the most important investment decisions they will make during their life.

Another useful way of looking at the possible influence of monetary factors on spending decisions is the size of the debt amortization charges in relation to annual income. There is clearly a great diversity in the size of debt charges in relation to income shown in

Table 2. Two-thirds of the families had no mortgage payments and almost three-quarters of the families had no instalment debt amortization payments. On the other hand, some young families had very large payments on home mortgages and instalment debt. For example, about 30 percent of the families with the household head in his 30's had debt charges between 10 and 20 percent of annual income and a further 18 percent were spending more than 20 percent of their income on debt servicing. For those currently buying new homes, the larger size of carrying charges in relation to income is even more pronounced. This is apparent in Table 3, showing the debt servicing and taxes in relation to family income for those buying new homes financed under the National Housing Act. Almost 60 percent of the purchasers were spending more than 20 percent of their income on taxes and debt servicing. For those who find these servicing charges high in relation to comparable data for the United States, you might note that mortgage interest rates are higher in Canada (higher even than in California) and mortgage amortization period is usually shorter (usually 25 years).

TABLE 3

RATIO OF GROSS DEBT SERVICE TO INCOME, NEW HOUSING LOANS APPROVED UNDER THE NATIONAL HOUSING ACT 1970

PERCENTAGES

0 -15.0	9.8
15.1-18.0	16.6
18.1-20.0	14.8
20.1-23.0	23.3
23.1-27.0	30.3
27.1+	5.2
Total	100.0

Sources: **Central Mortgage and Housing Corporation, *Canadian Housing Statistics, 1970*, Ottawa, CMHC, 1971, p. 80. The gross debt service includes payments of mortgage principal and interest together with property taxes.**

The overall importance of new debt in relation to new residential construction and car sales is also of interest. During 1970, mortgage loans (both conventional loans and loans under the National Housing Act) amounted to about 65 percent of new residential construction.[4] Paper purchased for new passenger cars in 1970 amounted to about 28 percent of the value of passenger car sales (with an average repayment term of 30 months).[5] Bearing in mind the extent of trade-ins of used cars and the reliance on the chartered banks and other sources of lending in new car purchases, the use of credit is important.

The point of these remarks on this micro-type data for Canada is that changes in money supply, interest rates, and the availability of funds can have an important effect on decisions to buy or not to buy, and decisions on the size and cost of a house, car, or other consumer durable. Young families, with limited liquidity or net worth positions, can purchase these expensive and durable items only with external sources of funds, and their ability to borrow in aggregate can be influenced by monetary policy and the degree of restraint or ease associated with changes in the supply of money. The study by Juster and Shay[6] also emphasizes this result from a study of micro data.

On the question of timing, this study emphasizes the early impact of changes in the stock of money on spending for consumer durables and housing, with a slower response on business plant and equipment. This is a more plausible result than the cautious comment on this point in the earlier Friedman-Meiselman study.[7] The slower response in plant and equipment spending is also consistent with the cyclical timing response of this sector in the National Bureau studies of cyclical timing and the Canadian studies of timing in the response to monetary policy. The investment response could very well be a response to the monetary effect in housing and other consumer expenditure areas.

[4]Bank of Canada *Statistical Summary*, May 1971, pp. 393 and 394.

[5]*Ibid.*, pp. 390 and 399.

[6]*Consumer Sensitivity to Finance Rates*, NBER, Princeton University Press, 1964.

[7]*Op. cit.*, p. 221.

ADDENDA

I should add that the Canadian pattern on housing expenditures would not show as quick a response to changes in money supply as is shown in the Meiselman-Simpson tables. The effects through interest rates and availability of mortgage funds, building permits, contract awards, until the maximum rate of value put in place is reached, would involve a lag of housing expenditures behind changes in money supply, rather than similar timing. The Canadian experience would thus correspond to the comments made by Sherman Maisel and Geoffrey Moore in their discussion.