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CONSUMER SPENDING and MONETARY POLICY: THE LINKAGES

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CONSUMER SPENDING and MONETARY POLICY: THE LINKAGES

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FOREWORD

This volume contains papers presented at a conference sponsored by the Federal Reserve Bank of Boston in June, 1971.

This conference, the fifth of a series covering a wide range of financial and monetary issues, brought together a distinguished group from universities, government and finance to exchange views on one of the most neglected aspects of monetary theory--the linkages between monetary policy and consumer spending.

It is hoped the distribution of these proceedings will contribute to an increased public understanding of the issues and prove useful to those responsible for policy decisions.

Frank E. Morris
President

Boston, Massachusetts

June, 1971

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CONSUMER SPENDING AND MONETARY POLICY: THE LINKAGES

Monetary Policy and Consumption:

Linkages via Interest Rate and Wealth Effects in the FMP Model

FRANCO MODIGLIANI

I. Introduction and Outline

The purpose of the present paper is to examine the implications of the Federal Reserve-MIT-Penn Model (hereafter referred to as the FMP model) with respect to the central question with which this conference is concerned, namely whether and, if so, to what extent, monetary policy affects economic activity through its direct impact on cosumers' expenditure. For the purpose of this paper we have chosen to concentrate on three major monetary policy variables: bank reserves, money supply and short-term interest rates. The model, however, incorporates several other variables within the control of the Federal Reserve such as reserve requirements, the discount rate and ceiling rates under regulation Q.

It will be shown that according to the FMP model the answer to the above question is decidedly affirmative and that indeed consumption is one of the most important, if not *the* most important, single channel through which the above tools affect

While I bear the full responsibility for the main text, I wish to stress that the model construction and estimation, the method of analysis, and the specific results of simulations are the outcome of a close collaboration with many other persons who have contributed to making the FMP model possible. The present version of the model is primarily due to the efforts of Albert Ando, Robert Rasche, Edward Gramley, Jared Enzler and Charles Bischoff, besides myself. The consumption sector is primarily the result of collaboration with Albert Ando. However, we owe a substantial debt to earlier collaborators, and notably Frank deLeeuw and Harold Shapiro, who were responsible for part of the earlier work on this sector, Morris Norman had a leading role in developing the simulation program that made possible the simulation results reported here.

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directly and indirectly the level of aggregate real and money demand and thus, the level of output, employment, and prices.

The rest of this paper is divided into three parts plus a long epilogue. In Part I, we provide a summary description of the consumption sector of the model which differs in several important

TABLES and FIGURES

respects from the corresponding sector of other existing models. We review both the major equations of this sector and the basic hypothesis that underlie these empirical equations. We do not, however, go into the details of the procedures used in the testing and estimation of parameters and in constructing some of the variables; these topics are dealt with in a chapter of a forthcoming monograph describing the FMP model which is being prepared jointly with Albert Ando. A preliminary draft of that chapter is available on request.

The major novelty of the FMP consumption sector consists in introducing explicitly aggregate private net worth as a major determinant of consumption. As will become apparent, it is primarily (though not exclusively) through this channel – the so-called wealth-effect – that monetary policy has a direct impact on consumption. In order to grasp fully the nature of this channel, it is necessary to review also the channels through which monetary policy variables affect consumer's net worth. This review completes Part I.

In Part II, we examine certain "partial equilibrium" implications of our consumption sector, and especially the implications of the wealth variable. In particular, we are concerned with the magnitude and pattern of response of consumption and income to a change in "autonomous" expenditure or, in other words, with the so-called Keynesian consumption multiplier. The need for this analysis stems from the fact that the introduction of wealth in consumption, coupled with the recognition of the feedback of consumption on wealth via saving, has some rather unusual implications which must be grasped to understand and evaluate the dynamic response of the entire system examined in Part III. For instance, it will be shown that if tax revenue is independent of income, then under an accommodating monetary policy (i.e. one that adjusts the money supply so as to keep interest rates constant) the long-run conventional Keynesian multiplier is *infinite;* while, with taxes, the size of the long-run multiplier is basically controlled entirely by the marginal tax rate. Also provided in Part II is an analysis of two further partial mechanisms which are important in understanding the links between monetary policy and consumption. One is the response of consumption and income to a change in net worth; the other is the effect of a change in interest rates via expenditure on durable goods, on the assumption that all other components of demand, as well as wealth, are unaffected by the change in interest rates.

With the background provided by Parts I and II, we proceed in the last part to examine the full response of the system to a change in the various policy variables. Our focus here is both on the magnitude and path of response and on the contribution of the consumption sector, especially via wealth effect, to this total response. This last question is analyzed by comparing the path of response of the full system with the response of a fictitious system in which we sever the link between interest rates and wealth via the effect of interest rates on the market value of corporate equity. The upshot of this section is a clear indication that in the FMP model the wealth effect is a crucial link in the response of aggregate output and employment to the policy variables, both in terms of magnitude and in terms of speed of response.

The epilogue endeavors to shed further light on the reliability of the results reported in the main text, through a number of tests dealing with certain critical issues raised by the so-called "reduced form" approach.

I. The Structure of the Consumption Sector – A Summary View

I.1 – Consumption

The structure of the consumption sector of the FMP model basically rests on the life-cycle hypothsis of consumption and saving which has been set forth in a number of previous papers.[1] This hypothesis states that the consumption of a representative household over some arbitrary short period of time, such as a year or a quarter, "reflects a more or less conscious attempt at achieving the preferred distribution of consumption over the life cycle, subject to the constraint imposed by the size of resources accruing to the household over its lifetime" (Modigliani, 1966). This hypothesis implies that consumption – defined as the sum of expenditure on non-durable goods and services plus the rental value of the stock of durable goods owned by the household – can be expressed as a linear function of labor income (net of taxes) expected over the balance of the earning span, and of the net worth (including the value of claims to pensions, etc.), with coefficient which depend on age, allocation preferences and, in principle, the rate of return on net worth (Modigliani and Brumberg).

For our present purpose we are interested in the aggregate consumption function which is obtained by aggregating over

[1] For a fairly up-to-date bibliography on the life cycle hypothesis, see the references cited in Modigliani (1970).

households in all age groups. It has been shown in Ando and Modigliani, that aggregate consumption can be expressed as a linear function of aggregate expected income and of aggregate net worth. Furthermore, the coefficients of the two mentioned variables can be expected to be reasonably stable in time under the further assumption (which is sufficient though not necessary) that tastes, the age distribution and the real rate of interest are reasonably stable over the relevant time horizon. We regard the first two assumptions as reasonable; the third assumption is much more open to question and will be touched upon again below.

The above considerations lead to the hypothesis that aggregate consumption can be approximated by a linear function of aggregate net worth and expected income.

Aggregate consumers' net worth is in principle directly observable, and we have endeavored to develop an explicit measure, with the cooperation of the Flow of Funds Section of the Board of Governors of the Federal Reserve System. Our measure is obtained, basically, by adding to the flow of funds estimate of money fixed assets, less debt, of the household sector, an estimate of the market value of corporate equity, of the market value of consumers' tangibles (consumers' durables plus residentail structures and land), and of net equity in farm and non-farm non-corporate business. The estimate of corporate equity is obtained by capitalizing the national income account estimate of net dividends by the Standard and Poor index of dividend yields, and coincides fairly closely with the estimate provided in the Flow of Funds series. In dynamic simulations of the model, net worth is endogenized by a perpetual inventory method; i.e., by adding to the beginning of period wealth, current household personal saving, an estimate of capital gains on tangibles, (computed from the endogenous change in the stocks and the endogenous change in price) and of the change in the market value of corporate equity. (See I.3 below). These changes do not unfortunately totally exhaust the sources of changes in wealth (they leave out, for example, capital gains on non-corporate business and on land and also on long-term bonds which, incidentally, are omitted also in the flow of funds estimates); there is, therefore, a small and rather erratic residual difference between actual changes in wealth and those obtained by the above method which, in historical simulations, we take as exogenous, and in projections we estimate as best we can.

In previous empirical estimates, dealing with annual data (Ando and Modigliani), the measure of wealth used in the consumption function was net worth at the beginning of the year, valued at average prices of the current year. Since in the FMP model the dependent variable is quarterly consumption, we use average wealth in the year preceding the current quarter, obtained as a weighted average of net worth at the end of each of the previous four quarters. The weights, which were estimated empirically, assign about half the weight to the current quarter with the rest distributed over the remaining three quarters with a rapidly declining pattern.

Expected labor income on the other hand is not directly observable; in previous work (Ando and Modigliani) we have approximated this variable by a measure of current net-of-tax labor income, adjusted for the effect of unemployment. In the FMP model, for a number of reasons explained in the forthcoming monograph, we have been led to replace labor income with personal income net of taxes and contributions, which essentially coincides with the standard measure of disposable income (except for the fact that we treat personal taxes on an accrual rather than on a cash basis). Because this measure includes a substantial portion of property income, which is subject to large transient fluctuations, we have approximated "expected" income with a distributed lag of actual income over the previous three years. Our final estimate of the consumption function can then be summarized as follows:

(1) CON = 0.67 x a weighted average of disposable income over the previous three years + 0.053 x a weighted average of net worth over the previous year.

The actual pattern of the weights is given in Appendix A, equation I.1. Figure A.1 compares the actual behavior of consumption with that computed from equation I.1.

Since the results of Section III concerning the role of consumption in the response to monetary policy depend critically on the presence of wealth in the consumption function and on the size of its coefficient, it is proper at this point to inquire about the reliability of equation (1) above. We summarize here a few major considerations which, in our view, provide solid ground for confidence in our estimates, both qualitatively and quantitatively.

(i) From a narrow statistical point of view we can report that the coefficients of wealth in the above equation are highly significant by customary statistical standards; (the t-ratios of the individual coefficients reach a value of around 8 for the two middle coefficients).

(ii) Not only does the addition of wealth improve the explanation of consumption but in addition it produces a fairly dramatic reduction in the serial correlation of the errors, from over .8 to .6.

(iii) Furthermore, both the size of the coefficient and their significance is quite sturdy under variations in the detailed specification of the equation or variations in the period of time chosen for the estimation, provided the period is sufficiently long and includes some cyclical fluctuations.

(iv) The coefficients reported above, which were estimated over the period 1954-1 to 1967-4, are quite consistent with the results for annual data for the period 1929-59 reported in Ando and Modigliani, and with evidence on the stability of the wealth-income ratio in the United States at least since the beginning of the century, analyzed in Modigliani (1966). To be sure, the coefficient of the wealth variable is somewhat lower than reported in the papers cited; but this decline is readily accounted for both in principle and in order of magnitude, by the change in the definition of income which now includes the return on property, (cf. Modigliani, 1966, pp. 176-177).

(v) The basic form of our equation is a fairly straightforward implication of the life-cycle model which has by now passed a number of favorable tests. See, for example, in addition to the references already cited, Houthakker; Modigliani (1970); Leff; Weber; Landsberg; Singh et al.

(vi) Finally, aggregate consumption functions of the general form (1) above have by now been estimated for a number of countries, despite the serious difficulties encountered in securing estimates of private wealth, and have confirmed fairly uniformly the importance of wealth in explaining the behavior of consumption. In particular, to the author's knowledge such estimates have been carried out for the United Kingdom, Australia, (Lydall), India, the Netherlands, Canada, and Germany, (Singh et al) and the wealth variable has been found to be highly significant with the possible single exception of India. The coefficients of the wealth variable have an appreciable scatter (though they are generally higher than our coefficient) but this is not too surprising in view of differences in the comprehensiveness of the concept used and in the quality of the basic statistics.

Quite recently the role of wealth in consumption for the United States has been challenged at least implicitly by some authors, and in particular by Fair (cf. Fair (1971b) and the references therein) on the ground that the wealth variable may really be proxying for some measure of "consumer sentiment." First, Fair (1971a) has shown that an index of consumer sentiment based on the series compiled by the Michigan Survey Research Center, and which he refers to as MOOD, makes a significant contribution to his equations explaining, respectively, expenditure on consumer durables, non-durables, and services (though in his service equation the highly significant contribution of the MOOD variable is somewhat marred by the fact that its coefficient is *negative).* Next, Fair (1971b) reports the finding that both durable and non-durable expenditure (in current dollars) are more or less significantly correlated with the Standard and Poor index of stock prices, but that when the variable MOOD is added to the equations, with appropriately chosen lags (one and two quarters for durables, and two quarters for non-durables but, surprisingly enough, never contemporaneous) then the S&P index becomes altogether insignificant. He concludes from this evidence that "the level of stock prices does not have much of an independent effect" (p. 22). These results and conclusion can give rise to some justified concern, for while our measure of wealth is total consumer net worth, it is nonetheless true that movements in the stock market contribute non-negligibly to the short-run movements of this total.

In assessing the relevance of Fair's conclusions for our present purpose, it should be noted that, as Fair and others have found, the consumer sentiment index is significantly correlated with an index of stock market prices (cf. Friend & Adams, Hyman). The direction of causality in this observed association could of course run either way. Fair has actually faced this issue and provides some interesting evidence that the causation runs, at least in part, from the stock market to MOOD (1971(b), pp. 11-13, and Table 1). Under these conditions, if monetary policy can affect the level of stock prices, it would still have a direct impact on consumption by way of its effect on consumers' sentiment – and whether this effect on sentiment, and thus finally on expenditure, is a nondescript psychological response or instead the consequence of an improved financial position is a rather idle question of little operational significance. In any event, we are able to report here a more direct response to Fair's challenge. We have actually taken Fair's MOOD index and added it to our consumption function. For the sake of completeness, tests were run both with the current value of MOOD and with the value lagged one and two periods. In either case, the addition of MOOD has a hardly noticeable effect on our estimates of the wealth coefficients or their significance. Specifically, when the current value of MOOD is added, the sum of the wealth coefficient drops but by .004, and the individual coefficients as well as the sum remain highly significant. The coefficient of MOOD has a t-ratio of somewhat over two, but the point estimate implies that an increase of 1 percent in the MOOD index would increase real per capita consumption at annual rates, now running at around $2,300, by only about one dollar (or aggregate consumption by $.2 billion.) Since in 50 of the 60 quarters for which MOOD is available, it has remained in the range 90-100, and its extreme values are 78 and 103, it is seen that the contribution of MOOD is at best rather negligible. (By contrast a 1 percent change in wealth, now running at around $3 trillion, changes per capita consumption by some four dollars in the first quarter and some eight dollar within a year). When we add instead the value of MOOD lagged one and two quarters – which is more consistent with Fair's specifications – the t-ratios of these coefficients are respectively 2.2 and 2.7 but both signs are *negative*! The point estimates are in both cases – 1 dollar per point of the index. In view of this result it is not surprising that the sum of the wealth coefficients actually rises somewhat, by .012, while the sum of the income coefficients drops by .1.

We thus seem to be fairly safe in concluding that the wealth effect does not exhaust itself on changing consumers' sentiment. We have, at the moment, no plausible explanation for the negative sign of lagged MOOD and merely note that it is consistent with the negative sign for MOOD lagged two quarters reported by Fair in his service equation. Finally, in view of its modest and marginally significant contribution, we do not plan at the moment to add MOOD to our consumption function, especially since this would require adding an equation to explain MOOD itself. However, for purposes of short-run forecasting one might gain a little by making use of the actual value of the index, if one is not bothered by the negative sign.[2]

One final point deserves brief mention in relation to our present consumption function. We have noted earlier that, in principle, the coefficients of this function and, in particular, the coefficient of wealth could be a function of the rate of return on wealth. We have made some sporadic attempts at testing this possibility but since they met with little success, mostly because of multicollinearity problems, they have been abandoned for the moment. In part, this decision was motivated by the consideration that it is not possible to establish a priori whether a higher rate of return should increase or decrease consumption. However, a recent contribution (Weber) reports some evidence that the rate of return may matter at least marginally and

[2] It is interesting that the addition of lagged MOOD has the effect of reducing the autoregression coefficient of the error term from 0.5 to 0.3; in part for this reason the standard error S_u drops from 9 to 7 dollars per capita.

that it may actually have a *positive* effect on consumption (i.e. a negative effect on saving). It is our intention to look further into this matter, but at the present this possible effect has been ignored.

I.2 Consumer Expenditure

Consumption, the dependent variable of equation (1), is not directly a component of aggregate demand. The relevant component is instead personal consumption expenditure (EPCE) which is obtained by subtracting from CON the rental value of the stock of durables and adding consumers' expenditure on durable goods (ECD) or gross consumers' investment is durables. This expenditure is accounted for by a model analogous to that used for several other investment sectors – vis., a stock adjustment or flexible accelerator model. That is, expenditure is proportional to the gap between the "optimum stock" and the initial stock of durables, after allowing for depreciation, which in the case of consumers' durables is estimated to be quite high, 22.5 percent per year. The optimum real stock in turn is a linear function of consumption in which the coefficients of consumption is itself a linear function of the real rental rate. Finally the real rental rate per year is measured by the ratio of the price index of durable goods to the consumption deflator multiplied by the sum of three terms: the depreciation rate, plus a measure of the opportunity cost of capital minus a measure of the expected rate of change of consumers' durable prices. As a measure of the (risk-adjusted) opportunity cost of capital we have used the corporate bond rate (RCB).

Our model also allows for a short-run dynamic effect, by adding to the argument of the durable equations the current level of saving. The rationale for this term is that some portion of transient variations in income, and hence saving, will be reflected in corresponding variations in ECD. The resulting equation for consumers' durable expenditure is reported in Appendix A.1, equation I.2, while further details about the model and its estimation are provided in the forthcoming monograph. We may finally note that from the expenditure on durables and the depreciation rate we can compute endogenously the current stock of consumers' durables which is then used to estimate the rental component of consumption – see Appendix A.1, equations I.3 to I.6.

It is apparent from the above description that our durable equation is not directly affected by wealth (or the stock market) except through its effect on consumption. In the light of the results of Fair and Hyman, we have been led to test the possible effect of MOOD, which might indirectly bring the behavior of stock prices to bear also on this component of expenditure. Preliminary results indicate that this variable has a positive coefficient with a t-ratio of around 2. The point estimate implies that a 1 percent change in the index would increase expenditure by some 3/100 of 1 percent of consumption or roughly $100 million at current rates. This is again rather small compared with the current rate of over $80 billion, but may bear further analysis. Since the MOOD variable is not at present in the model, for the present analysis we ignore the possible role of MOOD on durable expenditure. As a result we may perhaps tend to underestimate the wealth effect via the stock market, but the bias would seem to be of a second order of magnitude at best.

I.3 Monetary Policy, Interest Rates and the Market Valuation of Corporate Equity

As we have indicated, the main channel through which monetary policy affects consumption via wealth is through its effect on the market valuation of corporate equity which is an important component of net worth – roughly one-third at the present time. We need therefore to provide an outline of the nature of this mechanism in the FMP model.

a) Corporate Equities

Conceptually, the market value of equity is obtained by capitalizing the expected flow of profits generated by the existing corporate assets at a capitalization rate which depends on the real rate of interest, a risk premium and expected growth opportunities. Expected profits is a function of dividends (on the ground that under prevailing payout policies dividends tend to be roughly proportional to expected long-run profits) and of current corporate profits. The real rate of interest is approximated by the corporate bond rate and adjusted for the expected rate of change of prices.

We have had, perhaps not surprisingly, a great many problems in translating this conceptual framework into an operational one and the actual structure of the model and estimated coefficients leave us far from satisfied. On the whole we must consider this sector of the model as unfinished business, and we are continuing work on it even if with some qualms as to whether it will ever be finished to our satisfaction.

For the moment the market value of corporate equity is obtained by capitalizing net dividends by an index of dividend price ratio. This dividend yield in turn is estimated as a linear function of the bond rate with a short distributed lag (5 quarters) and of a measure of the expected rate of change of prices. This measure is simply a weighted average of past rates of change of prices with weights derived from coefficients estimated in the term structure equation (see below). In our empirical estimates, however, we have been unable to uncover any significant effect of price expectations until 1966; for earlier years therefore the real rate coincides with the money rate up to a constant. This procedure is clearly a rather arbitrary one though it finds some faint support in survey data on price expectations of business economists collected by Livingston and analyzed both in a forthcoming paper on the investment function and by Turnovsky. Finally the list of interdependent variables includes the ratio of current profits to dividends; as expected this variable has a negative sign on the ground that when current profits are high relative to current dividends, then expected profits are also high relative to dividends, which raises the price of stocks relative to dividends thus reducing the dividend yield. We have had no success in measuring variations in growth expectations except insofar as these may be captured by the last mentioned variable. Finally we have not made much headway in measuring changes in the risk premium except through a decreasing time trend terminating in 1960, which accounts mechanically for the sustained decline in dividend yields during the Eisenhower era.

The specific form of the equation and its estimated coefficients are reproduced in Appendix B.1. The one slightly cheering aspect of the equation for present purposes is that the estimate of the effect of change in interest rates is both quantitatively sensible and statistically fairly significant (a t ratio of about 4). Finally the equation fits the data better than one might have expected; however, we take limited satisfaction in a good fit when the equation rests on somewhat shaky theoretical underpinnings.

As a final remark we should point out that there exists an alternative version of the stock market equation which we have occasionally used in simulation and extrapolations. This equation differs from the one in Appendix B by one main feature, namely that it contains a short distributed lag on the rate of change of the money supply. The addition of this variable makes a non-negligible contribution to the fit (though it also tends to increase the serial correlation of the errors). This is not surprising in view of the findings reported by several investigators and in particular, Sprinkle.

However, we can find little justification for the role of this variable – unless it is proxying for some other variable or variables, e.g. for the level of the stock market credit or for short-term interest rates. Unfortunately every attempt at testing such variables directly leads to most disappointing results as these variables were consistently insignificant while the money supply remained significant. We still cannot see any direct mechanism through which the rate of change of money could affect market values – except possibly because operators take that variable as an indicator of things to come. But even this explanation is hardly credible except, perhaps, in the last couple of years, when watching every wiggle of the money supply has suddenly become so fashionable. For this reason we do not use this alternate equation in the analysis reported here. We can report however that comparison of simulation of changes in money supply using the alternative equation indicates that this equation implies a somewhat stronger but mostly a somewhat faster response (especially to monetary expansion. See below).

b) The Money Market and Short-term Interest Rates

To complete our picture we need still to review the channels through which monetary policy affects the long-term rate which enters the stock market equation. In the FMP model the point of impact of monetary policy on the system centers on the money market in which the short-term rates (represented in the model by the three-month Treasury bill rate and by the commercial paper rate) are determined by the interaction of the money demand equation and the money supply. The modeling of these markets needs only brief mention since it has been discussed in detail in a recent paper (Modigliani, Rasche, Cooper). In the current version of the model this section differs only in minor details from the structure presented there.

In short, the money demand depends basically on the short-term rate (r) and the level of income. Hence, if we take the money supply as the policy variable, then the short-term rate is determined by the given money supply relative to the level of money GNP; furthermore, since there is but a small simultaneous (i.e. within the same quarter) feedback from short-term rates to GNP, one may say that, in the shortest run, r can be made to take any desired value by an appropriate level of M. In the construction of the model, however, we have actually assumed that, normally, the policy variable controlled by the Federal Reserve is unborrowed bank reserves; in this situation the money supply is itself endogenous and is determined together with r by the simultaneous solution of the money demand and supply equations. The money supply depends – given enough time for adjustment – on unborrowed reserves (adjusted for reserve requirements) and on r relative to the discount rate (which controls target free reserves). Thus, in the last analysis, r and the stock of money are determined by unborrowed reserves relative to GNP and, to a minor extent, by the discount rate. However, because the money supply as well as the demand have rather complex patterns of gradual adjustment, at any point of time these variables depend also on the recent rates of change of unborrowed reserves, of GNP and of commercial loans (which in turn are closely related to changes in GNP).

The gradual adjustment of money demand to interest rates has the well known implication that a given change in the stock of money causes the short-term rate to overshoot considerably the new equilibrium level which is reached with a one quarter lag by the bill rate and somewhat more gradually by the commercial paper rate. (For the bill rate the overshooting in the first quarter is by a factor of roughly 6, while for RCP it is somewhat below 4). The situation is strikingly different in terms of the response to a change in unborrowed reserves; the gradual response of banks to a change in reserves implies that the money stock responds gradually and smoothly. For instance, in a dynamic simulation of the money sector alone (i.e. with GNP and commercial loans exogenous) the increase in the stock of demand deposits per billion dollar increase in unborrowed reserves is but $1.3 billion in the same quarter and rises gradually to $4.5 billion at the end of one year and to somewhat over $7 billion by the end of the second year. As a result the response of interest rates is also gradual and smooth. For instance, in the above mentioned simulation it is found that both short rates decline fairly sharply in the first quarter but then continue their decline till the third or fourth quarter; furthermore while the level reached then is lower than the equilibrium level the overshooting is by a factor of less than two. These rather different patterns of response must be kept in mind when we proceed to examine in Section III the response of the system to alternative policy variables, especially since the differences are amplified by the mechanism determining the long-term rate to which we now finally turn.

c) Long-term Interest Rates

The long-term rate in the model is at present measured by Moody's yield on AAA rated corporate bonds. (We are no longer entirely satisfied by this measure which is distorted by tax effects and hope at some point to replace or augment it by an index of new issue rates). This rate is essentially generated through a term structure equation accounting for the spread between the short-and the long-term rate. We think of this spread as equalizing the short-term rates with the expected holding yield of long term securities plus a risk premium to induce investors with pervailingly short interest to participate in holding the existing stock of long-term securities. The spread thus reflects primarily the expectation of capital gains or losses arising from expected changes in long-term rates. It is well known that this formulation implies that the long-term rate can be expressed as an average of the current short-term rate and of expected future short-term rates (or equivalently of the expected future long-term rate) plus risk premium. Following, and somewhat generalizing, the approach set forth in Modigliani and Sutch, and in Sutch, we hypothesize that expected future rates are the sum of the expected *real* rates plus the expected rate of change of prices ($\dot{p}$), and that both the expected real rate and the expected rate of change of prices are largely determined by the past history of the real rate, and of the rate of change of prices, respectively. This leads to an equation in which the long rate is finally accounted for by a long moving average of short-term past money rates measured by the commercial paper rate, RCP, and of past $\dot{p}$. The underlying theory would lead us to expect that the sum of the coefficients of the distributed lag on RCP should be close to unity, while the sum of the $\dot{p}$ coefficients should be around zero. This conclusion follows from the consideration that if both RCP and $\dot{p}$ remain constant for a sufficiently long time (and hence the real rate is itself constant) then future short-term money rates should also be expected to remain constant at the current level. Finally, the risk premium is approximated by a constant, plus a measure of instability of the short-term rate over the recent past.

The resulting equation, reproduced in Appendix B.2, is found to fit the data remarkably well (the standard error is but 8 basis points) and the coefficients satisfy rather closely the above specifications. (The sum of the r coefficients is .94 and that of the $\dot{p}$ coefficients .07).[3]

Two points are worth stressing in connection with our term structure equation. First, the presence of the $\dot{p}$ term implies that, even though the short-term rate in our model is basically a monetary phenomenon, which can be manipulated through monetary policy, the long-term rate cannot be so readily manipulated. For, if the Central Bank, by holding down short-term rates, endeavors to make the long-term rate artificially low, the resulting excess demand will cause accelerating inflation which, in turn, will cause the long-term rate to rise even if the short-term rate is prevented from rising by a sufficiently fast (and accelerating) growth of the money supply.

The second point concerns the role of the variable representing the recent instability of the short-term rate (which we measure operationally by an eight quarter moving standard deviation of RCP).

The coefficient of this variable is quite significant (t ratio of roughly four); it is also again quite sturdy under alternative specifications and periods of fit as long as they are long and with varied experience. We stress this point because it turns out, somewhat to our own surprise, that this term has an important effect on the response of the system to monetary policy because it creates a significant *asymmetry* between *expansionary* and *contractionary* policies. The reason is simply that, through that term, any substantial *change* in short-term rates tends to produce an increase in the long-term rate; thus a restrictive policy tends to raise long-term rates in two ways, namely by increasing expectations of future rates and by initially increasing the risk premium; on the other hand the effect of reduction in short-term rates is partly offset in the short run by the increased risk premium. We are inclined to the view that, qualitatively, this mechanism is a real one and limits the feasibility of a fast reduction in the long rate, even if short rates are made to fall fast; this certainly seems to square well with certain recent experiences. We have of course much less confidence in our numerical estimate of the size of this effect; some of the results reported below suggest that we may be overestimating it and that further effort at refining the estimates may be very much worthwhile.

[3] The sum of the p weights reported in the Appendix is 28.9, but this figure must be divided by 400 to convert the index of prices used to a percentage at annual rate, so as to have the same dimensions as the interest rate.

Having thus reviewed the sectors of the model that are essential for an understanding and evaluation of the results reported in III, we proceed in Part II to the analysis of certain crucial component mechanisms of the total effect.

II. Analysis of Some Partial Mechanisms

II.1 The Consumption Multiplier: Implications of Wealth in the Consumption Function

The multiplier is generally defined as the increment in output brought about by a change in "exogenous" expenditure -- i.e. in any component of demand that is not itself directly related to income -- usually expressed per dollar of increment in the exogenous expenditure. The excess of the multiplier over unity is thus a measure of the amplification of the exogenous change, whether brough about by a policy variable or otherwise. In the most elementary text book version of the Keynesian system only consumption is directly dependent on current disposable income and taxes are independent of income: thus

$$(1) \qquad Y = C + E$$

$$(2) \qquad C = c_0 + c(Y - T)$$

where E is exogenous expenditure and tax revenue, T, is also exogenous. Then

$$(s.1)\ C = [c_0 + c(E - T)]/(1 - c),$$

$$(s.2)\ Y = [c_0 + E - cT]/(1 - c)$$

so that the income multiplier is $\frac{dY}{dE} = \frac{1}{1 - c}$ and the consumptio multiplier is $dC/dE = c/(1 - c)$.

However, as soon as we generalize the consumption functio (C.F.) to allow for some lag of consumption behind income, incor will respond but gradually in time to a one time change in E. Hence the multiplier must be described by the difference between two paths; namely the path of income with and without the exogenous change. This difference expressed as ratio to dE can be thought of as the multiplier path and generally changes in value with t, the length of time elapsed since the change in E; *the* multiplier is then frequently defined as the limit reached by this ratio as t grows, if such a limit exists.

Let us denote by $[Y^*(t), C^*(t)]$ the path followed by [Y,C] after the change in E at t = 0. Then the income multiplier at date t can be expressed as $\frac{Y^*(t) - Y(t)}{dE} \equiv M_y(t)$, where Y(t) is the path in the absence of the exogenous change (i.e. for dE = 0); and the consumption multiplier at date t is $M_c(t) \equiv [C^*(t) - C(t)]/dE$. *The* multiplier could then be defined as $M_y = \lim_{t \to \infty} M_y(t)$; and similarly for M_c. For the above elementary model we find

$$M_y(t) = \frac{1}{1 - c} \text{ for all } t = M_y \tag{s.3}$$

and

$$M_c(t) = \frac{c}{1 - c} \text{ for all } t = M_c \, . \tag{s.4}$$

Suppose now we replace the elementary consumption function (2) with a simplified version of our C.F. in which we neglect the lags: thus

$$C(t) = c[\,Y(t) - T(t)] + w\,W(t) \tag{2'}$$

where W(t) is net worth at the beginning of period t, and w a constant. Assuming no capital gains or losses, we also have the identity

$$W(t) - W(t-1) = S(t-1) = Y(t-1) - T(t-1) - C(t-1)\,, \tag{3}$$

where S denotes personal saving. In turn (3) implies

$$W(t) = W(0) + \sum_{\tau=0}^{t-1} S(\tau) \qquad t = 1,2, \ldots$$

Substituting from (1) we then find

$$S(t) = E(t) - T(t)$$

and

$$C(t) = c[C(t) + E(t) - T(t)] + w\left\{W(0) + \sum_{\tau=0}^{t-1} [E(\tau) - T(\tau)]\right\} + c_0 .$$

Solving the last equation for C(t):

$$\text{(s.1')} \quad C(t) = \frac{1}{1-c}\left\{c[E(t) - T(t)] + w\,W(0) + w\sum_{\tau=0}^{t-1} [E(\tau) - T(\tau)]\right\} + \frac{c_0}{1-c}$$

Similarly $C^*(t)$ is given by the right hand side of (s.1′) but with E(t), T(t) replaced by $E^*(t)$, $T^*(t)$. Suppose that at t = 0 a once and for all increment dE is added to E so that $E^*(t) = E(t) + dE$. Then, from (s.1′) we find

$$C^*(t) - C(t) = \frac{1}{1-c}\left[c(dE) + w\sum_{\tau=0}^{t-1} dE\right]$$

and therefore

$$\text{(s.4')} \qquad M_c(t) = \frac{C^*(t) - C(t)}{dE} = \frac{1}{1-c}[c + wt] = \frac{c}{1-c} + \frac{w}{1-c}\,t$$

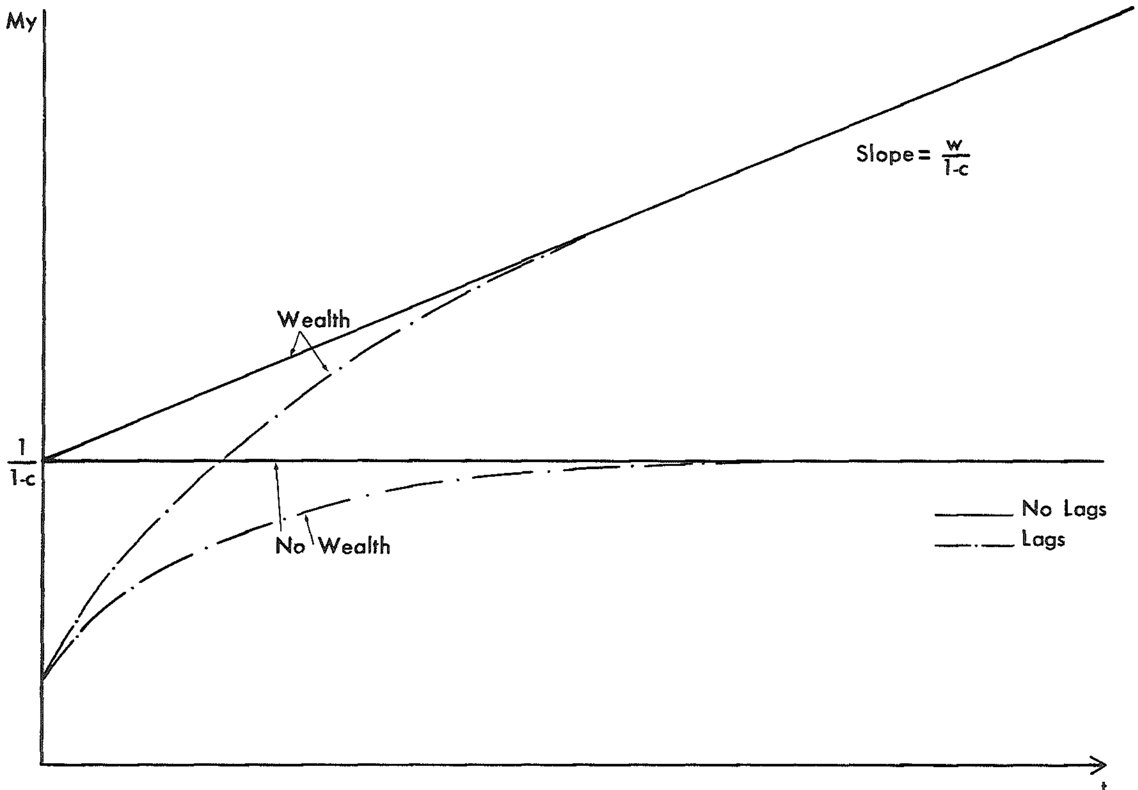
$$\text{(s.3')} \qquad M_y(t) = \frac{Y^*(t) - Y(t)}{dE} = \frac{1}{1-c}(c + wt) + 1 = \frac{1}{1-c} + \frac{w}{1-c}\,t\,.$$

Thus if the C.F. includes wealth linearly the *multiplier increases with time, linearly at the rate w/(1 - c);* and as t grows the *multiplier also grows without bound.* This apparently paradoxical result can actually be readily understood. The increase in the exogenous expendtiure dE can be looked at as an increase in "offset to saving" which cause: saving in every period to increase by the same amount dE. But the increase in saving in turn increases wealth which again increase: consumption and income, forever. The relation between the multiplier implied by standard C.F. and that implied by (2′) is showr graphically in figure 1a below by the two solid lines.

If we allow for consumption to depend on an average of pas income and wealth and let c and w denote respectively the sum o the income and wealth coefficients, then, in general, the multiplier

Figure 1a

TIME PATH OF MULTIPLIERS
FOR ALTERNATIVE SPECIFICATIONS OF THE CONSUMPTION AND TAX FUNCTIONS



a: Tax Revenue Constant

will approach asymptotically the graph obtained in the no lag case, as shown by the dotted lines in figure 1a.[4]

If, instead of taking tax revenue as a constant, we assume, more realistically, that it is proportional to income, say

$$(4) \qquad T = \theta Y$$

then, with the standard consumption function (2) one gets the well-known result

$$(s.3.\theta) \qquad M_y(t) = 1/[1 - c(1-\theta)] \qquad \text{for all } t \geq 0 .$$

On the other hand with our function (2′) one can readily establish that the result is

$$(s.3'.\theta) \qquad M_y(t) = \frac{1}{1 - c(1-\theta)} + \frac{\frac{1-\theta}{\theta}(1-c)(1-\lambda^t)}{1 - c(1-\theta)} ,$$

$$\lambda = 1 - \frac{\theta w}{1 - c(1-\theta)} < 1 .$$

Thus again the multiplier keeps growing in time (since $\lambda < 1$); however, in this case it approaches an asymptote:

$$M_y = \lim_{t \to \infty} M_y(t) = \frac{1 + \frac{1-\theta}{\theta}(1-c)}{1 - c(1-\theta)} = \frac{1}{\theta} .$$

It is seen that, in this case, the addition of wealth makes the limiting value of the multiplier, M_y, *totally independent* of the parameters of the consumption function and simply equal to the reciprocal of the (marginal) tax rate θ (though the time path $M_y(t)$ does depend on these parameters). What happens in this case is that, as consumption and income rise under the impact of the original change dE and the

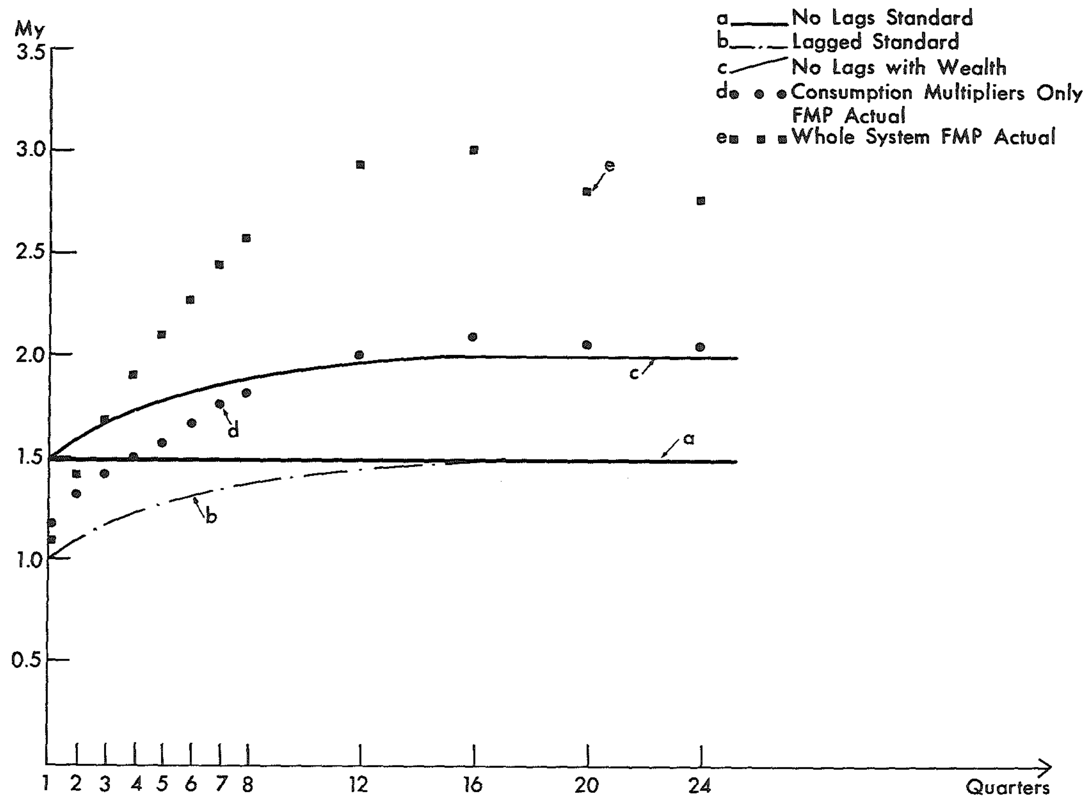
[4]Our result about the long-run multiplier follows directly from the fact that wealth appears in the C.F. with constant coefficients. It is not obvious, however, that this result is consistent with the life cycle model. Indeed, to derive from that model a C.F. of the form (2′), one needs a number of additional assumptions of "constancy" which might fail to hold when E is changed by a fixed amount once and for all. It can, in fact, be shown that our result is fully consistent with the life cycle model.

induced increase in saving and wealth, tax revenue also rises and this reduces disposable income and saving, and hence accumulation. The process comes to an end when the increase in income has become large enough so that the increase in tax take, $\theta M_y dE$, is just enough to offset the increase in dE. This obviously occurs when M_y is $1/\theta$. At this point dE is exactly offset by an increase in government receipts at the rate dE, the incremental saving is reduced to zero, and wealth stops growing. In figure 1b the solid rising curve c shows the approximate multiplier path implied by our C.F. (1) of part I, assuming an instantaneous response to income and wealth: it is computed by taking c = .7, w = .05 and θ = .5. The assumed value θ is a rough approximation to the marginal tax rate for the U. S. economy for the mid-sixties, when account is taken of both the personal tax rate, (Federal plus state and local) social security contributions, and the tax rate on corporate profits. Then from equation (s.3′ .θ), $M_y(0) \simeq 1.5$, $M_y \simeq 2.0$. Also $\lambda \simeq .96$ so that the approach to equilibrium is rather slow, around 4 percent per quarter. The solid horizontal line a shows by contrast the multiplier implied by the standard C.F. assuming the same values of c and θ.

The lower dotted curve d in figure 1b shows the actual multiplier path computed from a dynamic simulation of the FMP model in which an exogenous component of expenditure – specifically exports – was increased by $10 billion above its actual value, beginning with 1962.1, while all other components of demand, except consumers' expenditure, were taken at their historical level. This path differs from the theoretical path c for two main reasons: i) the gradual response of consumption to income, and, to a minor extent, to wealth; ii) the fact that consumers' expenditure includes durable goods and the response of this conponent includes "accelerator effects." For an interim period ECD has to rise enough to generate the desired addition to the stock of durables, though eventually the increment settles down to what is necessary to offset the depreciation of the increased stock. It is this accelerator effect that is responsible for the overshooting of the accelerator path, though this overshooting is quite modest because of the very gradual response of consumption.

Figure 1b

TIME PATH OF MULTIPLIERS
FOR ALTERNATIVE SPECIFICATIONS OF THE CONSUMPTION AND TAX FUNCTIONS



b: Tax Revenue Proportional to Income

As expected, the multiplier M_y is around 2. This rather modest multiplier reflects the powerful stabilizing effect of our very high marginal tax rate (combined with the assumption that neither the Federal nor state and local governments respond to the increased tax take by changing either tax rates or expenditure). It is also seen that the response is fairly fast, with some 75 percent of the total effect occuring within one year.

To complete the picture we also show by the upper dashed line c in figure 1b the multiplier response when we allow all other components of demand (except real Federal Government expenditure) to respond to the increase in output. We thus allow for i) "accelerator effects" on plant and equipment expenditure and inventories, ii) effects on residential construction, iii) for response of state and local government expenditure to the increase in the tax base, [5] and also iv) for larger imports (which reduces the multiplier). However since we keep the financial sectors and, in particular, *interest rates unchanged,* we are implicitly assuming a "permissive" monetary policy which accomodates the higher money income resulting from the increase in real output (and from the increase in prices which would accompany the expansion of employment) by an appropriate expansion of the money supply. Or, to put it in familiar text book language, we are measuring the effect of a change in exogenous expenditure on shifting the Hicksian IS curve, rather than the shift in equilibrium resulting from the intersection of the shifted IS curve with an unchanged LM curve.

It is not surprising that the resulting multiplier is distinctly larger, somewhat slower, and exhibits more pronounced overshooting than when only consumers' expenditure is endogenous. The peak value of the multiplier rises roughly from two to three. About 2/3 of the peal effect is reached within the first year, and by the second year the proportion rises to over 90 percent. In section III we shall have occasion to compare this response with the path resulting from a different monetary policy; viz. a constant money supply, and thus

[5] In the FMP model, both expenditure and receipts of state and local Government are explained endogenously.

assess the restraining effect of a non-accommodating monetary policy.[6]

II.2 Real System Response to Change in Wealth

Another useful way of assessing the role of wealth in the consumption function is to examine the effect on GNP of an exogenous shift in that variable. The direct effect on consumption can of course be estimated directly from the coefficients of the consumption function reproduced in Appendix A. From these we can infer e.g. that a $10 billion change in W would change CON by some $.3 billion in the same quarter and by $.53 by the end of one year. At current level of net worth this means that a 1 percent increase in W, roughly $30 billion, changes consumption by about $.8 billion in the same quarter and by $1.5 billion within a year. However, this measures only the direct effect on CON. To get the direct effect on consumers' expenditure one needs to add the effect on consumers' durables which is more spread in time. Finally, to get the full effect on GNP, one should take further into account the multiplier effect which we have seen to reach a value of roughly 3, but over an even longer span.

In order to see how these various lags interact we have carried out a simulation in which W was increased by $50 billion in 62.1 and all real sectors were taken as endogenous while the financial sectors are again exogenous. Since in 62.1 wealth was nearly $2 trillion, the assumed increase amounts to 2.5 percent. Figure 2a reports the results of this simulation for GNP, expenditure on durable goods (ECD) and total consumers' expenditure (EPCE) all in constant prices.

In assessing the results it is helpful to remember that the direct effect on CON should be around $1.5 billion in the first quarter, grow to some $2.5 billion by the end of one year, and then remain there. (These figures are only approximate because the change in W is

[6]It should be noted that since the multiplier reported in Figure 1b represents the response of the system to an exogenous change in any component of aggregate demand for real private GNP, it measures, in particular, the response to a change in government purchase of goods – provided, however, that the change in expenditure did not result from defense procurement. This is because in the FMP model defense procurement begins to affect GNP, through inventories, beginning with the time at which the order is placed, and hence well in advance of actual expenditure. The expenditure occurs only when the goods are delivered, at which time inventories are reduced, largely offsetting the expenditure. Similarly, expenditure on compensation of employees, which is not a component of private GNP, also generates a somewhat different multiplier path.

in money terms and hence the real effect is somewhat reduced in time by the increase in CON deflator; however in the chosen period this increase was small -- of the order of 1 percent per year). It is seen that, through the various amplifying mechanisms, GNP actually rises by 4.3 within two quarters (an elasticity η of .3) to 7 in one year ($\eta =$ .5) and reaches a peak effect of just over 8 by the seventh quarter ($\eta \simeq$.6), staying around that level till the end of the third year. It then declines slowly -- through this decline is, no doubt, due in part to increasing prices. Thus the direct effect on consumption, which is already sizable, gets amplified to a very substantial total. To illustrate, at current levels of W and GNP a 1 percent change in W would generate a change in GNP of nearly $3 billion within two quarters, over $4 billion within a year and nearly $5 billion before the end of two years. As for the composition of the total effect, it appears that, typically, around 2/3 is accounted for by consumers' expenditure and 1/3 by all other demand sectors (investment, plus state and local government, minus imports), though the share varies somewhat over time. It reaches its lowest point around the fourth quarter when the acceleration effects are most important. Some acceleration effects occur within the consumer expenditure sector itself through durables, though this is seen to be modest: the peak rate of durable expenditure is only some 30 percent higher than the steady state effect of about $1 billion.

In the light of these results it should not be surprising if a substantial portion of the impact of monetary policy were to occur through the role of wealth in the consumption function.

II.3 Real Systems Response to a Change in Interest Rates Via the Relative Cost of Durable Goods Services

The last partial effect to be examined here is the effect a change in interest rates on the rental rate of durables and thus on durable expenditure. We wish to stress from the outset that we have much less confidence in the numerical results about to be presented than in those given in the last subsections, because we do not regard our estimate of the coefficients of the rental rate in the durable equation as very reliable, especially with respect to the lag structure. We hope nonetheless that these results provide at least a bearable approximation to the order of magnitudes.

A first answer to the question posed could again be gleaned directly from the coefficients of the ECD equation given in

Figure 2a

RESPONSE OF DEMAND TO AN EXOGENOUS CHANGE IN NET WORTH

NET WORTH INCREASED BY 50 BILLION IN 1962.1

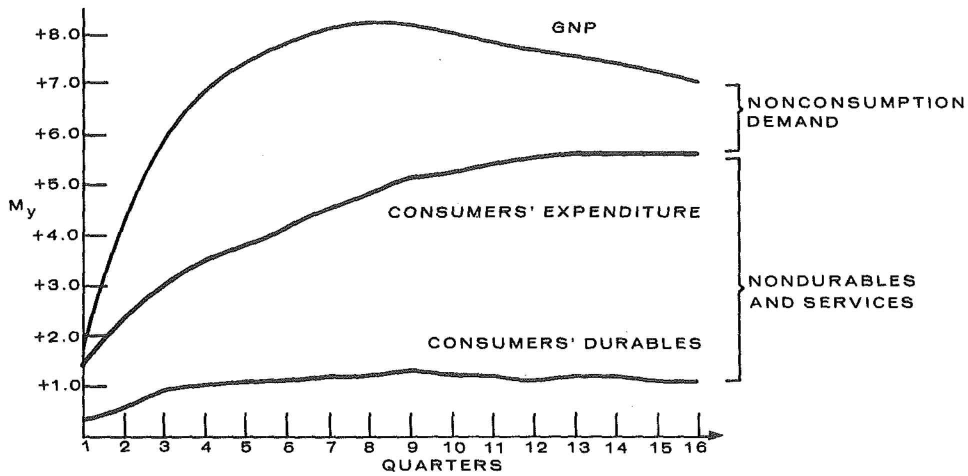
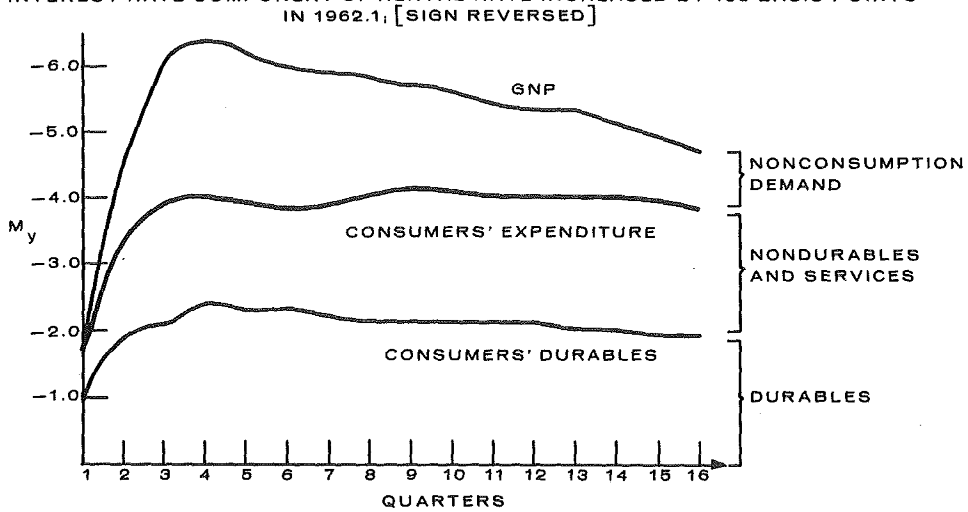


Figure 2b

RESPONSE OF DEMAND TO A CHANGE IN INTEREST COST OF DURABLE SERVICES

INTEREST RATE COMPONENT OF RENTAL RATE INCREASED BY 100 BASIS POINTS IN 1962.1; [SIGN REVERSED]



Appendix A: these tell us that a change of 100 basis points in the long-term rate (price expectation constant) would decrease durable expenditure by .002 of CON in the same quarter, and by more in the following quarter until the full impact effect of .0066 CON is reached in the fifth quarter. At current rates of CON, just below $500 billion, this would be a reduction of roughly $1 billion in the same quarter and over $3 billion by the fifth. These are again non-negligible magnitudes, though of course a change of 100 basis points in the long rate is a rather large one. But again these are only the direct effects, which do not even allow for the feedback effects through a change in the stock of durables. To estimate the total impact we must also allow for multiplier effects, and their distribution in time. Again we have endeavoured to throw light on these total effects through a simulation in which we have increased the long-term rate (RCB) by 100 basis points from 1962.1 on, while at the same time keeping it at the historical level for every other component of demand in which this rate appears, directly or indirectly, including the stock market. Our simulation therefore depicts the total effect of a change in RCB *only through its effect on the rental rate of durables.*

The results of the simulation are given in Figure 2b (with sign reversed). As background we may note that, since in the period '62–'65 CON was running around $330-380 billion, the direct effect should come to $.7 billion in the first quarter and rise to around $2 by the fifth quarter.

It can be seen from the table that initially, ECD rises a little more than these figures, reflecting the feedback of the multiplier effect on the desired stock of durables via CON; the peak effect is about $2.3 billion reached in the third quarter and maintained for the next year or so. But, because of the multiplier, the total effect on GNP soon becomes two to nearly three times larger, reaching nearly $5 billion by the second quarter and around $6 1/2 billion by the end of the year. Thereafter it declines very slowly returning to $5 billion at the end of four years.

Note that, given enough time, ECD declines again toward a long run level which is probably in the order of $1 billion. The overshooting in the first few quarters reflects a type of accelerator or rate of change effect of RCB. This can be seen as follows. The rise in RCB reduces the desired stock of durable goods. It can be shown that equation I.2 implies a long-run elasticity of the stock of durables with respect to RCB somewhat below .1. Since a change of RCB of 100 points is roughly a 20 percent change, the desired stock should change by some 2 percent or around $4 billion. Thus, in the long run, ECD should decline by the depreciation on 4 billion of stock, or around 1 billion. Initially, however, the decline must be larger so as to generate a decline of $4 billion in the stock itself. This is the acceleration effect referred to above.

In summary, the impact of interest rates via consumers' durable alone in the FMP model is again surprisingly strong, especially once we allow for direct and indirect effects. As an order of magnitude it appears that a 10 percent change in the real long rate would tend, within three quarters, to change real GNP by around six-tenths of 1 percent or around $4 1/2 billion at current rates, and this effect would be roughly maintained for a couple of years.

III. System Response to a Change in Policy Variables and the Role of Linkages Through Consumption

III.1 The Basic Approach

Our major interest here is in examining the implications of the FMP model concerning the role of the wealth effect in the response of the system to a change in policy variables, especially those traditionally associated with monetary policy. The basic technique by which we propose to analyze this problem consists in comparing the response of the entire system with the response to a "fictitious system" in which monetary effects through wealth are suppressed. This suppression is accomplished by the simple device of severing the connection between interest rates and the rate (RDP) at which dividends are capitalized. That rate is instead taken as exogenous (i.e. at its historical value, see below). Note that this is *not* equivalent to taking wealth as exogenous, since wealth contains many assets beyond equity in corporate enterprises; indeed as noted earlier, in recent years that component has amounted to roughly 1/3 of the total. Nor is it strictly equivalent to taking the market value of equity as exogenous. For, that value is obtained by capitalizing dividends and we continue to treat dividends as endogenous; thus any policy change which affects GNP will affect wealth by changing the flow of dividends both via real and via price effects. We proceed to list below a number of further operational aspects of our method of analysis which are essential for an understanding of the results, their scope, and limitations.

(i) For present purposes, we choose to measure "response" by the broadest conventional measure namely GNP, as defined in the

National Income Accounts. However, we exhibit the response of both real GNP (XOBE) and GNP in current dollars (XOBE$) from which one can also infer the price response. In principle, of course, we could also exhibit the response of any other endogenous variable of the system – say consumption or investment, or imports, or tax revenue, or other financial variables. However, because of limitation of space the results reported in figures and tables and the discussion in the text will focus exclusively on the two above mentioned measures of GNP.

(ii) The response is computed by the method of comparative dynamic simulations inside the historical period. That is, we first simulate the model with the policy variable on their historical path. We refer to this simulation as an "historical" one and denote the GNP so computed by GNP^c. Next, we run a second simulation with one or more policy variables changed in some specified way. We refer to this second simulation as a "policy" run and denote the resulting GNP by GNP^*. Finally, to complete the multiplier we subtract GNP^c from GNP^*, and, possibly, divide the difference by some measure of the change in the policy variable, in order to normalize the result. It will be recognized that, in the special case where the policy variable is an exogenous component of expenditure such as government expenditure on goods and services, the result of this operation is precisely the multiplier M_y, as defined in II.1. However, when the policy variable is a different one, then the notion of a multiplier will generally be ill-defined since the unit of measurement for the change in the policy variable is arbitrary, especially if that variable has a different dimension than the numerator, (as for instance if it were the stock of money, or the short-term rate). We still find it convenient to refer to the change in GNP as a policy multiplier but we shall have to make explicit the unit in which we measure the change in the policy variable.

(iii) Since our system contains a number of essential non-linearities, the multiplier response is in general not independent of "initial conditions," that is, of the state of the system at the beginning of the policy simulations or of the actual path of the exogenous variables over the period of the policy experiment. Because of limitations of space, we focus our attention on a single policy experiment generally starting in the near past, around the beginning of '67. The reason for choosing this particular period as the basic period of analysis is explained in (iv) below. We recall here that 1967 is a year in which unemployment was already quite low, and which was followed, historically, by a prevailing expansionary fiscal and monetary policy which further increased the inflationary pressures in the economy. To assess the sensitivity of our results to the specific initial and historical conditions we shall report, for comparison, selected results of a policy simulation beginning around 1962, a period of considerable slack of the economy followed by a very gradual expansion of aggregate demand, reduction of unemployment, and reasonably stable prices until 1965. The comparison also helps to assess whether the above described difference in initial conditions produces differential effects that are a priori credible and "sensible."

(iv) As we have indicated, several of our sectors allow for price expectational effects. In particular, such effects play a significant role more or less explicitly on (1) the stock market through RDP; and hence on any other variable that is directly related to RDP such as consumption, and plant and equipment expenditure; (2) equipment expenditure; (3) on expenditure on durable goods, (4) to some extent on housing starts; and finally (5) on long-term interest rates, both corporate, municipal and mortgage rates. We have also mentioned that, empirically, we have not been able to detect a significant direct effect of price expectations on either RDP or equipment and durable expenditures, until around 1966. On the other hand, the evidence suggests that price expectations were important throughout in affecting the relation between short-and long-term interest rates. As will soon become apparent, and is hardly surprising, the presence of a price expectational terms in sectors (1), (2) and (3) above is apt to be highly unstabilizing, especially for certain types of policies. We, therefore, felt it desirable to present multipliers both for the full system and for an artificial system in which the price expectational effects in (1), (2) and (3) are suppressed. These effects are automatically absent for any policy simulation which terminates before 1966. For simulations beginning on or after 1966, we can suppress the "price expectational mechanism" by the device of taking the rate of change of price term which appears in (1) (2) and (3) as a measure of expected p, as exogenously given at its historical value, instead of calculating it endogenously from the history of prices generated by the simulation. These simulations ex-price expectational mechanism enable us to assess the role of this mechanism. In addition, they also provide information on multipliers under initial conditions of price stability, since, in general, the price expectational term in our equations only begins to operate when the rate of change of prices rise above some threshold value (empirically estimated at 1.5 percent per year) and becomes fully operative only if $\dot{p}$ remains above this threshold for a substantial length of time (three years). It follows that our basic design consists in showing four different multipliers as follows: (a) full system with wealth effects; (b) same, without wealth effects; (c) full system without price expectational mechanism; and (d) same as (c) but without wealth. This enables us to examine not only the wealth effect but also its interaction with the price expectational mechanism.

(v) Because many of the policy variables in our system are functionally related to each other, the number of possible independent policy variables in any simulation is smaller than the set of policy variables. In carrying out a particular policy simulation one has to decide which other policy variables are taken as exogenous at their historical level, and this decision, in turn, determines which other potential policy variables are taken as endogenously determined. To illustrate, the set of our fiscal policy variables includes Federal expenditure, tax rates and government surplus; but only two of these variables can be chosen independently. Thus, in a simulation in which we change government expenditure we might take tax rates at their historical level. In this case, the receipts and the surplus will differ from their historical level and the expenditure effect will be partially offset by the fiscal drag (or built in stabilizers). Alternatively, we may take the surplus at its historical level, in which case, we cannot take tax rates as given. The same choices arise if the policy change were, say in money supply, except that now we would also have the choice of taking surplus and tax rates as exogenous and expenditure as endogenous. The multiplier will, of course, be quite different for the different possible choices. In the case of fiscal variables all this is well understood, and multipliers are generally defined on the assumption of given expenditure and tax rates and endogenous receipts and surplus. We shall here adhere to this convention; i.e. we will always take tax rates as given, and we also take Federal expenditure as given (in real terms) except when expenditure itself is the policy being changed. But when it comes to the monetary sector the situation is more complex and there are few clear precedents to go by. In particular, when we change a fiscal variable we could take as exogenous in the monetary sector any one of the following: (i) the money supply (currency plus demand deposits); (ii) the demand deposit component, (iii) the unborrowed base (bank reserves + net currency less borrowed reserves); (iv) unborrowed bank reserves.[7] Furthermore, if one takes unborrowed reserves as given, one also has the choice of taking as historically given the discount rate or instead the spread between the discount rate and the bill rate. Again, alternative choices can have significant effects on the size of the multiplier. For the present paper we have found it instructive to make different assumptions in different simulations and the choices made will be made explicit in each case.

III.2 The Expenditure Multiplier

We begin by presenting results for the multiplier response to an exogenous change in expenditure. This multiplier is of interest not merely because it measures the effect of a change in government expenditure on goods, but also because the response to any other policy variable is profoundly affected by "this multiplier". Indeed, this response can be looked upon as the superimposition of two effects: a direct effect of the policy variable on one or more component of aggregate demand plus the multiplier response to this direct effect.

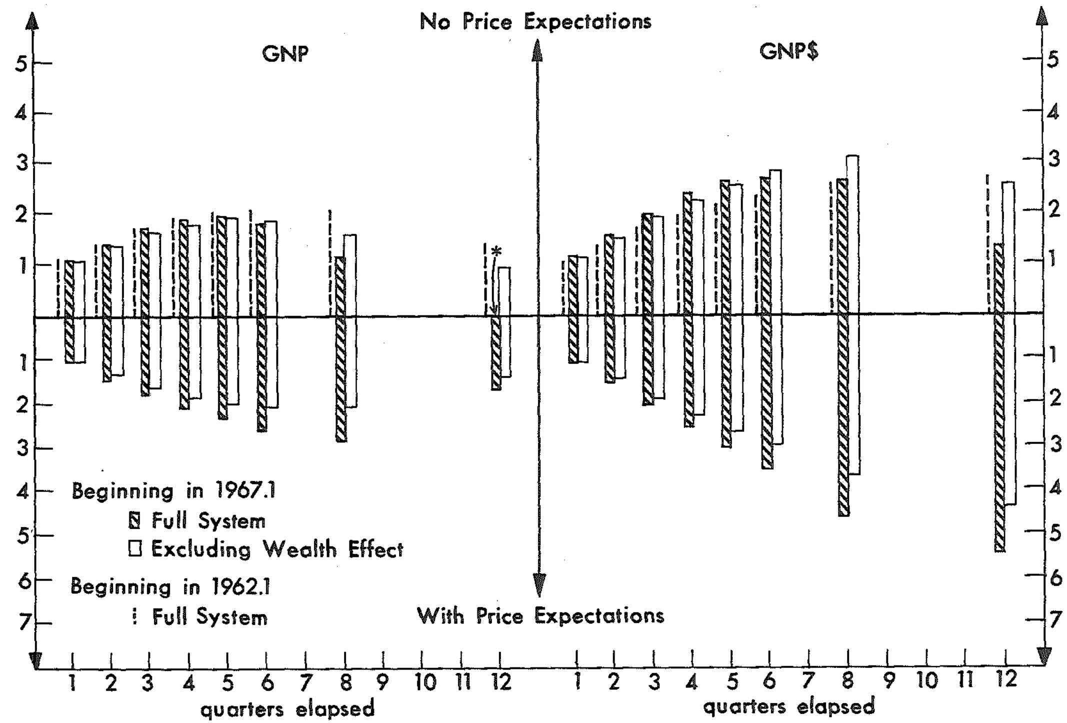
Unfortunately, for the reasons explained in III.1, (v), "the multiplier" turns out to be an ill-defined concept, for it depends on what assumptions are made as to which monetary variable is exogenous. One possible assumption is that the exogenous monetary policy variable is the short-term interest rate, the Central bank supplying whatever amount of monetary base is required to maintain the short-term rate at the historical path. The multiplier under this assumption actually coincides approximately with the multiplier we have already presented in section II.1, figure 1b. We say "approximately" because there we took as given not just the short-term rates but all interest rates. Now, to a first approximation in our system all rates are determined by the history of the short-term rate (at least if we take as historically given the ceilings on all deposit rates). However, this approximation is really a good one only if the rate of change of prices does not differ significantly from the historical path,

[7] It is more questionable whether one could take as exogenous the total base or total bank reserves, at least in the short run, for borrowing initially responds to changes in the unborrowed component. In particular, under the present system in which required reserves are against *past* deposits, at least in the very short run, the asset decisions of (member) commercial banks largely determine (up to the very small level of excess reserves) the amount of reserves that the central bank *must* provide unless it wants to force banks to violate their reserve requirements; what the Fed can control is the volume of unborrowed reserves which in turn determines the extent of borrowing.

Figure III.1

EXPENDITURE MULTIPLIERS

Based on 10 Billion Change in Exports



*negative value -0.7 omitted

for otherwise, as already indicated under II.3, the long rate could move relative to the history of short rates.

Another possible assumption, which is frequently made, explicitly or implicitly, in speaking about *the* multiplier, is to take the money supply as given. This is the multiplier which we present in Figure III.1 but with one modification: what we take as historically given is not the total money supply but, more narrowly, the stock of demand deposits. This multiplier therefore assumes that the central bank provides all the base necessary to enforce the historical level of deposits and to accommodate the currency demand of the public. This particular choice for the exogenous monetary policy variable is perhaps a little unusual and indeed it was made more out of computational convenience and precedent than as a result of careful deliberation. However, it should be remembered that this definition will be roughly equivalent to taking the total money supply as exogenous as long as the policy experiment does not generate a significant discrepancy between the historical and the simulated ratio of demand deposits to currency, which is general can be taken as a good approximation. We shall therefore take the liberty of referring to this multiplier as "the multiplier-money-supply-given."

Our quantitative results are summarized in Figure III.1 in which we have tried to pack a good deal of information. First, the left portion of the figure deals with the real GNP multiplier while the right-hand side presents multipliers for GNP in current dollars, GNP$. In each half, the histograms appearing *above* the heavy horizontal line refer to multipliers computed *excluding* the price expectational mechanism for the quarter indicated at the bottom of the figure. The histograms appearing below the horizontal line are multipliers including the price expectation mechanism. Finally, for each quarter, we exhibit two columns: the black column shows the multiplier for the full system, while the white column shows the multiplier *excluding* the wealth effect. Both multipliers were obtained from a policy simulation in which real exports were increased by $10 billion beginning in the first quarter of 1967. Finally, the dashed vertical lines which appear for each quarter only on the upper left portion of the figure show the multiplier for a similar simulation beginning in the first quarter of 1962.

Examination of the black columns in the left top portion and comparison with Figure lb, which shows the "multiplier-interest-rate-given," brings out immediately some important facts. Taking money supply exogenous has very little effect on the multiplier M_y during the first year; in both cases, M_y begins just over one and reaches just below two by the end of the first year. Furthermore, excluding the wealth effect reduces the multiplier, but very marginally; in other words during the first year the wealth effect contributes but little to the size of the multiplier. But beginning with Q5 things look quite different. First, when M is given, M_y reaches its peak in Q5 as compared with three years when r is given, and the peak is very much lower, around two instead of three. Second, starting from Q6 the wealth effect actually *reduces* the multiplier and this unfavorable effect grows rapidly larger.

These results, are, at least qualitatively, very much in line with what one should expect. With M given, the increase in money GNP, shown in the right hand portion of the diagram, causes short-term interest rates to rise, which rise gradually communicates itself to long rates. The rise in long rates in turn tends to choke off some investment and also to reduce the value of corporate equity, choking off some consumption. This second effect, however, is absent when we exclude the wealth effect, and this explains why, with M given, the wealth link has eventually the effect of *reducing* the multiplier. On this ground, one would actually expect the multiplier cum-wealth to be lower than ex-wealth from the very first quarter rather than beginning with Q5 as in the graph. The reason why initially things work out the other way is that, while the higher interest rates do tend to increase the dividend price ratio, RDP, there is a small additional effect via the profit/dividend variable appearing in the RDP equation, which tends to lower RDP, and initially outweighs the interest effect.[8]

It is apparent from the graph in the right portion of the figure that the same general picture holds for the GNP$ multipliers, except that the increase in prices accompanying the increase in GNP leads to a higher multiplier, reaching a peak of 2.7 after six quarters (as compared with five for GNP). Of course, the very same price effect that bolsters the GNP$ multiplier contributes to reducing and turning around the GNP multiplier.

How sensitive are these multipliers to initial conditions? A rough qualitative answer can be obtained from the top left portion of the diagram by comparing the black histograms with the dashed line, showing the behavior of the multiplier in a relatively slack period, beginning in '62.1. It will be seen that the multipliers for the two

[8] As noted in I.3, the earning/dividend ratio enters with a negative sign; also, the increase in GNP through the multiplier increases corporate profits, while dividends are very sluggish; hence, the ratio rises, tending to reduce RDP and thereby having a favorable effect on wealth.

simulations are very close, indicating little effect of initial conditions. The earlier period multiplier is just a little higher and reaches a peak a little later because, through the curvilinearity of the Phillips curve, the multiplier effect on the rate of change of prices is a little lower in the early, slack period, which permits a little more growth in GNP. On the whole, this conclusion is qualitatively sensible; expenditure multipliers on real GNP are larger when there is more slack. Indeed, in the limit, if we started out with the labor force already at a very high rate of utilization, one would expect the real multiplier to dwindle toward zero as the government expenditure would have to crowd out rapidly other components of expenditure. The difference shown in the graph is perhaps smaller than one might expect; but, then it should be remembered that in 67.1 the rate of unemployment was still at 4.2, as compared with 5.5 in '62.

The fact that the GNP multiplier eventually decreases, both cum- and ex-wealth effects should not be regarded as surprising. Indeed, one can readily show that if our system is stable (as it seems to be at least with money supply given) then, in the longest run, the real multiplier, given M, must be zero. This is because as long as the multiplier is positive, prices must keep rising faster than in the base simulation (because of lower unemployment) and GNP$ must therefore be higher and so must interest rates. But the higher interest rate must tend to crowd out investment in any event, and consumption as well, if we allow for the wealth effect. In the longest run, therefore, the additional real exogenous increase in demand must displace an equal amount of other expenditure, leaving GNP unchanged. In this respect, our model should please the monetarists. But the relevant question is how long is the required run. It will be seen that for the simulation beginning in '67, the multiplier is negative by the twelfth quarter – crossing zero after about two and one-half years. For the earlier, slack period simulation, the zero crossing point is more like three and one-half years. Strictly speaking, of course, the zero crossing is not quite the end of the story, for, the response of the system to the shock is cyclical and, hence, the multiplier path will continue to oscillate around zero indefinitely. However, since the oscillations are quite damped, the first crossing point does provide a good fix as to the speed of the crowding-out effect. Using this criterion, the FMP model suggests that this effect occurs fairly fast, though much less so than the monetarists seem to hold.

What can we say about the longest run limiting value of the GNP$ multiplier? In contrast to the real multiplier we can be sure that in our model it will be positive. Indeed the limiting value of the interest effect must be positive in order for the exogenous increase to crowd out other components (and since, with GNP unchanged, real tax revenue must eventually also be unchanged if we assume real taxes to be a function only of real income, at least to a first approximation); but, with a higher r, there will be a higher velocity of circulation, which, with M constant, implies higher GNP$ through a higher price level.

Turning now to the lower half of the chart, we see that the price expectational mechanism considerably amplifies both multipliers, even with M given; the peak value of GNP is now around three and is reached after three years; the reason of course is that, at least for a while, the higher interest rates are offset by more bullish price expectations, which reduce pro tantum the "real" rate. Since this same expectation also tends to reduce RDP relative to the long rate, the wealth effect, at least initially, tends to amplify the multiplier. None the less, it is seen that eventually M_y reaches a peak and begins to decline rapidly, for with M given, eventually the increase in interest rates exceeds the increase in the expected rate of change of prices. In view of the low unemployment in the simulation period, the XOBE$ multiplier gets quite high; it reaches 6 by the end of our simulation and is still rising, though presumably it is not far from its peak.

Summarizing then, in the absence of price-expectational effects recognition of the wealth effect on consumption does not significantly affect our estimate of the real income multiplier in the first few quarters. But, eventually, it leads to a somewhat *lower* value, by contributing to the crowding out effect via consumption. With price expectations the wealth effect increases the multiplier somewhat over a period as long as three years, though again the effect is quantitatively modest.

III.3 Change in Money Supply (Demand Deposits)

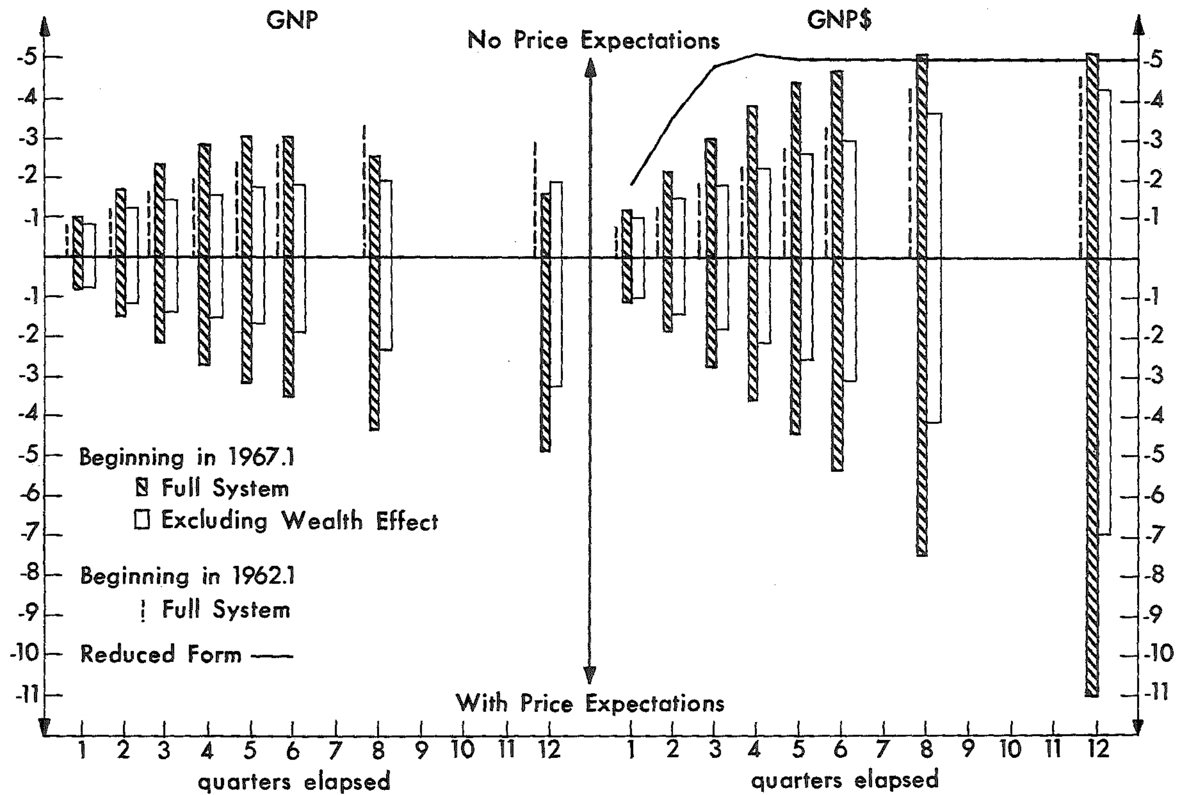
Figure III.2 summarizes our results concerning the effect of an exogenous change in the stock of demand deposits. The results shown in part A were obtained from a simulation in which demand deposits (MD$) were reduced by $1 billion in 67.1 and another billion in 67.2. The choice of this particular pattern was dictated by two considerations. On the one hand, we wanted the change in M to be large enough so that our multipliers would not be distorted by rounding off errors. On the other hand, we wanted to avoid a large

Figure III.2A

RESPONSE OF GNP TO AN EXOGENOUS CHANGE IN THE STOCK OF DEMAND DEPOSITS

Effect, per Billion, of a 2 Billion Decrease Spread Evenly Over 2 Quarters

[sign reversed]



sudden jump in M which, for reasons discussed in I.3 would produce a sharp transient change in the short rate and hence increase the "risk premium" component of the long-rate equation. Since the stock of demand deposits in '67 was around $140 billion, an increase of $2 billion in a single quarter would have represented an annual rate of increase of some 6 percent over and above the historical growth which was already in the order of 4 percent. By smoothing the $2 billion increase over two quarters we halved the annual rate of increase in M over the period in which the additional M was injected. The histograms in Figure III.2 show the effect of the change in demand deposits on GNP beginning with the quarter of the second of the two increments, namely '67.2, per billion change in M.

In some respects the result of simulation of changes in M, discussed in this section, may be regarded as the most relevant ones for the purpose of this conference. We must warn, however, that in the light of the view of the monetary mechanism that underlies the construction and estimation of our model, we regard these results as somewhat less reliable than those resulting from a change in unborrowed reserves, reported in the next section.

Before looking at the results, it may be useful to observe that, from knowledge of the structure of the model, we can again deduce the limiting value of the multipliers in the longest run. By a reasoning analogous to that developed in III.2, one can readily show that, given time enough, our model has very classical properties: to a first approximation, money is neutral (though not "superneutral") and the quantity theory holds. Hence in the longest run, neither GNP, nor interest rates, can be affected by the change in M while GNP$ must change by dM times the velocity of circulation computed at the value of r prevailing for the undisturbed system. For the period covered by our simulation the velocity of circulation of demand deposits is of the order of five to six. But once again, we must stress that these results are of little more than academic interest; what is really important is what happens in the "short run", especially the first four to eight quarters, and, for an answer, we now turn to Figure III.2A.

The first impressive result here is the very large contribution of the wealth effect both to the size and the timing of the multiplier. In real terms, we see that, if we ignore the wealth effect, the multiplier, represented by the white columns, is modest and slow; it reaches a peak of just about two, after two years, and tends to remain at that level one year later. By contrast when we allow for the wealth effect – black columns – the peak effect is reached in the fifth quarter and that peak is just over three. By that quarter, the *wealth effect via consumption accounts for nearly half of the total.* Thereafter the multiplier decreases fairly rapidly; by the end of three years it is less than 1.5 and is appreciably smaller than the multiplier ex-wealth.

The results are equally striking when we turn to the XOBE$ multiplier. Ex-wealth the multiplier is rather sluggish, though it eventually rises to nearly five by the end of three years. But cum-wealth it rises rapidly; it reaches almost four by the end of one year, of which again, half is accounted for by the wealth effect; it is close to five by Q 6 and over five by Q 8 when it reaches a flat peak.

One significant feature of these GNP$ multipliers cum-wealth is that they bear at least a family resemblance to the kind of numbers that have come out of the Monetarist analysis a-la-Federal Reserve Bank of St. Louis. From the well known "reduced form" equations of Andersen et al (see e.g., Andersen and Carlson) in which the change in GNP$ is regressed on a distributed lag of past changes in the stock of money and other variables, one can readily compute the cumulated effect of GNP$ of a two-step change in money supply which was used in our simulation. The solid curve plotted above the histograms in the top right-hand side panel shows the effect implied by their latest regression available to us, estimated through the third quarter of 1970.[9]

Although somewhat different results would be obtained if one used the coefficients reported in some other estimates, the broad picture would not be appreciably different. It is apparent that their response still rises faster and turns around earlier than ours; however, the differences are not terribly large. In particular, both estimates agree that most of the effect is reached by the fifth quarter, and that effect is very similar in magnitude. By contrast, the multiplier ex-wealth bears much less resemblance to theirs.

While the broad similarity is in some sense encouraging and suggestive we should warn the reader against making too much of it. For a number of reasons, discussed below, the similarity is less than might appear, and furthermore, we are not at all sure that it should be very close. First, since our multiplier is computed for a change in demand deposits, it should be really larger than theirs, by something like one-fifth. Second, as we have observed, our lag is really somewhat longer than theirs. Third, and most important, our

[9]These estimates were kindly supplied by Anderson in a letter dated February 3, 1971.

multiplier is significantly affect by *initial conditions*, and is *not symmetrical* with respect to expansion or contraction in the stock of money.

The effect of initial conditions is illustrated by the vertical lines drawn next to each histogram, which show the multiplier for a policy simulation beginning in the slack period – 1962.1-2. Because of the greater slack in the economy we find, as in the case of the expenditure multiplier, that the GNP multiplier reaches a peak which is both higher and later; and, by the same token, the GNP$ response is also slower, reflecting the smaller rate of change of prices. Again, our multipliers are somewhat different if we allow for the price expectational mechanism, as can be seen from the lower panels of Figure III.1. Interestingly enough, the differences are actually rather minor for the first five-six quarters, because the price expectational mechanism is rather slow in getting going. However, once it gets going, toward the end of the second year, it carries the multipliers to much higher levels. The larger GNP multiplier reflects the lower *real* rates of interest while the larger GNP$ response results from the higher *money* rates which cause an increase in velocity. Needless to say, we are inclined to think that the significant dependence of the multipliers on initial conditions implied by our model is more intellectually satisfying and a-priori credible than the independence implied by the reduced form estimates.

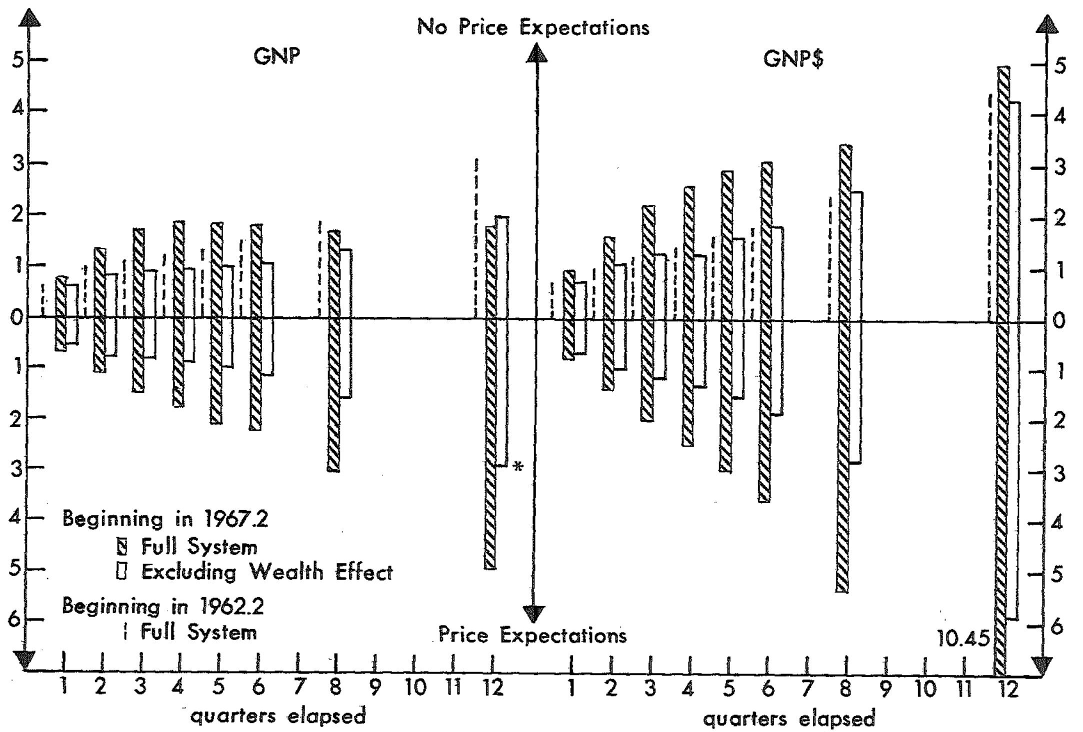
The asymmetry of expansionary versus contractionary policy is brought out rather dramatically by contrasting Figure III.2A with III.2B, which gives the results of a policy simulation in which the stock of demand deposits was *increased* by $2 billion distributed over 1967.1 and 2. As a result of the various mechanisms discussed in Part II, the multipliers here are considerably slower; in particular, the GNP$ multiplier does not reach its peak of around five until the third year.

How reliable and credible is this marked asymmetry in the response of changes in money supply? The notion that monetary policy is more powerful and faster in *reducing* than in *expanding* activity is of course a very old one, though our model accounts for this by a mechanism somewhat different from that traditionally visualized ("You can lead a horse to water but you cannot make it drink"). On the whole, we feel that the mechanism in our model is credible; it is possible, however, that it may be quantitatively overestimated. This possibility arises in part from the fact that in constructing and estimating our model we have assumed that the exogenous policy variable is primarily unborrowed reserves (or

Figure III.2B

RESPONSE OF GNP TO AN EXOGENOUS CHANGE IN THE STOCK OF DEMAND DEPOSITS

Effect, per Billion, of a 2 Billion Increase, Spread Evenly Over 2 Quarters.



*Wealth Effect Added

possibly short-term interest rates) but not the stock of money or demand deposits. For reasons noted in Part II, the asymmetry is especially marked when the policy variable is the stock of money. As will be shown in the next section, when the policy variable is for example, unborrowed reserves, the asymmetry is greatly reduced.

In the last paragraphs we have emphasized that the similarity between our money multipliers and those implied by St. Louis reduced form equations is really less close than might at first sight appear from the graphs in Figure III.2. Before moving on, we must, at least briefly, raise the other side of the question: should one really expect a close similarity? While this is not the place for us to engage in an extended criticism of the limitations of "reduced" form estimates, we must at least record here our serious misgivings about the reliability of the coefficients of St. Louis-type equations as a measure of response to exogenous changes in money supply. These misgivings are based on numerous considerations a few of which may be mentioned here.

i) In order for the reduced form to yield sensible estimates, it must be assumed that the response of the system to changes in money supply are reasonably stable in time. Yet both a priori considerations and the results of simulations presented above suggest that the response is instead significantly affected by such initial conditions as the slack in the economy, the general level of short-term rates, and the elasticity of price expectations.

ii) Of the other many exogenous variables that affect expenditure only some single measure of government expenditure is typically allowed for in the reduced form and the fiscal multiplier implied by the reduced form coefficients of these variables is patently absurd.

iii) There are ample grounds for doubting that as a rule and on the average the money supply can be regarded as exogenous over the period used in the tests. If, part of the time, the exogenous policy variable, at least in the short run, has been interest rates or unborrowed reserves, then one can expect the reduced forms to overestimate the size and speed of response of GNP to exogenous change in the money supply, and the bias will be compounded by failure to allow for the effect of other exogenous variables.

iv) Our grounds for doubt are also supported and reinforced by a number of empirical tests, a few of which are summarized in the epilogue to this paper. In particular, we provide there some empirical evidence that the reduced form coefficients can yield very unreliable and biased estimates of the response of the system to exogenous changes in money supply and, in particular, may tend to systematically overestimate the speed of response. We suggest, therefore, that, while the broad consistency between reduced form and simulation results is encouraging, the differences of detail do not deserve serious consideration, at least for the present.

We can now summarize the results of this section as follows.

(i) The multipliers generated by a contraction in the stock of demand deposits are quite substantial for the first two to three years both in real and in money terms; in particular, the GNP$ multiplier reaches a level of around five within 6 to 8 quarters; (ii) the wealth effect plays a major role in this result accounting for nearly half of the response in the first two to six quarters; (iii) if we sever the wealth effect the multiplier is much more sluggish and does not approach the steady state level until three years or so; (iv) the multiplier path depends non-negligibly on initial conditions; more slack in the economy leads to a larger response in real terms but the response is slower both in real and money terms; (v) the response to an *expansion* of the stock of money appears to be appreciably slower than the response to a *contraction*, but the difference may be overestimated by our model.

III.4 Effect of a Change in Unborrowed Reserves

The results of this experiment are reported in Figure III.3. The policy simulation consisted in increasing unborrowed reserves by $0.5 billion above the historical path, beginning in '67.1. In addition we aimed to prevent the initial fall in short-term rates, resulting from this action, from reducing the spread between market rates and the discount rate, which in turn would tend to reduce borrowing, offsetting in part the expansion of unborrowed reserves. In principle, this aim can be achieved by taking exogenous – that is, at the historical level – the spread between the discount and bill rate, thus making the discount rate endogenous. For purely technical reasons we have actually found it convenient to use an approximation which consists in making exogenous the spread between the discount rate and the average value of tthe bill rate in the previous two quarters.[10]

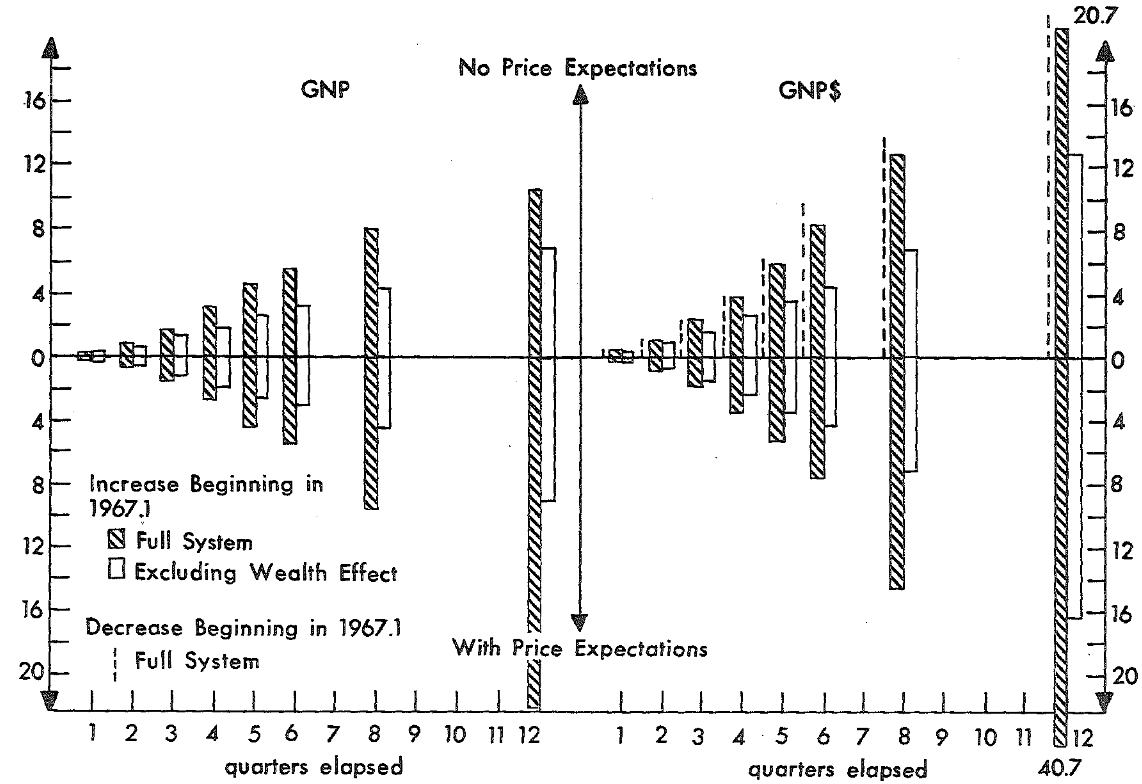
As background, we may note that a change in unborrowed reserves under these conditions should tend, in the longest run, to produce a change in the supply of demand deposits of roughly .5x7, or $3.5 billion. This change in turn should eventually lead to a change in GNP$ in the order of $20 billion. The longest run GNP multiplier, on the other hand, should still tend to zero.

We believe the picture emerging from Figure III.3 is self explanatory and, hence, shall limit ourselves to a few observations. (i) The response is clearly rather slow, as the money supply responds but gradually to the increase in reserves and in turn GNP responds gradually to the change in M. Still, by the end of the third year, the GNP$ multiplier seems to be close to its limiting value. (ii) The wealth effect again plays a major role in the response but only beginning with Q 4; between Q 4 and Q 8, it accounts for nearly half of the response. (iii) The price expectational mechanism makes again little difference for the first two years or so though it eventually becomes quite large. (iv) A *decrease* in unborrowed reserves has again a somewhat larger effect than an *increase* but the difference is now rather minor – the effect is very nearly symmetrical. This conclusion can be deduced from a comparison of the black columns shown on the upper right panel with the height of the vertical lines drawn next to each bar. These show the effect of a *decrease* in unborrowed reserves by .5 beginning again in '67.1 (with sign reversed). The reason for the far greater symmetry is that the response of short-term rates to a change in unborrowed reserves, in contrast to a change in M, is fairly smooth and, hence, does not significantly activate the variability effect in the term structure equation. To illustrate, for the simulation in which unborrowed reserves were increased in '67.1, one finds that the commercial paper rate declines fairly gradually throughout the first year to a maximum of some 60 basis points, and thereafter gradually moves back toward the original level. In the simulation cum-price-expectations, it actually eventually increases above the original level.

[10]The technical advantage of this procedure is that the discount rate in quarter t is then predetermined instead of simultaneous. There is nothing logically difficult about making the discount rate simultaneous, but it requires some changes in the simulation programs which have not as yet been readied.

Figure III.3

RESPONSE OF GNP TO A 0.5 BILLION CHANGE IN UNBORROWED RESERVES



III.5 Response to Change in Short-term Rates

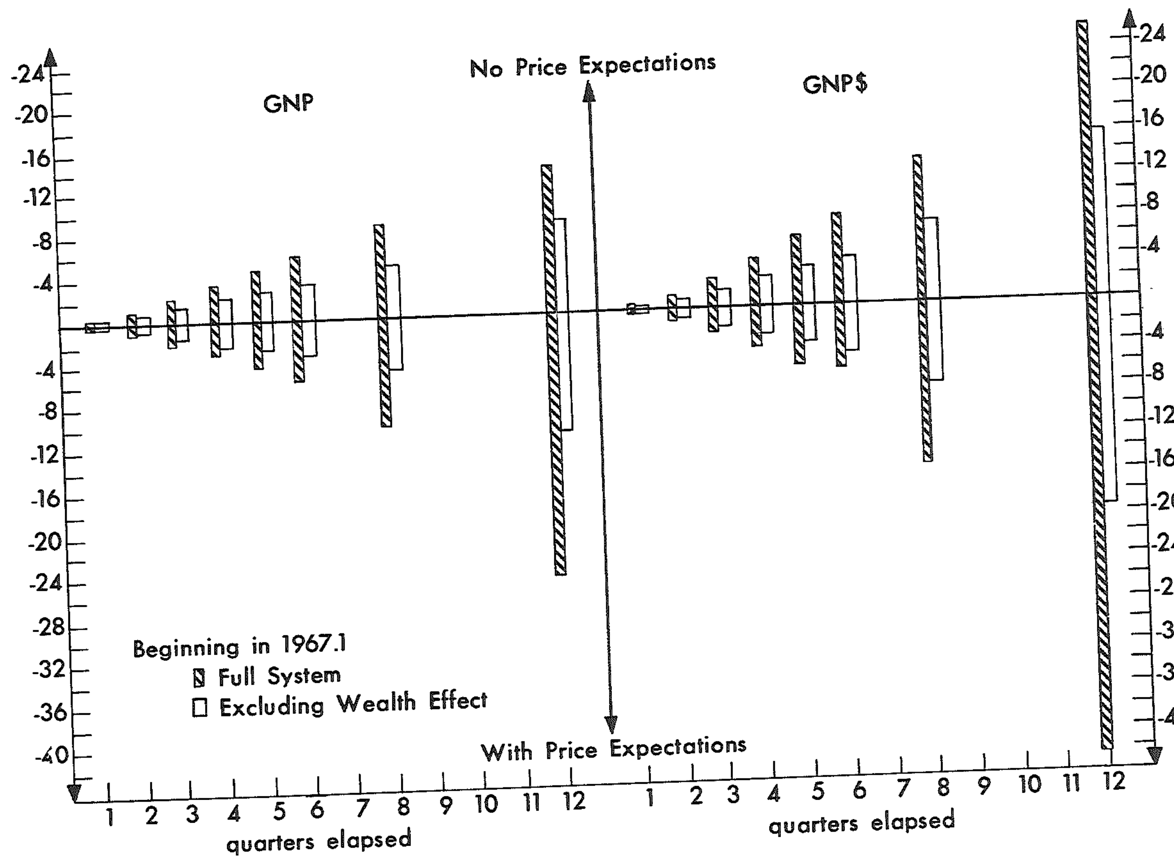
Figure III.4 reports the results of simulations in which the short-term rate – measured by the Treasury 3-month bill rate – was increased by 50 basis points beginning in '67.1. Again the figure should, by now, be self-explanatory. However, a few comments are appropriate about the reasonableness of the results and their implications.

In a sense, this simulation is of particular interest. Indeed, as we have pointed out repeatedly, in our model monetary policy works entirely through its impact on the short rate, – though the effects of the short rate on the system are to some extent different than is usually visualized. In particular, in our model these effects include the wealth effect through consumption and also a rather complex rationing effect on the housing market if, when market rates change, ceiling rates are kept unchanged and they are (or become) effective. Note here again a possible source of asymmetry, since a rise in market rates may produce effects (by making the ceiling effective) that a decline might not. However, interpretation of the results of this simulation is much more complicated because it is difficult to estimate the longest run multipliers as a guide to an understanding of the path and speed of response. Unfortunately, the causes of this difficulty can only be mentioned very briefly and superficially here.

The root of the problem lies in the fact that, in the longest run, our model tends to exhibit the characteristics of so-called "neo-classical" growth models. As in these models there exists also for our model – at least if we assume tax revenue approximately homogenous of first degree in money income and government expenditure proportional to income – a unique "natural real rate of interest" that is consistent with the model moving along a golden age growth path, with the natural rate of growth determined by technological progress and population growth. The natural real rate of interest is determined by the production function, the parameters of the consumption function, the natural rate of growth, and fiscal policy in the sense of the ratio of government deficit (or surplus) to GNP. Together with this real rate there is a "natural" money rate which equals the real rate plus the rate of change of prices, determined in turn by the rate of growth of the money supply (which must also be assumed constant on the golden age path). A policy of trying to force the interest rate away from this natural rate must eventually throw the system off the golden age path. In particular, holding the rate too low by an appropriate monetary

Figure III.4

RESPONSE OF GNP TO A CHANGE OF 0.5 IN THE TREASURY BILLS RATE



policy, must tend to cause inflation at an accelerating rate. More generally, when the price expectational mechanism is working, a policy of holding the money rate constant tends to make the system unstable. To illustrate, an initial disturbance that raises output and employment and, hence, the rate of change of prices, p, will cause a fall in the *real* rate, thereby increasing investment and consumption, and thus raising output and $\dot{p}$ further and causing still further excess demand. It is this mechanism that accounts for the quite explosive behavior of GNP and especially GNP$ in the lower panels of the figure, in which the price expectational mechanism is allowed to operate.

In view of the complexities outlined above and limitations of space, we shall make no attempt at a detailed interpretation of figure III.4. We will merely note that the response builds up slowly, but eventually gets quite large, even if the price expectational mechanism is suppressed, and that the wealth effect makes again a very significant contribution beginning in the second or third quarter and building up to a peak of over one-half by the end of two years.

EPILOGUE

SOME EVIDENCE OF THE MODEL'S ABILITY TO CAPTURE MONETARY EFFECTS ON CONSUMPTION AND ON THE RELIABILITY OF THE REDUCED FORM APPROACH

1. Review of Findings and Outline of Further Tests

In this paper we have endeavored to show that the consumption sector of the FMP model plays a critical role in the mechanism that translates changes in monetary variables into changes in overall economic activity. In particular, we have shown that roughly one-half of the response to a change in either the money supply or unborrowed reserves or short-term rates is accounted for by the effect of these variables on wealth and of wealth on consumers expenditure. This holds for several quarters following the initial change. Some additional effects occur through the impact of interest rates on consumer durable expenditures. We have also shown that, if, and only if, account is taken of the wealth effect, one obtains a path of response to changes in money supply which bears some resemblance in both pattern and magnitude to results obtained by the so-called reduced form approach. On the other hand, the response to government expenditure implied by the model remains absolutely irreconcilable with the reduced form estimates.

How relevant and reliable are these results as a description of the true mechanisms that have been at work in the U.S. economy in recent decades and will be in the near future? There is, of course, no conclusive answer to this question. In the last analysis the reader must ask himself whether he is prepared to accept the modeling of the individual sectors of the FMP model and their interrelation. Measures of closeness of fit provided in the Appendices, and the results of simulations of sectors and of various partial mechanisms are relevant, though obviously not conclusive evidence in reaching a final assessment.

In order to provide further help to the reader in forming his judgment, we briefly report here the results of two further sets of tests which may be of some value in bolstering confidence in the relevance of our results. The first set is designed to provide evidence on whether our model has succeeded in capturing the major systematic mechanisms through which monetary variables, and, in particular, the money supply, affect consumption, and more generally GNP The second set deals with the problem created by apparent discrepancies between the implications of our model and those of reduced form estimates. Those discrepancies are of some magnitude even with respect to the response to monetary variables, but are drastic when it comes to the response of fiscal variables. Our tests are designed to show why these discrepancies should not, at this time, be a serious source for concern as they reflect more on the reliability of presently available reduced form estimates than on the validity of the model.

2. "Reduced Form" Tests of the FMP Model Specifications of the Monetary Mechanism

As is well known, the monetarists have successfully shown that there is a marked correlation between the money supply and consumption expenditure. In particular, recent work of the monetarists at the Federal Reserve Bank of St. Louis has shown fairly impressive correlation between *changes* in consumer expenditures in current dollars and current and lagged changes of some measure of the money supply. These findings are confirmed by the results reported in the paper prepared by Meiselman and Simpson for this conference – see especially Tables 8 and 9, and 13 to 16.

Suppose now that we use the FMP model to carry out a long dynamic simulation; that is, we start the model at some point of time t, and let it generate all the endogenous variables up to the present, by providing no additional information other than the actual course of all the exogenous variables. The output of this simulation will then include a time series of consumer expenditure both in constant and in current dollars. Let us denote by $EPCE\$^c$ the computed value of consumption in current dollars, and by $\Delta EPCE\$^c$ the first difference of this series. Since our model does not track perfectly, especially in a simulation extending over a decade or more, there will be differences between $\Delta EPCE\$$ and $\Delta EPCE\$^c$. If our model fails to capture some of the systematic effects which generate the observed association between $\Delta EPCE\$$ and ΔM, current and lagged, then one should expect that the simulation error, $E \equiv \Delta EPCE\$ - \Delta EPCE\$^c$, should itself be correlated with a distributed lag of ΔM. Thus, our basic test consists in regressing E on a distributed lag of ΔM, or in estimating the regression equation:

$$(1) \quad E(t) = \sum_{\tau=0}^{m} v_\tau \, \Delta M(t-\tau) + V$$

where V is the constant term. If we have failed to specify adequately all of the channels through which M, current and lagged, affects EPCE\$, then we should expect to find that the distributed lag explains a significant portion of the error E, or, equivalently, that the multiple correlation coefficient, R, of the above regression equation is significantly different from zero.

The test just described admits of an alternative enlightening interpretation. Consider first the St. Louis type equation obtained by regressing ΔEPCE\$ on ΔM current and lagged

$$(2) \quad \Delta EPCE\$(t) = \sum_{\tau=0}^{m} a_\tau \Delta M(t-\tau) + A\,.$$

Suppose next we run the same type of regression, but using as the dependent variable ΔEPCE\$^{c}, or

$$(3) \quad \Delta EPCE\$^c(t) = \sum_{\tau=0}^{m} b_\tau \Delta M(t-\tau) + B\,.$$

It is then easy to establish, from well known properties of least squares estimates, that the coefficients of (2) and (3) are related to those of (1) by the equations

$$v_\tau = a_\tau - b_\tau\ ,\ \tau = 0,\ldots,m,\ V = A\text{-}B\,.$$

It is apparent from the above that if, because of misspecification of the relevant channels, our model tended to *underestimate* the effect of ΔM on EPCE\$ than the individual coefficients v_τ or, at the very least, their sum, should be significantly positive. Conversely, a finding that the sum of weights is not significantly positive would enable us to reject the hypothesis that our formulation tended to underestimate systematically the cumulative effect of changes in M on consumption. More generally, if the multiple correlation R of Equation (1) is not significantly different from zero, then this would imply that the change in consumption-generated by the model bears a relation to ΔM current and lagged which is not significantly *different* from the relation exhibited by the actual change in consumption. Put somewhat loosely, such a finding would imply that our model is able to account, up to insignificant differences, for the observed pattern of association between ΔEPCE\$ and current and lagged values of ΔM.

Since the structure of our model implies that the money supply can affect consumption, as well as every other component of demand, only through its effect on the short-term rate, it would appear that the most effective way of testing whether our formulation captures all of the monetary effects is to take as the exogeneous monetary variable in our long-run dynamic simulation, not the money supply directly, but rather the pivotal short-term rate, namely the three-months Treasury bill rate, RTB. This approach eliminates possible errors due to errors in the money demand equation in computing the bill rate from the money supply. (These errors are typically small but could still produce irrelevant disturbances, especially since they are somewhat serially correlated.) Furthermore, it sharpens the test of our central hypothesis that the money supply has no effect on the system except through its impact on short-term rates. Other exogenous variables for our simulation include Federal government expenditures, transfers, grants-in-aid, tax rates, population, productivity trends, and a host of other minor variables which are described in the list of exogenous variables obtainable from Wharton EFA, Inc.[1] In all tests reported below, "computed values" were obtainable from a dynamic simulation beginning in 1958.I, and terminating in 1969.IV, and all "reduced form" equations were estimated over the same period, unless otherwise noted.

In carrying out our test, we still need to specify the nature of the distributed lag to be used in Equation (1). Unfortunately, quite a variety of specifications has been used by the St. Louis school at different times, both in terms of the length of the lag---running typically between four and eight quarters---and in terms of the method of estimating it---unconstrained least squares or Almon polynomial of different order and with a variety of a priori constraints. To conserve space we present here only results using an eight quarter lag and two methods of estimation: unconstrained least squares and third degree Almon polynomial, constrained to zero at the ninth quarter. We chose to focus on eight-quarter lags because the policy simulations reported in the text suggest that lags are typically quite long. We have however made a number of tests with shorter lags and

[1]In addition, one important adjustment we made in the stock market equation: Because the dividend yield equation makes some occasional non-negligible short-term error, and because we see no reason to let our failure to account fully for this variable control the quality of our simulation, we have taken as exogenously given the single equation error of this equation. Note that this procedure is not equivalent to taking the dividend-price ratio as exogenous for we still allow errors in other endogenous variables to produce errors in the dividend yield.

consistently found that minor differences in this specification did not materially affect the conclusions reported below.

Before proceeding to an analysis of the results we must call attention to one likely bias of our proposed test. It can be shown that if, at least some of the time, the policy target of the monetary authority were not directly the money supply but rather some variable such as unborrowed reserves, or free reserves, or interest rates, then the actual money supply would tend to be *positively* correlated with the error E, of the model, even if the model's specification were completely correct, or at least unbiased. Thus a finding that the sum of the coefficients of equation (1) is moderately positive would not justify rejecting the hypothesis that our specifications were unbiased, whereas a finding that the sum is negative would correspondingly strengthen the conclusion that the model's specifications were not systematically underestimating the magnitude of the response of the system to changes in money supply.

The results of our test are reported in Part A of Table E.1. In the first three columns, the coefficients are estimated by unconstrained least squares. The pattern of coefficients in Column (1), where the dependent variable is the change in *observed* value of Consumers' Expenditure, looks rather puzzling, especially the sharp whipsaw shape at the tail end (though this shape is preserved even if the period of fit is extended back to the beginning of 1952.) In Column (2) the dependent variable is the change in *simulated* rather than actual expenditure. It is apparent that the pattern of coefficients is rather similar, except that the coefficient of current ΔM is rather larger and the whipsaw at the end is attenuated. As a result, when the difference between actual and simulated change (the model error, E) is regressed on current and past values of ΔM in Column (3) the individual coefficients are mostly small and entirely insignificant, as evidenced by the t-ratio given below each coefficient. The portion of the error explained by the distributed lag is also entirely insignificant, as evidenced by the very low R^2 and by an entirely insignificant value of the F statistics. Finally the sum of the coefficients is seen to be *negative* rather than positive, despite the bias of the test mentioned earlier. We must therefore conclude that the results of this test unequivocally reject the hypothesis that our model systematically underestimates the impact of the money supply on consumption; more generally the results reject the hypothesis of any systematic misspecification.

As a check on these conclusions we present in Columns (4) to (7) the results obtained when the coefficients of the distributed lag are

TABLE E.1

REDUCED FORM TESTS OF THE FMP MODEL SPECIFICATION OF THE MONETARY MECHANISM

Independent Variables \ Dependent Variable	A: Based on Consumers' Expenditure[2] (EPCE$)						B: Based on GNP$		
	ΔEPCE$	$\Delta EPCE\$^{c}$	E ≡ ΔEPCE$- $\Delta EPCE\$^{c}$	ΔEPCE$	$\Delta EPCE\$^{c}$	E	ΔGNP$	$\Delta GNP\$^{c}$	E ≡ ΔGNP$- $\Delta GNP\$^{c}$
	Unconstrained L.S.			3rd Degree Polynomial Zero at t-8			3rd Degree Polynomial		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ΔM(t)	0.75	1.17	-0.42	0.32	0.73	-0.41	0.68	1.06	-0.37
	(1.3)[1]		(0.7)	(1.0)		(1.3)	(1.6)		(0.9)
ΔM(t-1)	0.24	0.20	+0.04	0.62	0.71	-0.09	1.30	1.27	0.03
	(0.3)		(0.1)	(4.0)		(0.6)	(6.4)		(0.1)
ΔM(t-2)	0.60	0.71	-0.11	0.70	0.65	0.05	1.39	1.27	0.12
	(0.8)		(0.2)	(3.8)		(0.3)	(6.0)		(0.5)
ΔM(t-3)	0.90	0.62	0.28	0.62	0.56	0.06	1.13	1.12	0.01
	(1.1)		(0.4)	(3.6)		(0.4)	(5.4)		(0.1)
ΔM(t-4)	0.58	0.78	-0.20	0.44	0.44	0.00	0.66	0.87	-0.20
	(0.7)		(0.3)	(3.5)		(0.0)	(4.3)		(1.3)
ΔM(t-5)	-0.14	-0.08	-0.06	0.23	0.31	-0.09	0.16	0.58	-0.41
	(0.2)		(0.1)	(1.6)		(0.6)	(0.9)		(2.4)
ΔM(t-6)	0.98	0.33	0.65	0.05	0.19	-0.15	-0.23	0.30	-0.52
	(1.24)		(0.8)	(0.3)		(0.9)	(1.0)		(2.3)
ΔM(t-7)	-1.22	-0.02	-1.20	-0.05	0.09	-0.14	-0.33	0.09	-0.42
	(1.81)		(1.0)	(0.3)		(0.9)	(1.7)		(2.1)
Constant	2.94	2.27	.67	2.75	2.33	0.42	4.39	3.18	1.21
	(3.12)		(.72)	(3.0)		(0.5)	(4.4)		(1.0)
Summed Weights	2.70	3.72	-1.02	2.95	3.73	-0.78	4.77	6.54	-1.77
				(5.0)		(1.4)	(6.6)		(2.4)
Measures of Fit									
R^2	.55		.14	.48		0.06	.58		0.09
D.W.	2.9		2.7	2.9		2.7	1.81		1.84
F			0.69			0.87			2.5
F* (.05 Significance)			2.3			2.9			2.8

[1] t-ratio.

[2] Period of Fit: 1959.4 – 1969.4.

estimated using a third degree Almon Polynomial, a procedure that smoothes out the improbable jagged pattern of coefficients of Column (1). It is readily apparent that the results of this second test confirm and reinforce in every respect our earlier conclusion.

In Part B of the Table we have applied the same technique to test for evidence of bias in the model as a whole, by taking as dependent variable total GNP rather than one specific component of it. The similarity of the pattern of coefficients of Column (7), where the dependent variable is the actual change in GNP$, with that of Column (8), where it is the change in simulated GNP$, is again apparent. We also note again a tendency for the coefficients of Column (8) to *exceed* those of Column (7), especially for the current quarter and at the tail end. Accordingly, the coefficients of Column (9) are prevailingly negative and not altogether insignificant, though the overall correlation remains quite low, and the F statistic is again insignificant.

On the basis of these tests, whose power is of course hard to assess, we must conclude that there is absolutely no evidence that the specifications of the FMP model tend to underestimate systematically the impact of money on consumption, or more generally on money GNP. Indeed, they suggest that, if there is a misspecification, it is in the direction of *overestimating* the impact of money, although even this indication is by no means conclusive.

3. The Power of Reduced Forms As a Method of Estimating Structural Properties

The conclusions of the last paragraph, while reassuring in a sense, present us with somewhat of a puzzle, for they seem hard to reconcile with the findings reported in Section III.3. In that section we pointed out that the response of GNP$ to a change in money supply implied by the FMP model was in fact rather smaller and slower than one could infer from the coefficients estimated by the reduced form approach. This concluding section is designated to shed some light on this puzzle. We propose to show that the likely answer to the puzzle must be found in the fact that the coefficients of reduced form as estimated by the St. Louis group, or in the Meiselman paper for this conference, tend to be seriously biased in the direction of overestimating the response of GNP$ (and its major components) to changes in money supply.

The evidence to be presented is basically in the spirit of a Monte Carlo experiment. Clearly we can think of the FMP model as a description of a possible economic system, regardless of whether it provides, in fact, an adequate operational description of the American economy in recent years. We can, therefore, regard the time series of GNP$ and its components generated by the dynamic simulation described in the previous section as representing the response of this economic system to the path of the exogenous variables used in the simulation. Furthermore, from the demand equation for demand deposits and the simulated value of other relevant variables, we can compute the time series of the money supply needed to produce the given path of the short-term rate. We can then ask the question: suppose an observer who did not know the structure of the FMP model tried to infer the response of GNP$ to changes in the money supply by the reduced form approach; how far and in what direction would his estimate differ from the true response implied by the structure of the model?

We begin by observing that if the model were linear there would be a true reduced form equation relating GNP (or any component thereof) to all the exogenous variables assumed in the simulation, including the money supply in place of the bill rate, since the bill rate could itself be expressed in terms of the money supply and all other exogenous variables. The coefficients of the money supply (current and lagged as far as necessary) in the last mentioned reduced form would measure the response of the system to an exogenous change in the money supply and would coincide with the response estimated by a policy simulation of the type underlying the results presented in Section III. But clearly the results could be quite different if the coefficients were estimated from a misspecified reduced form, e.g., using as independent variable only the money supply, with an arbitrarily chosen lag, and neglecting all other exogenous variables. Further difficulty would arise with a non-linear system, for then the true response to changes in M would vary with initial conditions.

One obvious and simple way to assess the size and direction of bias is to actually carry out the experiment. To this end we have estimated a reduced form by regressing the change in simulated GNP, $\Delta GNP\$^{c}$ on the simulated change in the stock of demand deposits $\Delta MD\$^{c}$. We use demand deposits rather than the total stock of money to make the results comparable with those of the policy simulations reported in Section III.2. The coefficients obtained using again a third degree Almon Polynomial are reported in Column (1), Table E.2. For comparison we report in Column (2) the coefficients estimated from a regression of actual changes in GNP$ on actual

TABLE E. 2

SIMULATION TEST OF REDUCED FORM ESTIMATES OF TRUE STRUCTURE

A - Reduced Form Coefficients

Quarter	$\Delta GNP\$^{c}$ on $\Delta MD\$^{c}$ (1)	$\Delta GNP\$$ on $\Delta MD\$$ (2)
t	1.85	0.79
	(3.5)	(1.6)
t-1	1.45	1.51
	(7.0)	(6.1)
t-2	1.20	1.68
	(4.5)	(6.2)
t-3	1.05	1.45
	(4.1)	(5.9)
t-4	0.95	0.99
	(5.3)	(5.1)
t-5	0.86	0.45
	(4.6)	(2.0)
t-6	0.70	-0.02
	(2.8)	(0.0)
t-7	0.43	-0.21
	(2.0)	(0.9)
Sum	8.49	6.67
Constant	3.47	4.07
	(3.8)	(3.4)
R^2	.73	.55
D.W.	1.05	1.71
S.E.	3.46	4.27

B - Response of GNP$ to a 2 Billion Change in Demand Deposits, Spread Over Two Quarters

Quarters Elapsed from First Change	True Causal Effect from Policy Simulation (1)	Based on Reduced Form Coefficients, Estimated on: Simulated Values (2)	Actual Values (3)
0	0.9	1.9	.8
1	2.4	5.2	3.1
2	4.3	7.8	6.3
3	6.1	10.1	9.4
4	7.7	12.1	11.9
5	8.8	13.9	13.3
6	9.4	15.4	13.8
7	10.0	16.5	13.5
8	10.2	17.0	13.3
9	10.1		
10	10.1		

changes in demand deposits. Once again the patterns of coefficients in Columns (1) and (2) are fairly close, but with the sum of weights again somewhat higher for the simulated values, largely because of the appreciably higher coefficient of current ΔM. It is also worth noting that, as expected, the sum of weights in Column (2) exceeds by some 25 percent the corresponding sum in Column (7) of Table E.1, in which the regressor was the total stock of money. Otherwise the pattern of coefficients is fairly similar and R^2 is only slightly lower. Note also that R^2 is larger in Column (1) than in Column (2); this is as one should expect since the computed values are not affected by the errors terms which attentuate the correlation of actual values. Indeed, reduced form estimated on computed values should tend to yield a perfect fit were it not for misspecifications in the reduced form used in the estimation.

We can now use the coefficients of Column (1) to derive an estimate of the response of GNP$ to a $2 billion change in demand deposits spread evenly over two successive quarters – the change which was used in our policy simulations. The result is shown in Part B of the Table, Column (2). For comparison, Column (3) shows the response implied by the reduced form coefficients estimated from the regression of *actual* values given in Part A, Column (2). The entries of the two columns can be compared with those of Column (1) which shows the true response of GNP$ to the stated exogenous change in demand deposits as obtained from the policy simulation. As we have seen, because of nonlinearities, this true response is somewhat dependent on initial conditions and the direction of the change in money supply; the figures we report are those corresponding to a *decrease* in M beginning in 1967.1, i.e., those corresponding to the policy simulation that produced the largest and fastest response among those tested. Even so, the response is strikingly smaller and slower than the response implied by the reduced form coefficients, shown in Column (2): in the first three quarters the latter response is larger than the true response by a factor of two, and eventually the overestimate settles down to about 70 percent.

The experiment of Table E.2 has also been repeated for individual components of GNP and while the results cannot be reported here in detail, it is worth noting that one finds a broad similarity between the *patterns* of response implied by reduced forms computed on actual and on simulated values, and the patterns obtained from policy simulation. In particular one finds, as in the Meiselman-Simpson paper, that for such components of GNP as consumers' expenditure, non-durable consumption, and state and local government expenditure the response continues to build up to the very end, while the peak response occurs quite early for housing expenditure and somewhat later for inventories and then plant and equipment. However, one finds large and varying differences in the *size* of the response.

In any event, insofar as GNP$ is concerned, the conclusion of our Monte Carlo experiment is unequivocal: the reduced form coefficients estimated on the time series generated by the model yield a severely upward biased estimate of the magnitude and speed of response of GNP$ to an exogenous change in the money supply.

It is unfortunately not possible to enter here into a detailed analysis of the causes of this bias. We can merely state that in our view the major source of bias lies in the fact that the computed money supply series is strongly positively associated with the movement of other variables which were taken as exogenously given in the simulation (including fiscal as well as other exogenous variables), and which, in terms of the model's specifications, account for a substantial portion of the simulated change in GNP$. The omission of these other variables in the reduced form gives rise to an error term which is positively correlated with the change in M, and hence produces an upward bias in the estimated coefficiencies of ΔM. To put the matter somewhat loosely, the reduced form attributes to ΔM part of the effect of changes in other omitted exogenous variables. Note also that the positive association with the omitted exogenous variables may be expected to hold not only for the computed, but also for the actual money supply, which is highly correlated with the computed one. And indeed if one regresses the simulated change in GNP on the actual rather than the computed change in demand deposits, one obtains coefficients which are quite close to those shown in Column (1) of Part A or Column (2) of Part B; in fact, the upward bias turns out to be even a little larger – the sum of weights being, for example, 9.3 instead of 8.5 as reported in Column (1).

Clearly this "Monte Carlo" experiment does not entitle us to conclude that the coefficients of the reduced form computed on actual values are a biased estimate of the true response of GNP$ to an exogenous change in the stock of money for the U.S. economy. Yet the fact that the figures of Columns (2) and (3) are fairly similar while both sets are quite different from the figures of Column (1) is quite suggestive; it provides at least a strong prima facie case for the hypothesis that the difference between the response as estimated from the FMP model and reported in Section III.3 and the response estimated from the standard reduced forms, reflects in good measure an upward bias of the latter. Note also that the size of this bias would depend on the specific circumstances of the period used in estimating the reduced form (i.e., on the degree of association between changes in the money supply and changes in the omitted exogenous variables over that period). This consideration might help to account for the instability of reduced form coefficients as evidenced, for example, by the result reported by Meiselman and Simpson for different periods (c.f. their Tables 3 and 9). Finally, the above mentioned biases could be further increased if and when the variable directly controlled by the monetary authority was, for example, unborrowed or free reserves or interest rates, a "crime" of which the Federal Reserve has been frequently accused by the monetarists.

There remains one significant puzzle to clear up. The argument developed in the previous paragraphs would imply that the major source of bias in the reduced form coefficients can be traced to failure to include in the regression other major exogenous variables beside a money measure. Yet in reduced form estimated by the St. Louis group, including such fiscal variables as government expenditure, deficit, or tax receipts, it is consistently found that the effect of these other variables is insignificant and/or extremely short-lived, while the coefficients of the monetary variable are hardly changed. These findings are confirmed by Table E.3 which reports the coefficients of a reduced form estimated by regressing the change in GNP$ on the change in money and in government expenditure on goods and services (ΔG$), over eight quarters, using again third degree polynomial. Column (1) reports the coefficients of ΔM and Column (2) those of ΔG$. It is apparent that the coefficients of ΔM are highly significant and almost identical with those reported in Table E.1 Column (7), estimated omitting the expenditure variable. On the other hand, the coefficients of the expenditure variable are small and insignificant, except possibly for the first, and turn quickly negative beginning with the third quarter. The implied expenditure multiplier, obtained by cumulating the coefficients of Column (2) and shown in Column (3), bears no resemblance to the multiplier implied by the FMP model and reported in Figure III.1.

In our view, however, these results as well as similar ones reported by other investigators are of very little relevance because of the serious misspecifications of the fiscal variable used, to which attention has been called by deLeeuw and Kalchbrenner, and especially by

Gramlich. In particular, Gramlich has pointed out the serious shortcomings of government expenditure, especially in a period in which changes in that variable are dominated by changes in defense procurements. As explicitly recognized in the FMP model, the stimulating effects of such procurement begin when the orders are placed and lasts while they are being processed, through their effect on inventory investment, while very little effect occurs in the quarter in which the goods are delivered and the expenditure is recorded, for the expenditure is then largely offset by a decline, or negative investment, in inventories.

The contention that, because of misspecifications, the coefficients of Columns (1) and (2) provide a totally distorted measure of the money supply and expenditure multiplier can again be at least indirectly supported by a "Monte Carlo" experiment. In Columns (4) and (5) of Table E.3 we report the coefficients of a reduced form estimated by regressing the simulated change in GNP$ on the simulated change in money supply and the simulated change in government expenditure – the latter variable being obtained as the product of the exogenously given real expenditure, used in the simulation, and the endogenously computed price index. In the absence of bias the coefficients of Column (4) should come close to those implied by the policy simulation of Figure III.2. Similarly, the expenditure multiplier of Column (6), obtained by cumulating the coefficients of Column (5), should come close to that reported in Figure III.1. What we find instead is that the coefficients of Column (4) are again hardly different from those obtained without the expenditure variable and reported in Column (7), and also very similar to those of Column (1), which we know appreciably overstates the magnitude and speed of response of GNP$ to change in M. Similarly, the expenditure coefficients of Column (5) and the implied multiplier of Column (6) closely resemble those of Columns (2) and (3), but bear no recognizable relation to the multiplier of Figure III.1.[2]

[2]It should be noted that Figure III.1 gives the response of GNP to a change in exports and therefore also to a change in government purchases of goods which do not go through the order process applying to defense procurement. The response to a change in real purchase of services is somewhat faster but not otherwise significantly different, as can be seen from the figures reported below, obtained from a simulation in which real expenditure on services was increased by $5 billion beginning in 1967.1. For reference the second row reproduces the multiplier underlying the black histograms in the upper right quadrant of Figure III.1.

MULTIPLIER RESPONSE OF GNP$
TO A CHANGE IN REAL GOVERNMENT EXPENDITURE

	Quarters Elapsed							
	1	2	3	4	5	6	8	12
On Services	1.47	1.92	2.20	2.43	2.67	2.80	2.57	1.57
On Goods (Based on Exports)	1.11	1.55	1.88	2.34	2.60	2.73	2.62	1.35

While this last experiment calls attention once more to the severe danger of bias in reduced form, it does not per se imply that reduced form could not possibly yield reasonable approximations to true response. What they rather imply is that one cannot expect to obtain reasonable estimates without painstaking attention to the specification of the variables to be used. It is at least suggestive in this context, that Gramlich (op. cit.), who gave careful consideration to the specification of both the monetary and fiscal variables, did obtain a set of estimates that appear *a priori* reasonable and are also roughly reconcilable with the results of the FMP policy simulations. This is especially true of the results reported in his Table 4, where the monetary variable is unborrowed reserves (which incidentally also yielded the lowest residual error variance.) In particular the sum of weights for unborrowed reserve, 25.7, which measures the cumulated effect of 1 billion change, after eight quarters, compares quite favorably with simulation results reported in Figure III.3 (12.6 per .5 billion implying 25.2 billions per billion for an increase, and -14, or -28 per billion, for a decrease). In the case of expenditure the agreement is not quite as good, though still reasonable (2.15 for Gramlich as compared with 2.62 for a simulation beginning in 1967.1 and 2.54 for one beginning in 1962.1).[3]

We thus feel entitled to close this epilogue on a somewhat cheerful note:

1. There is no evidence that the FMP model, according to which money affects economic activity only through the link of interest

[3]Although in the paper cited Gramlich reported only the sum of coefficients, the pattern of the individual coefficients, which he has kindly made available to us, also matches reasonably well the results of our simulation. For purpose of comparison with our Figure III.3 we give below the cumulated effect of a 0.5 change in unborrowed reserves implied by his coefficient for each of the eight quarters following the injection: -.8; -.1; 1.6; 4.0; 6.8; 9.4; 11.6; 12.8. Similarly the multiplier implied by his government expenditure coefficients are: 0.6; 1.1; 1.4; 1.7; 1.9; 2.0; 2.1; 2.2.

TABLE E. 3

SIMULATION TEST OF REDUCED FORM INCLUDING GOVERNMENT EXPENDITURE (G$) – DEPENDENT VARIABLE: CHANGE IN GNP$

	Estimated on Actual Values			Estimated on Simulated Values			
Lag	Coefficient of ΔM (1)	$\Delta G\$$ (2)	Expenditure Multiplier (Col. 2 Cumulated) (3)	Coefficient of ΔM^c (4)	$\Delta G\$^c$ (5)	Expenditure Using Multiplier (6)	ΔM^c Only (7)
0	0.70	0.86	0.86	1.29	0.66	0.66	1.31
	(1.6)	(2.2)		(2.9)	(2.1)		(2.8)
-1	1.42	0.14	0.99	1.40	-0.25	0.41	1.18
	(6.2)	(0.8)		(7.4)	(1.7)		(6.5)
-2	1.54	-0.24	0.75	1.30	-0.60	-0.19	1.03
	(6.9)	(1.1)		(5.6)	(3.4)		(4.3)
-3	1.25	-0.37	0.38	1.05	-0.57	-0.76	0.85
	(5.8)	(1.7)		(4.8)	(3.4)		(3.7)
-4	0.74	-0.33	0.05	0.73	-0.30	-1.06	0.67
	(4.5)	(1.9)		(4.4)	(2.3)		(4.2)
-5	0.17	-0.19	-0.13	0.39	0.05	-1.01	0.68
	(0.9)	(1.0)		(2.3)	(0.3)		(3.0)
-6	-0.26	-0.03	-0.16	0.12	0.32	-0.69	0.30
	(1.1)	(0.1)		(0.5)	(1.8)		(1.4)
-7	-0.37	0.06	-0.11	-0.04	0.35	-0.33	0.14
	(1.9)	(0.3)		(0.2)	(2.3)		(0.7)
Sum of Coefficients	5.2	-0.11		6.2	-0.33		5.9
Constant	3.95			3.62			3.73
	(3.7)			(4.9)			(4.6)
R^2	.61			.80			.75
DW	2.06			1.16			1.17

rates, significantly misspecifies the quantitative impact of money or its time path, though it may tend to *overstate* somewhat the long-run effect.

2. It may eventually be possible to reconcile the implications of a carefully specified structural model with those of carefully specified reduced forms, though much empirical, as well as theoretical, work remains to be done toward that highly desirable goal.

APPENDIX A

EQUATIONS OF THE CONSUMPTION SECTOR OF THE FMP MODEL

Key to symbols not explained elsewhere.

YD:	Real disposable personal income (billions of '58 dollars)
N:	Population (millions)
VCN$:	Consumers' net worth in current dollars ($, trillions)
PCON:	Consumption deflator (1958 = 100)
PCD:	Price index of consumers' durables (1958 = 100)
RCB:	Corporate bond yield
JIC:	Strike dummy
u:	Autocorrelated error term
e:	Residual error

The number in square brackets underneath each coefficient is the t-ratio. The number in parentheses above the coefficients is the identification number of that coefficient in the FMP model.

I.1 CONSUMPTION (CON, 4)

$$\frac{CON}{N} = \sum_{i=0}^{11} b_i \left(\frac{YD}{N}\right)_{t-i} + \sum_{i=0}^{3} c_i \left(\frac{VCN\$_{-i}}{.01 * PCON_{-i-1} * N_{-i-1}}\right) + \overset{(480)}{.6098} u_{-1} + e$$

b_0 = (1) .1087 [4.72]	b_9 = (10) .0239 [3.35]	c_0 = (476) 27.0447 [4.16]
b_1 = (2) .0983 [6.10]	b_{10} = (11) .0157 [2.76]	c_1 = (477) 15.8710 [7.94]
b_2 = (3) .0882 [8.68]	b_{11} = (12) .0077 [2.33]	c_2 = (478) 7.6389 [2.03]
b_3 = (4) .0783 [14.41]	$\sum_i b_i$ = .672	c_3 = (479) 2.3486 [.68]
b_4 = (5) .0686 [23.04]	$\sum_i c_i$ = 52.9032	
b_5 = (6) .0592 [14.19]		$\bar{R}_e^2$ = .9982
		S_e = .0074
b_6 = (7) .0500 [8.28]		$\bar{R}^2$ = .9973
b_7 = (8) .0411 [5.65]		S_u = .0090
		d-w = 1.86
b_8 = (9) .0324 [4.23]		

SAMPLE PERIOD: 1954.I - 1967.IV

CONSTRAINTS:

b_i: 2nd degree polynomial; constrained zero at t-12

c_i: 2nd degree polynomial; constrained zero at t-4

NOTES: Estimated on July, 1970 National Income Accounts revisions.

I.2 EXPENDITURES ON CONSUMER DURABLES (ECD,6)

$$\frac{ECD}{CON} = \underset{[1.51]}{\overset{(493)}{.2402}} + \underset{[3.50]}{\overset{(491)}{.3265}} \left[\frac{YD}{CON}\right] - \underset{[-3.66]}{\overset{(17)}{.2291}} \left[\frac{N}{CON}\right] - \underset{[-2.52]}{\overset{(494)}{.0034}} \; JIC$$

$$+ \sum_{i=o}^{5} b_i \left[\frac{PCD}{PCON}\right] * \left[.22 + .01 * RCB - Q * \sum_{j=o}^{12} c^j \left\{ \frac{PCD_{-i-j+1} - PCD_{-i-j}}{PCD_{-i-j}} \right\} \right]$$

$$\underset{[-2.75]}{\overset{(492)}{-.2983}} \left[\frac{KCD_{-1}}{CON}\right] + \overset{(18)}{.6014} u_{-1} + e$$

$b_o = \underset{[-.87]}{\overset{(495)}{-.2164}}$

$b_1 = \underset{[-2.51]}{\overset{(496)}{-.1743}}$

$b_2 = \underset{[-1.10]}{\overset{(497)}{-.1316}}$

$b_3 = \underset{[-.55]}{\overset{(498)}{-.0883}}$

$b_4 = \underset{[-.36]}{\overset{(499)}{-.0445}}$

$b_5 = \overset{(500)}{.00}$

$\sum_{i=o}^{5} b_i = -.6551$

$c = .87$

$\bar{R}_e^2 = .9271$

$S_e = .0041$

d-w = 1.75

$\bar{R}_u^2 = .8877$

$S_u = .0051$

SAMPLE PERIOD: 1954.I - 1968.IV

$$Q = \begin{cases} 0.0 & 1954.I - 1966.IV \\ 4.0 / \sum_{j=o}^{11} (.87)^j & 1967.I - 1968.IV \end{cases}$$

CONSTRAINTS: b_i: **2nd degree polynomial constrained to zero at t-5.**

I.3 DEPRECIATION ON CONSUMER DURABLES (WCD, 7)

$$WCD = .05625*ECD + .225*KCD_{-1}$$

I.4 STOCK OF CONSUMER DURABLES (KCD, 8)

$$KCD = .25*(ECD-WCD) + KCD_{-1}$$

I.5 IMPUTED INCOME FROM CONSUMER DURABLES (YCD, 9)

$$YCD = .0379 \left\{ \left[\frac{ECD}{8.0}\right] + KCD_{-1} \right\}$$

I.6 PERSONAL CONSUMPTION EXPENDITURES (EPCE, 45)

$$EPCE = CON - WCD - YCD + ECD$$

FIGURE A. 1

DYNAMIC SIMULATION OF REAL CONSUMPTION (1958 DOLLARS)
1958.1 - 1969.4

Actual Value ($billions)	Computed Value ($billions)	Residual ($billions)	Period	
289.172	291.086	1.915	1958	1
292.255	292.075	0.180	1958	2
296.070	294.355	1.714	1958	3
298.450	297.479	0.971	1958	4
302.531	301.076	1.455	1959	1
305.636	305.190	0.446	1959	2
308.269	308.407	-0.138	1959	3
310.660	310.975	-0.315	1959	4
312.755	313.027	-0.272	1960	1
316.944	314.766	2.178	1960	2
316.670	316.721	-0.052	1960	3
318.478	317.979	0.499	1960	4
320.251	319.749	0.502	1961	1
323.199	322.727	0.472	1961	2
325.719	326.083	-0.364	1961	3
329.936	329.911	0.024	1961	4
332.447	333.044	-0.597	1962	1
335.338	335.658	-0.321	1962	2
338.699	337.508	1.191	1962	3
342.702	339.614	3.088	1962	4

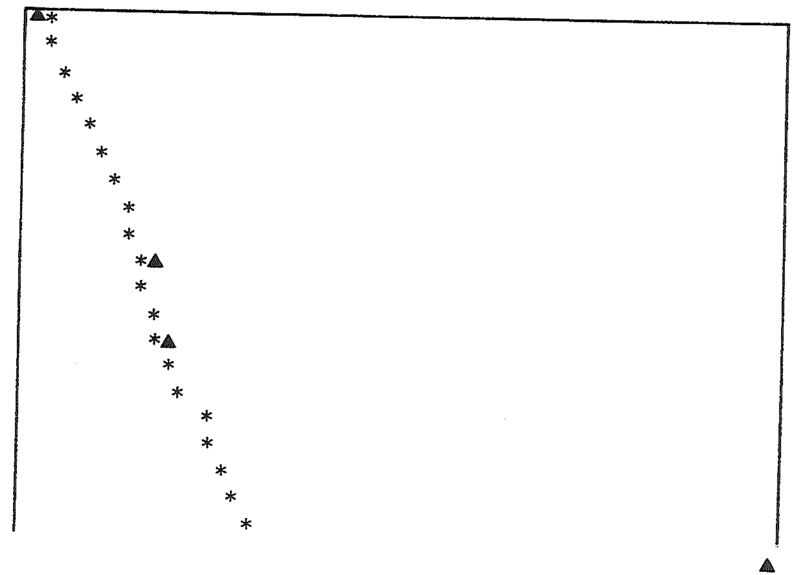
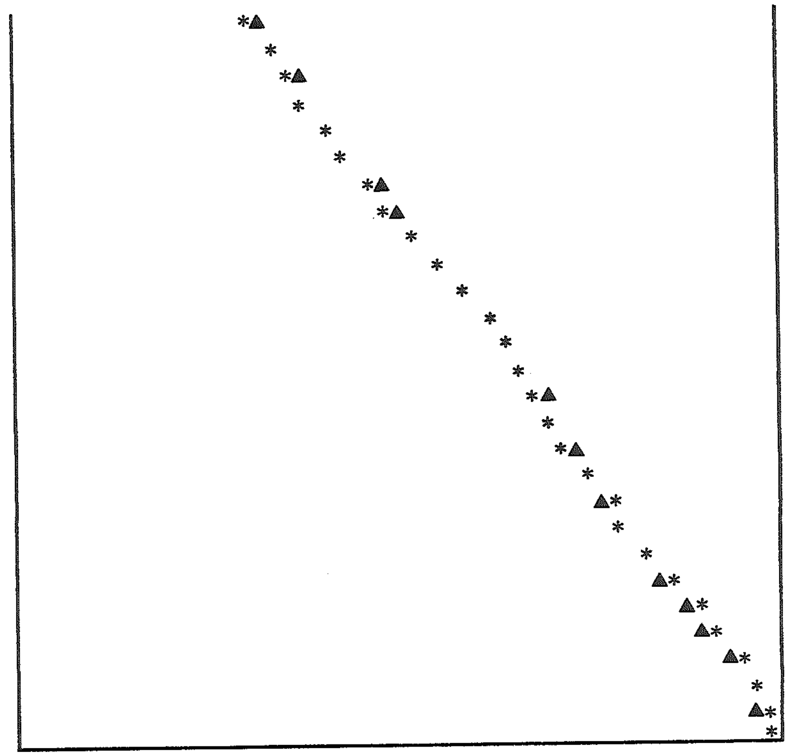


FIGURE A.1 (cont'd)

345.863	342.790	3.073	1963	1
348.140	346.893	1.247	1963	2
352.669	351.324	1.345	1963	3
354.118	355.545	-1.427	1963	4
361.269	360.066	1.203	1964	1
364.886	364.803	0.083	1964	2
372.626	370.129	2.497	1964	3
375.814	375.213	0.601	1964	4
379.141	380.135	-0.994	1965	1
386.485	385.590	0.895	1965	2
391.736	391.693	0.042	1965	3
399.201	398.110	1.091	1965	4
403.783	403.805	-0.022	1966	1
407.811	407.771	0.040	1966	2
412.527	410.865	1.662	1966	3
413.086	413.519	-0.433	1966	4
419.746	417.539	2.207	1967	1
423.080	423.106	-0.026	1967	2
426.125	429.213	-3.088	1967	3
429.150	429.150	0.000	1967	4
436.971	435.669	1.302	1968	1
439.570	441.519	-1.949	1968	2
446.631	447.655	-1.024	1968	3
449.083	453.177	-4.094	1968	4
453.960	457.598	-3.638	1969	1
458.316	460.823	-2.507	1969	2
462.702	463.445	-0.743	1969	3
466.063	465.025	1.038	1969	4



APPENDIX B.1

XVII DIVIDEND-PRICE RATIO AND VALUE OF CORPORATE SHARES

Key to symbols: YPCT\$: Net corporate profits after taxes, current dollars.
YDV\$: Net corporate dividends, current dollars.

XVII.1 DIVIDEND PRICE RATIO (RDP, 126)

$$RDP = \underset{[-3.45]}{\overset{(796)}{-.5964}} \left[\frac{YPCT\$}{YDV\$}\right] + \underset{[6.98]}{\overset{(795)}{.1205}} \max[53.0 - TIME, 0] + \underset{[1.63]}{\overset{(794)}{1.3602}}$$

$$\underset{[-4.42]}{\overset{(801)}{-.5299}} \; Q*W*400.0*.13\sum_{i=o}^{11}(.87)^i\left[\frac{PCON_{-i}-PCON_{-i-1}}{PCON_{-i-1}}\right] + \sum_{i=o}^{4} b_i RCB_{-i}$$

$$\overset{(800)}{+.6895}U_{-1} + e$$

$$b_o = \underset{[3.94]}{\overset{(802)}{.2350}}$$

$$b_1 = \underset{[3.94]}{\overset{(803)}{.1881}}$$

$$b_2 = \underset{[3.94]}{\overset{(804)}{.1410}}$$

$$b_3 = \underset{[3.94]}{\overset{(805)}{.0945}}$$

$$b_4 = \underset{[3.94]}{\overset{(806)}{.0471}}$$

$$\Sigma b_i = .7957$$

$R_e^2 = .946$

$S_e = .156$

$DW = 1.68$

$R_u^2 = .890$

$S_u = .223$

SAMPLE PERIOD: 1954.IV - 1969.II

$$Q = \begin{cases} 1.0 \text{ if } TIME > 80 \\ 0 \text{ if } TIME \leq 80 \end{cases}$$

$$W_t = \sum_{i=o}^{11} v_{t-i}, \qquad v_{t-i} = \begin{cases} (1/12) \text{ if } 400\left[\frac{PCON_{-i}-PCON_{-i-1}}{PCON_{-i-1}}\right] > 1.5 \\ 0 \text{ otherwise} \end{cases}$$

APPENDIX B.2

XVI.1 TERM STRUCTURE EQUATION FOR CORPORATE BOND RATE (RCB, 91)

$$RCB = \underset{[8.45]}{\overset{(890)}{.9004}} + \sum_{i=o}^{18} b_i RCP_{t-i} + \sum_{i=o}^{18} c_i \left(\frac{PCON_{-i} - PCON_{-i-1}}{PCON_{-i-1}} \right)$$

$$\underset{[3.80]}{\overset{(893)}{+.2736}} \sqrt{\frac{8 * \sum_{i=1}^{8} (RCP)^2_{-i} - (\sum_{i=1}^{8} RCP_{-i})^2}{64.0}} + e$$

b_0 = (891) .2116 [8.82]	b_{10} = (906) .0637 [13.99]	c_o = (892) -1.3036 [-.21]	c_{10} = (924) -1.1480 [-.93]]
b_1 = (897) -.0086 [-.69]	b_{11} = (907) .0610 [13.10]	c_1 = (915) 12.4900 [2.79]	c_{11} = (925) -1.5020 [-1.35]
b_2 = (898) .0101 [1.18]	b_{12} = (908) .0568 [11.64]	c_2 = (916) 9.8210 [3.14]	c_{12} = (926) -1.6910 [-1.64]
b_3 = (899) .0257 [4.30]	b_{13} = (909) .0513 [9.98]	c_3 = (917) 7.4840 [3.45]	c_{13} = (927) -1.7360 [-1.74]
b_4 = (900) .0384 [8.10]	b_{14} = (910) .0446 [8.40]	c_4 = (918) 5.4600 [3.37]	c_{14} = (928) -1.6540 [-1.64]
b_5 = (901) .0484 [10.84]	b_{15} = (911) .0370 [7.04]	c_5 = (919) 3.7310 [2.61]	c_{15} = (929) -1.4640 [-1.45]
b_6 = (902) .0559 [12.27]	b_{16} = (912) .0285 [5.91]	c_6 = (920) 2.2780 [1.60]	c_{16} = (930) -1.1850 [-1.24]
b_7 = (903) .0610 [13.14]	b_{17} = (913) .0194 [5.00]	c_7 = (921) 1.0820 [.75]	c_{17} = (931) -.8353 [-1.05]
b_8 = (904) .0638 [13.80]	b^{18} = (914) .0098 [4.25]	c_8 = (922) .1250 [.09]	c_{18} = (932) -.4342 [-.89]
b_9 = (905) .0650 [14.17]	Σb_i = .94	c_9 = (923) -.6122 [-.46]	$\sum_{i=o}^{18} c_i$ = 28.91

$\bar{R}^2$ = .9850
S_e = .0782
DW = 1.20

SAMPLE PERIOD:
1954.IV - 1966.IV

CONSTRAINTS: RCP_{-1}: **3rd degree polynomial constrained to zero at t-19**

$\left(\frac{PCON_{-1} - PCON_{-2}}{PCON_{-2}}\right)$: **3rd degree polynomial constrained to zero at t-19.**

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DISCUSSION

JAMES S. DUESENBERRY

On behalf of the directors I am glad to welcome you aboard, and I am sorry our weather forecasters are not quite as good as our economic forecasters. You can see I was posed with a few problems here, and I made a couple of correct predictions to solve them. First, I looked at the program and noticed we had an hour and 15 minutes for the discussion. Franco was supposed to take only 15, and that seemed to give me a long time to comment on his paper. But I knew Franco would solve my problem. The second prediction was made when Franco was a little bit late this morning. I said to Jack Noyes, "Well, Franco is writing another paper." I didn't know he could turn out that kind of thing before breakfast. But it is still a little bit difficult to comment on such a wealth of thoughts and information.

I must say our conference is off to an impressive start with Franco's paper. I think we are going to have a tremendous demand for the publication of these proceedings because this is a very important paper. It is a little hard to know how to deal with it though, because there is so much in it.

Let me start way back. I think if you go through the literature of the past 30 years, you will find quite a number of places where the notion is put forward that there is a linkage from monetary policy to consumption through wealth effects. But in contrast with the work on investment, there has been relatively little work on that linkage. Mostly, people put it down as one of the items on their list of possible ways in which monetary policy might affect output, income

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and employment. There are a certain number of theoretical papers in which wealth effects appear, but a much smaller volume of empirical work. Now what Franco has done at one gulp is to bridge that gap by giving us in this paper a complete set of linkages. I think that term is appropriate because if you examine what Franco has done, you see that he has worked through a very long chain of effects. He begins with changes in open-market operations, or unborrowed reserves, and goes from that to short-term interest rates, to bond rates, and to stock prices. Then he proceeds to consumption in the sense of rate of consumption of services, then takes into account the capital acquisitions effects for durable goods and picks up all of the secondary effects after he has the consumer expenditure effects. He shows a long chain with many, many links in it, each one of which is spelled out in the model, but emphasizes only a couple of those links and passes over the others rather quickly.

It is a little difficult to know how to deal with that. One cannot deal with each one of those links without making a comment which would be at least as long as the paper itself and indeed, I am afraid that I have to say that each one of the links is subject to some controversy. All I can do is to raise a couple of questions, and I am afraid that I am somewhat in the position of John Williams, my predecessor at Harvard. I used to say when I was younger that John Williams made a great reputation by responding to every proposition by saying, "Well, it is more complicated than that." You get a great reputation for wisdom that way. I have a feeling now that maybe it was more than just a ploy.

Stock-price Explanations

But let me try to make just a few observations on the substantive points here, and let me take it in reverse order starting with the stock-price explanations which play a crucial role in the model. As I noted a moment ago, that explanation begins with open-market operations and takes us to short-term rates and then to long-term bond rates and then finally to stock prices. The stock-price equation follows the basic logic that the value of stocks equals the discounted expected future dividends. That is the basic logic of stock pricing although it is a little bit hard to see that sometimes. In my course this year I went through that chain of reasoning, the sort of investment value approach to stock valuation, and my students said, "You mean that people buy stocks because they pay dividends?" I had to try to explain to them that each particular fellow may be mostly interested in the capital gain, but in the long run you have to conclude that if the stock doesn't have any hope of paying dividends, it isn't going to be worth anything. I had to tell them the story about the Chinese sardines. In a Chinese inflation, various commodities were used in lieu of money and one of them was a case of sardines that passed from hand to hand many times. Finally somebody opened it and discovered the sardines were bad. He went back to the guy he got them from and complained. The fellow said, "You're crazy! Why did you open them? Those sardines are for buying and selling, not for eating."

The stocks really are ultimately for eating and that is the basic logic of this model, and interest rates come in as the valuation factor, or at least as part of the valuation factor. And a rise in nominal or real interest rates ought to have an adverse effect on stock prices and vice versa. I think it is very important to get that effect in, but we do have to recognize that it entails a few problems. One of them is that the stock-price equations pay no attention to portfolio balance considerations. The implication is that the total value of equities in relation to other types of assets has no influence on the relative prices of stocks and bonds or anything else. While I think that would be a difficult effect to strain out, it is one aspect of the model that I think would bear further consideration.

Our second problem is that one would expect a very high variance about the equation because growth expectations and risk factors are subject to a good deal of change over time, so that for a given real interest rate and a given history of earnings, one still might expect to find a good deal of variation in stock prices. Indeed I think Franco has a little bit of a problem; if the stock-price equation in that model is very good, he is wasting his time being a professor at MIT.

Expectations Regarding Interest Rates

But there is a more fundamental problem from the standpoint of monetary policy. I would expect there would be some interaction among the risk factors, the growth expectations, and the monetary policy factors which are moving the interest rates. I would think that peoples' interpretations of the future of earnings and the nature of the risks to which they are exposed would depend on their interpretations of the reasons for a monetary policy which produces a particular level of interest rates at some point in time. And if they think that interest rates have gone up because there is a roaring boom ahead and the Fed may restrain it somewhat, that may, on one interpretation, lead you to think they would be very bullish about stocks. On the other hand it may be they conclude that ultimately this is going to produce a recession, and it makes them bearish. In any case it seems to me there is lots of interplay between monetary policy and the underlying growth and risk factors which enter into the valuation of stocks.

If you put those things together, I think one of the conclusions you have to reach is that if monetary policy works through this channel, then effects of monetary policy must be subject to an even greater degree of uncertainty and variation through time than we had expected from other types of approaches. Because we are after all pulling out one factor among a great many which affect the value of stocks, and if there is some interaction between our monetary policy and those other factors, then it is going to be very hard to predict its full effect.

Let me then pass on to the other leg of this operation--the effect of changes in wealth on saving and consumption decisions. Again the model is based firmly on some fundamental principles of economic theory. It starts from the proposition that saving and consumption choices are purposeful; people who save are doing so because they have some reason for wanting to accumulate assets--they want future consumption, or the income from wealth. Or they may wish to leave estates, or acquire a business or a house or something of that sort. They have some objective in failing to consume all their income at a particular point in time. The general proposition is that if they have some objective for sacrificing current consumption, and if through capital gains or some other route they acquire more wealth, then this weakens their desire for further accumulation somewhat and has a positive effect on their consumption and ultimately on their consumption expenditures. That is certainly a reasonable proposition. I think we have to exercise a little bit of care in the degree of our reliance of that basic logic because, as Professor Williams used to say, "Things are more complicated than that."

We must take into account the fact that wealth, and especially wealth in the form of equities which is emphasized in this paper, is held in extremely concentrated form. Only a very small fraction of the population holds any significant amount of equities. When we suppose that changing wealth in the form of equities changes aggregate consumption, we are placing a great deal of weight on the reactions of a relatively small part of the population, and a part of the population that is somewhat different from the rest. Oscar Wilde was asked whether he thought the rich were really different from other people and he said, "Yes, they've got more money." I am not sure that the logic of the life cycle kind of hypothesis applies particularly well to the very group which holds the most equity.

I suppose I can give you another classroom example. The man who is now the Aga Khan was a student at Harvard a number of years ago, and he took a course in economic theory in which he was exposed to the theory of indifference curves and the logic of consumer choice. When the lecture was all over, he went to the instructor and said, "That's very interesting. How does it work if there isn't any budget constraint?"

Motivations for Estate Building

I think that some of the holders of equity are in that position. To put it a little bit more concretely, the life cycle hypothesis leaves out of account the whole question of motivation of building estates. I think to some extent one can regard estate building as the continuation of the retirement problem. You can't take it with you, but you can leave it behind you. You can argue that the same kind of logic that makes you save during your working life in order to provide for retirement also makes you save to leave an estate. But I think that the estate motivation may be less tightly constrained and the notion that capital gains are going to result in more consumption--because people have already achieved a well-defined estate-building goal--is not quite so plausible as the logic that a man of moderate income who is trying to stretch out his consumption over his retirement will have to save during his working life. I think there is a good deal of room for play there, and I do not think we can expect very tight theoretical conclusions as to the effect of wealth on savings from that basic life cycle logic.

It is jumping the gun a little bit, but I think one can make some interesting comparisons with the Tobin paper, which are really favorable to the results which Franco has produced. If I read the Tobin-Dolde paper correctly, through capital gains they get rather larger effects of changes in wealth on consumption than Franco's coefficient of about .05. That makes sense to me if you suppose some people respond much more weakly than the life cycle hypothesis would indicate. When you take that into account, you get a smaller coefficient than the one calculated from the Tobin-Dolde simulations. In a way I think there is a certain consistency when you deal with a more complicated world than the Tobin-Dolde paper does; it is not surprising that Franco's coefficient is smaller than the one that they have. I think that lends some credence to the kind of coefficient that Franco obtained.

If his empirical coefficient had been as big as the simulated one in the Tobin model, which leaves a lot of things out of account--particularly estate building--I would be more skeptical than I am at its coming out this way. Nonetheless, we have tc regard these numbers as numbers which have a general theoretical rationale but which do not lead us to any tight numerical conclusion. We therefore must rest very heavily on the statistical procedures. Unfortunately, we are as usual dealing with a lot of statistical ambiguity, because these data are subject to many common trends and collinearity. I think it is more clear from the work that other people have done that one can get equally good estimates of consumer expenditure by other approaches which do not take the wealth effect into account as by those which do.

There is a paper by Saul Hyman in the Brookings Economic Activity Series which makes some comparisons between estimates of expenditure on durable goods with and without stock-price variables. It is a close race, but one cannot say there is a clear-cut effect here which can be explained only by the use of the stock-price variable. I think there is a great deal of reason to believe that that kind of effect does exist and one gets it out when one sets up the regressions in the appropriate way. However, we still have a good way to go in getting precise estimates of the exact magnitude of those effects.

Uncertain Policy Channels

That leads me to my final observation, which really is to repeat what I said before about the stock-price equations. If we believe that monetary policy has about half its effect through the channels which are delineated in this paper, then we have to conclude we are in the position of working monetary policy through a set of channels which one would expect to be very uncertain and changing. I spent the breakfast hour with Jack Noyes and Beryl Sprinkel kicking around the mysteries of why we got the peculiar combination of money supply and short-term interest rates that we got. When you pass from that to the bond rate, you get stuck in the morass of term structure and possible changes in the composition of the debt securities outstanding, with all kinds of complicated expectational effects. When you progress from the effects of bond yields to stock prices, you get yourself in another complicated chain of arguments, which suggests the possibility, as I said earlier, that the very changes in policy may create expectations which will produce uncertain results as to the outcome.

Finally, when you get from stock prices to consumption itself, you find yourself again in a situation in which there is a good deal of room for play as to what the magnitude and timing of the effects will be. I think this really does strengthen the case for the notion that the money supply-interest rate-value of assets-consumption channel is one of the channels through which monetary policy works. It does spell out a very reasonable set of hypotheses by which it can work. It also suggests that these channels are like Mississippi River channels which keep changing and make it very difficult to make monetary policy, particularly when you have to forecast a long way ahead. Nevertheless, I think it is a really very important contribution, particularly when this last bit--which I haven't had time to absorb--is added because it does suggest that there is some overall consistency between the different ways of judging the effect of monetary policy. Even though there is a great deal of uncertainty as to the timing and magnitude of the effect of any particular monetary action, I think this does help us make a lot more sense out of our notions of how monetary policy works than previously, when we had to rely much more heavily on the equally uncertain effects through housing and plant equipment investments. I end by congratulating Franco on his mighty work.

REBUTTAL

FRANCO MODIGLIANI

I am highly encouraged by Professor Duesenberry's comments, especially since I know from long experience that he is not an easy customer. My reply can be kept brief because I find myself in basic agreement not only with what he likes about the paper, but also with most of the questions he raises. His comments deal, in part, with some detailed criticism of individual channels and, in part, with the implications of the paper, and of his criticism, concerning the reliability of the timing and magnitude of response to monetary policy.

With respect to the determinants of market valuation of corporate equity he suggests that more explicit consideration should be given to the relative supplies of assets, particularly debt. Here we must distinguish between private and public debt. With respect to private debt, the model does rely on the Modigliani-Miller framework, according to which the total market valuation of firms is independent of the stock of debt outstanding except through tax effects. First, private debt cancels out and second, if the supply is excessive to suit portfolio preferences, individuals can always mix it with levered stock, while if they want more leverage than is provided by corporations they can lever their portfolio by borrowing on personal account.

As for the tax effect, we rely on the assumption that target leverage can be treated as a constant; this is not entirely satisfactory but does not seem to be grossly inconsistent with the facts. The situation is different with respect to public debt, which *is* a component of net wealth. In principle, one should expect that the risk premium commanded by risky assets, such as those of non-financial corporations, should tend to decline if the ratio of government debt to wealth rises, and, hence, the share of risky assets in the total declines. We have, at some point, made an attempt at tracking down this effect, but with little measurable success, in part perhaps because, in the relevant period, public debt has been a relatively small portion of wealth and has exhibited a declining, trend-like behavior.

Duesenberry also suggests that the impact of monetary policy on market valuation may not be stable. For instance, an increase in interest rates, which should tend to reduce market value, may fail to do so because it may support more bullish profit expectations, and thus would be accompanied by an offsetting increase in what is being capitalized. While the point is well taken it would seem that, in general, a rise in interest rates would be unlikely to trigger expectations of higher profits unless it was accompanied by a current increase in profits, in which case our equation would tend to capture the effect.

Concerning the links that go from wealth to consumption, he suggests that the effect of capital gain and loss must be weakened and made more uncertain by the heavy concentration of the ownership of stock. However, here one should recognize that the life-cycle model allows for a substantial concentration of wealth ownership in the older age group, and also suggests that these age groups should be more sensitive to variations in wealth. One should allow also for the indirect ownership of stock through pension funds. Nor do we wish to exclude some possible indirect effects through consumer sentiment. It might be added that, at one time, Frank de Leeuw, when he was still connected with the model, made an attempt at estimating separately the effect of changes in the value of corporate equity and that of changes in wealth from all other sources, on the hypothesis that the response to the first component might be smaller and, especially, more delayed. However, he was unable to find any convincing evidence that this was so, and the attempts were abandoned. Nonetheless, further probes in this direction would seem to be called for.

Unfortunately, *a priori* arguments as to whether the wealth effect should or should not be important cannot advance us very far and it would, therefore, be nice to be able to assuage the qualms of Professor Duesenberry and others by an appeal to empirical evidence. But he is quite right that this is a weak reed to lean on. Yet one can take some comfort from the fact that our consumption function does fit the data exceptionally closely and that the evidence for a significant role of wealth is overwhelming. It is true that when it comes to consumer expenditure, our model may not stand out equally well, but this is largely because our consumer durable equation does occasionally get into some trouble. That equation, incidentally, does not incorporate explicitly a stock market variable – except indirectly through consumption, which controls the desired stock of durable capital. Hence, the cited evidence of Hyman is not inconsistent with our model nor with our conclusion that wealth plays an important role in total consumption.

Despite this defense of individual links I must certainly agree with my critic that the linkages between monetary policy and consumption, traced out by the model, are extremely tortuous and fraught with possibilities for slippage. This holds at the very least with respect to the channels tying monetary policy with the market valuation of corporate equity. If it is true that something like a half of the average response to changes in money supply in the early quarters comes from this route, then there is justifiable ground for suspecting a good deal of variations around that average. In this sense, I can find little quarrel with Duesenberry's conclusion that while the FMP model has, hopefully, contributed a new understanding of the workings of monetary policy, it does not, at this stage, provide much ground for dispelling long-standing qualms about the reliability of the response.

Yet, what we have learned about the linkage mechanism, if valid, may still help improve policy making. For, in assessing whether a given policy is or is not having the intended restraining or stimulating effect, one can directly look at the behavior of the equity markets to see whether they are responding as intended and, if not, can take corrective action.

In concluding, it may be worth observing that the model also does not suggest any grounds for changing significantly our views of the channels or reliability of fiscal policy. Indeed, while the wealth effect may contribute some to an understanding of the monetarists' crowding-out effect, it appears to play but a very small role in the transmission mechanism. Unfortunately, this cheerful conclusion is somewhat marred by the fact that, to our knowledge, no one has yet been too sucessful in confirming these fiscal responses through reduced forms (though a good beginning has been made recently by E. M. Gramlich in the paper cited in the epilogue.

We have reason to believe that the kind of analysis touched on in the Epilogue holds good promise to help unravel this puzzle. In our view, this problem deserves high priority for one would feel much easier if one could obtain, in Duesenberry's words, "some overall consistency between the different ways of judging effects" as we hope we have succeeded in doing for monetary policy, at least partly, in our contribution to this Conference.

Wealth, Liquidity and Consumption

JAMES TOBIN and WALTER DOLDE

I. Monetary Influences on Consumption and Saving

In discussion of the effects on aggregate demand of monetary policies and events, investment spending has been the main focus of attention. Economists have devoted a great deal of theoretical and empirical effort to tracing monetary influences on plant and equipment expenditure and on residential construction. They have paid relatively less attention to monetary effects on consumption and saving. One reason has been the wide currency of a simple Keynesian consumption function, a mechanical relation of consumption to disposable income. It has not been easy empirically to improve on the approximation that consumption is a constant fraction of disposable income, although the short-run volatility of this fraction is a major source of uncertainty and error both in forecasting and -- as the unhappy memory of the 1968 surcharge reminds us -- in policy.

In this paper we consider various monetary influences on consumption and attempt to estimate their importance. We do not have a new aggregate consumption function to propose, and we cannot at this point hope to explain the instability of the propensity to consume that has been so troublesome to forecasters and policy makers. Our approach is semi-realistic simulation. Instead of postulating a macro-economic consumption function, we derive aggregate consumption explicitly from a model of the decisions of individual households. We simulate a population of households with semi-realistic demographic and economic characteristics. We assume that

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these households make consumption decisions and plans in accordance with certain rules of behavior and market constraints. More specifically, the households conform to a life-cycle model of consumption and saving.

Each of our simulations generates a hypothetical path of consumption and saving for the population as a whole. The simulations differ from each other in the economic environment to which the households are adapting. Some of the environmental differences can be associated with monetary policies. Any change in monetary policy alters the households' constraints and expectations, and its global impact is gauged by the difference in the resulting simulated aggregate path of consumption and saving.

"Semi-realistic" means that the overall characteristics of the hypothetical population resemble those of the population of the United States, and that parameters have been chosen so that the magnitudes of aggregate variables have a familar ring. But we cannot of course begin to mimic the actual population in detail, and we have necessarily made many untested *a priori* assumptions. Compared with usual studies of consumption, our work contains a much greater and bolder theoretical component and a much weaker component of conventional statistical estimation and testing. We do not defend this methodology here, nor do we regard it as a substitute for customary econometric methods. But the conventional methods have not been dramatically successful, and we do believe that microeconomic simulations can provide some interesting macroeconomic insights.

There are two major recognized channels of monetary influence on consumption: (A) changes in wealth and in interest rates, (B) changes in liquidity constraints. We shall also address ourselves to (C) changes in taxes, temporary and permanent. The third would traditionally be regarded as an aspect of fiscal rather than monetary policy. But the impact of a tax change depends, in our model, on the

TABLES and CHARTS

monetary environment in which it occurs, and for comparative purposes it is instructive to examine it within the same general framework.

A. Wealth and Interest Rates

Wealth, of course, has frequently been proposed as an argument in theoretical and statistical consumption functions.[1] Early in the Keynesian controversy the wealth effect on the propensity to consume became prominent as the vehicle for the "Pigou effect." Currently popular econometric consumption functions for the United States are essentially, suppressing lags, of the form

$$C = aY_d + bW \quad (I.1)$$

where C is real consumption, Y_d real disposable income, and W real net nonhuman wealth of households. With coefficients a and b of the order of .5-.7 and .03-.05 respectively, and with W normally five times Y_d, an equation of this kind is consistent with the observation that consumption is normally of the order of 90 percent of disposable income. At the same time, the equation implies a much lower marginal propensity to consume from changes in disposable income unaccompanied by changes in wealth.[2] In this respect it appears to be consistent with the abundant evidence that the marginal propensity to consume from income is lower in the short run than in the long run.[3]

[1]See Ackley, 1961, pp. 554-561 for a good summary.

[2]Ando-Modigliani (1963) and Arena (1964) have estimated consumption functions of this form. The consumption function of the MIT-Penn-SSRC econometric model is also essentially of this type.

One difficulty with the equation is that, although it requires a W/Y_d ratio the order of 5 or more in order to obtain a realistic C/Y_d ratio, it does not generate enough saving to maintain so high a wealth/income ratio. If the normal saving ratio is .10 and the growth rate of the economy is .035-.04, the equilibrium wealth/income ratio is only 2-1/2 or 3. The answer may be that household wealth grows by capital gains, some of which reflect corporate saving, as well as by personal saving as measured in the national income accounts. In principle these gains should be included in the disposable income used in the equation, but Arena's attempts to do so were not successful.

[3]This is not always true. In some cyclical fluctuations, the market value of household wealth has moved as much as, or more than, disposable income. Stickiness of consumption must then be attributed to inelasticity of income expectations rather than to stability in nonhuman wealth.

Monetary policy can affect household wealth by changing interest rates and the market value of securities and of other assets. Evidently this mechanism was important in the 1969-70 decline in stock and bond prices, and in the 1971 recovery of these markets. In the MIT-Penn-SSRC model, the consumption consequence of such asset revaluations in a very important component of the power of monetary policy over aggregate demand.

There is, however, some danger in applying a consumption function like (I.1) in this context. The historical variations of W which yield an empirical estimate of the propensity to consume from wealth have not been solely or even principally the kind of variations generated by monetary policy. The historical path of household wealth results from: (a) planned accumulation, the consequence of the very saving behavior that wealth is supposed to help explain, (b) unexpected gains or losses due to changes, actual or expected, in the capacity of the economy's capital stock to earn income for its owners, and (c) unexpected gains or losses due to changes in the discount rates at which the market capitalizes prospective earnings. These sources of change in wealth should not be expected to have identical effects on consumption. In particular, the changes engineered by monetary policy are of type (c) and necessarily involve changes in interest rates, while the other types do not.

Interest rates determine the terms on which households can make substitutions between present and future consumption. In theory a change in wealth connected with a change in interest rates will have not only "income effects" on consumption but also intertemporal "substitution effects." These are not included in equation (I.1), and indeed econometric studies of consumption and saving have been notably unsucessful in detecting them.[4] But in view of the formidable identification problems involved, we are not entitled to assume they do not exist. The model used in our simulations allows for a modest amount of intertemporal substitution. Therefore it is necessary and possible to specify various packages of changes in interest rates and asset valuations and to distinguish among their consumption effects.

The effects on current consumption of changes in wealth and in interest rates may depend on the importance of liquidity constraints, about to be discussed in section I.B. Capital gains which are realizable in cash or in enlarged credit lines may permit households

[4] As, for example, assumed by Ando and Modigliani (1963).

to escape from constraints on their current consumption. In these circumstances the apparent marginal propensity to consume from wealth will be higher than in a perfect capital market.

B. Liquidity Constraints

In macroeconomics there has always been tension between "wealth" and "liquidity" theories of consumption and saving. Should the income variables in consumption functions be liquidity measures -- disposable income, disposable income less contractual saving, etc. -- or should they be human wealth measures -- permanent or lifetime income? Should the stock variables be liquidity measures -- liquid assets -- or wealth measures -- net worth?

In a theoretically perfect capital market, the consumption plans of households are constrained only by their wealth, human as well as nonhuman. Households can turn future income from the assets they own and from their own labor into current consumption on the same terms on which they can convert ,current income into future consumption. Within the bounds of solvency, they can dissave and borrow at the same interest rates at which they can save and lend. In such a world, the wealth of households, including the "permanent income" from their labor, is the only relevant measure of their consumable resources.

Additional constraints arise when households cannot substitute one kind of wealth for another, or can do so only with a penalty. Human wealth may be illiquid because households are not allowed to have a negative nonhuman net worth position even when it is offset by the value of their future labor income. Alternatively, they may be allowed to borrow against prospective wages and salaries, but only at a penalty rate. The threshold at which liquidity constraints apply may indeed be a positive level of nonhuman wealth. Borrowing is often possible, or possible without penalty, only on a fraction of the value of real estate, securities, and other assets. Mortgage contracts and retirement plans typically require the household to build up its nonhuman wealth at a prescribed rate. The market inposes penalties not just for dissaving but also for saving at less than the contracted rates.

Monetary policy is one determinant of the tightness of such liquidity constraints. Easy money conditions induce lenders to liberalize their down payment and margin requirements, to reduce penalty rates, to make consumer credit available on easier terms, to take more chances on unsecured personal IOU's. In tight money periods lenders move in the opposite direction.

C. Permanent and Temporary Changes of Taxes

The effects of tax changes on consumption depend on the importance of liquidity constraints. In the hypothetical world of perfect capital markets, increases of tax rates reduce human and nonhuman wealth by lowering expected incomes from labor and property. They may also, by lowering after-tax interest rates, have substitution effects in favor of present consumption against future consumption. Temporary tax increases diminish wealth calculations very little and will have weak income effects.

The situation is quite different for taxpayers whose current consumption is constrained by liquidity. An increase in taxes withheld or required to be paid in cash will have a powerful effect; in principle the marginal propensity to consume will be 1.0. This will be true whether the tax increase is permanent or temporary, a distinction that is much less important in a "liquidity" theory of consumption than in a "wealth" theory.

One of the difficulties of aggregation that confronts macroeconomic specifications of the consumption function is that there are undoubtedly both liquidity-constrained and liquidity-unconstrained households in the economy, in proportions that vary from time to time. The younger and poorer households are more likely to be liquidity-constrained. One advantage of the microeconomic simulation method of this paper is that differential incidence of liquidity constraints can be systematically introduced and its consumption effects calculated.

II. The Life Cycle Model As a Framework of Analysis

Our framework for analysis of the questions raised in section I is the life cycle model of household consumption.[5] We begin with a simplified exposition of this model, in two stages. Many of the essential points can be illustrated by the familar textbook example of a consumer with a two-period lifetime. This is done in section II.A; section II.B sketches the extension of the model to multi-period consumption and saving decisions; section II.C points out some of its aggregative implications.

[5]The basic idea goes back to Fisher (1907, 1930). Its modern elaboration begins with Modigliani-Brumberg (1954). Our approach in this paper is a sequel to Tobin (1967).

A. Two-period Consumption Decisions

Consider a consumer with a two-period lifetime. In Figure 1 the horizontal axis measures first period consumption c_0 and the vertical axis second period consumption c_1. Labor incomes in the two periods are (y_0,y_1), marked as point y. Coordinate axes are also shown with origin at y. On these axes, W_0 is the value in first period consumption of the consumer's nonhuman wealth, and W_1 is its value in second period consumption. W_0 and W_1 are related by the one-period interest rate: $W_1 = W_0 (1+r)$. The point $(y_0,y_1 + W_1)$, labelled W_1, represents one feasible consumption combination, one involving zero current saving. In the assumed perfect capital market, the household can move in either direction from this point, on terms of 1+r units of deferred consumption for one unit of initial consumption. The point Y_0 measures the present value of total consumable resources, equal to $y_0 + \frac{y_1 + W_1}{1+r} = y_0 + \frac{y_1}{1+r} + W_0$. The point Y_1 is the value of total resources in terms of second-period consumption. The consumer can choose any point on the opportunity locus Y_0Y_1. In the illustration he chooses point c.

A liquidity constraint would be illustrated by a kink in the opportunity locus. For example, if the consumer could not consume in period 0 more than $y_0 + W_0$, the locus would be vertical from point W_0 to the horizontal axis. If he could exceed $y_0 + W_0$ only by borrowing at a rate $r_b > r$, the locus Y_1W_0L would have a steeper slope, $-(1+r_b)$ instead of $-(1+r)$, from W_0 to the horizontal axis at L. The kink could occur further to the left if the consumer were required to carry a positive amount of wealth into period two, or penalized to the extent he did not.

The consumer is assumed to have a preference ordering of consumption points (c_0,c_1) with the usual properties, and to choose a point on the highest attainable indifference curve. In the later sections of the paper we have represented these preferences by a particular utility function, and we will introduce that representation here. We assume that the consumer's prospective utility U is a discounted sum of utilities of amounts consumed in each period:

$$U = \sum_{i=0}^{a^*} u(c_i) \left(\frac{1}{1+\delta}\right)^i \qquad \text{(II. 1).}$$

The same one-period utility function u applies to every period; the marginal utility $u'(c_i)$ is positive and declines with c_i. Future utility is discounted at a subjective rate δ, the pure rate of time preference. In Figure 1, for example, the slope of an indifference curve is:

$$-\frac{u'(c_0)}{u'(c_1)}(1+\delta),$$

and in particular it is $-(1+\delta)$ for $c_1 = c_0$, i.e., along the 45° ray. The curvature of the indifference curves is related to the substitutability between consumption in different periods. We take for marginal utility

$$u'(c_i) = Bc_i^{-\rho} \qquad \rho > 0 \quad \text{(II. 2)}$$

so that $-\rho$ is the elasticity of (undiscounted) marginal utility with respect to c_i. The slope of a (c_0,c_1) indifference curve is then $\left(\frac{c_0}{c_1}\right)^{-\rho}(1+\delta)$. The larger the value of ρ, the faster the slope of the indifference curve changes as the ratio c_1/c_0 moves to the left or right of the 45° ray. A high value of ρ means high curvature and low intertemporal substitutability. Following Fellner (1967) and others, we take $\rho = 1.5$ in our calculations below.[6]

[6]Tobin (1967) assumed $\rho = 1$, as would follow from a logarithmic utility function. Ando and Modigliani, (1963, p. 59), on the other hand, assumed perfect complementarity, i.e., L-shaped indifference curves with the corner of the 45° line.

In a perfect capital market, a consumer maximizes U subject only to the budget constraint

$$\sum_{i=0}^{a^*} c_i d_i - \sum_{i=0}^{a^*} y_i d_i - W_0 = 0$$
$$\sum_{i=0}^{a^*} (c_i - y_i) d_i - W_0 = 0 \qquad \text{(II. 3)}$$

where the d_i are the market discount factors that convert consumption and income in period i to present values. In the two-period illustration $d_0 = 1$ and $d_1 = \frac{1}{1+r}$. The first order conditions of the constrained maximum are:

$$u'(c_i)\left(\frac{1}{(1+\delta)}\right)^i - \lambda d_i = 0 \qquad i = 0, 1, 2, \ldots a^* \qquad \text{(II. 4)}$$

where λ, the Lagrange multiplier, is the marginal utility of consumable resources. If market interest rates are constant, so that $d_i = \left(\frac{1}{1+r}\right)^i$, we have

$$\frac{u'(c_{i+j})}{u'(c_i)} = \left(\frac{1+\delta}{1+r}\right)^j \qquad \text{(II. 5).}$$

From (6) we know that undiscounted marginal utility must rise, fall, or remain constant with age according as δ is greater than, smaller than, or equal to r. If, for example, the market interest rate r exceeds the subjective discount rate δ, second-period consumption must exceed first-period consumption. The chosen combination will be to the left of the 45° line, as in Figure 1.

For our specific utility function, condition (II.4) becomes:

$$c_i = \left(\frac{B}{\lambda}\, d_i \frac{1}{(1+\delta)^i}\right)^{\frac{1}{\varphi}} \qquad i = 0, 1, 2, \ldots a^* \qquad \text{(II. 6)}$$

For example, in the two-period case $c_1 = c_0\left(\frac{1+r}{1+\delta}\right)^{\frac{1}{\rho}}$. The elasticity of c_1/c_0 with respect to 1+r is $\frac{1}{\rho}$, or .67 for our numerical assumption. This means roughly that a 100-basis-point rise in the interest rate will increase c_1 relative to c_0 by two-thirds of 1 percent.

An increase in consumable resources with no change of interest rates would be represented in Figure 1 by a parallel outward shift of the budget constraint. On our assumptions it would lead to a proportionate increase in c_1 and c_0, because the slope of an indifference curve derived from (II.2) depends only on the ratio of the two consumptions, not their absolute amounts. The same implication -- proportionate shift in all c's -- holds for the multi-period case.

A fall in the interest rate will tilt the opportunity locus counterclockwise and lead to intertemporal substitution. In general an interest rate decline will also have an income effect, enlarging the opportunity set for dissavers and restricting it for savers.

Both income and substitution effects are different if liquidity constraints are operative. So long as the consumer is at a kink in his opportunity locus, he will consume immediately 100 percent of any increment in currently available resources. The substitution effect, however, will be zero for small changes in interest rates.

As our discussion in section I.A indicated, changes in wealth induced by monetary policy are associated with interest rate changes, while other changes in wealth need not be. In Figure 1 the shift of locus from Y_0Y_1 to $Y_0^1Y_1^1$ reflects pure capital gain, with no change of interest rates. W_0 and W_1 increase in the same proportion, to W_0 and W_1. However, the shift of locus from Y_0Y_1 to Y_0Y_1, involves the same capital gain from W_0 to W_0 but provides no increase in W_1.

In the first case, the income effect is positive, and proportionately of the same magnitude whether the initial consumption choice was c or any other point on the budget constraint Y_0Y_1. In the second case, whether the income effect is positive, zero, or negative depends on whether the initial consumption choice was to the right of W_1, at W_1, or to the left of W_1. Only if the initial choice was to the right of W_1, involving dissaving in the first period, does the income effect work in favor of current consumption. In the illustration of Figure 1, c was to the left of W_1 and the income effect is negative. But while there is no substitution effect in the case of pure capital gain, the reduction of the interest rate in the second case always favors current consumption.

Obviously there are other possibilities. In the second case, $(Y_0''Y_1'')$, wealth consists entirely of claims that mature in the second period, claims that do not outlive the household. To the extent that claims are longer-lived, a smaller reduction of the interest rate will suffice to accomplish the given gain in initial wealth $W_0' - W_0$, and there will be a positive increment in W_1.[7] The two-period example does not permit us to exhibit the opposite case, where wealth consists of claims which mature short of the household's horizon. There will be some periods for which W_i is reduced -- as if the budget constraints cut below W_1 in Figure 1. Saving for consumption in late periods is less fruitful because of the low yield at which maturing claims must be reinvested.

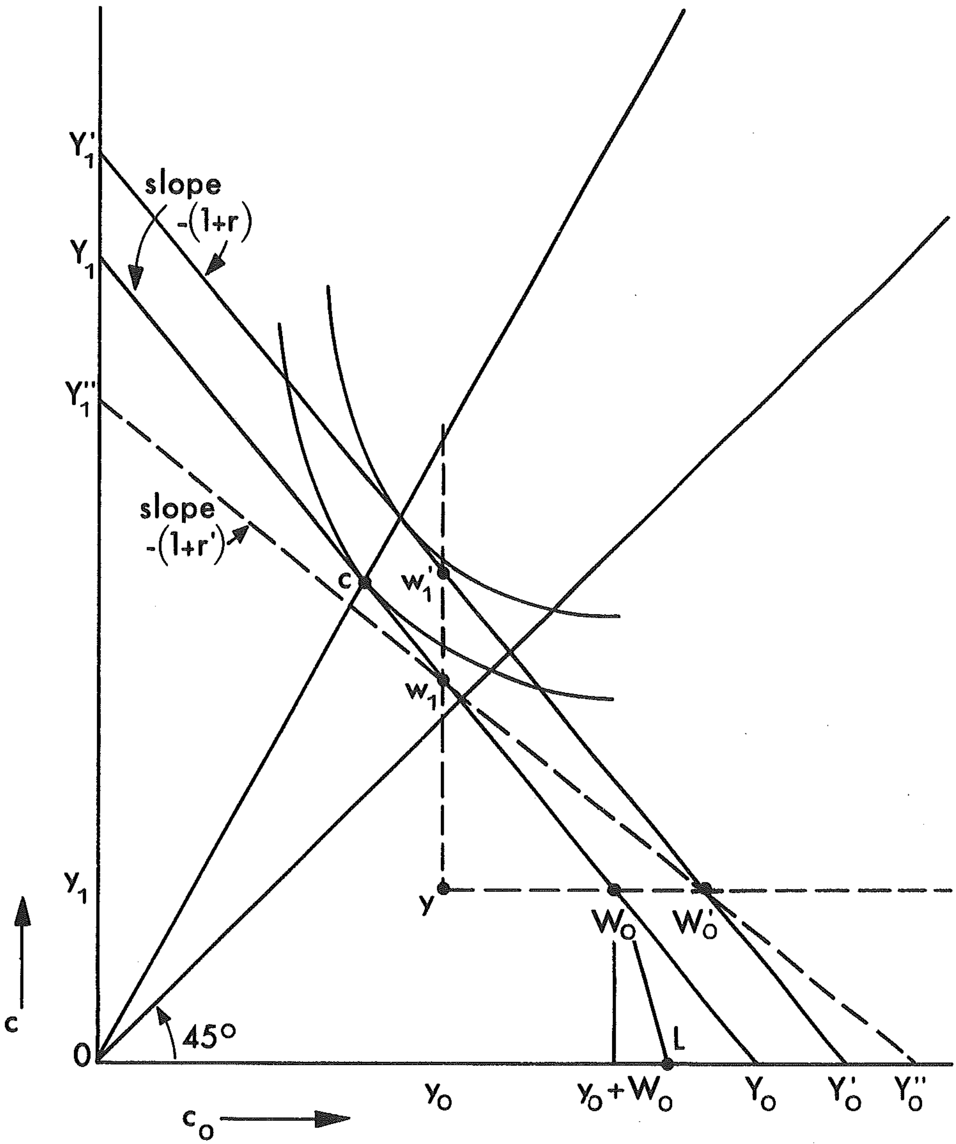
A case similar to the shift of opportunity locus to $Y_0''Y_1''$ arises when asset revaluations in security markets are regarded as temporary. This means that they are associated with temporary rather than permanent changes in discount rates. Consider, for example, consol-like claims that rise in value because of a decline in the interest rate connecting period zero and period one, while subsequent rates remain unchanged. These claims will revert to their old value after period one. The value of the household's wealth in current consumption is increased, but its value in future consumption is not.

[7] If wealth takes the form of consol-like claims, the new discount rate is:

$$r' = \frac{rW_0}{W'_0}, \text{ and } \frac{W'_1}{W_1} = \frac{(1+r')W'_0}{(1+r)W_0} = \frac{W'_0/W_0 + r}{1+r}.$$

In this case W_1 increases almost in proportion to W_0.

Figure 1.



Y'1
slope
-(1+r)
Y1
Y''1
slope
-(1+r')
c
w'1
w1
y1
y
W0
W'0
c
0
45°
L
y0
y0+W0
Y0
Y'0
Y''0
c0

It is possible that capital gains may accompany *increases* in interest rates, so that substitution effects oppose, while income effects favor, current consumption. This combination would be the result not of monetary policy but of optimistic revisions of expected future profits.

Finally, the modeling of tax changes in the two-period illustration is obvious. A permanent tax on labor increase reduces both y_0 and y_1, while a temporary tax lowers only y_0. The income effect on current consumption is obviously greater for the permanent tax except when the household is liquidity-constrained. Taxes on property income are like interest rate reductions.

B. Multi-period Lifetime Consumption Decisions

Consider a household at the beginning of its career, anticipating a sequence of labor incomes and deciding on a sequence of consumption rates within the limits set by its income prospects. In Figure 2 an expected income sequence is illustrated, and along with it a chosen consumption plan. Both the income sequence and the consumption plan are pictured in two ways, in current real dollars (dashed curves) and in dollars discounted to the decision date (solid curves).

The consumption plan is shown as smoother than the income sequence. The spirit of the life-cycle hypothesis is that consumers prefer steady consumption to fluctuating consumption. The one-period marginal utility of consumption, like (II.2) above, is declining. Households save and dissave in order to smooth out their income paths. Saving for retirement is the clearest example of such behavior, but certainly not the only one. Another example is debt financing by young people to obtain a standard of life beyond their current means but consistent with their occupational status and income prospects. Of course the household is not free to choose any paths for c that it desires. It is limited by its income sequence. Specifically, the sum of the differences between discounted y_i and discounted c_i -- the present value of its savings and dissavings from labor income -- must add up to zero over the lifetime, as in equation (II.3) above.

Figure 3 provides the same information as Figure 2 in different form. The curves are the integrals of the "discounted y" and "discounted c" curves. The Y curve shows for each age the cumulative total of labor income earned until that age, discounted to household age zero. Similarly the C curve shows the present value, as of age zero, of consumption through age a. At the terminal age a^* Y

Figure 2.

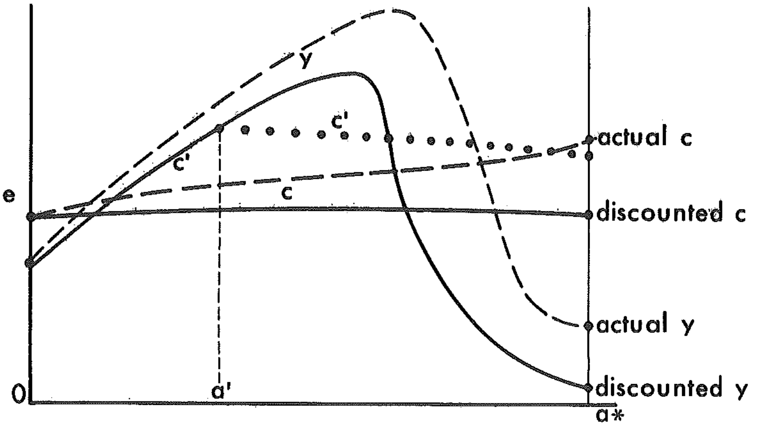


Figure 3.

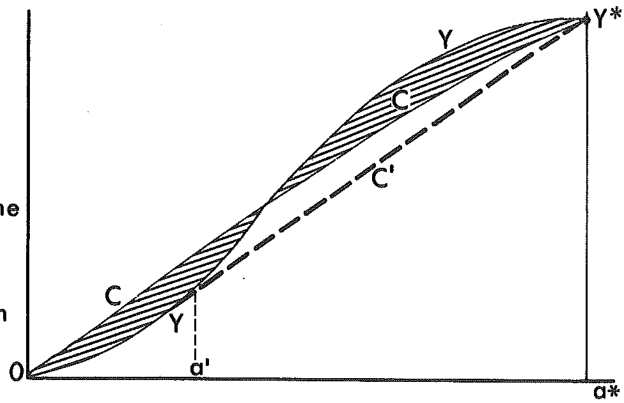
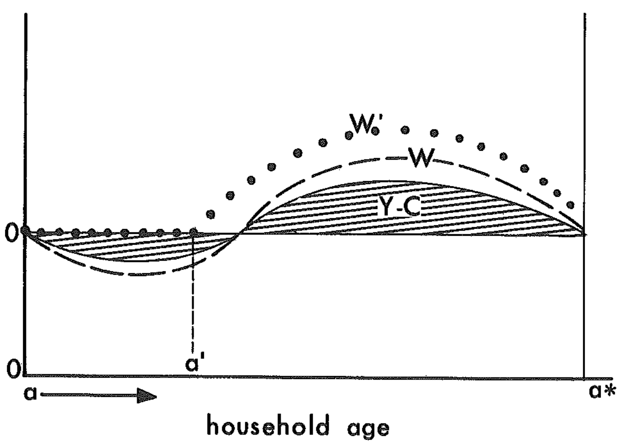


Figure 4.



and C meet. This is the budget constraint: The present value of lifetime consumption must be the same as the present value of lifetime income. Actual consumption, cumulated at current dollars, will generally exceed actual labor income summed over the whole life. The household will earn and consume some interest.

From the income and consumption paths the wealth profile of the household can be easily derived. In present value terms, nonhuman wealth W is just the vertical difference, positive or negative, between Y and C. These differences are shaded in Figure 3 and plotted in Figure 4 as "discounted wealth." By putting and discounting process in reverse, this present value wealth profile can be converted into a current dollar wealth profile -- the dashed curve "actual W" in Figure 4. If the household's expectations are realized, this is the course its wealth will follow as its plans are carried out.

This account has assumed that the household can save and dissave in a perfect capital market -- in particular, that the household can borrow against future labor income at the same interest rates at which it can save. The only constraint has been the lifetime budget constraint. Terminal wealth must not be negative, a restriction that limits total lifetime consumption but not its allocation among ages. In Figure 3 curve C must start at 0 and end at Y^*, but in between it may have any shape the household desires.

Consider, on the other hand, a simple liquidity constraint, that nonhuman wealth W can never be negative. The best the household can do, so constrained, is to consume its cash income in early years until a' and then follow the dotted curves c' and C' in Figures 2 and 3. Correspondingly, in Figure 4, discounted W will be O until age a' and then follow the dotted path. The less drastic constraint of a penalty borrowing rate, finite instead of infinite, would move the household in the same direction. In general, as the example illustrates, liquidity constraints *raise* the household's wealth profile.

In the illustration, the household begins and ends with zero wealth. The model can easily accommodate other assumptions. For a household beginning with inherited wealth, the Y and W curves of Figures 3 and 4 will start with positive intercepts. Inheritances anticipated at later ages would be shown as jumps in the Y curve. Similarly any planned or required bequest at a^* would be indicated by a positive difference between Y^* and C at a^*.

The plan made at age zero can be reconsidered and remade in the same manner at every subsequent age a. If external constraints and market interest rates conform to original expectations, and if the household's preferences are unchanged, the new decisions simply confirm the old, and the original plan will be executed. But if conditions and expectations change, the household will make a new plan for the remainder of its life.

In this introductory exposition of the model for a single household we have ignored some complications which we have to face in the applications of the model described later in the paper. These include allowance for life cycle variation of the size and composition of the household -- as children are born, grow up, and leave -- and actuarial allowance for mortality.

C. *Macroeconomic Implications*

The life cyle model has interesting implications for the economy as a whole. The income, consumption, saving, and wealth of a household depend on what profiles it is following and on its age. Aggregates of these variables can be obtained by summing over all households. Households differ both in profile and in age, but of course their age differences are much easier to observe. Specific results can be obtained by calculating the aggregate income, consumption, saving, and wealth of a population of households of different ages, all following essentially the same life-cycle profiles. The aggregate value of any variable is the sum of the profile variables for different ages, weighted by the number of households of each age. The aggregate will change from year to year as the population grows and its age distribution changes.

Allowance can also be made for steady growth of labor productivity. The expected income profiles of Figures 2 and 3 take general gains in labor income into account, as well as increases which are simply related to experience and seniority. A similar household starting a year later would face a higher income profile, shifted upward, as a first approximation, by the proportion γ at every age. With everything else equal, the model of consumption choice implies a similar proportionate shift in every other profile of Figures 2 to 4. The income, consumption, saving, and wealth of 10-year-old households in 1975 will all be $(1+\gamma)$ times as large as those of the 10-year-old households of 1974. The aggregate consequences is that all the macro variables will grow at the rate γ per year, plus any changes that may occur because of changes in the population of households of various ages.

In a demographic "golden age," the population is growing at a steady rate n per year and its relative age distribution is constant. Consequently the number of households of each age is growing at rate n. If it is also an economic "golden age," interest rates are constant and likewise so is the growth of labor productivity γ. The model then implies that all the aggregates are growing at the rate $n + \gamma$. Since this is the natural growth rate of the economy, the life-cycle model provides an explanation of saving behavior consistent with a neoclassical growth equilibrium.[8]

III. Description of the Simulations

In this section we describe more specifically the modeling of the consumption decision and the variables which influence it. The appendix contains a more complete mathematical treatment and indicates our data sources.

A. Demographic Assumptions

We distinguish among individuals by only three characteristics. The first of these is age, the central variable of the life cycle model. The second distinguishing characteristic is sex, since realistic calculations require some recognition of family structure and of the work habits and consumption requirements of different family members.

Finally we have divided the population into two income classes. The relative proportions of the population in the groups are those that existed in 1963 between the population above and below the poverty line. If different income groups face different opportunity sets (e.g., differential ease of access to capital markets), then aggregate consumption may depend on the income distribution. We have assumed that the two income classes differ only in the relative levels of their income profiles, not in the time shapes of the profiles or other demographic and economic circumstances.

The basic behavioral unit is the cohort, which consists of all adult females of a given age plus associated adult males and children of various ages. All cohorts are actuarially average. There are no unattached individuals or families of larger or smaller size.

An individual lives with his parental family until age 21 (in the case of males) or 18 (in the case of females). Any income earned as a teenager is contributed to the household, which in turn makes provision for the child's consumption needs until he leaves the household. At 18 the females form the nucleus of a new cohort, to which a

[8]See Tobin (1967).

complement of males, including newly matured 21-year-olds, are assigned. As the cohort ages it will gain some adult males from each new group of 21-year-olds. Some of the current crop of 21-year-old males are, in turn, assigned to older cohorts.

With a minor exception discussed in the appendix, a cohort loses its adult members only by death. Each cohort is disbanded when the female becomes 85. A specific, unchanging, perfectly anticipated mortality table is assumed. All people expect to die before age 85. The cohorts will include some adult males who are younger than the female and who will thus outlive the cohort. These men are assigned to new cohorts. No children are reassigned in this manner since the last age at which females bear children -- 49 according to the birth table assumed -- is such that all children have matured and left the cohort before it disbands. It is assumed for convenience that women do not bear children before age 18. The birth vector has been adjusted accordingly.

Although a number of demographically unrealistic simplifications have been made, none of them is quantitatively significant. The simplifications are necessary to make the computational burden manageable.

B. Income Expectations and the Consumption Allocation

In making its lifetime consumption plan the cohort is constrained not to allocate more than the present value of its lifetime resources. These total resources consist of human and nonhuman wealth. The former is the accumulated savings -- including capital gains -- of the cohort;[9] the latter is the present value of future labor income.

The evaluation of both sources of wealth involves expectations about their future income streams. For a number of reasons these income streams may be expected to vary with time.

Because of age-related differences in participation rates and in productivity, labor earnings vary with age, generally rising until about age 40 or 50 and then declining. For women, on the average, there is a slight decline related to reduced participation in the primary child-rearing years. We assume that the labor earnings of an individual of a given age and sex in any year will be a constant proportion of the labor income of a 40-year-old male in that year. Thus the relative income profile by age, for both men and women, will be assumed constant over time.

[9] Inheritances and bequests are ignored.

The absolute level of the profile, however, will change. We assume labor-augmenting technological change at a constant annual rate $\gamma = .0225$. Although factor rewards might be expected to be influenced by variations in the capital-labor ratio, we have not assumed an explicit production technology and such effects will not be considered.

A final source of variation in income streams will be changes in tax rates, both on property and on labor income. It is disposable labor income which is to be allocated to consumption or to saving, and it is after-tax property yields which are relevant to this allocation.

Having estimated the present value -- at current and expected rates of discount -- of its lifetime resources, the cohort then allocates these resources among all its members for all the years that they are expected to live.

The optimal allocation will be one for which the prospective marginal utility of a unit of consumption is the same in every year, so that total utility cannot be increased by shifting a unit from one year to another. We assume, of course, that the marginal utility of consumption in a given year declines with amount of that consumption. That is why the household seeks to avoid large differences in consumption between years. The marginal utility of a unit of consumption will also vary with the year in which it is to occur: we assume a pure rate of time preference of δ. Thus the value of a unit of utility from consumption t years hence has only $1/(1+\delta)^t$ times the value of a unit of utility today. In our simulations we have used $\delta = .02$.

The utility of consumption will also vary from year to year with household size and composition. This variation reflects economies of scale in household life and differences in the needs and priorities of various household members. To allow for these phenomena we weight the utility of consumption for children and teenagers differently from adults. In this calculation of household size, adults receive a weight of $w_a = 1.0$, while the weights for teenagers and children, w_t and w_c, are .5 and .2 respectively. Thus a consumption-year for a child is equal to $w_c = .2$ "equivalent adult years."[10]

Barring the complications discussed in section (III.C), the cohort maximizes its utility if it allocates its consumption -- discounted by a transformation of the difference between the expected interest rate and the rate of time preference -- so as to equalize consumption per

[10] For our purposes teenagers are defined as those children who earn incomes, aged 15-17 (female) or 15-20 (male).

equivalent adult year, where the equivalent adult years, too, are discounted by transformations of the interest rate, the rate of time preference, and birth and death rates.

C. Capital Gains and Interest Rate Changes

In the two previous sections, III.A and III.B, we have explained our model of the household sector of the economy. The households make the consumption decisions, and our purpose is to see how those decisions are affected by monetary policies and other events exogenous to the household sector. In Part II we discussed in general terms the policy and environmental changes of interest, and now we explain how we have modeled these "shocks" in our simulations. In this section we discuss capital gains and interest rate changes. In the two sections following we discuss how we have modeled liquidity constraints and their relaxation or tightening, and how we have modeled tax changes.

As we pointed out in Part II, capital gains and interest rate changes are intimately bound together. It is not possible to trace the effects of shocks of this kind without being explicit about the nature of the assets whose yields are assumed to change, and about the expected asset prices and interest rates.

We are assuming that the wealth of the household sector consists of various direct and indirect claims on the economy's capital stock. Monetary policies and events can change the valuation of the stock, and so can changes in the real earnings of capital due to technological or macroeconomic developments. But in the long run adjustments in the size of the capital stock or in monetary interest rates, or in both, keep market valuations of capital in line with reproduction costs. We do not provide a model of those adjustments, but we assume that our households know they will occur and we provide them accordingly with a plausible mechanism of expectations.

The present discounted value of the earning stream of capital per dollar of reproduction cost is

$$q = \frac{R_1^e}{(1+r_1^e)} + \frac{R_2^e}{(1+r_1^e)(1+r_2^e)} + \ldots + \frac{R_n^e}{(1+r_1^e)(1+r_2^e)\ldots(1+r_n^e)} + \ldots$$

where R_i^e is the expected net earnings i years hence and r_i^e is the expected one-year rate of interest in the i^{th} year. The R_i^e are net of depreciation and operating costs.

For a finite-lived piece of capital directly owned the R_i^e become zero at some point. If the R_i^e represent earnings on equity shares in a firm, however, they may not be expected to be zero. Rather it may be expected that the firm's shares will yield earnings in perpetuity. In the special case in which both R_i^e and r_i^e are expected to be constant forever at R and r, respectively, we know that $q = \frac{R}{r}$.

In long-run equilibrium q must equal one, i.e., the market value of a unit of capital stock must equal its reproduction cost.

Both R_i^e and r_i^e represent expectations about the future. For generating expectations we have assumed a mechanism which distinguishes between long run and temporary phenomena. Essentially, expectations are assumed to be regressive in the short run and adaptive in the long run. Suppose that rates of return have been constant for some time at a level $\bar{r}$. This $\bar{r}$ will come to be regarded as a normal level. Suppose, however, in some period, r rises above $\bar{r}$. It might then seem reasonable to believe that r will stay above $\bar{r}$ for a while but will eventually decline to $\bar{r}$: expectations in the short run are regressive. If r continues to exceed $\bar{r}$ for some time, however, it will be less reasonable to expect a return to $\bar{r}$. In fact, $\bar{r}$ will no longer be regarded as the normal level, and estimates of the normal level will be revised upward.

If earnings on equities (the capital stock) R diverge from what has been a normal level, an entirely analogous mechanism operates. The two processes are in fact linked since, as we have noted above, long-run equilibrium requires $R = r = \bar{R} = \bar{r}$ (i.e., $q = 1$). Thus the normal level of earnings on capital and the normal level of interest rates must be identical.

We will assume that R and r, if they differ from $\bar{R}$, will be expected to converge geometrically to $\bar{R}$ with 85 percent of the remaining difference expected to be eradicated in each year. We assume an adaptive mechanism for $\bar{r}$, where 80 percent of the weight is on $\bar{R}_{-1}$ and 10 percent each on the current levels of R and r:

$$R_i^e = \bar{R} + \theta_R^i (R - \bar{R}) \qquad \text{(III.1)} \qquad r_i^e = \bar{R} + \theta_r^i (r - \bar{R}) \qquad \text{(III.2)}$$

$$\bar{R} = (1 - \eta_R - \eta_r)\,\bar{R}_{-1} + \eta_R R + \eta_r r \qquad \text{(III.3)},$$

where we assume $\theta_R = \theta_r = .85$ and $\eta_R = \eta_r = .10$.

Actual values of R and r are assumed to be known and to be exogenously determined. Monetary policy will influence r in the first instance, while changes in R will be due to capital-augmenting technical change and other factors affecting the earnings of firms. Such effects are dynamically interrelated, as both affect $\bar{r}$ and hence each other. In part because they are interrelated, differences are viewed as temporary, since there exist natural forces in the economy causing R and r to reconverge to each other. As we have indicated above, however, there may be times when a permanent change in the earnings on capital is expected. This corresponds to a shift in $\bar{R}$ overriding the adaptive expectations of equation (III.3). In our simulations we will investigate the effects of changes in $\bar{R}$ as well as the effects of changes in R and r.

D. Liquidity Constraints

Monetary policy will affect consumption through its effects on borrowing conditions and liquidity constraints as well as through its influence on wealth. The monetary authority's ability to affect such credit conditions will be parameterized in two variables in our simulations. One of these will be a borrowing rate r_b charged on funds borrowed. In general r_b will exceed r, the market rate of interest (lending rate for individuals). The second instrument will involve quantitative restrictions as discussed below.

Foreseen dissaving, for example in the retirement years, presumably does not pose a liquidity problem, there having been sufficient time to reallocate the portfolio to provide necessary liquidity. It is in the younger years that liquidity constraints may be of consequence, forcing the household to save more, or dissave less, than it desires.

For the purposes of our simulations it will be assumed that a cohort undertakes at age $u_a = 25$ an illiquid investment of amount A, financed by debt on which the cohort commits itself to make annual payments of principal of A/T in each of T consecutive years.[11] Cohorts are not permitted to make advanced payments on their contracts. Both the illiquid investment and the debt bear the market rate of interest.

[11] A will be assumed to be $30,000 per adult female for new group 1 cohorts and $7500 for new group 2 cohorts in the first year of the simulations. It will be assumed to grow at the constant rate γ, the rate of growth of per capita income. The simulations assume T=20.

We introduce the concept of contractual saving, $\hat{s}$, saving required of the cohort in a given year. The contractual payments of principal, A/T, are one source of obligatory saving, but not the only one. If in some year the cohort wishes to save less than $\hat{s}$, it will have one borrowing option available to it. It will borrow at a penalty rate r_b, the principal to be reduced in $\hat{T}$ equal payments of $1/\hat{T}$ times the amount borrowed. We have used $\hat{T} = 5$.

$\hat{s}$ may differ from A/T, the amount due on the initial agreement, for two reasons. First, if any secondary borrowing has occurred in the past $\hat{T}$ years, the current obligation is the sum of the amounts due on the primary and such secondary obligations. Note that any borrowing in the last $\hat{T}$ of the T years of the initial contract extends the period in which the cohort is susceptible to saving constraints, since the secondary obligations are subject to the same stipulations as the primary contract.

The second reason $\hat{s}$ may differ from A/T is related to a second credit rationing instrument. Suppose E, possibly zero, is the amount currently due at secondary loan repayments, so that the total due is A/T + E. Lenders may require that only a fraction φ of the amount due actually be paid. Equivalently, lending institutions make available loans at the market rate of interest r in the amount:

$$(1-\varphi)\ (A/T + E).$$

φ cannot exceed 1 if advanced repayment cannot be required. Or the other hand, in order not to be a constraint under any circum stances, φ must equal negative infinity, or else r_b must equal the market interest rate r. For $\varphi > -\infty$, any borrowing in excess of:

$$(1-\varphi)\ (A/T + E)$$

occurs at the penalty rate r_b.

Monetary policies operate on consumption through these tw parameters, the penalty rate for borrowing r_b and the range of it applicability φ. Presumably by altering policy mix and institutiona structure the two parameters can be varied relative to one another. Ir our simulations, such variations create a wide range of credit marke opportunity loci facing cohorts. Borrowing can be prevented altogether with $\varphi = 1$ and r_b set prohibitively high. Algebraically smaller φ with r_b still prohibitively high corresponds to direct quantitative limits on borrowing. A lower r_b will permit price allocation beyond $(1-\varphi)(A/T + E)$.

The discussion has been in terms of a liquidity constraint faced only in the current period, and this is the basis on which our calculations have been made. But very likely a household expects also to be bound by similar constraints in the future. Calculation of the truly optimal consumption plan would then require explicit recognition of all possible future constraints and their costs. Indeed the timing of the undertaking of large illiquid investments should also be endogenous. The solution of such a nonlinear dynamic programming problem, however, is not computationally feasible for the present investigation.

E. Tax Rate Changes

A final element of the economic environment which affects consumption decisions is tax policy. All of the income streams above, both property and labor, are after-tax disposable incomes. We will consider uniform percentage reductions in incomes from each source separately and from the two together. We also examine the effects of temporary and permanent taxes. In both cases it will be assumed that the timing of the tax changes are perfectly anticipated. Interest payments are assumed tax deductible. Capital gains are taxed on an accrual basis.[12]

IV. Results of Specific Simulations

In this section we discuss the simulated effects of changes in policy instruments and of changes in expectations about the earnings stream of capital. Simulation 1, termed the "neutral" case for shorthand reference, represents the standard against which the other cases will be compared. The various simulations are defined in Table 1 and their differences relative to simulation 1 are noted. The actual time paths of r, R, q, and $\bar{R}$ for those cases in which they vary are presented in Table 2. The resulting time paths of aggregate consumption (C), aggregate wealth (W), and the personal saving ratio (S) are presented in Table 3.

[12]For computational convenience, taxes on future labor income of teenagers are not anticipated, though such taxes are imposed at the time the income is actually earned.

TABLE 1

DESCRIPTION OF EXOGENOUS CHANGES DEFINING THE VARIOUS SIMULATIONS

Simulation	Description
1	"Neutral." $r = R = \bar{R} = .0525$, $q = 1$ throughout. $r_b = .07$, $\varphi = 1.0$. No tax surcharges.
2	Interest rate changes. Starting in fourth period r declines, then rises back to initial level by ninth period.
3	Profit rate changes, short run. Starting in fourth period R rises, then declines to initial level by ninth period.
4	Profit rate changes, long run. Same short-run movement of R as in case 3. In addition, in sixth period long-run expectations change, $\bar{R}$ rises.
5	Eased liquidity constraint. $\varphi = .5$.
6	Differential liquidity constraints, $\varphi = .5$, $r_b = .07$ for higher income group. $\varphi = 1.0$, $r_b = .10$ for lower income group.
7	Tax surcharge plus capital gains. Five period increase in taxes on all income, reducing disposable income by 2 percent, coupled with an increase in R in the second period, later followed by a return to its initial level.
8	Temporary labor income tax surcharge. Labor income reduced by 2 percent for five periods.
9	Temporary property income tax surcharge. Property income reduced by 2 percent for five periods.
10	Temporary income tax surcharge. Combination of cases 8 and 9.
11	Permanent labor income tax surcharge, of same size as in case 8.
12	Permanent property income tax surcharge, of same size as in case 9.
13	Permanent income tax surcharge, of same size as in case 10.
14	Eased liquidity constraint. $\varphi = 0$.
15	Temporary labor income tax surcharge, of same size as in case 8, plus eased liquidity constraint. $\varphi = 0$.
16	Interest rate changes, same as case 2, plus eased liquidity constraint. $\varphi = 0$.
17	Profit rate changes, same as case 3, plus eased liquidity constraint. $\varphi = 0$.

TABLE 2

TIME PATHS FOR r, R, q, $\bar{R}$ IN THE SIMULATIONS WHERE THEY ARE NOT CONSTANT*

(YEARS)

Simulation	Variable	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
2,16	r	.0525	.0525	.0525	.0425	.0325	.0325	.0325	.0425	.0525	.0525	.0525
	q	1.0	1.0	1.0	1.043	1.089	1.089	1.090	1.044	1.0	1.0	1.0
	$\bar{R}$	.0525	.0525	.0525	.0515	.0497	.0483	.0471	.0472	.0483	.0491	.0498
3,17	R	.0525	.0525	.0525	.0625	.0725	.0725	.0725	.0625	.0525	.0525	.0525
	q	1.0	1.0	1.0	1.042	1.083	1.083	1.083	1.041	1.0	1.0	1.0
	$\bar{R}$	.0525	.0525	.0525	.0535	.0553	.0567	.0579	.0578	.0568	.0559	.0552
4	R	.0525	.0525	.0525	.0625	.0725	.0725	.0725	.0625	.0525	.0525	.0525
	q	1.0	1.0	1.0	1.042	1.082	1.082	1.082	1.041	1.0	1.0	1.0
	$\bar{R}$	.0525	.0525	.0525	.0535	.0625**	.0625	.0625	.0615	.0597	.0583	.0571
7	R	.0525	.0625	.0725	.0725	.0725	.0625	.0525	.0525	.0525	.0525	.0525
	q	1.0	1.042	1.083	1.083	1.083	1.041	1.0	1.0	1.0	1.0	1.0
	$\bar{R}$	.0525	.0535	.0553	.0567	.0579	.0578	.0568	.0559	.0552	.0547	.0542

*In other simulation these variables have the constant values they have in simulation No. 1, namely $r = R = \bar{R} = .0525$, $q = 1$, except that in simulations 9, 10, 12, 13, after-tax yields are 98% of .0525.

** Represents a change in long-run expectations other than as represented by the adaptive expectations mechanism of equation (III.3).

TABLE 3

TIME PATHS FOR AGGREGATE CONSUMPTION (C), MARKET VALUE OF WEALTH (W), AND THE SAVING RATIO (S), FOR VARIOUS SIMULATIONS

Simulation Number and Type	1 Neutral			2 Easy Money			3 Capital Gains--Short Run			4 Capital Gains--Long Run			5 Eased Liquidity Constraint			6 Differential Liquidity Constraints		
YEARS	C	W	S	C	W	S	C	W	S	C	W	S	C	W	S	C	W	S
1969	592.5	1894.8	.061	592.5	1894.8	.061	592.5	1894.8	.061	592.5	1894.8	.061	596.2	1894.8	.056	592.0	1894.8	.062
1970	607.9	1933.3	.066	607.9	1933.3	.066	607.9	1933.3	.066	607.9	1933.3	.066	614.3	1930.1	.057	607.2	1934.0	.068
1971	624.2	1976.3	.071	624.2	1976.3	.071	624.2	1976.3	.071	624.2	1976.3	.071	633.0	1967.4	.059	623.5	1978.2	.073
1972	641.3	2023.8	.076	655.4	2111.2	.054	650.6	2108.6	.089	650.6	2108.6	.089	652.1	2007.0	.061	640.7	2027.5	.079
1973	660.1	2076.3	.079	687.2	2243.5	.038	681.3	2258.9	.103	676.2	2256.1	.109	671.8	2049.2	.063	659.7	2082.1	.083
1974	683.4	2133.2	.078	706.2	2271.4	.042	705.6	2336.4	.101	701.7	2339.3	.107	693.4	2094.4	.064	683.0	2141.5	.081
1975	707.6	2190.8	.076	729.5	2302.9	.040	730.7	2415.8	.101	727.7	2423.6	.105	715.9	2141.6	.064	707.2	2202.1	.080
1976	732.1	2249.2	.075	738.5	2234.8	.057	744.9	2402.0	.088	742.7	2414.4	.092	739.3	2190.7	.065	731.8	2263.5	.079
1977	756.8	2308.6	.073	748.3	2184.5	.076	758.0	2376.0	.077	756.4	2391.8	.080	763.2	2241.8	.065	756.6	2326.3	.079
1978	781.5	2369.8	.075	772.5	2246.0	.077	782.7	2439.1	.077	781.6	2457.6	.080	787.8	2294.9	.065	781.5	2391.1	.079
1979	806.8	2433.1	.075	796.6	2310.4	.079	807.9	2504.4	.077	807.2	2525.3	.080	812.9	2350.1	.066	807.0	2458.2	.079

TABLE 3 (cont'd)

TIME PATHS FOR AGGREGATE CONSUMPTION (C), MARKET VALUE OF WEALTH (W), AND THE SAVING RATIO (S), FOR VARIOUS SIMULATIONS

Simulation Number and Type	Neutral			7 Temporary Surcharge Plus Capital Gains			8 Temporary Labor Income Tax			9 Temporary Property Income Tax			10 Temporary General Income Tax			11 Permanent Labor Income Tax		
YEARS	C	W	S	C	W	S	C	W	S	C	W	S	C	W	S	C	W	S
1969	592.5	1894.8	.061	590.0	1894.8	.046	589.5	1894.8	.050	593.0	1894.8	.057	590.0	1894.8	.046	584.6	1894.8	.058
1970	607.9	1933.3	.066	612.9	2002.9	.066	604.4	1925.6	.054	608.1	1930.8	.063	604.5	1923.1	.051	599.5	1930.6	.063
1971	624.2	1976.3	.071	637.4	2127.2	.084	620.3	1960.4	.059	624.0	1971.4	.068	620.1	1955.5	.056	615.3	1970.7	.068
1972	641.3	2023.8	.076	654.9	2185.7	.089	637.0	1999.1	.063	640.7	2016.8	.073	636.4	1992.1	.060	631.9	2015.4	.073
1973	660.1	2076.3	.079	674.5	2250.1	.093	654.4	2042.1	.067	658.7	2067.4	.078	653.3	2033.2	.065	649.6	2065.0	.077
1974	683.4	2133.2	.078	692.6	2230.9	.092	678.7	2089.8	.081	682.2	2122.9	.079	677.5	2079.1	.082	672.1	2119.4	.076
1975	707.6	2190.8	.076	706.4	2209.7	.078	702.9	2149.7	.079	706.5	2181.3	.077	701.7	2139.6	.080	695.7	2175.0	.075
1976	732.1	2249.2	.075	731.0	2269.8	.077	728.1	2210.5	.078	731.2	2240.2	.076	727.0	2201.0	.078	719.7	2231.3	.074
1977	756.8	2308.6	.075	755.4	2331.0	.077	753.5	2271.8	.076	756.0	2300.1	.075	752.6	2263.0	.077	744.0	2288.6	.073
1978	781.5	2369.8	.075	780.0	2394.1	.077	778.9	2334.2	.076	780.8	2361.7	.075	778.1	2325.9	.076	768.2	2347.5	.073
1979	806.8	2433.1	.075	805.0	2459.6	.078	804.3	2398.2	.076	806.1	2425.3	.075	803.6	2390.2	.076	792.8	2408.4	.074

TABLE 3 (cont'd)

Simulation Number and Type / YEARS	Neutral C	Neutral W	Neutral S	12 Permanent Property Income Tax C	W	S	13 Permanent General Income Tax C	W	S	14 No Liquidity Constraint C	W	S	15 No Liquidity Constraint, Labor Tax C	W	S	16 No Liquidity Constraint Easy Money C	W	S	17 No Liquidity Constraint Capital Gains C	W	S
1969	592.5	1894.8	.061	594.3	1894.8	.055	586.3	1894.8	.052	597.7	1894.8	.054	595.2	1894.8	.041	597.7	1894.8	.054	597.7	1894.8	.054
1970	607.9	1933.3	.066	609.4	1929.5	.060	600.9	1926.8	.057	617.0	1928.7	.053	614.4	1920.6	.040	617.0	1928.7	.053	617.0	1928.7	.053
1971	624.2	1976.3	.071	625.5	1968.6	.065	616.5	1963.2	.062	637.0	1963.4	.053	634.3	1946.4	.040	637.0	1963.4	.053	637.0	1963.4	.053
1972	641.3	2023.8	.076	642.3	2012.3	.070	632.8	2004.0	.067	657.7	1998.9	.053	654.9	1972.4	.038	675.7	2085.2	.027	665.5	2082.6	.068
1973	660.1	2076.3	.079	660.0	2060.8	.075	649.9	2049.6	.072	679.0	2035.4	.053	676.1	1998.5	.038	717.3	2196.3	.002	694.8	2216.3	.084
1974	683.4	2133.2	.078	682.6	2114.4	.075	671.5	2100.3	.074	700.9	2073.1	.053	697.9	2025.0	.054	740.2	2195.4	.005	717.0	2279.0	.085
1975	707.6	2190.8	.076	706.2	2169.6	.074	694.4	2153.0	.072	723.5	2112.1	.053	720.5	2064.4	.054	763.4	2192.6	.006	740.2	2345.1	.086
1976	732.1	2249.2	.075	730.9	2225.8	.072	718.2	2206.9	.071	746.8	2152.5	.053	743.8	2105.4	.054	766.7	2095.5	.019	755.6	2322.5	.073
1977	756.8	2308.6	.075	755.7	2282.8	.071	742.7	2262.1	.070	770.7	2194.5	.054	767.7	2147.9	.055	768.2	2021.8	.046	771.6	2287.3	.058
1978	781.5	2369.8	.075	780.6	2341.2	.071	767.0	2318.3	.070	795.2	2238.2	.054	792.1	2192.3	.055	790.9	2059.0	.049	797.3	2335.0	.057
1979	806.8	2433.1	.075	805.7	2401.4	.072	791.7	2376.3	.070	820.2	2283.6	.054	817.1	2238.3	.055	814.5	2099.3	.050	823.3	2383.4	.057

The simulations are hypothetical even though they are labelled with real calendar years. The first year corresponds to 1969. In particular, actual disposable income of historical 1969, $631.6 billion, will be disposable income for our 1969 as well, except in those simulations where tax surcharges are imposed. The 11 periods of each simulation are labelled 1969-1979.

Time paths for C and S are graphed for selected simulations in Figures 5 and 6. In examining these, it should be recalled that generally we have simulated both halves of a cycle in whatever exogenous variable is being changed. Thus in case 2, r first declines, then rises. In deriving estimates of various marginal propensities and elasticities, however, only the first period in which a change occurs is of interest to us, since it is only that period that *ceteria paribus* really obtains. By the next period people have begun to react to the changed environment.

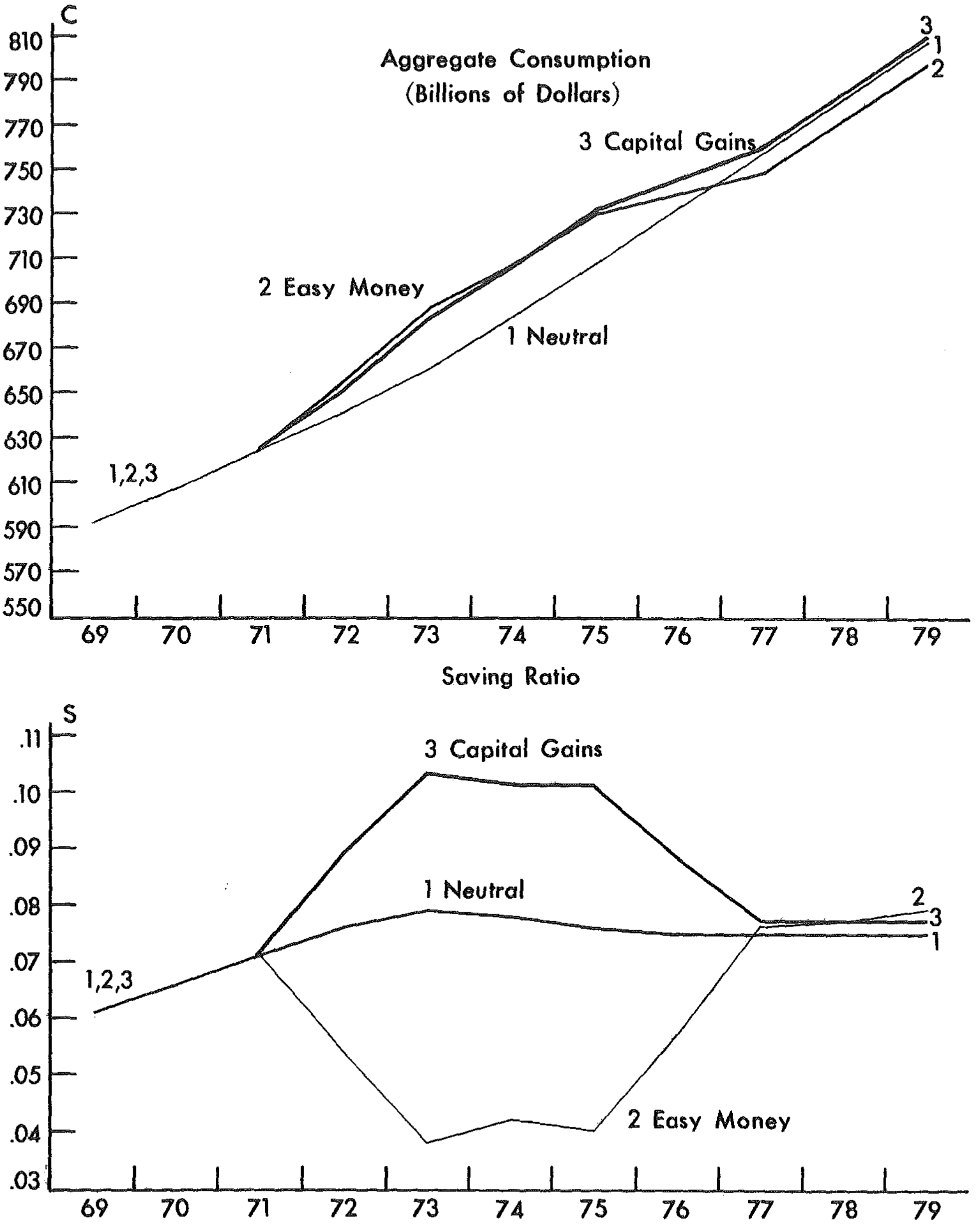
It is assumed that in the years prior to the start of the simulations r and R have been constant at .0525 long enough for .0525 to be regarded as the normal level for both. Hence $\bar{R}$ = .0525 and q = 1 initially. With regard to the obligatory saving required of younger cohorts, it will be assumed that all previous payments have been made on schedule and that no secondary borrowing has occurred.

Comparisons of certain of the simulations below will permit us to obtain approximate estimates of the marginal propensity to consume from total resources and its components. For reference we have calculated the average propensity for 1969 in our simulations. This average, the ratio of aggregate consumption to the present value of aggregate total lifetime resources, is .055. In a world from which liquidity constraints are absent, the marginal and average propensities are equal for a life cycle model.

An examination of simulations 1, 2, and 3 indicates that both lower interest rates and higher capital incomes stimulate consumption. In the former case (2) the actual disposable income of individuals has not changed (relative to case 1). Income streams from capital and from labor have not changed, though they are discounted at a new interest rate. In the latter case (3) disposable income has increased, since R, the earning stream from capital, has risen.

In both cases there has been an unanticipated increase in W, having a positive income or wealth effect on present consumption. The substitution effect works in opposite directions in cases 2 and 3, favoring current consumption in the former where r declines and

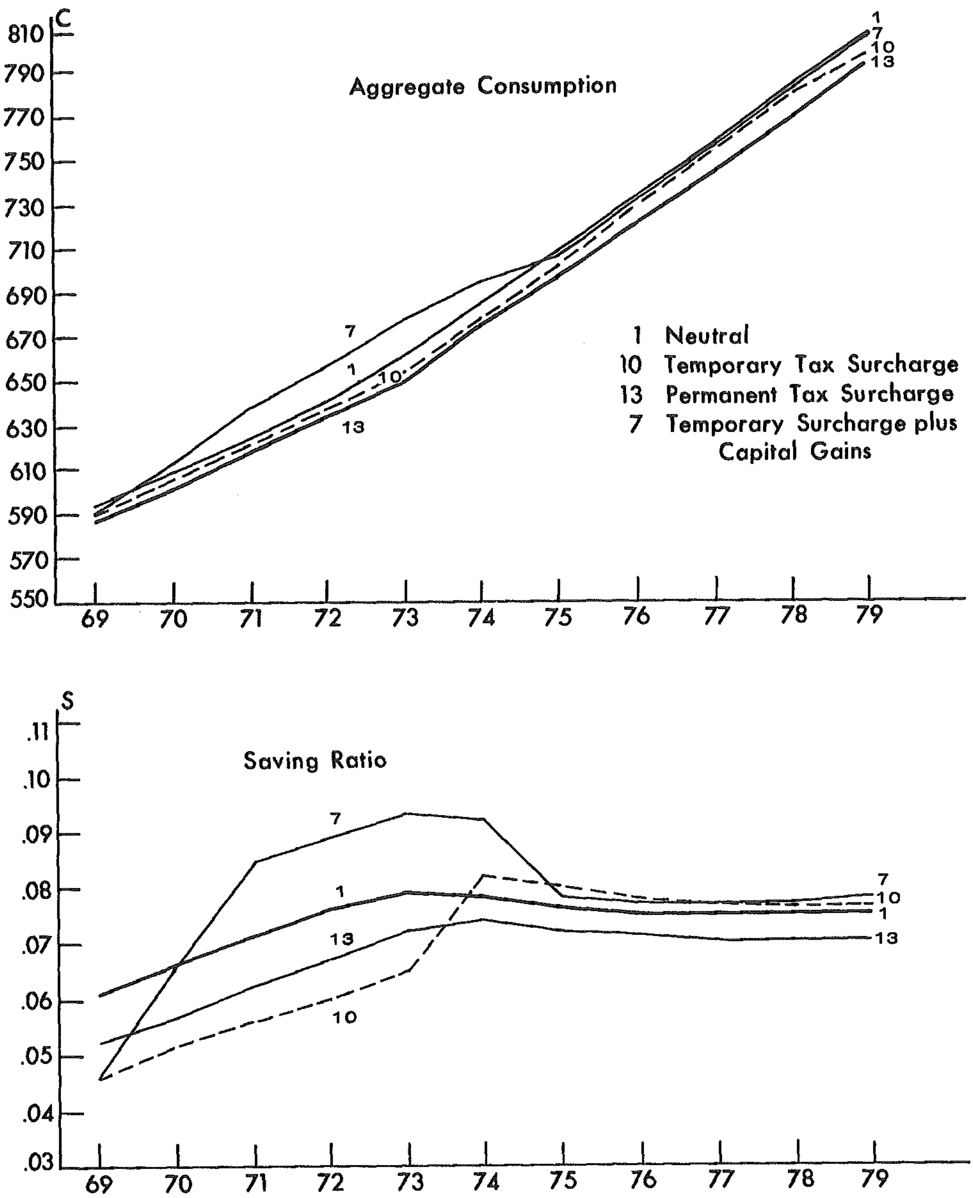
CHART V
SIMULATION PATHS 1-3



SOURCE: Table III; Paths 1, 2 and 3

Chart VI

SIMULATION PATHS 1, 7, 10, 13



SOURCE: Table III, Paths 1, 10, 13, 7 respectively working against current consumption in the latter case where r rises.[13]

Because we have observations on the two different cases we can derive approximate magnitudes for an aggregate marginal propensity to consume from wealth and for an interest-elasticity of consumption. Our technique as demonstrated in the appendix indicates that the marginal propensity to consume from wealth is of the order of .09 to .12.

This is our second estimate of the marginal propensity to consume from total resources. It is considerably higher than our finding above, affirming the theoretical reasoning about the effects of liquidity constraints. Some caution is required in attaching significance to the magnitude of the difference, however, since the current estimate, for reasons indicated in the appendix, is perhaps the least precise we have attempted. The indicated interest elasticity of consumption is between -.02 and -.43.

In an attempt to evaluate the influence of liquidity constraints on the marginal propensity to consume from wealth, we have repeated simulations 1, 2, and 3 in simulations 14, 16, 17 with the liquidity constraint relaxed sufficiently to insure that no cohorts were constrained in the years 1969-1972. Repeating the calculations described in the appendix, we find the probable values of the marginal propensity to consume out of wealth to be bracketed by .08 to .14. The interest elasticity is -.04 to -.72.

The changes in r and R in cases 2 and 3 occur in two equal steps in 1972 and in 1973 in the simulations. The percentage capital gains, measured by $\Delta q/q$, are roughly the same in both cases and roughly equal in the two years. Consumption also is increased in two roughly equal steps, but more in case 2 than in case 3. The consumption increments over the neutral case are $14.1 billion for 1972 and $27.1 billion for 1973 for case 2; $9.3 billion for 1972 and $21.2 billion for 1973 for case 3. As q declines in two steps in 1976 and 1977, the excesses of C over the neutral case also decline. Why does simulation 3 exhibit a smaller impact on consumption? The difference is in the direction of the substitution effects. It is shown even more dramatically by the saving ratios (.103 in 1973 for case 3 as against .038 for case 2.) The correspondingly greater capital formation in case 3 eventually leads to greater consumption there despite the substitution effect favoring saving.

[13]Recall that because expectations are such that equilibrium will be re-established with $R = r = \bar{R}$, and because $\bar{R}$ is influenced by R, r is expected to rise even in the case where it is R that has changed initially.

Simulation 4 differs from simulation 3 only in that in 1973 long-run profit expectations change. The substitution effect favoring current saving is greater, but certainly more moderate than the difference between the long-run profits rates (72 basis points in 1973) might superficially indicate. The explanation lies in the fact that the current levels -- and hence the expected levels for the immediately following years -- of R and r are the same in the two cases (R = .0725, r = .0525 in 1973). Since the expected rates in the near future have more influence than those further distant, the effects on consumption are not too dissimilar.

Simulations 5, 6, and 14 examine the influence of changes in the instruments affecting liquidity. Case 5 differs from case 1 only in that φ is .5 in the former rather than 1.0. In case 14, φ is zero. That is, it is possible in case 5 (14) for individuals to borrow up to half (the entirety) of their contractually required saving at the market rate of interest r rather than at a penalty rate r_b. In case 1 all of the borrowing incurs the penalty rate. The result in case 5 is to increase consumption by $4 billion to $11 billion in various years, with wealth accumulation suffering a concomitant decrease ($83 billion over the 10-year period). In case 14 consumption exceeds that of case 1 by $5.2 billion to $18.9 billion. Accumulated wealth is less by $149.5 billion.

In simulation 6 the two income groups face different liquidity constraints. As in case 5, the higher income group is assumed to be able to forego half of its required saving costlessly (φ = .5) and to be able to borrow beyond that at a rate of 7 percent (r_b = .07). The lower income group may not borrow costlessly (φ = 1.0), and they must pay more for the funds they do borrow (r_b = .10). Relative to those in case 1, the credit market conditions are eased for the higher income group and are more stringent for the lower income group. The negative incentive on the consumption of the poorer group has a stronger influence, as aggregate consumption declines slightly relative to case 1.

The savings ratios are better indicators of the effects in the later years. By then greater disposable income due to more capital accumulation permits more absolute consumption. By 1979 wealth in case 6 exceeds wealth in case 1 by $15.1 billion.[14]

[14]Most of this, however, reflects an artificiality in the simulations. In our calculations, not only reduced consumption but also reduced penalty interest payments permit greater accumulation. The institutions engaging in lending are considered exogenous to the household sector. Hence disposable income equals not just consumption plus saving, but rather consumption plus saving plus penalty interest premiums on loans. We intend in further calculations to redistribute these payments as incomes to wealth-owners.

A comparison of cases 8 to 13 with case 1 indicates that a labor income tax reduces consumption, a property income tax increases it, and a general income tax -- a combination of labor and property income taxes -- decreases consumption, but less than the labor income tax alone initially. In these simulations the time paths of other variables, including the before-tax rates of return, r, R, and $\bar{R}$, are the same as in the reference simulation, case 1. The variable q remains at par, in the face of the tax on property income, because it is assumed that R and r are lowered in the same proportion.

The taxes on labor income have only wealth or income effects on consumption. They do not affect rates of return, do not have a substitution effect. The property income tax has both, with the substitution effect in favor of current consumption (since after-tax rates have declined) being stronger than the effect of the income lost in tax payments.

In principle a tax surcharge that is expected to be temporary should have little effect on current consumption, the effect being spread over the remaining years of life. Comparing cases 1 and 8 for 1969, we find consumption reduced by $3.0 billion. The aggregate expected reduction of lifetime resources is $47.8 billion (not shown). Thus our third estimate for the marginal propensity to consume from total resources is .063.

To test our theoretical proposition that operative liquidity constraints may increase this marginal propensity, we have duplicated the comparison of cases 1 and 8 with a relaxed liquidity constraint ($\varphi = 0$) in cases 14 and 15. We find a reduction in first period consumption of $2.5 billion, indicating that the tighter credit market conditions of simulation 8 enhance the effectiveness of the tax increase by about 20 percent. The corresponding marginal propensity to consume is .052, close to the average propensity (and theoretical unconstrained marginal propensity) of .055 and somewhat lower than the liquidity-constrained .063 found in simulations 1 and 8.

In simulation 11, in which labor income streams are reduced uniformly for all years, a $162.4 billion decrease in total resources leads to a $7.9 billion decrease in first period consumption. The corresponding marginal propensity, which is roughly the marginal propensity to consume out of total resources, is .049.

As we noted above, a general income tax increase does not initially lower consumption as much as a labor income tax alone because of the disincentive effect on saving of lower expected rates of return. The decreased capital accumulation eventually leads to a reversal, however, with more consumption occurring in the case of the labor income tax alone. It must be recalled, however, that we do not attempt to take into account the system-wide response of before-tax rates of return to variations in the size of the capital stock.

One of the explanations offered for the apparent ineffectiveness of the tax surcharge of the 1960's is that capital gains enjoyed by individuals had a more than offsetting effect on consumption. We have found results consistent with this explanation in simulation 7. There we imposed a temporary (five-year) reduction of 2 percent on all income as in case 10. The corresponding tax revenue is $12.6 billion for 1969. In addition, we assumed increases in capital earnings starting in the second year as indicated in Table 2. In the first year, before the first increments to wealth, consumption is less than in the standard case by $2.5 billion. With the first capital gains, however, consumption increases by $5.0 billion, and ultimately by $14.4 billion, relative to case 1.

In the discussion of the use of temporary changes in taxes as stabilization policies, a consumption tax has been suggested as a more powerful alternative to an income tax.[15] A temporary consumption tax contains, as an income tax does not, an incentive to postpone spending. It has a substitution effect as well as an income effect. For illustration, we have simulated (but not tabulated) the results of a flat rate consumption tax, unexpectedly imposed and known to last only one year. As expected, this tax is much more effective than an equivalent income tax in discouraging current consumption. Comparing equal yield ($14.5 billion) one year consumption and income taxes, we found the former reduced consumption by $13.2 billion (relative to case 1) while the latter was only one-eighth as effective, cutting consumption by only $1.7 billion.

V. Conclusions

1. The method is promising. The model generates aggregates which are realistic and plausible in magnitude and in their simulated time paths. We are certainly not entitled to conclude that American households are actually conforming to the life-cycle model, much less to our specialization of it. But assuming that they are doing so gives reasonable results. In further work more attention should and can be paid to sources of differences among households other than

[15] See Tobin, 1969, pp. 211-2.

age; to the effects of uncertainties on consumption and accumulation plans; to the diversity of assets available for saving; and to other features of the "real world" that the model of the present paper omits or oversimplifies.

2. Revaluations of nonhuman wealth do, according to the model, have important effects on consumption and saving. But these effects depend significantly on the nature of the revaluation, in particular on the concomitant changes in current and expected interest rates. In our "easy money" simulation (2), a reduction of interest rates brought about by monetary policy increased consumption by 16.1 percent of the increase in wealth it accomplished. In simulation 4, wealth and consumption both rise because of a nonmonetary shock: profits and expected profits rise. The increase of consumption is 8.8 percent of the increment of wealth.

3. Liquidity constraints make a difference. In our simulations they are binding on younger and poorer segments of the population. In their absence, the marginal propensity to consume currently from an increase in consumable resources -- current wealth plus the present value of labor income -- would be the same as the average, about .055. Our simulations indicate the marginal propensity to consume from current wealth to be .09 to .12. The excess is attributable to the role of realizable capital gains in relieving liquidity constraints on current consumption.

For the same reason, the marginal propensity to consume from current disposable income is higher than it would be in a perfect capital market. Our simulations of tax changes give permanent changes 2.6 times as much effect on current consumption as temporary (five-year) changes. This difference is in the expected direction, but in a model without liquidity constraints it would be larger, 3.4 times instead of 2.6 times. These comparisons would be more striking if our "temporary" tax rise lasted a shorter time.

4. Monetary policies tighten or relax liquidity constraints. Changes in those constraints, including the differential between borrowing and lending interest rates, have important effects in themselves, as comparison of simulations 1, 5, 6, and 14 indicates. Moreover, the tightness of liquidity constraints helps to determine the effectiveness of other policy instruments. A temporary tax increase, for example, is 1.2 times as powerful in the tight credit simulation (8 relative to 1) as in the easy credit simulations (15 relative to 14).

To construct a complete story of the linkages of monetary policy to the propensity to consume, it would be necessary to specify how given Federal Reserve operations simultaneously change interest rates, capital values, and liquidity constraints. We have not attempted to provide those links in the chains of causation.

APPENDIX

DATA SOURCES AND INITIAL CONDITIONS

The initial population was that of the United States on July 1, 1969 as estimated in *Current Population Reports* (Series P-25, 1970, Table 1, p. 12) for ages 0-84. The estimated 1.29 million people aged 85 and above were ignored. The birth rates by single age of mother were interpolated from grouped data for 1967 reported in the *Statistical Abstract of the United States* (1969, p. 48). As noted in the text the birth rates for women younger than 18 were set at zero. To compensate, birth rates for ages 18-21 were increased slightly.

Mortality rates for 1967 for ages 0-69 also came from the *Statistical Abstract* (1969, p. 54). For ages 70-84, mortality rates were interpolated from crude death rates calculated from grouped data in *Demographic Yearbook of the United Nations* (1969, pp. 169, 603). The interpolations from the two sources were constrained to be continuous at age 69.

The simulations required the assigning of all males and of females younger than 18 to cohorts. No direct observations were available on the initial values of the

$$N_{pm}(x, a), N_{pmc}(x, a), N_{pmt}(x, a), N_{pfc}(x, a), \text{ or } N_{pft}(x, a)$$

(number of adult males, male children, male teenagers, female children, female teenagers, respectively, aged a in cohorts with adult females age x). The $N_{pm}(x, a)$ were approximated by frequency distributions $\pi_m(x, a)$ of husbands aged a by age of wife (x).

Unmarried males were assigned with the same distribution used for husbands. Thus for $N_m(a)$ the total number of males aged a, $N_{pm}(x, a)$ is given by

$$N_{pm}(x,a) = \pi_m(x,a) \cdot N_m(a)$$

Note

$$\sum_x N_{pm}(x,a) = \sum_x \pi_m(x,a) \cdot N_m(a)$$

$$= N_m(a) \sum_x \pi_m(x,a) = N_m(a)$$

since for the frequency distribution $\pi_m(x, a)$ the sum $\sum_x \pi_m(x, a) = 1$. The $\pi_m(x, a)$ were interpolated from tables grouped both by x and by a in *Current Population Reports* (Series P-20, 1969, Table 17, p. 83).

The distributions for children and teenagers were interpolated from tables in *Current Population Reports* (Series P-20, 1969, Table 6, p. 51) which strictly applied only to age distributions of youngest children. This distortion was somewhat offset, however, by the fact that the distributions as used were assumed to apply to the age of the mother (cohort age) while the reported distributions were by age of head of household. Further, the distributions were restricted to be consistent with the assumptions that females do not bear children before age 18 nor after age 49.

The preceding discussion applies to the derivation of the initial distributions among cohorts. Distributions for later years of the simulations are generated through the use of the appropriate birth and mortality rates as the simulations progress. The only additional demographic assumptions required concern the assignment of new 21-year-old males and 18-year-old females, and of the males surviving the disbanding of the 84-year-old cohort. It is assumed that the initial distribution of 21-year-old males, $\pi_m(x, 21)$ applies in all future years as well. Similarly, the new cohort forming with 18-year-old females is assigned $\pi_f(a) \cdot N_f(18) = N_{pm}(18, a)$ males where the π_f are constant over time and are interpolated from *Current Population Reports* (Series P-20, Table 17, p. 83).

The implication of assigning to the new cohort a full complement of males of various ages is that some males originally assigned to one cohort are reassigned to a younger cohort. A more realistic model of household formation would of course resolve the problem, but such completeness is not feasible. The current simplification has only minor effects and only on the younger cohorts.

The two income groups correspond to groups above and below the Level 1 Poverty Line as defined in Projector and Weiss (1966, p. 37) (roughly $3000 for a family of four in 1963). The indication there, and the assumption we have used, is that 70 percent of the population is in the higher income group and that their income is four times as great as that of individuals of the same age and sex in the lower income group. After approximate adjustment for omitted items (life insurance cash balances, pension rights, annuities) the average net worth of group I was also about four times that of group II.

The actual wealth profiles by age used as initial conditions were interpolated from Projector (1968, Table S17, p. 316), then scaled up to give a wealth-disposable income ratio of 3.0 for the first year simulated. The four-to-one ratio between net worth of individuals in the two groups was maintained. In interpolating, net worth of zero for cohorts aged 18 and 85 was assumed.

In a similar manner, interpolated labor earnings by age for 1967 from Projector and Weiss (1966, pp. 162-6) were scaled up to $532.1 billion. This is the labor share of disposable income in 1969 consistent with the wealth-disposable income ratio and rate of return on capital assumed. Again the four-to-one ratio between the earnings of the two groups was maintained. Thus a male aged i in group j (j=1,2) earns $\beta^m_{ji} \cdot y^m_{1,40}$ and a female earns $\beta^f_{ji} \cdot y^m_{1,40}$, where $y^m_{1,40}$ represents the labor income of a forty-year-old male in the first group. We have $\beta^m_{2,i} = 1/4 \cdot \beta^m_{1,i}$ and $\beta^f_{2,i} = 1/4\beta^m_{1,i}$. The β^m and β^f are assumed constant over time, while $y^m_{1,40}$ grows exponentially at the rate γ:

$$y^m_{1,40}(t+1) = (1+\gamma)y^m_{1,40}(t) \quad .$$

In deriving the β^m and β^f from Current Population Reports (Series P-60, 1969, Table 3, p. 26), the median incomes reported there were multiplied by the percentage of the age-sex group receiving income to account for participation rates. Since the estimates do not exclude property income, we have the set β^m_{ji}, β^f_{ji} for i $\geq$ 65 equal to zero.

DERIVATION OF AN ALLOCATION RULE: NO LIQUIDITY CONSTRAINTS

For ease of explication we shall present the analysis of this section in terms of a behavioral unit consisting of a single individual. The grand utility function of a cohort will be a sum of individual utility functions, weighted by appropriate equivalent adult weights.

We assume the utility function $u(c_0, c_1 \ldots, c_{a^*-x})$ for an individual aged x has the specific form

$$u(c_0, c_1, \ldots) = \sum_{i=0}^{a^*-x} u(c_i)(1+\delta)^{-i} \frac{s(x+i)}{s(x)} \qquad (A.1)$$

where

$$u(c) = A - Bc_i^{-\rho+1} \qquad (A.2)$$

and a* is the last age to which individuals survive given the mortality table assumed, δ is the pure rate of time preference, s(x) is the probability of surviving from birth to age x, A and B are arbitrary constants of no consequence (except that B must be positive), and $-\rho$ is the (constant) elasticity of marginal utility. We assume $-\rho = 1.5$. (Assuming a form for u of u(c) = log c as in Tobin [1967] is equivalent to choosing $\rho = 1$.

Assuming first a world of perfect capital markets with no constraints on dissaving and no divergence between the borrowing and lending rate, the optimal consumption plan results from maximizing the Lagrangean

$$\mathcal{L} = \Sigma u(c_i)(1+\delta)^{-i} \frac{s(x+i)}{s(x)} + \lambda \left(W(1+r_0) + W_h - \Sigma c_i (1+\tilde{r}_i)^{-i} \frac{s(x+i)}{s(x)} \right) \qquad (A.3)^*$$

*W is multiplied by $(1+r_0)$ since in this discrete model there is a distinction between beginning of period and end of period stocks. W is interpreted as the beginning of period stock and thus earns r_0W in the current period. The model is recursive rather than simultaneous: first production occurs, using the beginning of period capital stock, then the savings decision allocates output between consumption and investment.

W is the market value of non-human wealth

$$W = \left(\sum_{i=1}^{\infty} R_i^e (1+\tilde{r}_i)^{-i}\right) K = qK\,, \qquad (A.4)$$

and W_h is human wealth

$$W_h = \sum_{i=0}^{a^*-x} y_i (1+\tilde{r}_i)^{-i} \frac{s(x+i)}{s(x)}\,. \qquad (A.5)$$

The expected labor income i years hence is y_i. $\tilde{r}_i$ is the expected i period rate of interest

$$(1+\tilde{r}_i)^i = (1+r_1^e)(1+r_2^e)\ \ldots\ (1+r_i^e) \qquad (A.6)$$

where r_j^e is the expected one period rate of interest j periods hence. Differentiating (A.3) and eliminating λ from the resulting first-order conditions yields

$$c_i = \left(\frac{1+\tilde{r}_i}{1+\delta}\right)^{\frac{i}{\rho}} \cdot \frac{W(1+r_0) + W_h}{\sum \left[(1+\tilde{r}_i)^{\frac{\rho-1}{\rho}} (1+\delta)^{\frac{1}{\rho}} \right]^{-i} \frac{s(x+i)}{s(x)}} \qquad (A.7)$$

The second factor on the right of (A.7) is a constant independent of i. Consumption per person-year in the i^{th} year exceeds (is the same as, is less than) c_0 if $\tilde{r}_i > \delta$ ($\tilde{r}_i = \delta$, $\tilde{r}_i < \delta$). Since recalculation occurs every year, only the first year of the consumption plan need be actually realized.

DERIVATION OF AN ALLOCATION RULE: WITH LIQUIDITY CONSTRAINTS

Let $\hat{s}$ represent the amount of saving the individual is obligated to do in the current period. As indicated in the text, $\hat{s}$ will equal a fraction φ of A/T plus any payments due on secondary loans undertaken. If an individual wishes to save less than $\hat{s}$, he has only one option. He may borrow at a rate r_b, paying back by making equal payments against the principal of $1/\hat{T}$ in each of the next $\hat{T}$ years.

Let $\hat{c}$ be the amount of consumption which would result if exactly $\hat{s}$ were saved out of current income. Then the Lagrangean is

$$\mathcal{L}' = \Sigma u(c_i)(1+\delta)^{-i} \frac{s(x+i)}{s(x)} + \lambda_1 \left(W + W_h - (c_0 - \hat{c}) \Sigma (r_b - r_i^e) \frac{\hat{T}-i}{\hat{T}} (1+\tilde{r}_i)^{-i-1} - \Sigma c_i (1+\tilde{r}_i)^{-i} \frac{s(x+i)}{s(x)} \right) + \lambda_2 (c_0 - \hat{c}) \qquad (A.8)$$

The term $(c_0 - c)\Sigma(r_b - r_i^e) \frac{T-i}{T} (1+\tilde{r}_i)^{-i-1}$ represents the net interest loss on new borrowing, $c_0 - \hat{c}$. The constraint associated with the multiplier λ_2 insures that individuals cannot lend at the higher borrowing rate r_b, i.e. $c_0 - \hat{c}$ must be non-negative. Differentiating and solving for the c_0 yields

$$c_0 = \left(\frac{1}{1+Q}\right)^{\frac{1}{\rho}} \frac{W + W_h + \hat{c}Q}{\Sigma \frac{s(x+i)}{s(x)} \left[(1+\tilde{r}_i)^{\frac{\rho-1}{\rho}} \frac{1}{(1+\delta)^{\rho}} \right]^{-i} + [1+Q]^{\frac{\rho-1}{\rho}} - 1}, \quad \lambda_2 = 0 \qquad (A.9)$$

or

$$c_0 = \hat{c}, \quad \lambda_2 \geq 0,$$

where

$$Q = \Sigma (r_b - r_i^e) \frac{\hat{T}-i}{\hat{T}} (1+\tilde{r}_i)^{-i-1}$$

AN APPROXIMATE ESTIMATE OF THE MARGINAL PROPENSITY TO CONSUME FROM WEALTH AND THE INTEREST ELASTICITY OF CONSUMPTION

Let us summarize the influence of r_1^e, r_2^e, ..., r_n^e, ... on aggregate consumption by a single variable r^e. Similarly let us indicate the impact of the R_i^e by R^e. Let W denote aggregate wealth. Then we can write current aggregate consumption as

$$C = C(W(R^e, r^e), r^e, \pi, \ldots) \qquad \text{(A. 10)}$$

π, the current aggregate earnings on capital enter separately because, as noted above, W as a valuation of the earning stream from non-human sources does not include earnings in the current period. We need not specify the other variables affecting consumption since they will be held constant in obtaining our estimates.

Differentiating (A.10) with respect to R^e, r^e, and π yields

$$dC = C_W(W_R dR^E + W_r dr^e) + C_\pi d\pi + C_r dr^e \qquad \text{(A. 11)}$$

where C_W, W_R, W_r, C_π, C_r represent partial derivatives of the functions C and W with respect to the subscripted variables. Now $C_\pi = C_W$ since an extra dollar of market value of wealth and an extra dollar of income -- income in the present period only -- both command the same consumption value today and hence both augment the present value of cohort lifetime resources by the same amount.

Assume that the various partial derivatives C_W etc. are approximately constant in the neighborhood of variation of the values of C, W, π , r^e, and R^e involved in our simulations. Then we may apply equation (A.11) to the non-infinitesimal changes in variables between two of our simulations for which all other variables are unchanged. The 1972 values of the variables for simulations 1, 2, and 3 meet this criterion. Thus dC is the difference in the 1972 values of aggregate consumption between cases 2 and 1: dC = 655.4 - 641.3 = 14.1. For case 3, dC = 9.3. The expression $(W_R dR^E + W_r dr^e)$ is dW, and is 87.4

and 84.8 for the two cases respectively. $d\pi$ is zero for case 2 and 20.3 (not shown) for case 3. Since $C_\pi = C_W$ we may write

$$14.1 = 87.4\, C_W + C_r dr_2^e \qquad \text{(A. 12)}$$

$$9.3 = 105.1\, C_W + C_r dr_3^e \qquad \text{(A. 13)}$$

where dr_2^e and dr_3^e are the changes in r^e from case 1 for cases 2 and 3 respectively.

The dr_i^e are unobservable, but we can bracket their values. From table 2 we see that in case 2, the current interest rate in 1972 is .0425, which is less than that in case 1 by .01. $\bar{R}$, the normal rate to which future rates are expected to return, is less in case 2 than in case 1 by .001 = .0525 - .0515. The differential between the two cases in expected one period rates of return in 1972 is nearly -.01 for early periods and is closer to -.001 for later periods. dr_2^e is some weighted average of these differentials, and is thus bounded by -.01 and -.001. Similarly dr_3^e is a weighted average of 0.0 (differential between cases 1 and 3 in r) and 0.001 (differential in $\bar{R}$). Solving the two equations (A.12, A.13) by using the four sets of boundary values dr_2^e = (-.01, -.001), dr_3^e = (0, .001) yields the solutions for C_W and $C_r \cdot \frac{r}{C}$ presented in the text. In converting to the interest elasticity values of r and C for 1972 in simulation 2 were used.

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DISCUSSION

GARDNER ACKLEY

Before getting down to my specific assignment, I want to offer my congratulations to Frank Morris and his associates for centering the attention of this Conference on consumer spending.

Consumer spending is one of those subjects about which my own intellectual history can best be described as "the more I know the less I know." To some extent I think this description summarizes the experience of the entire economics profession -- or at least of that generation whose careers began, as mine did, just in time to be caught up in the Keynesian revolution. It didn't take most of us very long -- after digesting Keynes, and after looking at early national income and product data -- to be convinced that we knew all we needed to know about aggregate consumer spending, and that our real puzzles lay in investment spending, and in the macroeconomics of prices, wages, and income distribution.

But confidence -- my own, at least -- that consumer spending is easy to understand, has progressively deteriorated. The deterioration of my confidence has, if anything, accelerated in the last few years as I have been asked to pose as a GNP forecaster, and as I have realized more concretely than ever before how much difference the shift of a few tenths of a percentage point in the saving rate can make for a forecast, and thereby for a policy prescription. It does seem to me that economists have been continually peeling away one after another layer of mystery or misunderstanding about consumer spending, only to find another, denser one below. I hope -- but I

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must say I am not very confident -- that our discussion here today will get us at least a little closer to the kernel of truth. In any case, I regard the effort as extremely high on the priorities list for macroeconomics. That is why I am glad that Frank and his associates planned this Conference on the theme of consumer spending.

Part of our subject matter traces back to the resolution of one of our earliest puzzles about consumption. Macroeconomic observation appeared to show that, in the long run, aggregate consumption was roughly proportional to income, not a declining fraction of a rising income as Keynes' introspection, the evidence of budget studies, and national income and product data for the 1930s had all suggested. The belief that the marginal propensity to consume was less than the average -- and perhaps even declined as income rose -- was of course a powerful strand in the Stagnationist position. It supported apocalyptic visions of an inevitable crisis of capitalist development -- as well as a cheap case for income redistribution.

Causes of Differences in Savings Rates

But Jim Duesenberry, Jim Tobin, Franco Modigliani (who are here), Milton Friedman (who is at least well represented here), and others helped us to see how we could reconcile data that related to differences in individual consumption behavior at different levels of individual income with data relating to changes in aggregate consumption as aggregate income changed. One part of this reconciliation involved the recognition that much of the *difference* in savings rate at different incomes had to do with *stages in the life cycle:* many of the dissavers or low savers with low incomes were young families, whose consumption reflected not only current income but also expected future income; others were families with retired earners engaged in planned dissaving. Many of the high-income, high savers were people at the peak of their earning capacity, repaying their early debts and preparing nest eggs for retirement. Further cases of high saving at high incomes and low or negative savings at low incomes perhaps represented persons with substantial temporary or windfall components of income, positive or negative. Still another part of the reconciliation consisted of correcting the misclassification, as "consumption," of consumers' investment in durable goods.

Now it is one thing to recognize that these factors may well provide all or an important part of the reconciliation between cross-section and time-series evidence on consumption; or to hypothesize on the basis of them that consumption depends not only on current but also on past and expected future incomes; or even perhaps to conclude that changes in the age distribution and the family structure of the population might powerfully affect aggregate personal saving. But it is quite a further step to hypothesize, as Modigliani explicitly does in his paper here that "the consumption of a representative household over some arbitrary short period of time, such as a year or a quarter, reflects a more or less conscious attempt at achieving the preferred distribution of consumption over the life cycle, subject to the constraint imposed by the size of the resources accruing to the household over its lifetime"; and then to use this hypothesis as the entire basis for a theory of consumption behavior -- as does Modigliani, and as do Tobin and Dolde.

I happen to be singularly unconvinced as to either the correctness or the usefulness of this hypothesis. But my problems with it are made rather more acute in the case of Dolde and Tobin than they are in the case of Modigliani and collaborators. For the empirical hypothesis that aggregate consumption spending depends on wealth as well as on income does not require full acceptance of the individual behavioral hypothesis which I have just quoted. It could be based on far less restrictive -- possibly even on quite unrelated -- behavioral hypotheses. But the Dolde and Tobin simulations, and their implications for prediction and policy, are based on the full and complete acceptance of this individual behavioral principle (more royalist than the King, as Jim Duesenberry suggested) -- but with one major modification, namely, "subject to liquidity constraints."

Three Different Impacts of Wealth on Consumption

Now if one is going to simulate the life cycle hypothesis of consumer behavior, I doubt that one could do a better job, at least as a starter, than Dolde and Tobin have done. They clearly show that the theory requires at least three different kinds of impacts of wealth on consumption, depending on whether a change in wealth consists of (a) wealth accumulated from saving, with no change in the parameters that are assumed to effect the desired level and pattern of accumulation; or (b) changes in wealth associated with changes in the expected earning power of real assets; or (c) changes in asset values associated with changes in interest rates. This should make us cautious about empirical macro-functions which use a single undifferentiated wealth variable, and that is all to the good.

Nevertheless, let me make a couple of complaints regarding their methodology which seem largely independent of my basic difficulties with the underlying hypothesis. Then I will try to explain briefly some of my more fundamental reservations about the entire exercise.

As I understand it, Dolde and Tobin assume a population which consists of 134 different kinds of families. These families are cross-classified according to 67 different ages of the wife (ranging from 18-85), and according to two income brackets (poor and non-poor), the average income of the former being taken as 1/4 that of the latter. The initial number of families in each class and the initial differences among their characteristics more or less correspond -- in many but not all respects, and with various adjustments and simplifications -- to the actual population, income, wealth, and debt structures of 1969. But each family within each of these 134 types is assumed to be "actuarily average." That is, it has the same size, age and sex composition, income level, lifetime income profile, debt-repayment schedule, access to borrowing, and wealth as every other family in its class. Therefore, it also has the same consumption and saving.

Realism of the "Average" Liquidity Constraint Assumption

One hundred thirty-four family types must be a fairly large number to manipulate, and I can well understand the reasons for not having twice, or 10 times, as many. Yet I cannot agree that the crudeness of the division is of slight consequence for the results, which is what the authors sometimes suggest. The model might be adequate if it were not for the very great importance of the one qualification that the authors impose on the strict life cycle hypothesis, namely, "subject to liquidity constraints." The reason is that liquidity constraints are not symmetrical in their effects. They constrain consumer spending when liquidity is inadequate, but an excess of liquidity does not, I think, symmetrically expand such spending.

Take a specific example. Assume that the average non-poor family, wife aged 48, is marked by a structure of family size and composition, income and income expectations, wealth, debt and required debt repayment -- and hence of consumption and saving -- such that the total impact on consumption of a given temporary tax increase could be spread in unconstrained fashion over the remaining years of the family's life in a way that would maximize discounted lifetime utility. For the *average* family in this class, in other words, there is no liquidity constraint. But when we recognize that non-poor families, wife aged 48, comprehend a wide variety of different family sizes and compositions, incomes and income expectations, wealth, required debt repayment -- and hence of individual consumption and saving -- then liquidity constraints might require or induce a great many of these families to meet the added tax payment all or largely out of current consumption. The remaining families in the class would not, however, spend correspondingly more. Simulating the behavior of the *average* family in each of 134 classes thus seems to me to fail to do justice to the wide variety of individual situations that must impose liquidity constraints on a great number of them. If liquidity constraints are important -- and I am sure that I believe they are more important than do our authors -- then the "actuarily-average" assumption must greatly underplay their impact.

While we are on the liquidity constraint assumption, let me also complain that in the simulations used, these constraints are not assumed to be substantially, or at all realistically, constraining. As I understand it, all families are assumed to have quantitatively unlimited access to credit; and have no hesitation in using it, so long as the substitution of current for future consumption will increase discounted utility. The constraint lies in the fact that, if families have contractual debt repayments, then all or some part of their borrowing -- at the margin -- may be at a penalty interest rate. In most of the simulations, the penalty interest rate is 7 percent. In one case the penalty rate for the poor is 10 percent. I wonder if that realistically or significantly reflects the kind of liquidity constraints which exist.

Now the more severe the constraint imposed by a family's illiquidity, and the more numerous are the families exposed to such constraint, then, as the authors show, the less significant will be the effects on consumption of changes in wealth and/or interest rates, and the greater the effect of temporary tax changes. If the authors have greatly underrepresented the effects and the incidence of these constraints, their simulations must give quite misleading quantitative results. I may add that I am puzzled by the assumption that monetary policy can significantly and differentially affect -- or ever afford to be aimed to affect -- the two particular dimensions in which the authors assume liquidity constraints to vary. Structural policies, yes; direct controls, yes; but general monetary policy? I very much doubt it.

Consideration of Changes in Earned Income

My second general problem with the simulation model relates to its neglect of what I had assumed was the most powerful implication of the life-cycle hypothesis, namely: that consumption should vary with changes in the expected level and time pattern of future labor income. In the present treatment, consumption is seen to vary with changes in the expected earning power of non-human wealth but not in that of human wealth. Yet the latter quantity is far larger and -- I should guess -- every bit as variable. The model contains no parameter (other than the rate of taxation of labor income) which is readily variable to explore the implications of changed expectations of labor income. My own guess is that small changes in expected labor earnings should swamp the effects of substantial changes in all the other variables considered in the model, and that changes in these expectations often -- even typically -- accompany changes in monetary and fiscal policy, and changes in asset yields.

To be sure, the present study is aimed at the effects of policy, and of monetary policy in particular. But as Tobin and Dolde continue their simulation studies, I hope they will find some way to expand their model to permit systematic analysis of variations in expected labor incomes.

Now let me turn to my problems with the hypothesis itself in its broadest form. What does it assume?

First: It assumes that each family has at all times a *definite, conscious* vision

· of the family's future size and composition, including the life expectancy of each member;

· of the entire lifetime profile of the income from work of each member -- after the then applicable taxes;

· of the present and future extent and terms of any credit available to it;

· of the future emergencies, opportunities, and social pressures which will impinge on its consumption spending;

· of present and future interest rates and rates of return on any equities it owns (after taxes); and (as one part of the solution of a system of simultaneous equations) of the amount of its saving or dissaving in every future year, and of the wealth it will own and the debts it will have at all future points of time.

Does each family have at all times such a definite, conscious vision of its economic future? I wonder. Indeed I wonder if it even always knows a number of the *current* facts assumed to be most important: the current available rates of return on savings; the current cost and availability of credit; even its current income, consumption, saving, and asset values. Yet for the assumed process of intertemporal allocation to be meaningful, and for it to have most of the consequences deduced, the family needs to have a reasonably clear vision on these and other matters extending well into the future.

I have been trying to use that greatest of all research techniques of the economist -- introspection -- to discover whether I now or ever possessed any reasonably clear vision on most of these matters. I may be a pecularily unimaginative guy, but I think that my answer has to be negative. To be sure, I never assumed that someday I would be a millionaire and therefore never thought very much about borrowing a half million dollars to buy a yacht. But I believe that the theory requires a somewhat more sensitive vision than that.

Second: The theory assumes that the family's vision, whether correct or incorrect, is held with sufficient *certainty* for more than a short period ahead to be meaningful. Otherwise, the discount for uncertainty -- and the changing discount for changing degrees of uncertainty -- would appear to prevent any rational or stable lifetime planning of consumption. It may be that there are (or have been) more stable societies than ours, in which people live much as their fathers did, where one is reasonably certain what he can expect and what will be expected of him. But in a world numb with "future shock" does this behavioral hypothesis really have meaning for our society? My own uncertainty discounts for the year after next are exceedingly high!

Third: The theory assumes that each family makes rational, conscious, and rather complex calculations based on its vision, which result in a lifetime plan for spending and saving; and that it repeats these calculations, and alters its lifetime spending plan, on the basis of every significant change in the information which it receives or the expectations which it holds. These must be conscious and rather sophisticated calculations, not at all intuitive, and ones that use fairly precise -- i.e., quantitative -- information and fairly precisely formulated expectations. Do people actually go through these assumed calculations, and repeat them each time there is a change in monetary or fiscal policy, as well as each time there are independently occuring changes in the economic environment? Some do, I am sure. But how many? The past five years have seen some of the most pronounced changes we are ever likely to witness in monetary and fiscal policy, as well as in levels of equity prices, values of owner-occupied houses and other consumer assets, and, of course, in incomes and (I assume) income expectations. I suppose that, as an economist, I should be ashamed to confess that I cannot think of a single consumption or saving decision which I have made in this period which was consciously or (so far as I can reconstruct) unconsciously influenced by these changes -- other than in income and income expectations. If *you* have made such changes in your consumption spending over the past five years, was it a continuous revaluation based on each 10 basis point change in interest rates and each 10 point change in the Dow Jones? This would seem to be what is required if monetary policy is going to accomplish any even reasonably fine tuning through consumption effects.

Fourth: The hypothesis assumes that each family starts with nothing and ends with nothing. Its lifetime consumption equals its lifetime income. Dolde and Tobin casually remark that if the family plans to make bequests or if it receives or expects to receive them, this circumstance can easily enough be accommodated into the theory. But does this not dismiss without analysis what may well be a large part of the phenemenon of saving? If each family actually had zero lifetime saving, and income and population were constant, aggregate personal saving would have to be zero. Positive saving, of course, arises from population and income growth. But does it not also arise in significant amounts from net accumulations passed from one generation to the next? If even one generation planned to and did consume over its lifetime its entire resources, could not much of our wealth be wiped out? Bequests and capital preservation seem to me to be major facts of life. Certainly not all bequests and all failures to consume capital are accidental or irrational. How then do they fit into the pattern of rational allocation assumed by the theory? What aspects of economic evolution or economic policy might influence the size of such planned bequests? How might they influence the strength of the desire to save, or the pressure to preserve or to spend capital? Surely the theory leaves what seem to me to be exceedingly crucial questions dangling.

Let me conclude by suggesting a fifth assumption that life-cycle theorists must be making. They must assume that alterations of current consumption behavior arising from altered lifetime spending plans based on lifetime utility maximization are not swamped by those changes in consumption that respond to other influences, and therefore that allocating research effort to this approach is an efficient investment in seeking to understand and thus better to forecast consumer spending. My previous questions must imply that I have some doubts about this assumption. However, I think that we all must follow with great interest the continuing work of those who assume that lifetime utility maximization provides a fruitful framework for analyzing consumption and saving behavior.

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REBUTTAL

JAMES TOBIN

I will begin with Gardner's last remark. One response to it is that there is no difficulty in accommodating initial wealth and bequests into the life cycle model. One can, for example, extend the life cycle to include the famous three generations from shirt sleeves to shirt sleeves, instead of just one generation. That could be done, and I think that we will try to do that in further work if we are not altogether discouraged by what Gardner said.

But the more important response is this: What is wrong about what Gardner said is the assertion that it is not possible to account for the existing volume of wealth in a country like the United States without assigning a substantial part of that wealth to the bequest motive. The fact is I have made some calculations of this in a paper published a few years ago called "Life Cycle Saving and Balanced Growth."[1] With the growth rates of population and productivity in the United States, and with the demographic structure and income profiles characteristic of the U.S. population, one can account for -- without any bequest motive whatsoever -- the holding of wealth in relation to income of the order of magnitude which exists in the United States. Even though no generation saves, the economy as a whole saves because of the growth of population and per capita income. There is a revolving fund which is saved up by young people and middle-aged people and then turned over by old people to younger people who are coming along in the next generation. The fund would be constant in an economy stationary in both population and productivity. But it is not constant -- it is forever growing in a

[1]See: *Ten Economic Studies in the Tradition of Irving Fisher,* Wm. Fellner, ed., New York: J. Wiley & Sons, 1967, pp. 231-256.

growing economy, and it can easily be of the magnitude of the wealth/income ratios we have observed. So I think that Gardner has misunderstood the situation on that point.

Many of Gardner's complaints about the modeling of the things we were trying to take into account are well taken. I think that in subsequent work we would like to include more income classes and more differences among consumers within income classes. As Gardner correctly pointed out, there are some important nonlinearities in the model, particularly those introduced by liquidity constraints. These mean that averages of the results are not the results of the average determinants. He is correct in that, and we can do more to avoid biases of aggregation.

Nevertheless, I think we did a lot of disaggregation. And in doing a lot of disaggregation we called attention to a number of phenomena which are usually concealed in completely aggregative approaches to the same problem: for example, age differences and liquidity constraints. It is a little annoying, I must say, when you engage in a certain amount of disaggregation, to be told that you should have done more: and that since you didn't do more you might as well rely on the old aggregative relationships which didn't do any. I don't know what the optimal amount of disaggregation is. There are limits of space in the storage of computers and even limits to the time of people like Walt Dolde, but we probably can do more and will push along that line.

The logic of the consumption functions used by practicing economists has shown for a good many years a tension between a liquidity theory and a wealth theory. The Keynesian consumption function, the basis of the Keynesian multiplier, relates consumption to disposable income. It really is largely a liquidity theory. Otherwise there is no explanation why you should expect consumption to be related to the current flow of income in any constant systematic manner. Rather you would expect it to be related to these longer run calculations of resources that we have tried to deal with.

Now if it had been true that the income-flow theory of consumption was a resounding success, and that its indications were being borne out all the time, then we wouldn't need to go into the wealth theory or the life cycle theory and all that. We wouldn't need to seek a more fundamental theory about why saving ratios are what they are and how they relate to various parameters. But we all know that the cash income theory is not a resounding success. The assumption that in our economy there is a tight income-consumption linkage enforced by the fact that people don't have any other source of money to spend is false. The linkage is not that tight. We saw an example in the miscalculation made in regard to effects of tax surcharge.

So we face the necessity of formulating a more fundamental model. There is ample evidence that the permanent income or life cycle theory is moving in the right direction, away from the strictly mechanical disposable income consumption relationship.

The general issues of methodology of economics would take us into a long argument. I think that much of what Gardner said about that would be a criticism of all economics. Economists do make rather pure abstract assumptions about the way decisions are made by business firms and by households, for all kinds of problems. If you are going to say, "Well, *I* don't make them exactly that way and I don't know people that make them that way," then we are really left looking for some other method of constructing hypotheses and figuring out their implications. In my opinion, these things do work out at the margin and in the aggregate in a good enough way to justify our procedures. Pretending, even if somewhat counterfactually and unrealistically, that decisions are made on a rational basis -- or with some purpose to them, as Jim Duesenberry said -- is a worthwhile way of proceeding. If it isn't a worthwhile way of proceeding, then I would like to know what other way we should proceed.

The Impact of Monetary Policy on a Revised Version of "Consumer Spending"

PAUL J. TAUBMAN

Once upon a time in a faraway place, cattle was used for money. Alas, one black and gloomy day a wicked witch destroyed half the herd. With the fall in the supply of money, consumption of milk and meat declined. In such a golden age, it is easy to construct a link between the money supply (or monetary policy) and consumption. Thus to reduce the debate among economists, maybe the U.S. should switch to the bull standard.

Until the fortunate day arrives, it is necessary to determine the less obvious links between monetary policy and consumption in both the short and long run. This paper will concentrate on the short run in which the appropriate definition of consumption is the *purchase* of durable and nondurable goods and services.

Suppose for the moment that the monetary policy undertaken is an increase in the money supply.[1] It is important to realize that such increases are not accomplished by the dropping of currency from a helicopter but by changing the monetary base through open market operations or through changes in reserve requirements. How could such changes in the money supply affect consumers? The four possible channels through which consumption could be affected are: wealth, interest rates, nonprice rationing, and consumer confidence. Let us consider in detail each of these possible routes.

[1]Other monetary policy actions are changes in the supply of Federal government bonds (bills and notes) and/or credit terms. We will consider the effects of these changes.

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The Wealth Effect

The Federal Reserve could increase the money supply and thus banks' net worth. Even with such an increase in the short run (real) interest rates could remain constant though eventually the rate should decrease. Of course an increase in bank net worth would also be reflected in consumer wealth. In addition the value of consumer wealth would increase when interest rates dropped and bond and stock prices rose.

Should an increase in wealth lead to an increase in current consumption? The standard answer of monetarists and others is yes, because it is presumed that current consumption is not an inferior good. This answer is presumably based on a model in which people allocate consumption over time with a budget constraint that includes initial wealth plus present and future earnings. Such a model certainly is given in Klein.[2] However, the most provocative discussions of such a model are contained within the permanent income hypothesis of Friedman[3] and the lifetime earnings hypothesis of Modigliani and Brumberg.[4] But as I understand their models, the wealth effect induced by counter-cyclical money supply and interest rate changes should have only minimal effects because

[2]Klein, L., *The Keynesian Revolution,* The MacMillan Company, 1907.

[3]Friedman, M., *A Theory of the Consumption Function,* Princeton University Press, 1957.

[4]Modigliani, F., and Brumberg, K., "Utility Analysis and Aggregate Consumption Functions: An Attempt at Integration" (mimeo).

TABLES and FIGURES

permanent and lifetime income would be changed trivially.[5] But temporary changes in income are supposed to be saved.[6]

Still people may not have such long run expectations and the wealth effect may play a role. (If an increase in the money supply eventually leads to price increases, the Pigou effect also can affect consumption.) It is important to note, however, that logically total consumer wealth and not the money supply is relevant and that the short run correlation between the two series need not be strong. If the major linkage between monetary policy and consumption is via this route, and if the correlation between money and wealth is weak, then the monetarists have been backing the wrong mastadon.

Effect of Interest Rate Changes

Next, consider the effect of interest rate changes. At this point we will worry about the substitution between present and future consumption. If one treats consumption in each future time period as a different good, then a change in the interest rate need not discourage present consumption if it is a complement to some future consumption.[7] I believe, however, that most monetarists and Keynesians would agree that the short-run interest rate substitution effect on present consumption is small, almost negative. In principle, however, there is a type of monetary policy which should generate large impacts. Suppose the banks were to have clearance sales on auto or other durable good loans. Then consumers should be willing to advance their purchase date for the durable.[8]

[5] Of course each individual could expect to switch back into money before the next counterbalancing interest rate increase. I don't think that either Professor Friedman or Professor Modigliani would be comfortable basing his analysis on such a fallacy of composition.

[6] However, in these theories saving includes investment in durables. Such investment should be included in consumption for short-run analysis.

[7] See Patinkin, D., *Money, Interest and Prices,* Row, Peterson and Co., 1955, and Leviatan, N., "Multiplied Future Consumption as an Aggregate," *American Economic Review,* 1966.

[8] In general, the stock of durables provides services of varying quality. In the short run, consumers may vary the quality of services by advancing or postponing purchase dates or by substituting repairs for replacement. A fairly big impact could occur here. Cf Chow, G., "Statistical Demand Functions and Their Use for Forecasting," *The Demand for Durable Goods,* A. Harberger ed., University of Chicago Press, 1960.

Nonprice Credit Rationing

The third possible linkage is via nonprice rationing of credit. If for some reason banks have not set market clearing prices for consumer loans, then an increase in the money supply could lead to more loans and more consumption at a given interest rate. While it is often alleged that commercial banks, S&L's and others do use nonprice rationing, it is difficult to demonstrate this in general and in particular for consumer oriented loans.[9] Except in a few crisis periods and immediately thereafter, it might be expected that credit rationing is an unimportant link. There are, however, several reasons why this conclusion could be wrong. First I would argue that until recently banks were very wary of consumer instalment debt, auto loans etc. and treated these items as residual loan categories. Thus for consumers a form of nonprice credit rationing was in existence, though in varying proportions for much of the period.[10] Secondly banks can respond to money supply changes by altering the borrower characteristics that are acceptable. Since the available data do not present interest rates by risk class for consumer loans, we could have a situation where "average" interest rates are unchanged but where loans and consumption increase. These linkages would be very difficult to isolate by specific variables, but even the money supply is probably not a good proxy because of the greater acceptability of consumer loans by banks during the sample period.

Consumer Confidence

The final linkage between the money supply and consumption can be through consumer confidence. Keynes, if not Keynesians, would argue that the marginal propensity to consumer varies with confidence and/or with expectations. Why would the money supply be related to confidence? Changes in the money supply can affect interest rates and stock market capitalization rates. In turn it has been shown that variations in stock prices (about a trend) are correlated with consumer attitudes and with consumption (net of the

[9]However, as explained below, an important part of consumption is related to housing starts, which can be affected by credit rationing and interest rate changes.

[10]Moreover, such a situation means it is very difficult to estimate the demand for auto and other loans. See Dhrymes, P., and Taubman, P., "An Empirical Analysis of the Savings and Loan Industry," *Study of the Savings and Loan Industry,* I. Friend ed., Federal Home Loan Bank Board, 1969.

impact of disposable income).[11] On the other hand many other cyclical variables such as the unemployment rate and the length of the work week have also been found to be correlated with consumption and automobile purchases.

To me there are still some basic problems that must be resolved before accepting the expectation linkage. First, stock market changes affect directly only a very small percentage of the population. (In any sample period, extending back into the 50's, the percentage would have been even smaller.) Of course confidence is supposed to be different from the capital gains included in wealth effects; thus, people other than stockholders could be affected by stock market developments. But I would be surprised if most people follow the market. Of course peoples' confidence can be affected by cyclical developments they know about, e.g. unemployment, but then the effect of monetary changes would have to come via the previous linkages. Thus I would not be willing to accept monetary policy as having a direct link via confidence.

Monetary policy has more slings than the money supply. As far as the monetarists are concerned, it is an outrageous fortune that one can find statements in Friedman to the effect that changes in the supply of bonds should affect the economy as much as changes in the money supply.[12] Of course open market operations have offsetting effects on the supply of bonds and money. Since such switches would cause the types of effects discussed earlier, there would be no need to study the supply of bonds and money separately. But the government can leave money unchanged and issue new bonds to cover a deficit. Thus even if monetarists do not want to include all consumer wealth in the consumption function, some of them should include government bonds.

Other policy tools such as interest rate ceilings can lead to rationing type linkages which can have an indirect impact on consumption. For example such ceilings can affect housing starts but a large amount of consumer durables (stoves, air conditioners) are installed when the housing unit is built (see below).

[11] See for example Friend, I., and Adams, G., "The Predictive Ability of Consumer Attitudes, Stock Prices and Non-Attitudinal Variables," *Journal of the American Statistical Association,* 1964.

[12] I am sure the effects would be the same for credit rationing.

Finally we should at least acknowledge the possibility that consumption determines the money supply with increased demand for durables leading to more loan demand and deposits. I would think however, that such an explanation is more relevant for business investment.

The Data

Ultimately all the above arguments should be subjected to empirical verification. I think such validation is extremely difficult to accomplish not only because some of the concepts and mechanisms are hard to quantify, but also because the standard data on consumption and income available from the Department of Commerce are quite inappropriate for the purpose of short-run employment (and price) analysis. Indeed they are the data I would characterize as the weakest link in the verification of the various theories.

In a longer paper from which this one is drawn, I give a more detailed analysis of the deficiencies (for short-run analysis) of the standard data and of the changes I have made. To save space I will give only a brief summary here. A comparison of the data in 1964 is given in the appendix. Some items of consumption do not cause employment as conventionally measured.[13] The most well known example is the imputed consumption for owner-occupied homes. There are also corresponding items of income that cannot be spent on those consumption items that cause employment. I eliminate these items from consumption and income. Second, disposable income includes current employer contributions to and earnings on private pension funds while benefits paid do not enter into disposable income. I reverse this procedure and treat private pensions in a manner similar to the public pensions (Social Security). Personal non-taxes, which are fines and payments to public hospitals and colleges, are currently subtracted from personal income. Instead, following the suggestion in Klein,[14] I treat these items as consumption. Finally the household sector currently includes nonprofit institutions, but to the extent possible, I remove them.

[13] On the other hand, the data include consumption expenses such as brokers' fees which are for personal business. These items should be included in consumption for my purposes but not for welfare comparisons. Cf Machlup, F., *The Production and Distribution of Knowledge in the United States*, Princeton University Press, 1962.

[14] Klein, L., "Saving Concepts and Data," *Savings in the Modern Economy*, W. Heller ed., University of Minnesota Press, 1953.

In figure 1, the ratios of consumption to disposable income on the official and revised bases for annual data are given. Thus the new series has a lower average propensity to consume, it has a different cyclical pattern, and it does not have the increase in level for 1959-64 apparent in the official series. Both series show a sharp drop in the average propensity since 1964. I will comment on the cause of this decline later.

I have estimated functions for each of the categories of food, clothing, personal care, household operations, housing, transportation, personal business, recreation, education, medical, and foreign travel. These categories are functional groupings that in some instances include items that are durable, nondurable, or services.[15,16]

The equations have been estimated by ordinary least squares for the period 1954-1965 without taking into account interequation restrictions and without specifying a utility function. (The reasons for these choices are given in the larger paper.) Where appropriate, I have corrected for serial correlation using the scanning technique described in Cochrane-Orcutt. All flow variables are expressed in real per capita terms.

Results

The (quarterly) equations to be discussed are given in Tables 4 and 5. First let us finish some preliminary matters. For the period 1954-1965, my revised quarterly series appear to be more useful than the official data. For example in those consumption categories in which there have been no revisions, revised disposable income yields a higher R^2 than does the official income series. Moreover, the revised series has an elasticity of consumption with respect to disposable income much closer to 1.

[15]This breakdown was chosen because it combines those items among which there is much substitution. A durability breakdown does not accomplish this goal as well. A more detailed functional breakdown was used by Houthakker, H., and Taylor, L., *Consumer Demand in the United States, 1929-1970,* Harvard University Press, 1966, while a more aggregrative one was used by Pollak, R., and Wales, T., "Estimation of the Linear Expenditure System," *Econometrica,* 1969.

[16]Some of the quarterly data were obtained by interpolating annual series.

Speed of Adjustment

One important question for both monetary and fiscal policy is how quickly and consistently responses occur. The results I have obtained for disposable income, which I would expect to be pinned down more easily than wealth or interest rate effects, are not encouraging. For example, one way to examine the lags in responses is to include in the equation a number of previous quarters of disposable income. For each category of consumption, I computed equations in which each of up to four quarters of lagged disposable income was entered as a separate variable. Whether I used two, three, or four lags (and regardless of other variables included) seldom is more than one disposable income figure significant, and never more than two. Except for the housing and transportation categories, only the current disposable income figure was important. These results, which suggest a quick response to income changes, may be because of multicollinearity.

An alternative way to examine the speed of adjustment to income changes is to include the lagged dependent variable. (There are other roles that such a variable can play.) When the lagged dependent variable is included in the various equations, as shown in Table 1, we find a coefficient ranging from .7 to .98 in seven categories (clothing, personal care, housing, medical expenses, foreign travel, recreation, and education).[17] With such speeds of adjustments, less than 60 percent or 30 percent respectively of the long-run effect of a change in income is felt in one year. Given such slow adjustments, one would expect some of the lags in disposable income to be significant.[18] Of course it could be argued that the inclusion of the lagged dependent variable – even with serial correlation – is not appropriate, but I remain to be convinced of that.

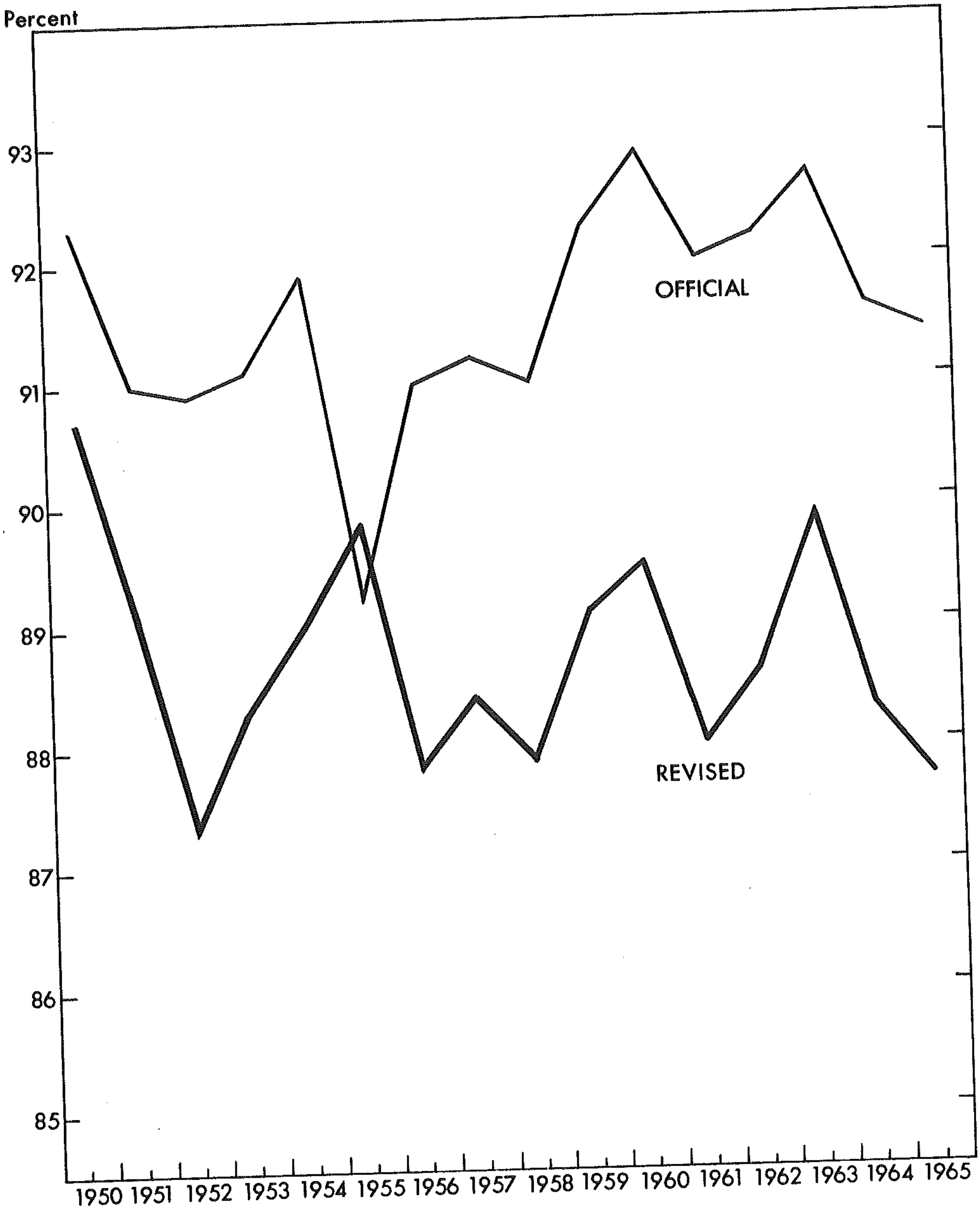
The explanation for these contradictory results may be the following: Over the span of, say, a year, the effect of a change in income can have an impact of X, but the particular impact felt in any quarter could be highly uncertain and variable for several reasons. First, the quarterly income and consumption series may have a large

[17] As noted earlier, we have eliminated the effect of serial correlation in these equations.

[18] Even if it were argued that we have omitted some longer lags of Y, these omitted variables should be positively correlated with both consumption and the included lags in disposable income; hence, the coefficients on the included income variables should be based upward.

FIGURE I

RATIOS OF CONSUMPTION TO DISPOSABLE INCOME



amount of offsetting error from quarter to quarter (because of seasonal adjustment and other smoothing techniques). Second, the effect of an income change on consumption may be dependent on many other variables. The lagged dependent variable is significant because it tends to pick up the long-run cumulative impacts. An alternative explanation is that the lagged dependent variable is significant because of other phenomena and that it is wrong to interpret the coefficient as a speed of adjustment.

Another somewhat surprising aspect of these results is that transportation and household operations, which contain most of consumer durables, do not have significant lagged dependent variables. But this can be explained in terms of a Houthakker-Taylor derivation of the equation estimated. In their analysis the lagged dependent variable's coefficient can represent either a habit or a stock adjustment effect. For food the declining average propensity to consume in the sample period apparently is captured by the negative coefficient. For the other two categories the stock adjustment effect (on the transformed lagged stock) is outweighing any other effect of C_{t-1}. Thus when estimates of the stock of autos and of durables are included in the equations for transportation and household operations, there is only a marginal improvement in the equation but the coefficients on C_{t-1} increase. Moreover when housing starts are included in the household operations, equation C_{t-1} becomes positive and significant. (See below for a more complete discussion.)

Accepting the results for each equation in Table 1 at face value, the one quarter effect of an income tax change would be .43 or 60 percent of the long-run effect (in equations with C_{t-1}).

While I consider these results interesting, they are not particularly germane to the topic of this conference. As a first step in examining the linkages problem, I included an individual's net worth series in each of my equations. The net worth variable, which was kindly supplied by Robert Rasche from the Fed-MIT-Penn model data bank, includes a) financial assets net of liabilities b) the value of physical assets such as houses, autos and other durables.[19] As noted earlier, it is the net worth variable and not the money supply that should be relevant to consumption.

Even after eliminating serial correlation, and thus some spurious correlation connected with the business cycle, there are some effects of the wealth variable as shown in Table 2. For example, coefficients

[19]The net worth variable is in real, per capita terms.

TABLE 1

LAGGED RESPONSES OF CONSUMPTION (REVISED DATA)

Category	Constant	Y_t	Y_{t-1}	14-24	25-34	65+	Rel. Price	C_{t-1}	$\bar{R}^2$/D.W.	$\hat{\rho}$	Long Run MPC
Food	272.0	.212	-.086	6.236	.97	2.834	-62.3	-.164	.90	-.20	.11
	(4.6)	(5.5)	(2.1)	(2.8)	(.6)	(1.4)	(1.4)	(1.3)	2.1		
Food	228.4	.199	-.093	5.777	.950	2.797	-54.0	—	.90	-.34	.11
	(5.4)	(5.8)	(2.5)	(2.9)	(.6)	(1.5)	(1.3)	—	2.2		
Clothing	-61.4	.081	-.069	4.732	-.614	1.741	40.1	.815	.95	-.57	.06
	(2.5)	(4.9)	(4.1)	(4.5)	(.9)	(2.2)	(1.9)	(11.4)	2.2		
Clothing	177.3	.102	-.012	4.687	.172	-.695	-175.0	—	.91	.16	.09
	(2.0)	(4.2)	(.5)	(2.2)	(.1)	(.3)	(2.7)	—	2.9		
Personal	3.6	.006	-.006	.043	-.108	-.098	.5	.963	.99	-.40	.01
Care	(.4)	(3.3)	(2.8)	(.3)	(.9)	(.8)	(.1)	(24.2)	2.0		
Personal	18.8	.001	.007	.554	-1.284	-.195	7.7	—	.93	.70	.01
Care	(1.0)	(2.0)	(1.5)	(1.4)	(4.8)	(.5)	(.5)	—	1.7		
Housing	95.8	.001	.025	-.040	.325	1.000	-119.3	.723	.99	.15	.09
	(3.3)	(.08)	(3.3)	(.1)	(1.2)	(2.5)	(5.2)	(13.8)	1.9		
Housing	247.6	.020	.048	.283	-.069	1.140	-264.8	—	.93	.25	.07
	(4.8)	(1.6)	(3.3)	(.3)	(-1.8)	(1.1)	(4.8)	—	1.9		
Household	136.9	.121	.059	.601	-.097	.673	-189.5	-.052	.95	.72	.17
Operations	(1.5)	(5.4)	(2.3)	(.3)	(.1)	(.4)	(2.9)	(.4)	1.8		
Household	137.3	.119	.053	.655	-.123	.572	-187.1	—	.95	.70	.17
Operations	(1.6)	(5.6)	(2.3)	(.4)	(.1)	(.3)	(2.9)	—	1.9		
Medical	20.1	.012	-.005	1.346	-.718	-.090	-6.8	.826	.99	-.18	.04
	(1.3)	(2.1)	(.9)	(3.6)	(2.2)	(.3)	(.8)	(13.0)	2.1		
Medical	1.4	.022	.013	1.850	-1.450	-.116	47.1	—	.97	.65	.04
	(.05)	(2.5)	(1.3)	(2.6)	(2.5)	(.2)	(2.7)	—	1.9		

TABLE 1 (cont'd)

Personal Business	.7 (.1)	.013 (4.5)	.004 (1.2)	.519 (2.4)	-.300 (2.4)	-.155 (.7)	-3.0 (17.5)	.091 (1.7)	.99 1.9	.62	.02
Personal Business	-2.3 (.3)	.014 (5.3)	.005 (1.6)	.474 (2.2)	-.302 (2.2)	-.092 (.4)	-3.0 (20.2)	— —	.98 .5	.69	.02
Transportation	431.4 (1.5)	.023 (.3)	.152 (1.8)	-4.539 (.7)	-5.494 (1.0)	-8.816 (1.3)	-271.8 (1.9)	.110 (.8)	.41 1.9	.61	.20
Transportation	412.8 (1.4)	.027 (.4)	.168 (2.1)	-6.043 (1.0)	-4.772 (.9)	-8.301 (1.2)	-276.4 (1.9)	— —	.32 1.8	.66	.19
Recreation	41.5 (2.2)	.043 (6.0)	.016 (1.7)	.552 (1.0)	-.301 (.8)	-.547 (.9)	-38.6 (3.5)	.050 (.4)	.92 1.7	.70	.06
Recreation	41.1 (2.2)	.043 (6.1)	.018 (2.5)	.548 (1.0)	-.256 (.7)	-.510 (.9)	-39.3 (3.7)	— —	.918 1.6	.73	.06
Education	-1.5 (.2)	.003 (1.2)	-.002 (.8)	.285 (2.4)	-.022 (.3)	.062 (.5)	-1.8 (.4)	.929 (18.9)	.96 2.1	-.14	.01
Education	-8.5 (.9)	.006 (2.4)	.004 (1.4)	.221 (1.1)	-.144 (.9)	-.160 (.7)	-.40 (.1)	— —	.36 1.9	.87	.01
Religious Activity	Put into Personal Outlays										
Foreign Travel	2.0 (2.0)	.0003 (1.0)	-.003 (.9)	.020 (1.0)	-.025 (1.3)	-.003 (1.7)	.5 (.4)	.827 (8.6)	.99 2.7	-.31	0
Foreign Travel	5.1 (2.5)	-.0005 (.8)	.0002 (.4)	.075 (1.9)	-.043 (1.1)	-.114 (3.0)	6.6 (5.9)	— —	.97 2.0	.30	0
Σ Coefficients a/		.43	.08	9.0	-6.3	-3.4					
Σ Coefficients b/		.55	.21	9.1	-7.3	-5.4					

a/ Equations with C_{t-1}

b/ Equations without C_{t-1}

significant at the 5 percent level can be found in medical expenditures and personal care (when C_{t-1} is not used) and at the 10 percent level for food and recreation. While each of these coefficients is positive, their sum is less than .02 in the first quarter.

Personally I am surprised at the categories given above. There are, however, several things to consider. First, a colleague, who has done substantial work in the consumption area, has told me that these - rather than durables - are the items in which he would expect the wealth effect to appear.[20] Second, in equation 2 in Table 3, we present a household operations equation which has a significant coefficient of .009 on the real net worth variable. This equation differs from the earlier ones in the inclusion of the number of housing starts of the previous quarter. The logic for including this variable is that household durables which behaved countercyclically in much of the postwar period,[21] are built-in (or included) with the erection of new single- and multi-family housing units.

In Table 3 we also present some transportation equations which contain a strike dummy (for autos) for the fourth quarter of 1964 and the unemployment rate. Despite the inclusion of these variables, transportation is not related to real net worth.

While Houthakker and Taylor,[22] have shown that the equation estimated can be derived from a stock adjustment mechanism, some readers may feel better if a durable stock were introduced directly. When we do so, we find that the coefficients in household operations and transportation are not significant once we correct for serial correlation. We also introduced an interest rate variable into household operations and the average weekly payment into the transportation equation, but neither variable is significant (see Table 3).

Thus, what we have found is that real net worth has an impact on food, personal care, medical care, recreation and household operations with the biggest effect (in the short run) on household operations. In addition, household operations are related to housing starts, which in turn are related to interest rates as well as to

[20] I have told him that being so, I would only accept dinner invitations conditional on the interim stock and bond market developments.

[21] See Guttentag, J., "The Short Cycle in Residential Construction," *American Economic Review,* 1961.

[22] Houthakker and Taylor, *op. cit.*

nonprice credit rationing.[23] There are, however, no direct interest rate effects on consumption. Thus, there are some links between monetary policy and consumption.

These equations of course are estimated only through 1965. I have not yet tested the equations for the last half of the 60's, which contain major variations in monetary and fiscal policy.

But I leave the reader the following piece of information to reconcile with his prejudices and various theories: If one examines the ratio of the various types of consumption to disposable income (either the official series or my definition), the only category in which there is a sharp and continuing drop is food and tobacco. Thus, the increase in the saving rate is due to the decrease in average propensity to consume food (primarily for home use) and, to a lesser extent, tobacco.

[23] Dhrymes and Taubman, *op. cit.*

TABLE 2

EFFECTS OF BEGINNING NET WORTH (REVISED DATA)

Category	Constant	Y_t	Y_{t-1}	14-24	25-34	65+	Rel. Price	C_{t-1}	$N.W._{-1}$	$\bar{R}^2$/D.W.	$\hat{\rho}$	Long Run MPC*
Food	262.4 (4.4)	.221 (5.7)	-.098 (2.4)	6.031 (2.7)	1.024 (.6)	.999 (.4)	-31.2 (.6)	-.187 (1.5)	.009 (1.7)	.91 2.1	-.17	.10
Food	215.5 (5.1)	.206 (6.1)	-.105 (2.8)	5.520 (2.8)	.986 (.7)	1.177 (.6)	-26.2 (.6)	— —	.008 (1.7)	.90 2.3	-.34	.10
Clothing	-75.5 (2.2)	.083 (4.9)	-.070 (4.1)	5.185 (4.0)	-.904 (1.0)	1.411 (1.4)	59.9 (1.5)	.795 (10.1)	.002 (.6)	.95 2.2	-.56	.06
Clothing	125.8 (1.4)	.102 (4.2)	-.019 (.7)	4.806 (2.2)	.521 (.3)	-.488 (.2)	-127.4 (2.0)	— —	.004 (.5)	.53 2.7	.87	.08
Personal Care	3.6 (.4)	.006 (3.2)	-.006 (2.7)	.043 (.3)	-.108 (.9)	-.098 (.7)	0.5 (.1)	.963 (13.3)	-.0001 (.003)	.99 2.0	-.40	.01
Personal Care	35.3 (2.4)	.002 (.6)	.005 (1.2)	.826 (3.1)	-1.217 (6.5)	1.104 (4.2)	4.8 (.4)	— —	.006 (8.6)	.99 1.8	.43	.01
Housing	93.1 (3.2)	-.0002 (.03)	.0215 (3.1)	-.048 (.1)	-.290 (1.0)	.939 (2.1)	-119.0 (5.1)	.749 (12.4)	.0004 (.3)	.99 1.9	.15	.10
Housing	251.3 (5.1)	.026 (2.0)	.054 (3.9)	-.305 (.3)	-1.911 (3.8)	1.979 (2.2)	-263.2 (7.3)	— —	-.008 (3.8)	.95 1.5	.25	.08
Household Operations	135.3 (1.5)	.121 (5.3)	.061 (2.2)	.619 (.3)	-.199 (.2)	.725 (.4)	-187.0 (2.8)	-.052 (.4)	-.001 (.2)	.95 1.8	.72	.17
Household Operations	135.6 (1.5)	.119 (5.5)	.056 (2.2)	.671 (.4)	-.226 (.2)	.627 (.3)	-184.5 (2.8)	— —	-.001 (.2)	.95 1.9	.71	.17
Medical	38.8 (2.2)	.017 (2.9)	-.007 (1.3)	1.595 (4.3)	-1.040 (3.0)	-.526 (1.5)	-14.7 (1.7)	.710 (8.7)	.002 (2.2)	.99 1.9	.49	.03
Medical	19.8 (.7)	.028 (3.2)	.003 (.3)	2.220 (3.4)	-1.415 (2.5)	-.404 (.6)	-24.9 (1.4)	— —	.005 (2.5)	.98 1.92	.49	.02

TABLE 2 (cont'd)

Personal Business	1.0 (.1)	.013 (4.4)	.004 (1.3)	.518 (2.4)	-.323 (2.2)	-.147 (.7)	-3.0 (17.4)	.091 (1.6)	-.0002 (.3)	.98 1.9	.62	.02
Personal Business	-2.0 (.3)	.014 (5.2)	.005 (1.6)	.477 (2.1)	-.319 (2.1)	-.087 (.4)	-3.0 (20.0)	– –	-.0002 (.3)	.98 1.8	.69	.02
Transportation	460.1 (1.5)	.025 (.3)	.146 (1.6)	-4.655 (.7)	-5.482 (1.0)	-9.494 (1.3)	-298.1 (1.8)	.109 (.7)	.006 (.2)	.37 1.9	.62	.19
Transportation	439.4 (1.4)	.030 (.4)	.161 (1.9)	-6.201 (1.0)	-4.715 (.9)	-8.887 (1.2)	-302.1 (1.8)	– –	.006 (.2)	.28 1.8	.67	.19
Recreation	40.6 (2.3)	.045 (6.3)	.006 (.6)	.592 (1.1)	-.128 (.3)	-.662 (1.2)	-40.1 (3.7)	.132 (1.2)	.003 (1.8)	.94 1.7	.58	.06
Recreation	42.1 (2.3)	.044 (6.3)	.014 (1.8)	.559 (1.0)	-.099 (.2)	-.582 (1.0)	-42.3 (4.1)	– –	.003 (1.5)	.93 1.6	.67	.06
Education	-.3 (.04)	.003 (1.2)	-.002 (.7)	.291 (2.4)	-.054 (.5)	.085 (.7)	-2.7 (.5)	.924 (18.3)	-.002 (.6)	.96 2.1	-.14	.02
Education	-9.1 (.9)	.006 (2.3)	.004 (1.4)	.232 (1.1)	-.156 (.9)	-.152 (.7)	.19 (.0)	– –	-.0004 (.5)	.36 1.9	.87	.01
Religious Activity	Put into Personal Outlays											
Foreign Travel	2.2 (2.0)	.0003 (1.0)	-.0003 (.9)	.020 (.9)	-.026 (1.3)	-.039 (1.7)	.4 (.4)	.817 (8.1)	.0001 (.5)	.99 2.6	-.30	0
Foreign Travel	5.6 (2.7)	-.0004 (.7)	.0001 (.1)	.076 (1.9)	-.042 (1.1)	-.131 (3.2)	6.2 (5.1)	– –	.0001 (1.0)	.97 2.0	.26	0

***Calculated from each equation but ignoring the effect of $N.W_{-1}$.**

TABLE 3

SOME HOUSEHOLD OPERATIONS AND TRANSPORTATION EQUATIONS

	Constant	y_t	y_{t-1}	14-24	25-34	65 +	Rel. Price	C_{t-1}
Household Operations								
1.	-35.5	.098	.082	.632	-1.062	-.430	48.1	–
	(.3)	(3.6)	(2.8)	(.3)	(.6)	(.1)	(.5)	–
2.	-46.8	.099	.057	2.014	1.402	-.952	69.9	.170
	(.4)	(3.5)	(1.7)	(.9)	(.8)	(.4)	(.7)	(1.2)
3.	-96.8	.107	.045	–	–	–	65.3	.195
	(1.5)	(4.1)	(1.5)	–	–	–	(.9)	(1.5)
4.	100.5	.101	.005	2.976	-.751	-2.211	-178.9	.284
	(1.1)	(4.4)	(.2)	(1.9)	(1.1)	(1.6)	(3.2)	(2.8)
5.	162.4	.091	-.002	1.897	-.767	-2.384	-160.2	.392
	(2.3)	(4.4)	(.09)	(1.5)	(1.3)	(1.8)	(3.0)	(4.3)
Transportation								
6.	207.9	.027	.170	-3.945	-2.907	-6.103	180.1	–
	(.5)	(.3)	(2.0)	(.5)	(.5)	(.7)	(.7)	–
7.	99.9	.033	.108	1.280	-2.780	-6.361	288.0	.260
	(.2)	(.4)	(1.2)	(.1)	(.5)	(.7)	(1.0)	(1.7)
8.	-46.2	.012	.140	–	–	–	170.3	.260
	(.2)	(.2)	(1.7)	–	–	–	(.7)	(1.1)
9.	815.8	-.037	.087	-2.449	-12.120	-10.926	-217.4	-.014
	(2.8)	(.6)	(1.3)	(.4)	(2.5)	(1.8)	(1.4)	(.1)

TABLE 3 (cont'd)

	$N.W_{t-1}$	Dist	Stk Dur_{t-1}	Int	Housing $Starts_{t-1}$		$\bar{R}^2$ D.W.	$\hat{\rho}$
Household Operations								
1.	.007	-20.4	-.020	-3.9800	—		.97	.64
	(1.0)	(.3)	(.6)	(1.4)	—		1.76	
2.	.009	-5.2	-.044	-4.4700	—		.96	.47
	(1.3)	(.1)	(1.3)	(1.6)	—		(1.85)	
3.	—	—	.011	-2.3170	—		.96	.50
	—	—	(.6)	(1.1)	—		1.88	
4.	.007	86.3	—	—	.081		.98	.24
	(2.0)	(1.2)	—	—	(5.0)		2.10	
5.	.009	—	—	—	.073		.98	.12
	(2.5)	—	—	—	(5.0)			
			Stk $Auto_{t-1}$	Monthly Payment	Unemp Rate	Stk Dummy		
Transportation								
6.	-.004	-188.4	.001	-1.6210	—	—	.37	.65
	(.2)	(1.0)	(.02)	(1.4)	—	—	1.65	
7.	.002	-170.5	-.003	-1.8490	—	—	.55	.45
	(.1)	(.9)	(.1)	(1.7)	—	—	1.86	
8.	—	—	-.019	-1.9940	—	—	.50	.59
	—	—	(.9)	(1.9)	—	—	1.79	
9.	.005	—	—	—	-10.3	-16.4	.10	.79
	(.3)	—	—	—	(4.2)	(3.1)	2.00	

TABLE 4

OFFICIAL AND REVISED PERSONAL DISPOSABLE INCOME FOR 1964 (BILLIONS OF DOLLARS)

	Official	Revisions	New Series
Total	438.1	Given Below	399.7
1. Wage and Salary	333.7	0	333.8
2. Other Labor Income	16.6	+ Pension Benefits	
		- Pension Contributions	4.1
3. Proprietor's Income	52.3	- Noncorporate and Farm Inventories	
		- Nonprofit Property Income	
		- Imputations	47.4
		- Taxes on Proprietor's Income	
		- Income Received by Fiduciaries but Not Distributed	
4. Interest Income	34.8	- Services Furnished Without Pay by Financial Intermediaries	24.0
		- Bank Service Charges and Trust Services and Safe Deposit Rent	
5. Rental Income of Persons	18.0	- Net Rentals to Owner-occupied Dwellings	.5
		- Property Taxes	
6. Transfer Payments	36.7	- Business Transfers	34.2
7. Dividends	17.8	0	17.8
8. Personal Contribution for Social Security	-12.5	0	-12.5
9. Personal Tax and Nontax	-59.4	a) - Capital Gains Tax	
		b) + Personal Nontaxes to Public Institutions	-49.4
		c) + Estate and Gift Taxes	

TABLE 5

OFFICIAL AND REVISED PERSONAL CONSUMPTION EXPENDITURES FOR 1964
(BILLIONS OF DOLLARS)

	Official	Revisions	New Series
Total Consumption	401.2	Given Below	353.2
1. Food and Tobacco	100.8	0	105.8
2. Clothes, Accessories	40.4	0	40.4
3. Personal Care	7.1	0	7.1
4. Housing	59.3	Subtract Out	
		a) Owner-occupied Nonfarm	22.1
		b) Farm Rental	
		c) Space Rental-institutional	
5. Household Operations	58.1	0	58.1
6. Medical Care	25.8	Add "Nontax" Payments to Public Hospital	29.4
7. Personal Business	20.1	Subtract Out	11.9
		a) Bank Service Charges	
		b) Services Furnished by Financial Institutions	
8. Transportation	51.4	0	51.4
9. Recreation	24.6	0	24.6
10. Private Education and Research	5.2	Subtract Out Education Expenses	4.7
		Add Student Fees and Veteran Tuition	
11. Religious	5.7	Subtract Out All	0
12. Foreign Travel	2.8	0	2.8

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DISCUSSION

F. THOMAS JUSTER

Taubman's paper is basically an adapted version of one originally designed for a rather different use. Essentially, the paper looks at consumption regressions using a rather standard set of variables: income, age distribution, relative prices, and assorted lags. A net worth variable constitutes an added starter, so to speak, to see how its coefficient behaves in the context of a standard consumption model. It is important to note, for evaluating the paper, that Taubman's major contribution is an emphasis which says that the trouble with many of our empirical consumption functions is that they do not pay enough attention to the basic data underlying the regressions. Taubman looks particularly at the income variable, and re-estimating it to reflect more of a cash flow concept, and less of an accrual.[1] Taubman thus has gotten away from saying that income is what the Office of Business Economics says it is, and has seriously tried to structure an income variable which ought to be more closely associated with the consumption categories whose behavior he is trying to explain.

In general terms, this is certainly in the spirit of the kind of experiment one would like to see done. It is only in the context of a model that provides a really good specification of the influence of other variables that one can hope to identify the influence of monetary or wealth variables on consumption. In that sense, the paper makes a significant contribution to the subject of the conference.

[1]This useful contrast was made at the conference by Jim Tobin.

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Model Explains Long-term Trends

There are some questions about the paper which I think ought to be raised, and there are some other related questions that are worth dwelling on for a few moments. To begin with, there are two very different sorts of models to examine if one is interested in looking at wealth or monetary effects on consumption. I would distinguish between models whose basic thrust is to explain trends in consumption from one whose basic thrust is to explain cyclical variability. The thrust of the Taubman model is to explain trends or longer term kinds of influences, since the variables in the model, with the exception of income, are all variables with little cyclical content.

Part of the reason for this choice, which I take to be a conscious one, is Taubman's definition of consumption as expenditure by consumers. This is not my preferred definition, and it is not a definition that the profession has increasingly adopted. Most studies recognize the important distinction between consumption as a flow of services and consumer expenditures as a flow of dollars. Taubman lumps together "consumer capital" expenditures with expenditures that represent flows of services. If one wishes to examine the cyclical content of consumer expenditures, it is surely going to be found mainly in consumer capital spending -- houses, cars, major durables, etc. One of the ways in which the minimal cyclical content of the model shows up is in the use of a single income variable. Taubman does not differentiate expected or permanent income from transitory or unexpected income, and that distinction is, of course, critical for analysis of expenditures on consumer capital. One cannot make any sense out of equations designed to explain consumer capital outlays, whether on automobiles, housing, or home appliances, unless permanent or expected income is distinguished from transitory income. The only variable in the Taubman paper which approximates that distinction is the unemployment rate, which is a very good proxy for transitory income; but that variable appears toward the back of the paper where Taubman takes a more careful look at expenditures on household operations and transportation.

Net Worth Variables

Secondly, I would like to raise some questions about the net worth variables. These queries apply not only to Taubman's paper, but to both the Modigliani and Tobin-Dolde papers as well. Taubman is using a total (marketable) net worth variable in the regressions.

The relevant wealth variable could conceivably be more narrowly defined or more broadly defined than that. For example, net worth for most people consists almost entirely of future earnings. One might argue that the influence of future earnings is picked up with an income or wage rate variable. But that may not be true, and the relation between current earnings and discounted future earnings may vary over time. Let me be more explicit. If we think that a major part of wealth is human wealth, and that this part of wealth has an important impact on the flow of consumption over time, I think we also have to recognize that the discount factors applied to expected future earnings are not necessarily invariant with respect to the economic environment. To illustrate, one might reasonably take a much longer view at the present time of the relevant horizons for income and consumption decisions than 15 or 20 years ago, simply because certain kinds of economic vicissitudes have become much less frequent in the last few decades. Hence the influence of net worth, measured as expected future earnings, may well be different in a consumption equation now than it would have been in previous years because the uncertainty factors applying to future earnings are less, given the reduced cyclical variability of the system. People may be willing to bet on a more predictable path for future earnings. While this kind of influence creates difficulties for time series regressions, I don't think it can be ignored.

Secondly, and moving in the opposite direction, some part of net worth as defined in the Taubman variable (and also in the Modigliani and Tobin-Dolde papers) is housing equity. While housing equity is all very nice, there are very few situations in which one can use it to finance consumption expenditures. Moreover, the degree to which housing equity can be monetized has probably changed over time because of changes in the attitudes of borrowers as well as in the practices of financing institutions. Still and all, most families probably do not view housing equity as being available for anything -- it just sits there and grows indefinitely or until the house is sold. Thus it may have little influence on the kind of consumption decisions examined in these models, and perhaps ought therefore to be removed from the net worth construct in consumption equations.

Nonprice Rationing

Next, let me make a few comments about Taubman's nonprice rationing discussion. To begin with, I would like to correct a misconception that seems widespread among the conferees. When a group of monetarists get together and talk about interest rates, they use numbers like 5, 6, and 7 percent. When a group of consumption economists get together and talk about interest or finance rates, they don't talk about rates like 5, 6, or 7 percent, but about ones that range from 12 to 40 percent and up. So my notion of the relevant rate, if we are talking about consumer borrowing decisions, is an order of magnitude different from that of the monetarists. For example, the *penalty* rate for low income households in the Tobin-Dolde paper is 10 percent. Even after tax, that seems low by a factor of about 3.

A second point, which bears on nonprice rationing, relates to some evidence appearing in a paper I put together some years back with Bob Shay. We found very marked differences in the responsiveness of classes of households, characterized as rationed and unrationed, to interest rates. Rationed households were those that did not have the option, given the market rates they faced, of borrowing for preferred maturities or of borrowing preferred amounts, and they were generally constrained from borrowing except when simultaneously acquiring an asset. That is, rationed consumers could borrow to buy a car because the car was collateral, but they could not in general borrow for consumption. Unrationed consumers were those whc could generally borrow preferred amounts at going rates.

What we found in the analysis was that rationed consumers were in general quite unresponsive to changes in interest rates; they were already constrained to borrow lower amounts than they preferred at existing rates, and changes in market rates were therefore irrelevant. For unrationed consumers this was not the case; changes in rates lec to changes in borrowing decisions.

Given our definitions of rationed and unrationed consumers, it is probable that the proportions of these two household types have been changing over time, and that the proportion of unrationed consumers (with free access to capital markets) is growing rapidly while the proportion of rationed consumers is declining. To the extent that that is the case, smoothing out the life-cycle consumption pattern by borrowing is a much more plausible mode than under circumstances where the great majority of consumers are tightly constrained in their borrowing options. My guess is tha steady changes of this sort have been going on, and I would therefor expect that, whatever the influence of monetary policy o consumption 10 years ago, it is probably different now and probabl stronger.

Consumer Confidence

Now let me turn to the consumer confidence question. There is a comment in Taubman's paper to the effect that, if one views confidence as acting via changes in stock market capitalization rates, changes in confidence are not very important because they apply to a small fraction of the population -- and to an even smaller fraction during the period that Taubman investigates. In the first place, I am not sure that changes in the stock market really affect only a small fraction of the population; that seems an open question. Many people have a stake in pension funds that are invested in equities. While I don't think that people generally make careful calculations about how much their pension equity has grown in the last year, I do think that people are generally aware of their retirement provisions. If pension equities get to be a little healthier than before, people may well think that it is not quite so important to sock funds away for retirement, and they may tend to be a little more relaxed about spending current income. That describes a wealth effect on consumption, operating via the influence of equity in pension funds. The same is true of equity in mutual funds, where a great many families have something invested.

It is also possible that the notion of who "owns" stock is really a function of how the family is defined. A large fraction of wealth is concentrated among relatively older people. Many of these people have children with families of their own, and it is not uncommon for parents to finance expenditures for children. It may also not be uncommon that a good year in the stock market means a larger amount of intergenerational transfers.

All those considerations add up to the fact that one should not be dogmatic about the consequences for consumption of changes in wealth that take the form of equities. There are many routes by which consumption could be affected, and the fact that one percent of the population owns a large fraction of the total may not carry much weight when it comes to determining the consumption effects.

Secondly, even if it were true that the relative importance of the wealth variable has changed over time, I see no reason why the relationship cannot be handled statistically. There are straightforward ways of handling variables that do not have the same influence in every period of time. The combination of an equity variable which measures wealth and an interaction variable which measures the changing influence of wealth on consumption is surely not unmanageable. And in trying to measure the consumption influence of wealth and of monetary policy, my judgement would be that the monetary variables have become considerably more important over time in their impact on consumption.

There have been several comments at the conference, mainly in the Modigliani paper, regarding the degree to which it is useful to take into account empirically something called consumer sentiment or mood (as it is called in the Fair paper and elsewhere). One way to bring this variable into the analysis is to recognize that changes in consumer sentiment may represent much the same phenomenon as changes in capitalization rates for equities. That is to say, there may well be a difference between the subjective perception of wealth and a number that someone at the Federal Reserve Board or the Office of Business Economics records as wealth. The relevant behavioral variable is not necessarily a particular number that OBE says is total net worth, but is presumably a subjective notion that people have as to how well off they are. And this depends heavily on how people view the world -- their uncertainties, their hopes and fears, and the discount they apply to the future.

The consumer sentiment variable seems to represent this kind of phenomenon. As has been shown before, sentiment is related to stock price movement. However, it is determined by other things as well, and I tend to regard it as kind of a catchall for measuring changes in perception of overall well-being and thus as representing a subjective estimate of total (human plus nonhuman) wealth. Bu does the sentiment variable improve empirical estimates o consumption? My view is that sentiment is used incorrectly in the Modigliani model, and also in the Fair model. In work that I hav done, and also in Saul Hyman's Brookings paper, consume sentiment or subjective wealth has an explanatory value only when i is changing systematically or changing by large amounts. Modigliani' results don't, I gather, support the proposition that the sentimen variable in its continuous form has a net impact. This was also true o Hyman's paper in its original form, where it was tried as a cyclic variable in a fully specified stock adjustment model for durables. Bu when Hyman substituted a filtered version of the same variabl eliminating all but the systematic or large changes, the resul improved dramatically. One explanation is that when sentiment not changing, the standard measure of wealth is fine; but whe sentiment is changing, the standard measure of wealth needs to l adjusted -- essentially a kind of capitalization effect.

The empirical results using the filtered sentiment variable are ve strong in the Hyman paper and they are equally strong in my ov work; both papers are concerned only with durables expenditures. I would not expect filtered or unfiltered sentiment to have an impact on nondurables, nor on the flow of consumption services. And I would expect that Modigliani would get very similar results if he tried the filtered version of consumer sentiment rather than the continuous version.

Let me make this one final point on methodology. As I indicated earlier, what seemed most useful in the Taubman paper was recognition of the simple fact that one is not going to make significant progress in estimating the effects of monetary policy or wealth on consumption unless one pays serious attention to the data. It also seems to me that we are about at the limit of what can be expected from analysis of time series data. There must be millions of consumption functions now in existence, half of which use wealth and half of which don't, and there must be negative degrees of freedom left in the data. The computers are too fast and it is too easy to run regressions. Thus the notion of trying to get behavioral results out of time series data strikes me as excessively optimistic. For that reason, I am much attracted to the general approach that Jim Tobin and Walt Dolde use in their paper. They essentially argue: let's forget about the time series, try instead to structure a micro-relationship, and then aggregate. I really don't see any way to get at wealth effects other than by approaching the data at the micro-level. This implies different kinds of data than we have been accustomed to using, and it implies much greater expenditures for data. But if we are not going to be here ten years from now, saying roughly the same things except that the intervening experience will have a lot more weight and this year's experience a lot less, we have to move in the direction of using micro-analysis to specify behavioral relationships, building in initially arbitrary and subsequently less arbitrary assumptions about the parameters, and then trying to produce macro-models by aggregating. In short, I don't see any hope for progress in this or many other areas unless we begin to move in the direction of serious empirical micro-models that attempt to take account of the kinds of complexities that actually exist.

The Economic Impact of the Stock Market Boom and Crash of 1929

GEORGE D. GREEN

In a recent issue of *Newsweek* three eminent economists were asked:

> "John Kenneth Galbraith has said that we are reliving the dismal history of 1929. Do you think the stock market will keep falling? If it does, will there be another Great Depression?"

They replied in the following ways:

> Henry Wallich: After 1929, the Dow Jones industrial average dropped by about 90 percent. I see nothing of that sort ahead. And even if the stock market suffered further reverses, the economy still would not be decisively affected.

> Milton Friedman: The stock crash in 1929 was a momentous event, but it did not produce the Great Depression and it was not a major factor in the Depression's severity . . . . Whatever happens to the stock market, it cannot lead to a great depression unless it produces or is accompanied by a monetary collapse.

> Paul Samuelson: In our economy, the market is the tail--and the tail does not wag the dog, which is gross national product. The decline has cut a quarter of a trillion dollars from people's net worth and that will be a depressant, but not a major one, on consumption and investment spending.

> A week later Professor Galbraith replied sharply that "The 1929 crash had a deeply depressing effect on consumer spending, business investment and overseas lending and it disrupted the international trade and monetary system. From the evidence, it was an important factor in the depression that ensued."[1]

[1] *Newsweek*, May 25, 1970, p. 78, and June 1, 1970, p. 4.

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Since Professor Galbraith is outnumbered three to one in this debate, let me cite just one more opinion for his side. In June, 1934, the Senate Committee on Banking and Currency concluded two years of often sensational hearings on "Stock Exchange Practices" with the following observation:

> The economic cost of this down-swing in security values cannot be accurately gauged. The wholesale closing of banks and other financial institutions; the loss of deposits and savings; the drastic curtailment of credit; the inability of debtors to meet their obligations; the growth of unemployment; the diminution of the purchasing power of the people to the point where industry and commerce were prostrated; and the increase in bankruptcy, poverty, and distress--all these conditions must be considered in some measure when the ultimate cost to the American public of speculating on the securities exchanges is computed.[2]

Over the 40 years since the stock market crash a great many economists, historians and other observers have contributed to this dialogue. Yet we seem no closer to any agreement on the economic impact of the boom and crash. The two most recent books on the subject take virtually opposite positions. One could also take the

TABLES

[2]U.S. Senate, Committee on Banking and Currency, 73 Cong., 2 sess., *Report* No. 1455, "Stock Exchange Practices," p. 7.

agreement of Milton Friedman and Paul Samuelson upon its minimal impact as a sure sign that something is wrong, that the subject must deserve further study![3]

Impact on Aggregate Spending

My purpose in this paper is to clarify theoretically and to quantify empirically how much impact the movements of the stock market had upon the economy. The first task is to obtain, from the vast bulk of the literature on the great crash, a set of well-defined hypotheses as to *how* the boom and crash might have had their effect. In terms of modern macroeconomic theory this requires that we demonstrate some ultimate impact, direct or indirect, upon aggregate spending: consumption, investment, net exports, or government spending. This impact might be transmitted through a variety of causal channels--changes in family incomes or wealth, changes in conditions of money or credit, changes in confidence or expectations, et cetera. But no explanation or hypothesis is well defined until it connects up with a change in some form of spending. A great many of the attempted explanations in the literature fail this elementary test.

In the next six sections of the paper I will set forth six hypotheses distilled from the preceding literature, and expressed as far as possible in layman's terminology. Once each hypothesis is properly specified, we face the more difficult empirical problems. I have derived rough quantitative estimates of the *direct, initial* impacts of the stock market experience upon specific macroeconomic variables: consumption, investment, money supply, et cetera. The market might have affected consumption via its influence upon dividend income (hypothesis No. 1), wealth (No. 1), or expectations (No. 3). It might have affected investment spending via stock yields and the cost of finance (No. 2), or expectations (No. 3). It might have affected either consumption or investment spending via its impact on the supply of money or credit (Nos. 5, 6), or the liquidity of financial intermediaries (No. 4).

This paper estimates only the direct, first round impacts of the stock market boom and crash. To study the full impact, direct and

[3]Robert T. Patterson, *The Great Boom and Panic* (Chicago, 1965), pp. 215-245. Robert Sobel, *The Great Bull Market* (New York, 1968), pp. 12-13, 146-159. John Kenneth Galbraith, *The Great Crash, 1929* (Boston, 1954) is of course the classic work. One useful previous attempt to estimate the market's impact is Giulio Pontecorvo, "Investment Banking and Security Speculation in the Late 1920's," *Business History Review*, XXXII (1958), 166-191.

indirect, would of course require an explicit macroeconometric structural model, specifying multiplier-accelerator interactions among spending categories, feedbacks between the financial and real sectors, and dynamic lags. In other words, to explain the full impact of the stock market would be virtually to explain the entire depression economy itself. I have not attempted a task of that magnitude, though I have drawn upon the econometric models of Klein and others at several points in the analysis. For a discussion of the great depression some sort of neo-Keynesian model, including a monetary and financial sector, is clearly more appropriate than a neo-classical model which posits a continuous full employment equilibrium. My implicit macroeconomic model is of that neo-Keynesian variety.

I. Effect on Consumption of the Loss of Dividend Income

The first hypothesis to be tested is: The stock market boom generated higher dividends and capital gains which augmented the income and wealth of American households and raised consumer spending. The crash brought lower dividends and capital losses, and thus lowered consumer spending.

We can dismiss at a glance the possible impact of changes in dividend income (see Table 1). During the boom years of 1928 and 1929 dividends fell far behind the rise of stock prices. The year-to-year increase of aggregate dividends reached just $0.6 billion in 1928-29, while the annual decrease after the crash reached $1.2 billion in 1931-32. Even if we assume that this entire change in dividend income went to changes in consumption (MPC = 1), it would never account for more than about 20 percent of the annual change in consumer spending. The shift in 1929-30, right after the crash, was only 4 percent of the shift in consumer spending.

If we turn to capital gains and losses we encounter a surprising problem of measurement. A glance at the financial pages of any major newspaper indicates that the nation's stock exchanges are probably the most intensely monitored sector of the entire economy. Yet for all the data on the fluctuations in the prices of individual stocks or of price indices, there is little information on aggregate values. We do have monthly figures on the total value of outstanding shares on the New York Stock Exchange (see Table 2). In principle, several adjustments should be made in these numbers in order to obtain a measure of the capital gains and losses experienced by American households. We should correct for new stock issues and retirements, and more important, for the portion of these listed stocks which are owned by corporations or foreigners.[4]

We sometimes forget that the New York Stock Exchange was only one of 34 exchanges operating in this country in the 1920's. We really want to know the capital gains and losses from all corporate stocks traded on all these exchanges (and even those traded privately perhaps). The only clue we have as to the relative importance of the nation's largest exchange is the fact that on July 31, 1933, the value of outstanding stock on the NYSE ($32.762 billion) represented 34.5 percent of the total for all 34 exchanges.[5]

If we boldly assumed that (1) the relative size of the NYSE and other exchanges remained constant, and (2) prices on all the exchanges always moved parallel to those on the NYSE, we could get one rough estimate of aggregate gains and losses to households by doubling the shifts in value shown in the NYSE data.[6] The results are shown in Table 3.

Capital Gains and Losses

A second approach relies upon Goldsmith's estimates of national wealth for 1922, 1929, and 1933, plus his annual estimates of household saving through purchases of corporate stock. The capital gains and losses (differences in holdings on balance sheet dates, less cumulated saving during the interval) are allocated annually according to changes in an index of common stock prices. This more complicated procedure is presumably superior because it reflects changes in stocks outstanding (e.g., new issues) and in the proportion held by households. The results are shown in Tables 4 and 5. The fairly close conformance of the two procedures is also reassuring.

[4] Goldsmith's data indicate that at the end of 1922 households held 73 percent of the corporate stock appearing on the national balance sheet. At the end of 1929 they still held 74 percent, but by the end of 1933 their share had fallen to 56 percent (while the share of non-financial corporations had risen sharply). See Raymond W. Goldsmith, Robert E. Lipsey, and M. Mendelson, *Studies in the National Balance Sheet of the United States* (New York, 1963), II, 319.

[5] Senate Committee on Banking and Currency, *Report* on "Stock Exchange Practices,' pp. 8-9.

[6] This would involve inflating the NYSE data by 1/34.5 to include other stock exchanges and deflating by .74 to reflect the share of outstanding stock held by households (see note 4 above). No correction has been made for new issues or stock retirements.

Obviously households experienced very large "paper" gains and losses on corporate stocks in the market boom and bust of 1927-33. But how many of these paper gains and losses were actually "realized" through sales? We can get some indication from the gains and losses recorded on income tax returns. The data, from a very careful study by Lawrence Seltzer, are given in Table 7. The IRS source data contain some biases of course. Taxpayers presumably under-report their capital gains and exaggerate their losses. Prior to 1928 persons with net deficits in their statutory income were not required to file returns (this probably meant primarily an under-reporting of capital losses, which offsets the above biases). The most serious downward bias arises from the exclusion of capital gains upon property transferred ("realized"?) at death; we must look to estate tax records to adjust for this omission. The second limitation in the data is that they cover gains and losses upon all property, not just corporate stocks. Detailed data for 1936 reveal that 79 percent of realized capital gains and 68 percent of losses arose from corporate stocks and bonds. Thus, by using Seltzer's original data for all gains and losses we can surely offset any downward bias due to under-reporting.[7]

In order to estimate capital gains "realized" at death we look to a study of estate tax data by Horst Mendershausen (see Table 6). The high tax exemption on estates means that we have data only on the wealthiest 1 percent of those dying in each year, persons with gross estates of over $100,000. But the ownership of corporate stock is heavily concentrated in the upper income groups, so we have probably captured a substantial portion of the gains and losses from such stock.[8] The gains or losses "realized" during the year of death are

[7]Lawrence H. Seltzer, *The Nature and Tax Treatment of Capital Gains and Losses* (NBER, New York, 1951), pp. 110-112, 145.

[8]Horst Mendershausen, "The Pattern of Estate Tax Wealth," in Raymond W. Goldsmith, *A Study of Saving in the United States* (Princeton, 1956), III, 287, 324-326. Let us make an illustrative calculation of the corporate stocks held by decedents with estates of less than $100,000. About one million adults died in 1929. Assume an average estate of $20,000, of which 10 percent was held in corporate stocks (these should both be very generous estimates). Then the bottom 99 percent of decedents owned $2 billion of stock, just matching the holdings of the wealthiest 1 percent.

Obviously not all stocks transferred at death were actually sold at the time by the heirs. But since we are seeking an upward biased estimate of "realized" capital gains and losses, we include the full amount of these estate transfers in our final estimate. This procedure easily compensates for the omission of the untaxed estates, as noted above.

estimated very roughly from the percentage rise or fall in an index of stock prices. These figures are then added to Seltzer's to provide an upward-biased estimate of total realized capital gains and losses (see Table 7).

Impact of Capital Gains or Losses on Consumer Spending

Having estimated both the paper and realized capital gains and losses in the stock market, we now come to the really tough empirical question. How much impact did they have upon the consumer spending of American households?

Ando and Modigliani, in their study of the "life cycle" saving hypothesis, have estimated that the marginal propensity to consume out of net worth is about .06. That is, for each dollar of his net worth a consumer will increase his spending by six cents. This coefficient is generated from annual time series data for 1929-59, and is generally confirmed in Ando's estimates for 1900-28; hence it seems reasonable to apply it to the years around 1929. John Arena has estimated a similar function which, however, includes a separate term for the capital gains on net worth during each year. He derives (from post-war data) an MPC on these capital gains of about .03, but he cannot confirm statistically a significant difference between this capital gains coefficient and his estimate of the broader Ando-Modigliani coefficient for net worth.[9]

If we apply the Ando-Modigliani coefficient to the total paper capital gains and losses in the stock market,[10] the implied shifts in

[9]Albert Ando and Franco Modigliani, "The 'Life Cycle' Hypothesis of Saving: Aggregate Implications and Tests," *American Economic Review,* LIII (1963), 55-84, and corrections in LIV (1964), 112-113. John J. Arena, "Capital Gains and the 'Life Cycle' Hypothesis of Saving," *American Economic Review,* LIV (1964), 107-111. In more recent estimates using the MIT-FRB econometric model, Ando and Modigliani have derived a coefficient of .04; see Frank deLeeuw and Edward Gramlich, "The Channels of Monetary Policy," *Federal Reserve Bulletin,* (June, 1969), p. 481. I can think of several arguments for questioning the stability of this parameter during the extraordinary years of stock market boom and crash, but they are not unambiguous enough to suggest an alternative estimate.

[10]Strictly speaking we should be deducting from capital gains (or losses) any changes in household borrowing to finance stock purchases, in order to arrive at changes in net worth. Brokers' loans, bank loans, and other loans on securities were large in the boom of 1928-29, probably reaching a peak of $18 billion in September, 1929. But the year-to-year change in such loans, which is the relevant statistic for changes in net worth, never exceeded about $3 billion. Such small amounts would not significantly affect our estimates. See Shaw Livermore, "Loans on Securities, 1921-32," *Review of Economic Statistics,* XIV (1932), 191-194, and Goldsmith, *A Study of Saving,* I, 710.

consumer spending are a very large part of the actual historical changes in consumption.[11]

YEARS	Estimated Shift in Consumption Due to Stock Market Changes ($ billions)	Observed Change in Consumer Outlays ($ billions)
1928	2.2	1.7
1929	-1.1	2.9
1930	-2.7	-7.4
1931	-3.2	-10.9

The meaningless 1929 comparison would presumably be clarified if we could use quarterly data to separate the nine months of boom and the three months of crash. Note also that the results are quite sensitive to the value of the coefficient; if we had used Arena's estimate (.03) our inferred consumption shifts would be half as large.

If, by contrast, we apply the Ando-Modigliani coefficient not to the paper capital gains and losses, but only to the much smaller realized gains and losses, the impact upon consumption becomes nearly negligible. In 1928 it would shift consumer spending by only $0.3 billion.

It obviously makes a great deal of difference whether we calculate the impact on consumption from the large paper capital gains and losses or from the much smaller realized gains and losses. Which, then, is the correct procedure? Pontecorvo and other observers have suggested that only the realized gains and losses should be considered as influencing consumption.[12] A simple version of this argument would imply that the stock had to be sold (the gain realized) in order to finance the consumer spending. On theoretical grounds this is a weak argument, since it assumes a sharp segmentation of consumer wealth. Consumers who enjoyed capital gains (increased net worth) could finance their spending by selling off other assets or by borrowing (perhaps even using their stock as collateral!).

[11] First column derived by multiplying capital gains and losses from Table 4 by .06. Observed consumer outlays from Barger's data, in Marvin Hoffenberg, "Estimates of National Output, Distributed Income, Consumer Spending, Saving, and Capital Formation," *Review of Economic Statistics,* XXV (1943), 169.

[12] Pontecorvo, *op. cit.,* pp. 186-187.

Impact on Consumption Overestimated Through Use of Paper Capital Gains and Losses

Theoretically, then, the larger paper gains and losses seem to be the appropriate variable by which to estimate changes in consumer spending. Despite the theoretical appeal of the larger estimates, there are three arguments which lead me to conclude that they substantially overestimate the market's impact upon consumer spending. First, persumably consumers normally respond to shifts in stock prices only imperfectly, and with some lag in recognition and adjustment. Spending decisions are not based on day-to-day or even month-to-month fluctuations in net worth, but upon some subjective perception of more "permanent" changes. To approximate such responses we might appropriately "smooth out" some of the sharpest fluctuations in stock prices. Many households obviously held stocks right through the sharp peak in the market in September, 1929, without adjusting their spending either to their temporary capital gains or to the counterbalancing paper losses after the crash.[13]

Secondly, the unusually low ratio of realized to paper gains and losses during the boom and crisis years of 1927-31 may be the symptom of a short-term downward shift in the Ando-Modigliani MPC out of net worth. Perhaps individuals decreased their propensity to spend out of capital gains in order to retain more of their wealth in the rising market. On the other hand, the capital losses after the crash, and the resulting illiquidity and danger of bankruptcy, may have temporarily raised the MPC coefficient for net worth, compelling consumers to make unusually large reductions in their spending for given reductions in their wealth.

A third piece of evidence strengthens my inclination to consider the estimated shifts of consumption based upon paper gains and losses as an upper limit value. Nancy Dorfman has run a regression of per capita real consumption upon Milton Friedman's estimates of permanent income per capita, for the years 1919 to 1938. The crucial years 1927 to 1930 all fall perfectly on the regression line There are no large residuals to show an effect of capital gains (no counted in permanent income) upon consumption.[14]

[13]Our use of annual data (and omission of the strong peak during 1929) is one crude way of "smoothing" our capital gains data.

[14]Nancy S. Dorfman, "The Role of Money in the Investment Boom of the Twenties an the 1929 Turning Point" (unpublished Ph.D. dissertation, University of California, Berkeley 1967), pp. 170-172. Admittedly a better test would be to look at residuals in th Ando-Modigliani consumption function.

Although the aggregate data leave considerable leeway for doubt, I am presently inclined to conclude that capital gains and losses in the stock market during 1927 to 1931 caused shifts in aggregate consumer spending of less than $1 billion per year.

Concentration of Stock Ownership

Another line of research may eventually help to reduce the range of uncertainty about the impact of the market upon aggregate consumer spending. We can move toward the microeconomic level of analysis.Rhetoric in the 1920's, often repeated uncritically by historians, spoke of stock market speculation as a popular pastime for the masses. Housewife, shoe-shine boy, and laborer supposedly joined the businessman and the Wall Street "insider" to seek their fortunes. Yet all the responsible estimates clearly show that only a small minority (8 percent) of the population actually owned stock, and that within this minority the substantial holdings were heavily concentrated in the hands of the wealthy few, with 500,000 to 600,000 individuals owning between 75 and 85 percent of the outstanding stock.[15]

Given this heavy concentration of stock ownership, we should not expect to observe much direct impact (via capital gains and losses) upon the purchases of mass consumption items. Rather the effects on spending should be concentrated in luxury consumer goods and services, and in consumer durables. Ideally we should undertake multivariate analysis of these consumer purchase categories to sort out the particular influence of the stock market. We must settle instead for a glance at the gross output data. The available evidence gives only selective and weak support to our hypothesis of large impacts. Automobile sales did reach record levels in the spring of 1929 and fell off dramatically in November; between 1929 and 1930 the reduction in this one item was over $1 billion. But how much of this decline was caused by capital losses in the stock market? Other monthly data on luxury consumer spending--such as railroad passenger mileage, foreign travel, hotel occupancies, or visits to National

[15] Alfred L. Bernheim, et al, *The Security Markets* (New York, The Twentieth Century Fund, 1935), chapter III and Appendix I. The number of stockholders apparently did increase sharply during the boom years, probably between 50 and 100 percent. The total number of stockholders reached approximately ten million individuals in 1930, but the percentage of value held by the highest income groups increased even during these years of spreading ownership.

Parks--adhere closely to seasonal and trend values, reflecting no visible response to the boom or crash.[16]

II. Effect on Capital Spending

The second hypothesis is: Low yields on stocks and the easy speculative atmosphere of the boom market stimulated corporations to finace expanded real investment spending through new stock issues. After the crash, higher yields and a more restrictive market caused a contraction of real investment spending.

It is true that the average yield on common stocks (the ratio of dividends to prices) fell substantially during the 1920's from nearly 6 percent in 1923 to under 3 percent at the peak of the boom in September, 1929 (see Table 8). At the peak of the boom, yields on common stocks were well below those on less risky corporate and government bonds.[17]

But falling current yields or earnings/price ratios did not necessarily make stocks a cheap form of financing. If a businessman believed that the market price of his company's stock accurately reflected the potential growth of its future earnings, he would not consider a low current yield ratio "cheap"; his opportunity cost of financing would consider those higher future earnings. On the other hand, if stock buyers were bidding yields down in anticipation of speculative capital gains from the stock market, rather than capital gains from future company performance in the real economy, then businessmen might consider stock prices "unrealistically" high, and perceive the yields as "cheap."[18]

The temporary bulge in stock issues in 1928-29 suggests that many businessmen did consider them a financing bargain. The data collected by the *Commercial and Financial Chronicle* on issues of corporate stocks and bonds for "new capital" show a dramatic increase during the decade, and a sharp decline after the crash (see Table 8). Raymond Goldsmith's data show that new issues of stocks

[16]U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1957* (Washington, D.C., 1960), p. 462. *Survey of Current Business,* Annual Supplement, 1932, pp. 9, 119-123, 273-275.

[17]*Historical Statistics,* pp. 656, 658 (See Table 8.) Pontecorvo, *op. cit.,* pp. 178-179. Robert Sobel's claim that price/earnings ratios were not abnormally high in the boom is quite misleading; he gives fragmentary data rather than the more comprehensive averages, and for 1928 rather than 1929. See Sobel, *op. cit.,* pp. 119-122.

[18]Dorfman, *op. cit.,* chapter VII.

and bonds provided about one-third of total corporate sources of funds (1923-29), making them second in importance to internal sources (55 percent) such as retained earnings and depreciation allowances. Stocks alone provided about 19 percent of total financial sources; this was a much higher percentage than Goldsmith observed for other years of the 20th century. These statistics certainly lend apparent support to the hypothesis that easy financing via corporate stocks stimulated real investment spending.[19]

Appearances can be deceptive! A further examination of these statistics will cause us to reject the hypothesis. The basic source of confusion is the failure to distinguish between financial capital and physical capital. The term "new capital" as used in the *Financial Chronicle* refers to financial capital, to those issues not used for refunding or retirement of old securities. Many of these "new capital" issues provided funds for corporate mergers or acquisitions, or for financial "working capital." We want to know how much of this new financial capital actually paid for new physical capital, plant and equipment or inventories.

A series published by Moody's Investors Service of new security issues for "productive purposes" (see Table 8) gives us a good measure of such real capital formation, although it excludes inventory accumulation and involves some rough estimation. The data give striking refutation to our hypothesis. While new issues of stocks and bonds were rising dramatically from $2.6 billion to $8 billion, the amount going to finance real investment remained virtually constant, between $1.5 and $2 billion per year. Between 1921 and 1929 new issues financed only about 26 percent of corporate gross investment, at a steady pace apparently little affected by the stock market boom.[20]

A very thorough study by George Eddy of "Security Issues and Real Investment in 1929" provided decisive and more detailed evidence for that climatic year of the boom. After carefully tracing the ultimate use made by each corporation of its share of the $8.002

[19] Raymond W. Goldsmith, *Financial Intermediaries in the American Economy since 1900* (Princeton, 1958), pp. 222-223.

[20] George Eddy, "Security Issues and Real Investment in 1929," *Review of Economic Statistics*, XIX (1937), 90-91. Dorfman, *op. cit.*, p. 108. The division of new issues between stocks and bonds was strongly influenced by yields and expectations (Pontecorvo, *op. cit.*, pp. 176-179). But we cannot infer from this fact how stocks and bonds shared the financing of *real* investment. Eddy's data for 1929 show that the stock issues went disproportionately to mergers and other financial purposes, while the bond issues went disproportionately to real investment.

billion of new issues listed in the *Financial Chronicle,* Eddy concluded that only \$2.002 billion financed real investment spending. Common and preferred stock accounted for 74 percent of the \$8 billion of new issues, but only 54 percent (\$1.074 billion) of the \$2 billion of real investment. Thus the booming stock market of 1929 directly financed only \$1.1 billion out of \$17.2 billion of gross private investment.[21]

What about the second part of our hypothesis, the impact of the crash upon stock financing of real investment? Moody's series of "productive" new issues reached its peak in 1930 (not 1929!) but we know that this was due mainly to large new bond issues, especially by public utilities. Stock yields rose sharply as prices collapsed, and after mid-1930 new issues slowed to a trickle. But even if we assume that new issues of stock financed no real investment at all after 1929, this could only have caused a reduction of \$1.1 billion in annual real investment spending. If we believe that the real economic decline which began in mid-1929 had its major causes outside the stock market, then we would expect some decline in externally financed real investment even without the crash. External finance is always most important in an expanding economy, while internal finance (liquidity, cash flows from retained earnings) matters more in recession.[22]

In summary, the stock market boom induced a flood of new corporate stock issues, some substituting for bonds or other securities and some doubtless representing net financial expansion which would not otherwise have occured. But the volume of real physical investment financed directly by new stock issues remained constant and apparently unaffected by the market boom. The stock market crash probably reduced real investment by much less than \$1 billion per year, with the main impact largely offset in 1930 because of shifts back to bond issues.

[21]Eddy, *op. cit.*, pp. 79-86. Hoffenberg, *op. cit.*, p. 169. See below, pp. 21-22, for brief discussion of indirect uses of those funds.

[22]This is the "bifurcation hypothesis" of investment theory. See Michael K. Evans, *Macroeconomic Activity: Theory, Forecasting, and Control* (New York, 1969), pp. 90-92, 128-129.

III. Psychological Impact on Consumption

The third hypothesis is: The stock market boom of 1928-29 improved consumer and business expectations, confidence, and optimism, and thus raised consumption and investment spending. The crash brought lower expectations and pessimism, and therefore lowered spending.

Casual assertion of the great psychological impacts of the stock market boom and crash pervades the literature. Perhaps its popularity is directly related to the difficulty of proving or disproving it. If all other casual connections between the market and the economy have been found wanting, one can always fall back upon the psychological impact. I will attempt to demonstrate the severe limitations of the assertion by showing its conceptual weakness and by indicating the direct and indirect evidence against its importance.

All decisions are based upon "expectations." Behavioral theories in the social sciences, and particularly those in economics, do not ignore or deny the role of expectations or psychology in decisions. Rather, they assume that these inner psychological states are usually (and on the average) related in some stable, predictable fashion to observable, "objective" conditions in the decision maker's environment. Most businessmen, for example, make their decisions about real investment spending with "psychological expectations" that are strongly influenced by such "objective" data as income, sales, capacity utilization, interest rates (or stock prices!), prices vs. costs, etc.

We do not enhance our explanatory powers, then, if we refuse to probe beneath such vague and all-embracing terms as "confidence" or "expectations" to the underlying objective conditions. Instead we should construct behavioral models in which we spell out more precisely and explicity just how we believe the decision making actors respond to given information and situations. Perhaps they will extrapolate (or "forecast") the present level of prices or costs or profits into the future. Or perhaps they will usually "expect" some rate of increase or decrease from present levels. Once we have specified these "normal" responses we can speak more meaningfully, and more narrowly, of a "shift in expectations," as referring to some change in the response parameters.

How does this conception apply to our discussion of the stock market? It means that much of the shift from "optimism" and "confidence" in 1928 or 1929 to "pessimism" and "a mood of hesitation" in 1930 or 1931 represented merely a normal, predictable response to changes in objective conditions--declining GNP, falling profits, rising unemployment. We should then rephrase our hypothesis to ask whether there was some *additional "subjective" shift* of expectations, some alternation of the "normal response" of decision makers to these changing objective conditions, and whether any such shift was related to the stock market.

What sort of direct evidence do we have regarding the influence of the stock market upon the "optimism" or "pessimism" of Americans, or the influence of those attitudes upon spending decisions? The evidence is overwhelming that "expectations" about the future of the stock market itself shifted upward in 1928 or 1929; masses of buyers began betting upon a rising market. Similarly, the evidence of "panic" psychology in the market in October and November, 1929, is undeniable. There is also much testimony to suggest that these states of "confidence" or "panic" among buyers and sellers of stocks were influenced by the perception of changing conditions in the real economy. For example, the belief in a "new era" of "permanent prosperity" surely influenced the way many people capitalized current corporate earnings in 1929.

The state of expectations in the stock market in December, 1929, and the first half of 1930 is more ambiguous. Certainly the mood of panic had receded. Stock prices stabilized and even recovered some of their lost ground, and most observers suggested a feeling of mild optimism about the future of the market.

But our chief purpose is not to describe the shifting "expectations" about the stock market itself, nor to explain those shifts in terms of changes in the real economy. We seek some evidence that the changing expectations in the market "carried over" and influenced expectations about spending on real output, consumption and investment. At this crucial juncture there is remarkably little supporting evidence for the hypothesis. Where are the people saying, "The stock market boom has so raised my optimism [though not my income or wealth!] that I am going to buy a car, or add a wing to my factory"?

In the midst of the crashing market on Black Thursday (October 24, 1929) President Hoover issued a statement that "the fundamental business of the country--that is, the production and distribution of goods and services--is on a sound and prosperous basis." Similar statements were issued by economists, businessmen, and newspaper editors over the next several months. Historians, like Monday morning quarterbacks, have cited these statements as examples of poor forecasting or empty rhetoric. Let us admit that Hoover's statement was a bad forecast, and even a bad description of the present state of the economy at the time. It is still a striking piece of evidence against our expectations hypothesis. Hoover is trying to reassure the "panicky" speculators. He assumes that the real economy influences expectations in the stock market, not the other way around! The frequent repetition of such optimistic commentary in early 1930 strongly suggests that "pessimism" and "panic" in the stock market did not immediately cause a sharp adverse shift in expectations about the real economy.[23]

Let us turn now to the indirect evidence on the expectations hypothesis. Assume that there was a substantial subjective increase in "optimism" in 1928-29, beyond any changes in "objective" economic conditions, or that there was a substantial "pessimistic" shift in subjective expectations after the crash. If these altered attitudes affected spending decisions, we would then expect to find large "unexplained residuals" in our consumption or investment functions. The actual spending should be substantially higher in 1928-29 and substantially lower in 1930-31 than we would "predict" (estimate) from an econometric model which assumes stable, "normal" responses to changes in the objective variables.[24]

I have examined a number of plausible models for consumer and investment spending which have been fitted to data from the American economy in the inter-war years (e.g. 1920-1941). None of them show the sort of large residuals for the years 1928-31 which would support our hypothesis of subjective shifts toward "optimism" and "pessimism." In Nancy Dorfman's regression of per capita real consumption on per capita real consumption on per capita

[23] Sobel, *The Great Bull Market,* pp. 137-146. Hoover's quotation is on p. 137.

[24] It is not necessary to believe that our econometric model is perfectly correct in its specification for this approach to be useful. It is enough that our excluded variable (the shift in expectations) be uncorrelated with the included variables, such as permanent income, profits, or past physical capital. If the correlation were high, movements of the included variables would "pick up" and "mask" much of the influence of our expectations variable, leaving no residuals. I would argue that stock market expectations depend mainly upon capital gains and losses. These capital gains are not included in measured income or profits and their statistical correlation appears to be fairly low (I have not tested this rigorously.). If, however, stock market expectations are strongly influenced by the performance of the real economy (as well as by market performance), this correlation will undermine my procedure. Many economists do assume that in general the stock market is a fairly good "barometer" or "leading indicator" whose movements reflect or anticipate (i.e., correlate with) swings in the real economy. But the historical discussions also emphasize that any such correlation broke down during 1928-30, when the market was "over-optimistic" relative to the real economy.

permanent income, the years 1927-31 fall right on the line. In Lawrence Klein's econometric model (I) real investment is a function of past and current profits and the initial stock of physical capital. His regression does show actual investment in 1929 which is $1.1 billion above the estimated investment level. But the Moody's investment series and George Eddy's careful study of the stock issues and real investment in 1929 seem to close that loophole. Klein's more detailed model (III) of plant and equipment investment (as a function of current and lagged output and initial capital stock) has no residuals over $750 million. These results seem to leave fairly little empirical maneuvering room for any massive expectations effects upon aggregate spending.[25]

IV. Impact on Banks

Our fourth hypothesis is: The crash threatened the liquidity and solvency of financial intermediaries, especially investment trusts, holding companies, and commercial banks. Their illiquidity or failure restricted credit flows or tied up or destroyed liquid assets which were essential to consumers and businesses.

Galbraith has argued that the investment trusts and holding companies caused a reduction of real investment spending. They fought to sustain the dividends of the operating companies which they controlled, since these dividends were their vital source of income and liquidity in a falling stock market. High dividends at a time of tumbling profits meant a sharp drop in retained earnings which could finance real capital formation.[26]

This argument is logical enough, but the effect in 1929 must have been quantitatively insignificant. The total assets of investment companies and investment holding companies reached a peak of $7.4 billion in 1929 and declined to $3 billion by 1933. Compare this to commercial bank assets of $66 billion, or to the value of stock on the New York exchange alone of $65 billion. These investment companies owned only 3.6 percent of outstanding corporate stock, and

[25] Dorfman, *op. cit.*, pp. 170-172. Lawrence R. Klein, *Economic Fluctuations in the United States, 1921-1941* (New York, 1950), pp. 68-69, 102-114.

[26] Galbraith, *The Great Crash*, p. 183. Galbraith implies that investment holding companies were sharply different from other corporations in their determination to sustain dividends during recession. But John Lintner has shown that dividends for *all* corporations behave this way. This puts the burden of proof more heavily upon Galbraith, since only the differential behavior of investment holding companies would support his argument. See Lintner, "The Determinants of Corporate Savings," in Walter W. Heller, et al (eds.), *Savings in the Modern Economy* (Minneapolis, 1953), pp. 248-253.

thus controlled about that share of corporate dividends. Even if every single dollar of corporate dividends which they received had been retained and had been spent on real investment, only about $225 million of added investment would have occured (3.6 percent of the $6.3 billion of corporate dividends).[27]

There is virtually no evidence to support the popular impression that the suspension and failure of commercial banks after 1929 was the result of their prior involvement in financing stock market "speculation." It is easy to tell colorful stories about Charlie Mitchell and his National City Company, the highly promotional and hard selling investment banking affiliate of the National City Bank of New York (of which Mitchell was also president). It is much more difficult to show that the success or failure of such affiliates (did many fail?) affected the solvency of the commercial banks.[28]

The waves of bank failures began not right after the stock market crash, but after October, 1930, and again in 1931 after the international monetary crisis. The heaviest losses were suffered not on stocks but on real estate and business loans, and on government and corporate bonds. Bank failures came not to Wall Street, where the stock market credit was concentrated, but to small independent country banks and to banks in communities which had suffered the heaviest losses of income and employment in the depression.[29]

Commercial banks owned only 0.8 percent of the outstanding corporate stock in 1929, a total of $1.2 billion. Of course their really significant involvement in Wall Street came through "loans on securities" to brokers and dealers or to individual speculators. These loans "for purchasing or carrying securities" reached $8.3 billion in 1929, compared to toal commercial bank assets of $66 billion. Thus

[27] Raymond W. Goldsmith, *The Share of Financial Intermediaries in National Wealth and National Assets, 1900-1949* (New York, 1954), pp. 68-71. Goldsmith, *Financial Intermediaries in the American Economy since 1900,* pp. 73-74. Some investment (especially holding) companies used financial "leverage" of course, controlling (but not receiving) *all* of the dividends of a company while owning 51 percent (or often less) of its stock. As an offset against this, they oftened owned shares of stock in companies whose dividend policies they did not control. I have assumed for convenience that these effect roughly cancelled.

[28] Patterson, *The Great Boom and Panic,* pp. 50-52. I have not investigated in any detail the possible linkages exposed by the Congressional Hearings of 1932-34 on "Stock Exchange Practices."

[29] Lester V. Chandler, *America's Greatest Depression,* 1929-1941 (New York, 1970), pp. 77-84. Milton Friedman and Anna Schwartz, *A Monetary History of the United States, 1867-1960* (Princeton, 1963), chapter 7.

if all these loans had defaulted after the crash, the losses would have represented 13 percent of bank assets. In fact, however, bankers suffered very little loss on such loans. The risks and losses were borne by the borrowers, and the banker could easily check on a daily basis to assure himself that the security collateral was sufficient to cover the loan.[30]

V. Impact on Credit

Our fifth hypothesis is: Stock market speculation absorbed credit funds, diverting them away from financial real investment (or consumer) spending. After the crash the release of funds from speculation made money and credit more available to finance real spending.

This argument, as stated above, still has several points of confusion or ambiguity imbedded in it. Does it refer to all credit, to bank credit, or to money? Does it assume some sort of fixed, limited "pool of funds," where increased allocations to one user (the stock market) automatically mean decreased allocations to others? With these problems in mind we shall consider several versions or variations of the original hypothesis.

In one important mechanical sense, stock market transactions cannot "absorb" funds: for every buyer of stock who gives up funds there is a seller who receives them! Dollars going "into the market" do not disappear, but "come out the other side." Even if the first seller uses his funds to buy other stocks, eventually some seller removes his funds from the market. From this perspective, then, one might in principle measure the impact of market transactions upon the real economy by comparing what stock sellers *actually do* with their funds to what buyers *would have done* with their funds if they had not bought stocks. The alternatives for both groups obviously include: buying current output (either consumption or investment); buying existing physical capital; buying other stocks (outstanding, or new issues); buying bonds, mortgages or other financial assets; retiring old debts or securities; "hoarding" bank deposits or currency.

In practice this formulation does not seem to lend itself to empirical verification. It does suggest one specific inquiry, however. What happened to the billions of dollars raised by new issues of

[30]Goldsmith, *Financial Intermediaries in the American Economy since 1900*, p. 225. Goldsmith, A Study of Saving, I, 710. Charles O. Hardy, *Credit Policies of the Federal Reserve System* (Washington, D.C., 1932), p. 174.

corporate stocks which were *not* used to finance real investment spending? If they went to financing mergers or acquisitions, what did the recipient companies or individuals do with the funds?

If they were re-lent into the call loan market, where did they eventually flow into real expenditures? Further study of the financial statements of the issuing corporations (along the lines of Eddy's study) might at least permit us to identify the first links in these chains of transactions. It appears likely that in the late 1920's most of the financial capital from new issues went to mergers and acquisitions. Perhaps as much as $3 billion of corporate funds (including the excess cash balances of many corporations *not* issuing new stocks) went into brokers' loans.[31]

Another fruitful perspective comes from the modern theory of "balancing portfolios." Imagine that all holders of wealth--individuals, corporations, financial intermediaries, etc.--desire to hold some mixture of assets: physical capital, consumer durables, stocks, bonds, mortgages, insurance policies, money, or other financial assets. A strong speculative boom which attracts investors to the stock market will thus reduce their demands for other assets in their portfolios. Lower bond and mortgage prices mean higher interest rates. Lower prices on existing physical capital mean a lower profit on investment in new physical capital. While lower yields and higher prices on stocks would stimulate real investment by stock-issuing corporations (our second hypothesis above), the higher cost of financing (and perhaps lower profit expectations) would reduce those types of real investment customarily financed by bonds or mortgates. Thus while directly or indirectly raising real investment through stock issues, the stock market boom also indirectly depressed it elsewhere in the economy. Conversely, the market crash shifted asset demands back toward bonds and mortgages, and encouraged real investment activities which they financed. Unfortunately, I have not yet figured out a way of testing or quantifying the implication of this "portfolio balancing" theory.

Perhaps the most controversial version of this fifth hypothesis focuses narrowly on bank credit. Did the "speculative" stock market boom "absorb" bank credit or "tie up" bank deposits, leaving less credit and money available to meet the "legitimate" needs of industry, agriculture, and commerce? The Federal Reserve leaders used this argument to justify their restrictive monetary policy actions

[31] Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics* (Washington, D.C., 1943), pp. 497-498.

in 1928 and 1929. The issue was vigorously debated among monetary economists through the early 1930's. After examining this debate, and gathering some relevant statistics, I have come to the following conclusions.

1. Loans by banks to stock exchange brokers and dealers did not keep billions of dollars "tied up in financial circulation." The brokers merely extended the chain of financial intermediation, channeling funds through margin loans to corporations issuing new stocks or to individuals selling old stocks. By these channels the real savings of bank depositors soon flowed into some form of expenditure.[32]

2. During 1928 and 1929 virtually all the increase in brokers' loans came from non-bank sources (corporations, foreigners, wealthy individuals). To the extent that brokers or their customers used these outside funds to repay debts to banks, bank credit was actually released for other uses. In the three months after the crash in October 1929, these non-bank lenders withdrew over $4 billion of funds from brokers' loans. The banks were able to increase their intermediation in this crisis, lending $1.3 billion to stock brokers and speculators in the first week of the crash alone. This was done without a proportionate contraction of bank credit to other customers, because the Federal Reserve (especially the New York Bank) expanded bank reserves.[33]

3. Stock market transactions did not tie up large amounts of bank deposits. Stock brokers could themselves handle a huge transactions volume by bookkeeping entries on their own books, or by netting out daily balances among brokers. Because of this economizing of their deposit balances, brokers' deposits had an extremely high and elastic velocity of turnover. During the mid-1920's brokers required only about $20 million of deposit balances to conduct billions of dollars of transactions![34]

[32]Lauchlin Currie, "The Failure of Monetary Policy to Prevent the Depression of 1929-32," *Journal of Political Economy,* XLII (1934), 145-177. John H. Williams, "The Monetary Doctrines of J. M. Keynes," *Quarterly Journal of Economics,* XLV (1931), 558-573. Harold Barger, "The Banks and the Stock Market," *Journal of Political Economy,* XLIII (1935), 763-777. Harold L. Reed, *Federal Reserve Policy, 1921-1930* (New York, 1930), chapter V. Hardy, *op cit.,* pp. 148-172.

[33]*Banking and Monetary Statistics,* p. 494. Portecorvo, *op cit.,* p. 181. Friedman and Schwartz, *op. cit.,* p. 335.

[34]Hardy, *op cit.,* p. 167.

Of course the "speculators," the buyers and sellers of stocks, also utilized bank deposits, not only in New York but all around the country. But they too could conduct transactions through their brokers' accounts rather than bank accounts, and could increase the average velocity of their deposits by lending in the call loan market.[35]

The argument that the stock market "tied up" bank deposits implies that there was only a fixed "pool of funds" available. With a fixed total money supply (and fixed velocity!) more dollars circulating in the financial sector (the stock market) must mean fewer dollars available for transactions in the real sector. But this implicit assumption does not fit the facts in our case. Both the dollar volume of stock market transactions and its rate of increase were small compared to the volume and rate of increase of bank debits, that is the transactions volume in bank demand deposits (bank debits = MV = money supply multiplied by transactions velocity or annual turnover). The $90 billion of shares traded on the New York Stock Exchange in 1929, even if each transaction had been conducted by check (rather than on brokers' accounts), amounted to only 15 percent of the $592 billion of debits in the reporting New York City banks. The estimated $225 billion of stock transactions on all exchanges were 18 percent of bank debits ($1237 billion) in all commercial banks. The $16.7 billion *rise* in stock transactions from 1928 to 1929 on the NYSE was only 16 percent as large as the ($102 billion) rise in debits of New York City banks, while the rise in all exchanges ($42 billion) was 26 percent of the rise in debits of all commercial banks. Most of this increase in bank debits came through rising average velocity, and only a little through increased deposits. As noted above, the stock market exhibits a uniquely high transactions velocity for money.[36]

[35] *Ibid.*, p. 168.

[36] See Tables 2 and 9 for data in this paragraph. There are no available statistics on the dollar volume of stock exchange transactions, even for the New York Stock Exchange. I constructed the series in Table 2 by multiplying the number of shares traded by the average price of shares outstanding, If we assume that lower priced shares trade more actively, then these figures may have a slight upward bias.

The NYSE data on shares traded do not include odd lot transactions (of less than 100 shares). Round lot transactions accounted for roughly 2/3 of total shares traded on the NYSE. In 1928-29 that exchange conducted about 60% of the share trading volume on all exchanges (U.S. Senate, Committee on Banking and Currency, 73 Cong., 2 sess., *Hearings* on "Stock Exchange Practices," Part 17, p. 7854). Thus we can "inflate" the NYSE volume ($90 x 3/2 x 10/6 = $225 billion) to obtain an estimate for trading volume on all exchanges.

Most versions of this fifth hypothesis have contained theoretical flaws or have implicitly assumed institutional arrangements or conditions contrary to the historical facts. The "portfolio balancing" theory is logical enough, but it implies both upward and downward shifts in different categories of spending, and it is not readily amenable to quantitative estimation.

VI. Effect of Tight Monetary Policy

Our sixth and last hypothesis is: Fear of a speculative boom and bust in the stock market led the Federal Reserve to tighten monetary policy and retard aggregate spending in 1928 and 1929. Fear of a recurrence of speculation after the crash inhibited the Federal Reserve from adopting a vigorously expansionary monetary policy to combat the deepening recession during 1930.

Notice the lack of symmetry in the hypothesis. Both before and after the crash the Federal Reserve's response to the stock market led to monetary contraction. I believe the research of Elmus Wicker and Milton Friedman make a persuasive case for both parts of the hypothesis, though I am not ready to assign a dollar value to the economic impact of the Fed's behavior.

There was sharp disagreement within the Federal Reserve system about how to combat security speculation in 1928-29. One group, dominating the Board in Washington, favored direct action, "moral suasion" to restrict bank loans to brokers or speculators. They hoped in this way to fight speculation without restricting credit to other "legitimate" borrowers in industry, commerce, and agriculture. The other group, led by the New York Bank, denied that the Fed could control the ultimate use of credit which it created, and advocated a sharp rise in discount rates to squelch speculation and permit a resumption of easier money thereafter. But both groups agreed on their dual objectives of preventing speculation and promoting a stable economy; they differed only over the means to reach these goals. Friedman contends that the chosen policies restricted too little to stop stock market speculation, but too much to permit the economy's stable growth. Wicker agrees that tight money over-restricted the economy. But he differs with Friedman in believing that tight money actually furthered speculation; the higher interest rates attracted more non-bank funds to Wall Street than the Fed could withdraw through its direct action on the banks.[37]

[37] Friedman and Schwartz, *op. cit.*, pp. 254-256, 290-292. Elmus Wicker, *Federal Reserve Monetary Policy, 1917-1933* (New York, 1966), chapters 9 and 10.

During the stock market crash of October 1929, the New York Federal Reserve Bank acted aggressively to permit the banks to replace the credits to brokers and dealers which were being recalled by non-bank lenders. After the panic had subsided the New York Bank continued to press within the system for lower discount rates and expanded open market purchases of government securities. Most of the Federal Reserve Board and the presidents of the other Federal Reserve Banks continued to reject such expansionary monetary policies throughout 1930. One important reason was their fear that premature and excessive credit expansion might cause a resumption of speculation in the stock market. They also believed that they had already (at least passively) eased credit conditions through lower discount and acceptance rates; any attempt to "force" further credit expansion upon an economy whose demand for credit had diminished would be either futile or dangerously inflationary. Thus confusion in monetary theory must share the blame with fear of speculation as a cause of Federal Reserve failure in 1930. [38]

Even if we agree that the stock market boom and crash influenced the Federal Reserve toward a more restrictive monetary policy, the impact upon the money supply (or interest rates, or other financial variables in our implicit macroeconomic model) remains uncertain. What is the appropriate counterfactual? If the Federal Reserve officials had not been so preoccupied with the dangers of speculation, what policy rules or criteria would they have followed instead, and what alternative discount rates, reserve levels and money supply would they have specified? The struggles for power within the Federal Reserve System and the confusions over "real bills," international money, and other aspects of monetary theory which prevailed during those years make this more of an exercise in political and intellectual, rather than in economic, history.

My own hunch, informed mainly by the research of Friedman and of Schwartz, Wicker, and Chandler, is that they would have lowered the discount (and acceptance) rates more quickly in the last half of 1929, but would probably not have conducted vigorous open market purchases of bonds. The larger fallacies of their "real bills" theories would probably still have inhibited large open market purchases once the recession gained momentum in 1930-31. The greatest impact of the stock market, therefore, probably came right at the turning point in 1929, when a relatively small shift in monetary controls might have counteracted the early stages of mild recession.

[38] Friedman and Schwartz, *op. cit.*, pp. 367-375. Wicker, *op. cit.*, pp. 144-158.

VII. Other Channels of Causation Between the Stock Market and the Economy

At least three avenues for further inquiry remain wide open. Many points of theory and evidence on the preceding six hypothesis certainly need more work. I have tried to identify some of the weak spots along the way.

Second, other hypotheses, other channels of causation connecting the stock market and the economy, need to be specified and examined. I can suggest a few possibilities.

1. Did the boom and crash increase the inequality of income distribution, and would this have significant impacts on consumer or investment spending?

2. How did the stock market affect America's net exports, and other components of her balance of payments? How much were sales of foreign bonds and securities increased, and with what effects? Did the boom market attract unusual inflows of short-term foreigr capital into call loans, or into stocks themselves?

3. What impacts arose from shifts of stock ownership amon sectors of the economy during boom or crash? Shifts betweer business and households might affect consumption versus investmen spending. Shifts between financial and non-financial corporation might alter real investment or the liquidity of the public. What wa the impact of the increase and changing composition of loans t brokers and dealers? Of brokers' loans to customers buying o margin?

Third, we must explore the full, indirect impacts of the stoc market boom and crash upon the macroeconomic system. Most the estimates presented in this paper indicate that the direct effec were "small," or at least smaller than previous writers have suggeste The largest impacts, a shift or perhaps $1 billion per year consumer spending and some shift in the money supply in 1929- might be incorporated in subsequent models.

Of course even if all the direct effects from the stock market w small, they might indeed still have had a very large ultimate e nomic impact, if acting upon a dynamically unstable economy. E a tiny initial disturbance could then trigger a huge depression. Bu that case we should concentrate our historical explanations of depression upon the nature and historical sources of that system instability in the larger economic structure. To emphasize the st market boom and crash would be to mistake the symptom for disease.

TABLE 1

DIVIDEND INCOME

YEARS	Dividends ($ billions)	Change in Dividends over previous year ($ billions)	Change in Dividends as % of change in National Income	Change in Dividends as % of change in Consumer Spending
1927	5.0	+0.3	*	*
1928	5.3	+0.3	8%	18%
1929	5.9	+0.6	19	21
1930	5.6	-0.3	2	4
1931	4.3	-1.3	9	12
1932	2.7	-1.6	11	14
1933	2.2	-0.5	*	23

*In opposite direction.

Source: Marvin Hoffenberg, "Estimates of National Output, Distributed Income, Consumer Spending, Saving, and Capital Formation," *Review of Economic Statistics*, XXV (1943), 156,169.

TABLE 2

NEW YORK STOCK EXCHANGE

YEARS	Market Value of All Listed Stocks January 1($ billions)	Average Price Per Share Outstanding*	Volume of Shares Traded (millions)	Value of Shares Traded ($ billions)
1925	27.072	64.61	452.211	29.2
1926	34.489	66.03	449.103	29.6
1927	38.376	69.38	576.991	40.0
1928	49.736	79.64	920.550	73.3
1929	67.478	80.08	1124.609	90.0
	89.668 (Sept.)	89.13 (Sept.)	–	–
1930	64.708	54.50	810.633	44.2
1931	49.020	34.27	576.765	19.8
1932	26.694	17.60	425.234	7.5
	15.663 (July)	11.89 (July)	–	–
1933	22.768	22.29	654.816	14.6

***Average of twelve monthly figures (first day of each month).**

New York Stock Exchange Yearbook, **1932-33, pp. 110-113, 117, 157.**

TABLE 3

ESTIMATES OF CAPITAL GAINS AND LOSSES FROM VALUE OF STOCK OUTSTANDING ON NEW YORK STOCK EXCHANGE ($ BILLIONS)

Beginning of Year	Stock Outstanding NYSE	Change	Estimated Capital Gains or Losses on all Exchanges
1925	27.072	7.417	14.8
1926	34.489	3.887	7.7
1927	38.376	11.360	22.7
1928	49.736	17.742	35.5
1929	67.478	22.190	44.4
Sept. 1929	89.668	-24.960	-49.9
1930	64.708	-15.688	-31.4
1931	49.020	-22.326	-44.6
1932	26.694	-11.031	-22.1
July 1932	15.663	7.105	14.2
1933	22.768	10.327	20.7
1934	33.095	–	–

TABLE 4

ESTIMATION OF ANNUAL CAPITAL GAINS AND LOSSES ON COMMON AND PREFERRED STOCKS HELD BY NON-FARM HOUSEHOLDS (1922 - 1933)

End of Year	Stock Prices	Change in Stock Prices	Allocation of Capital Gains or Losses
1922	75.1		
1923	73.9	-1.2	-$ 0.9 billion[4]
1924	88.1	14.2	10.9
1925	106.7	18.6	14.3
1926	111.4	4.7	3.6
1927	141.2	29.8	22.9
1928	188.3	47.1	36.2
Sept. 1929	237.8	49.5	38.1
1929	163.7	-74.1	-57.0
		88.6	68.1
1930	117.0	-46.7	-$44.6 billion[5]
1931	61.2	-55.8	-53.2
June 1932	35.9	-25.3	-24.1
1932	51.0	15.1	14.4
1933	77.1	26.1	24.9
		86.6	-82.6

Total capital gains from end of 1922 to end of 1929 ($68.097 billion) derived by taking the change in holdings between those dates ($138.296 - 55.520 = $82.776 billion)[1] and subtracting the cumulation of saving in the form of corporate stocks during the intervening years ($14.679 billion).[2] Similarly, the total capital losses between the end of 1929 and the end of 1933 ($82.646 billion) are derived by taking the change in holdings ($57.113 - 138.296 = $81.183 billion)[1] and subtracting the cumulation of saving ($1.463 billion).[2]

These total capital gains and losses are then allocated on an annual basis according to changes in Standard and Poor's Index of Common Stock Prices.[3] In addition, the peak (September, 1929) and through (June, 1932) prices are used in order to give an estimate of capital gains and losses to those dates.

[1] **Raymond W. Goldsmith, Lipsey, and Mendelson,** *Studies in the National Balance Sheet of the United States* **(New York, 1963), II, 319.**

[2] **Raymond W. Goldsmith,** *A Study of Saving in the United States* **(Princeton, 1955), I, 482 - 483.**

[3] **Board of Governors of the Federal Reserve System,** *Banking and Monetary Statistics* **(Washington, D.C., 1943), 480 - 481. The average of December and January prices was used, in order to maintain comparability with Goldsmith's data. See** *Studies in the National Balance Sheet,* **II, 15.**

[4] $\$1.2 \times \frac{68.097}{88.6} = \$0.9$

[5] $\$46.7 \times \frac{82.646}{86.6} = \$44.6$

TABLE 5

OWNERSHIP OF PREFERRED AND COMMON STOCK BY HOUSEHOLDS, AND CHANGES DUE TO SAVINGS AND CAPITAL GAINS (LOSSES) ($ BILLIONS)

YEARS	Jan. 1 Holdings	Saving[1]	Capital Gains[2]	Dec. 31 Holdings
1923	55.5	1.1	-0.9	55.7
1924	55.7	1.1	10.9	67.7
1925	67.7	1.9	14.3	83.9
1926	83.9	1.6	3.6	89.1
1927	89.1	1.8	22.9	113.8
1928	113.8	2.9	36.2	152.9
1929	152.9	4.3	38.1	195.3 (Sept.)
	195.3 (Sept.)	—	-57.0	138.3
1930	138.3	0.9	-44.6	94.6
1931	94.6	0.3	-53.2	41.7
1932	41.7	0.0	-24.1	17.6 (July)
	17.6 (July)	—	14.4	32.0
1933	32.0	0.2	24.9	57.1

[1] Raymond W. Goldsmith, *A Study of Saving in the United States* (Princeton, 1955), I, 482 - 483.

[2] My estimates, based on Goldsmith data. See previous table.

TABLE 6

VALUE OF STOCKS FROM ESTATE TAX RETURNS AND ESTIMATED CAPITAL GAINS IN YEAR OF DEATH

Year of Death	Number of Returns	Gross Estates ($ millions)	% Held in Stocks	Value of Stocks ($ millions)	Estimated Capital Gains in Year of Death* ($ millions)
1922	13,013	2495	31.3	781	133
1923	12,403	2350	31.4	738	-118
1924	14,013	2958	32.9	973	156
1925	13,142	3386	37.4	1266	215
1926	9,353	3146	38.9	1224	49
1927	8,079	3503	43.3	1517	319
1928	8,582	3844	48.4	1860	465
1929	8,798	4109	47.7	1960	-294
1930	8,333	4042	47.2	1908	-763
1931	7,113	2796	38.2	1068	-972
1932	8,727	2027	31.8	645	-129
1933	10,353	2244	34.9	783	266

*Applying percent rise in Standard and Poor's Index of Common Stocks during the year to the value of stock indicated.

Source: Horst Mendershausen, "The Pattern of Estate Tax Wealth," in Raymond W. Goldsmith, *A Study of Saving in the United States* (Princeton, 1956)

TABLE 7

REALIZED CAPITAL GAINS AND LOSSES FROM INCOME AND ESTATE TAX RETURNS ($ MILLIONS)

YEARS	Net Gain	Net Loss	Excess of Gains	Gains Realized at Death*	Total Realized Gains
1922	991.4	759.6	231.8	133	365
1923	1168.5	976.8	191.7	-118	74
1924	1513.7	476.8	1036.9	156	1193
1925	2932.2	359.7	2572.5	215	2788
1926	2378.5	212.8	2165.8	49	2215
1927	2894.6	276.1	2618.5	319	2938
1928	4861.8	357.4	4504.4	465	4969
1929	4769.3	1876.7	2892.6	-294	2599
1930	1261.2	2620.8	-1359.6	-763	-2123
1931	501.2	3219.3	-2718.1	-972	-3690
1932	183.5	2865.6	-2682.1	-129	-2811
1933	620.7	2024.0	-1403.3	266	-1137

*Estimates from Table 6.

Source: Lawrence H. Seltzer, *The Nature and Tax Treatment of Capital Gains and Losses* (NBER, New York, 1951), p. 367.

TABLE 8

STOCK YIELDS, EARNINGS/PRICE RATIOS AND NEW ISSUES OF STOCKS AND BONDS

YEARS	Yield on Common Stock (Percentages)	Earnings/Price Ratio (Percentages)	New Issues of Stocks and Bonds	
			Financial Chronicle ($ billions)	*Moody's Investors Service* ($ billions)
1923	5.94	11.38	2.635	1.624
1924	5.87	10.27	3.029	1.941
1925	5.19	11.19	3.605	1.824
1926	5.32	10.05	3.754	1.801
1927	4.77	7.57	4.657	1.781
1928	3.98	7.30	5.346	1.495
1929	3.48	6.23	8.002	1.787
Sept. 1929	2.92	–	–	–
1930	4.26	–	4.483	1.939
1931	5.58	–	1.551	.796
1932	6.69	–	.325	.203

Sources: U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1957*, pp. 656, 658.

George Eddy, "Security Issues and Real Investment in 1929," *Review of Economic Statistics*, XIX (1937), 91.

Lester V. Chandler, *American Monetary Policy, 1928-1941* (New York, 1971), p. 28.

TABLE 9

BANK DEBITS AND DEPOSIT TURNOVER (VELOCITY), FOR DEMAND DEPOSITS IN COMMERCIAL BANKS (1921 - 1933)

YEARS	ALL COMMERCIAL BANKS		N. Y. CITY WEEKLY REPORTING MEMBER BANKS	
	Debits ($ billions)	Velocity	Debits ($ billions)	Velocity
1921	569	32.6	203	54.9
1922	620	34.2	235	61.8
1923	658	34.1	234	65.5
1924	687	34.4	258	66.5
1925	788	36.3	307	71.9
1926	838	37.7	332	77.8
1927	915	41.0	384	85.3
1928	1075	46.8	490	106.3
1929	1237	53.6	592	124.4
1930	892	40.4	376	77.0
1931	658	33.2	258	54.7
1932	456	27.3	165	37.6
1933	424	26.8	158	34.8

Source: Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics* (Washington, D.C., 1943), p. 254.

DISCUSSION

PHILLIP D. CAGAN

Did the 1929 stock market crash deepen the subsequent business depression? In the public's view it did, but economists have been skeptical. Now that wealth variables have recently made their way into consumption functions, a reappraisal of the 1929 crash is in order. George Green's paper re-examines the question and still concludes that the crash had minor effects on economic activity. His paper is concerned with measuring the size of the capital gains and losses and then assessing the effect. I generally agree with his conclusion that it had minor effects. Let me comment first on the measurement of capital gains and losses and then on the wealth variable and its effects.

Measurement of Capital Gains and Losses

Green's figure for capital losses needs to be scaled down. By no stretch of the imagination can one say that the entire decline in stock prices in 1929-1933 helped to produce the business contraction. Stock prices fell first because business earnings fell and second because there was a revaluation of dividend-price ratios. Only the second of these begins to approximate an independent effect of the crash. A change in the market value of a given stream of dividends is on a different footing than a decline in dividend payments.

To be sure, nothing that happens in the stock market is completely independent of what goes on in the economy. A change in dividend-price ratios may be justified by business prospects. But at

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least it is largely determined within the stock market, in the sense that it reflects the anticipations and preferences of market participants. Changing preferences first overvalued stocks before 1929 and undervalued them afterward. The large reduction in financial wealth allegedly constrained expenditures for both consumption and investment. But the part due to the decline in dividends reflected the reduction in activity and played no independent role. After all, land values collapsed in the 1929-33 debacle too, but I haven't heard the depression blamed on that.

It seems to me to come closer to the usual view of the crash to count just the amount due to the revaluation of dividend streams. I would make one further minor adjustment to exclude revaluations reflecting changes in the level of interest rates. While this can be ignored in the pre-crash period when corporate bond yields were roughly constant, a small adjustment is needed for the subsequent period, when yields rose.

To calculate the capital gains up to the 1929 crash, I start with 1925, well before most of the outlandish speculation began. Another starting point would not give greatly different results. In Green's Table 8 we find that the dividend yield on stocks fell 1.7 percentage points from 1925 to 1929. This is a change in preferences by market participants--speculative fever if you like. We may recalculate the market value of the 1929 dividend stream, using the 1925 dividend yield of 5.19 percent. The 1929 stream of $5.9 billion thus had a capitalized value of $114 billion. By the lower dividend yield in 1929 of 3.48 percent, the capitalized value was $169 billion. The increase of $56 billion is my estimate of the capital gain. It is an overestimation, since it includes new issues. We should count just the increase in value of new stock after it had been issued, but such refinements would not alter the general order of magnitude. Green's figure for the capital gain--which includes the rise in stock prices due to both the increase in dividends and in dividend yields, but does not adjust for new stock issues--is given in his Table 5 as $115 billion for the same period. By excluding the effects of dividend payments, we cut his total in half.

On the down side we obtain a similar cut. From 1929 to 1932 the dividend yield rose 3.2 percent, of which 0.1 percent can be attributed to a rise in corporate bond yields. The 1929 dividend stream, when capitalized at the higher dividend yield prevailing in 1932 and with an adjustment for the rise in bond yields, had a market value of $90 billion, a decline from 1929 of $80 billion.

Green's figure for the capital loss is $179 billion, again over twice as much.

Effect of the Decline in Wealth

Now what was the effect of the decline in financial wealth on the economy? Conceivably it could have affected the demand for money balances, business investment, and consumer expenditures. In the usual demand function for money balances, real wealth has an elasticity of about unity. The crash reduced the demand for money balances, therefore, by the same percentage as the decline in total wealth and thus, for a given money stock, stimulated the economy. While this effect is not usually attributed to the crash, such stimulative effects, as well as the other depressing effects, should be counted. Given some of the crazy results we can sometimes derive from models, it might turn out that stock market crashes are good for the economy!

The effects usually mentioned, however, are those which affect expenditures directly. A stock market decline can instill pessimism about the business outlook and thus discourage investment undertakings. It can also make everyone feel poorer and want to consume less. It is this latter result which the so-called wealth effect is concerned with. Green uses a coefficient of .06 for the wealth effect on consumption, which comes from some earlier work of Ando and Modigliani. With the .06 coefficient, Green uses his figure for a capital gain of $115 billion in the 1925-29 period to find that consumption was higher by $7 billion in 1929 compared with 1925. The capital losses thereafter imply that consumption in 1932 was lower compared with 1929 by $11 billion, which was 38 percent of the actual decline in comsumption.

This makes the wealth effect on consumption appear to be very important. To obtain the independent effect, however, this figure should be reduced to the lower capital loss figure (which I calculated) of $80 billion. If we take .06 of that, we get $4.8 billion, which was 17 percent of the actual decline in consumption. The revision is appropriate, because the coefficient was estimated from a multiple regression which held other influences on consumption constant. Only the part of the change in wealth uncorrelated with other influences should be counted. Moreover, this uncorrelated part was probably a smaller fraction of the total decline in wealth in

1929-32 than in the post-World War II period, when dividend streams were fairly stable and most of the variation in stock prices reflected revaluation. The 17 percent figure still makes the crash appear to be important though not so eye-catching. To find the total effect on the economy, we should multiply by the total effect on aggregative expenditures of an autonomous change in wealth. Based on fiscal multipliers of current econometric models, the multiplier appears to lie between one and two.

Green argues that his estimate is probably too high. He points out that a consumption function containing only permanent income does not have large residuals in the 1925-1932 period. You can see this in the chart of the permanent income function that I fitted for Milton Friedman in his study of the consumption function. It shows no important residuals during this period. In other words, we don't need the addition of market wealth to explain consumption in the 1925-32 period. The decline in permanent income incorporates the decline in dividends, and nothing seems to be left over for the rise in dividend-price ratios to explain. One might argue that there was a lag in the effect of the stock market decline and only when the capital losses appeared to be permanent did people begin to take them into account in their consumption. But that would push the effects on consumption into the middle or later 1930's, at which time consumption was higher than the regression predicted, not lower as such a lagged wealth effect would imply.

Green relies heavily on this evidence that the consumption function without wealth fits the data fairly well. But, of course, one's conclusion here depends on what importance he attaches to the wealth effect. According to the earlier Ando-Modigliani study, wealth has a significant independent effect. The issue is whether changes in the market value of wealth affect aggregate expenditures importantly in the short run.

Increase in the Role of Monetary Effects

The recent attention to the wealth variable increases the role of monetary effects in the FRB-MIT econometric model, which is laudable. The early versions slighted those effects. Interest rates, although included in all the relevant equations, did not play a major role, whereas the market value of wealth enhances interest-rate effects due to changes in monetary growth. This econometric application follows upon the lavish attention which the theoretical literature has paid to the wealth effects of money. The result in the

FRB-MIT model is that wealth, and in particular the stock market, becomes the major channel of monetary effects on the economy.

I find this hard to believe. First of all, do people adjust their consumption to ephemeral changes in wealth? It is true that they do not know which way the market is going to change, so that current stock prices are the best estimate of future discounted levels. But that doesn't mean that consumption is adjusted as quickly to changes in stock prices as to an increase in wage and salary income. It is also true that every time the stock market takes a plunge *the Wall Street Journal* runs a story on how bad business is at Tiffany's. No doubt the stock market hits luxury expenditures, but such effects are very limited. Moreover, it seems to me that Tiffany's suffers more from the short-run psychological elation or despair of winning or losing in the stock market than from an adjustment of consumption levels to permanent changes in wealth.

Moreover, conventional theory teaches (correctly I believe) that changes in monetary growth produce portfolio adjustments and substitutions among assets and affect expenditures through the supply of loanable funds and the rates of return on assets. These substitution and liquidity effects are not fully represented by the usual expenditure equations because of the variety of channels and interest rates involved, which are hard to measure with the available statistical techniques.

I am not denying that new money adds to wealth, but the increase in wealth due to a change in the money stock is usually insignificant. As the new emphasis on wealth implies, the important effect of monetary policy on wealth comes through changes in interest rates, which can produce large changes in the market value of wealth, and this could no doubt have some effect on spending. But these are likely to be transitory changes in wealth, while the main effects of wealth on consumption will be those of a permanent nature. The changes in interest rates produced by variations in monetary growth tend to be temporary, aside from the effect of changes in the anticipated rate of increase of prices.

It would be helpful to re-examine the 1920's and 1930's with the new consumption durables and other refinements. Either wealth has entered the equation spuriously, or it had a much greater effect in 1929-33 than Green, I, and others believe. Perhaps the stock market reflects changes in monetary growth without being a transmission mechanism of monetary effects. Would it remain significant if one put lagged monetary growth in as a proxy for channels of monetary effects otherwise omitted? Or possibly the wealth variable represents something else. Some recent work suggests that it is a proxy in the equations for consumer sentiment or expectations about the future. Sentiment and wealth are not conceptually the same thing, though they might vary similarly over business cycles. Consumer sentiment does not work through the stock market, for the would limit its influence to a relatively small group; and, while the stock market may influence consumer sentiment, so do many other things.

Whether on the right track or not, the present emphasis on wealth as a major channel of monetary effects gives an ironical twist to the old view that changes in wealth are an undesirable side effect of monetary policy. In the early 1950's, for example, monetary policy was thought to require large changes in interest rates to be effective, and this was considered dangerous precisely because it would produce large variations in wealth. Recall Lawrence Seltzer's 1946 article entitled "Is a Rise in the Rate of Interest Necessary or Desirable?" in the *American Economic Review.* He expressed a widespread view that variations in wealth could endanger the solvency of financial institutions and, for that reason as well as others, induce changes in consumer and business expectations and expenditures which would be volatile and difficult to control. Seltzer was concerned over possible increases in interest rates in the early post-World War II years, but similar views lay behind the condemnation of stock market speculation in the 1920's. The view that changes in wealth are a very clumsy and undesirable way to stabilize economic activity is still very strong. With the new emphasis of the Federal Reserve on growth of the monetary aggregates, monetary policy has to be willing to allow wide fluctuations in interest rates and runs up against its long-standing tradition of preventing such fluctuations.

Extent of Recent Declines in Wealth

Recent experience has shown, however, that quite large declines ir the market value of securities can occur without seriou: repercussions on the economy. I have made some rough estimates oi the recent capital losses of the *household sector* from the flow oi funds account. In 1965 that sector held bonds worth $65 billion Applying the change in an index of market yields for each bon(group, and assuming (to be on the low side) an average maturity o the bonds outstanding of only five years, the capital loss in marke value up to 1970 was 13 percent. In addition, the cost of living ros(another 26 percent, so in real terms the decline was 36 percent. Jus from 1968 to 1970 the capital loss was 7 percent in nominal value and 19 percent in real terms. Again for the household sector, corporate share holdings declined 14 percent from 1968 to 1970; adding in the price rise, there was a 25 percent decline in their corporate share holdings in real terms.

Of course, actual wealth did not decline equally because of new savings. If we look at the net financial worth of households, it nevertheless declined $49 billion, or 3 1/2 percent, from 1968 to 1970. A decline in this total is an unusual occurrence, and even these figures do not allow for the market decline in bond prices, which the flow of funds takes at their maturity value. By my figures this would increase the decline by another $6 billion. The total decline in wealth from 1968 to 1970 was about 16 percent in real terms. If we apply a .05 coefficient to the dollar change, consumption from 1968 to 1970 would supposedly have been reduced $12 billion in real terms. That is a large figure. It excludes financial institutions, which also suffered tremendous capital losses in terms of the market value of their assets. (Depreciation due to inflation is counted in the figures for deposit holdings of the household sector.)

Yet what terrible consequences resulted from this gigantic decline in financial wealth? We did have the 1969-70 credit crunch, but it was due to monetary restraint and not to the decline in wealth. If anything, the decline in wealth alleviated the crunch by inducing more saving, which augmented the supply of loanable funds. Financial institutions were under strain, but much of that reflected the re-channeling of credit flows produced by deposit-rate ceilings and other regulations and cannot be attributed to the decline in asset values. To be sure, savings and loan associations were technically insolvent in 1969 with the sharp rise in mortgage yields; that reflected a very special situation which everyone agrees needs to be corrected by institutional reforms.

Apart from financial institutions, what was the effect of the decline in household wealth? Not all the evidence is in, but I do not detect serious consequences for the economy. I believe we have vastly overrated the dangers of interest-rate fluctuations and the accompanying changes in wealth. While they have some troublesome side effects, they are not a high price to pay, when necessary, for a flexible monetary policy to stabilize national income and prices. Moreover, while interest rates may fluctuate more at times if policy pays less attention to them, more stable monetary growth should, on the whole, result in less fluctuation in interest rates as well as in economic activity.

Monetary Policy and Consumer Expenditures: The Historical Evidence

DAVID I. MEISELMAN and THOMAS D. SIMPSON

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 macro-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	ΔM_{1_t}	$\Delta M_{1_{t-1}}$	$\Delta M_{1_{t-2}}$	$\Delta M_{1_{t-3}}$	$\Delta M_{1_{t-4}}$	$\Delta M_{1_{t-5}}$	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
$M1_{t+4}$	.341	.012	.288	.573	-.057	.300	.251
$M1_{t+3}$	.311	.008	.212	.597	-.055	.272	.331
$M1_{t+2}$	.496	.215	.345	.639	.129	.496	.378
$M1_{t+1}$	.583	.353	.405	.599	.376	.646	.498
$M1_{t}$	.603	.345	.449	.608	.492**	.698**	.645
$M1_{t-1}$	.628	.355**	.475	.629	.376	.688	.663**
$M1_{t-2}$	.629**	.342	.499	.617	.102	.612	.643
$M1_{t-3}$	.603	.221	.527**	.685**	-.161	.514	.527
$M1_{t-4}$	.520	.172	.409	.683	-.347	.385	.377
$M1_{t-5}$	.346	-.016	.282	.639	-.245	.252	.228
$M1_{t-6}$	.208	-.108	.181	.518	-.078	.171	.137
$M1_{t-7}$	.215	-.050	.195	.431	-.040	.188	.156
$M1_{t-8}$	.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
R2	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	0.662	0.180	0.281	0.235	0.581	0.218	1.210	2.672	3.488
	(1.89)	(1.22)	(0.37)	(2.08)	(2.91)	(1.30)	(1.04)	(4.19)	(3.20)	(2.53)
B_{t-1}	2.274	1.051	0.538	0.387	0.144	0.847	0.376	1.050	3.324	6.202
	(4.17)	(2.73)	(1.55)	(4.06)	(2.52)	(2.68)	(2.54)	(5.14)	(5.64)	(6.37)
B_{t-2}	2.306	0.934	0.637	0.306	-0.019	0.830	0.542	0.270	2.576	6.179
	(3.57)	(2.05)	(1.56)	(2.71)	(-0.28)	(2.22)	(3.10)	(1.12)	(3.69)	(5.36)
B_{t-3}	1.653	0.341	0.333	0.088	-0.104	0.602	0.709	-0.549	1.104	3.188
	(2.68)	(0.78)	(0.85)	(0.81)	(-1.62)	(1.68)	(4.24)	(-2.38)	(1.66)	(2.90)
B_{t-4}	0.642	-0.430	-0.221	-0.159	-0.070	0.277	0.794	-0.996	-0.355	-1.276
	(1.15)	(-1.10)	(-0.62)	(-1.64)	(-1.20)	(0.86)	(5.26)	(-4.79)	(-0.59)	(-1.28)
B_{t-5}	-0.171	-0.818	-0.579	-0.265	0.021	0.011	0.636	-0.836	-1.007	-3.989
	(-0.20)	(-1.38)	(-1.08)	(-1.80)	(0.24)	(0.02)	(2.79)	(-2.65)	(-1.11)	(-2.65)
Sum	8.164	1.740	0.888	0.638	0.206	3.148	3.276	0.149	8.314	13.793
	(8.58)	(2.59)	(1.47)	(3.83)	(2.08)	(5.71)	(12.69)	(0.42)	(8.09)	(8.12)
Constant	1.652	0.066	0.010	0.024	0.034	0.552	1.034	0.116	1.768	2.259
	(3.18)	(0.18)	(0.03)	(0.27)	(0.63)	(1.83)	(7.34)	(0.60)	(3.15)	(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
R2	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	0.015	0.282	0.513
	(3.88)	(1.26)	(2.33)	(2.96)
M_{t-1}	0.179	0.031	0.420	0.741
	(5.47)	(2.42)	(3.27)	(5.86)
M_{t-2}	0.193	0.047	0.464	0.733
	(7.88)	(4.63)	(4.99)	(5.99)
M_{t-3}	0.182	0.060	0.451	0.555
	(7.30)	(6.09)	(5.26)	(3.64)
M_{t-4}	0.160	0.071	0.411	0.288
	(5.26)	(5.82)	(3.58)	(2.41)
M_{t-5}	0.136	0.077	0.365	0.028
	(4.47)	(5.99)	(2.83)	(0.20)
M_{t-6}	0.115	0.078	0.325	-0.110
	(4.31)	(7.08)	(2.85)	(-0.58)
M_{t-7}	0.098	0.074	0.294	–
	(3.20)	(7.77)	(3.23)	–
M_{t-8}	0.079	0.064	0.266	–
	(1.98)	(5.09)	(2.44)	–
M_{t-9}	0.051	0.048	0.225	–
	(1.39)	(2.91)	(1.55)	–
M_{t-10}	–	0.026	0.148	–
	–	(1.82)	(1.12)	–
Sum	1.32	0.592	3.652	2.747
	(11.13)	(18.57)	(12.44)	(7.52)
Constant	1.077	0.773	0.922	2.244
	(7.28)	(7.23)	(6.42)	(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

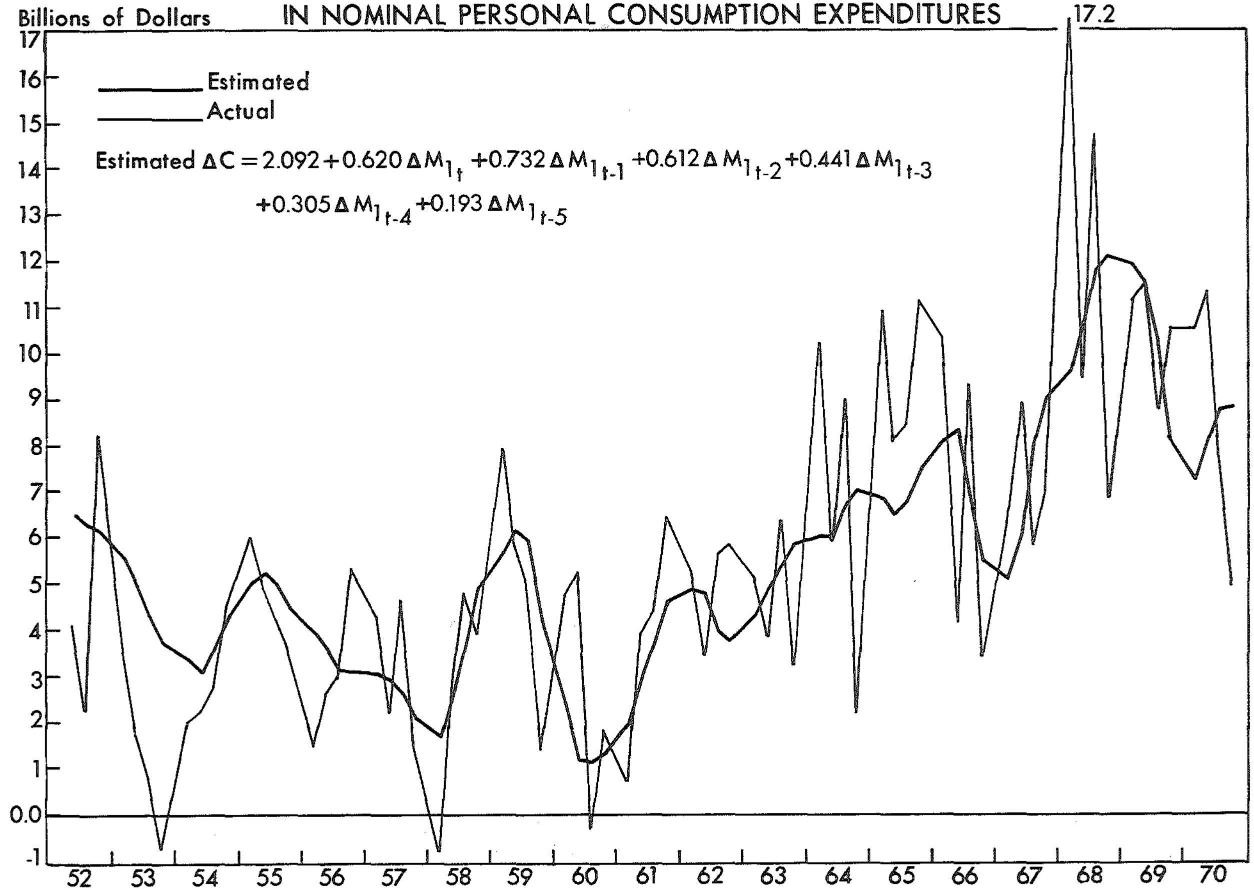
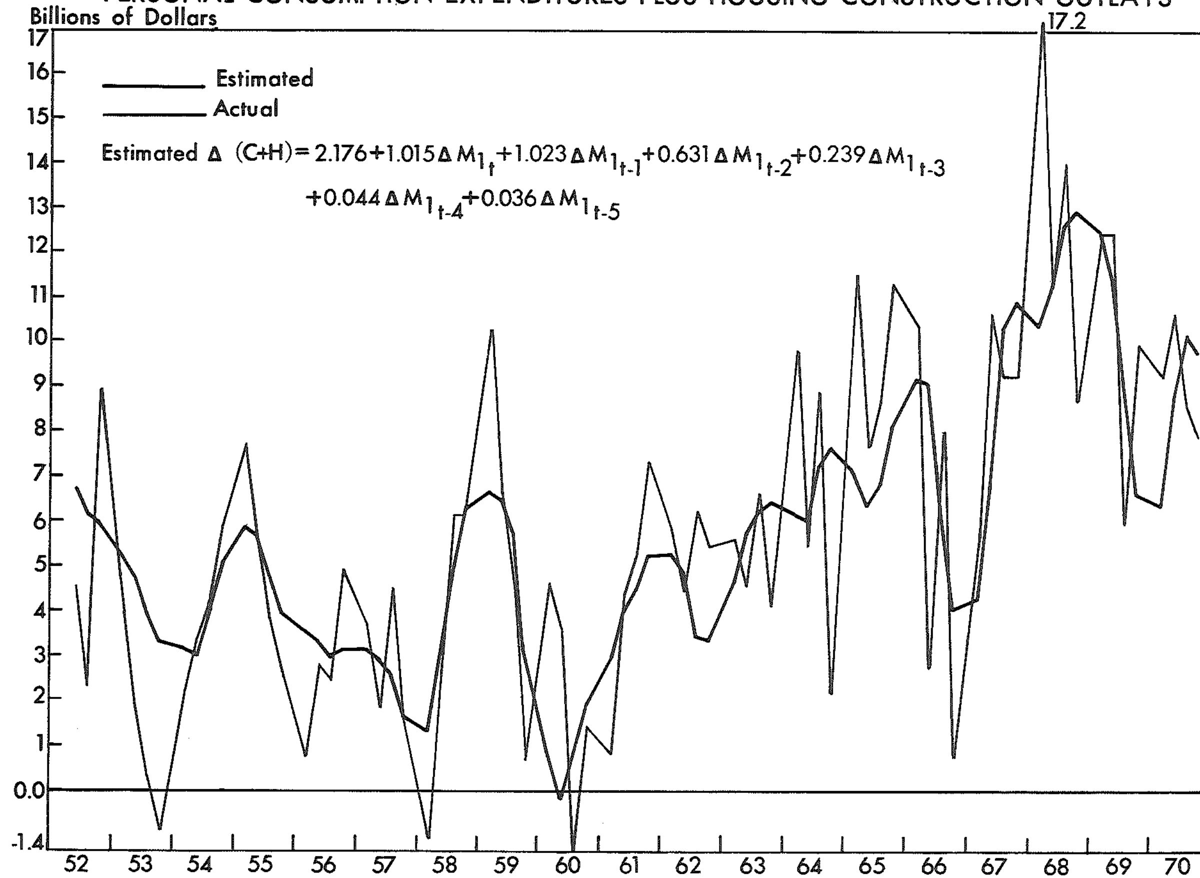


CHART II
ACTUAL AND ESTIMATED FIRST DIFFERENCES IN NOMINAL PERSONAL CONSUMPTION EXPENDITURES PLUS HOUSING CONSTRUCTION OUTLAYS



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

Monetary Restraint and Instalment Credit

RICHARD T. SELDEN

For as long as one can remember, monetary policy has been tossing about on a sea of controversy. The issues change from year to year, of course. Yet, curiously enough, it is difficult to detect anything like a convergence toward a consensus on such basic questions as: (1) What *is* monetary policy? (2) How does it work? (3) How well does it work? (4) How could its effectiveness be enhanced, its possible adverse side effects minimized?

Let me say at once that this paper does not pretend to settle these matters. However, it is based on the premise that progress can be made by taking an intensive look at one relatively small sector of the economy. The sector explored here is the market for consumer instalment credit. Section I discusses alternative views on the first two questions raised above; Section II briefly outlines some salient features of the institutional setting of instalment credit markets in the United States; Section III examines general evidence relating to the responsiveness of instalment credit to changes in monetary policy during 1952-70; and Section IV presents detailed information on the behavior of one important nonbank source of instalment credit, sales finance companies, during periods of monetary restraint. The major conclusions are summarized in Section V.

I. How Monetary Policy Works

Obviously one will have a hard time tracing the effects of monetary policy unless one has a correct understanding of what monetary policy is, how it works, and when it is tightening or easing.

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Taken literally, monetary policy is public policy with respect to the volume of money. For various reasons, however, many economists are dissatisfied with such a simple definition. Some prefer to *think* in terms of "credit policy," while continuing to *speak*, unfortunately, of monetary policy. This may seem to be an innocuous semantic distinction, since bank credit is merely the asset counterpart of bank deposits, the major component of the money supply. However, the total volume of credit in a modern economy is far greater than bank credit and its movements need not parallel those of bank credit. A given volume of bank credit, moreover, is consistent with a wide range of money supplies--especially in this day of negotiable CDs, bank-related commercial paper, and head office borrowings of Euro-dollars. A further point to note is that "credit policy" embraces a wide variety of selective controls over credit terms and the structure of lenders' portfolios--usually with only negligible effects on the money supply.

Clearly, those who favor a credit policy orientation have in mind a macro-model in which variations in the demand for money are apt to assume major significance in producing changes in aggregate demand for goods and services, while exponents of the literal definition view

TABLES and CHARTS

the demand for money as being stable even in the face of substantial variations in the volume of credit or in credit terms. Which of these two approaches is best is an empirical matter about which it is still possible for honest men to differ. Nevertheless, it would greatly clarify policy discussions if those who believe that credit is the crucial variable would cast their arguments explicitly in terms of credit policy rather than monetary policy.

Some economists, perhaps recognizing that the "credit vs. money" issue remains unresolved, have taken the "cop-out" of identifying monetary policy with "central bank policy": monetary policy is any action that is customarily carried out by central banks. In addition to simplicity this has the advantage that it brings us closer to what the authorities actually are doing, as against what outsiders believe they are trying to do, with respect to money and credit. Central banks generally do not operate directly on either money or credit; rather, they vary such policy instruments as their lending rates, their government securities portfolios, and commercial bank reserve requirements. If one is interested in the authorities' intentions, one may do better to examine the behavior of instruments rather than the presumed targets. On the other hand, it must be pointed out that by focusing on central bank actions one runs a risk of overlooking important dimensions of monetary and credit policies since ordinarily central banks are not the only public entities that influence money and credit. Moreover, is there really any virtue in concentrating on intentions? My view is that for most problems one ought to look at the net result of instrument manipulations on whatever one regards as the strategic monetary or credit variables, rather than at what these manipulations may tell us about intent.

Channels of Monetary Impact

There is still another theoretical issue of great practical import for this paper: Through what channels does a "monetary" impulse proceed to impinge on the economy? The standard theory holds that monetary restraint affects the economy according to the following sequence: (1) a tightening in the reserve position of the banking system leads to (2) increased cost and reduced availability of bank credit, which leads to (3) increased cost and reduced availability of credit generally, which leads to (4) a reduction in the level of debt-financed spending on goods and services, which implies (5) a reduction in aggregate demand for goods and services. According to this theory, instalment credit, insofar as it responds to monetary restraint, becomes more costly or is rationed more stringently, by both banks and nonbank lenders, when bank reserve positions are tightened. As a result, some prospective purchasers of autos (for example) either are unable to obtain credit or are deterred from doing so by its high cost; in either event, outlays on autos are less than they otherwise would be.

The Portfolio Balance Theory

In contrast to this standard theory, I would like to suggest a radically different version of how monetary restraint impinges on instalment credit, or on any other sector of the economy, for that matter.[1] According to this theory (call it the portfolio balance theory), (1) a reduced rate of monetary growth leads to distorted wealth portfolios throughout the economy, which leads to (2) reduced rates of acquisition of nonmonetary wealth, which implies (3) reductions in aggregate demand for goods and services, which leads to (4) reductions in demand for credit. The portfolio balance theory suggests that monetary restraint affects instalment credit only indirectly. Reductions in monetary growth cause some households to hold less money per dollar of nonmonetary wealth than they wish to hold. Consequently, they slow down their rates of acquisition of autos and other types of nonmonetary wealth. Since the demand for instalment credit appears to be largely derived from the demand for durable goods, this implies a fall in the demand for instalment credit. Thus, on this theory instalment credit may respond to monetary restraint even though some lenders do not experience any particular trouble in obtaining funds to finance new credit extensions--i.e., even though there is no reduction in the availability or increase in the cost of instalment credit.

Note that the standard theory and the portfolio balance theory are in no sense mutually exclusive explanations of how monetary policy works. Indeed, both have a certain plausibility, and it would not be surprising to find evidence that both processes have affected instalment credit in the United States.

[1]The theory has been set forth more fully in Milton Friedman and David Meiselman, "The Relative Stability of Monetary Velocity and the Investment Multiplier in the United States, 1897-1958," in *Stabilization Policies* (A series of Research Studies prepared for the Commission on Money and Credit) (Englewood Cliffs, N. J.: Prentice-Hall, 1963). See also Milton Friedman and Anna J. Schwartz, "Money and Business Cycles," *Review of Economics and Statistics,* February 1963 (Supplement), pp. 59-63.

Identification of Periods of Restraint

Let us turn to the practical problem of identifying periods of monetary restraint. Chart I shows a number of time series that might conceivably be used for this purpose. At the top are two highly correlated series that probably indicate quite faithfully the policymaker's intentions: free reserves and an index compiled by Brunner and Meltzer from Federal Open Market Committee directives.[2] Both series suggest that the Federal Reserve has consistently tightened policy at the beginning of business expansions and relaxed policy late in expansions, well before the onset of recessions. However, one gets a far less complimentary view of Federal Reserve performance from the next four lines, which show growth rates in narrowly-defined money (M_1), broadly-defined money (M_2), bank credit, and the monetary base.[3] These growth rates in monetary aggregates may be interpreted in at least two rather different ways. Milton Friedman, among others, has suggested that the key aspects of the growth rate series are their turning points: periods of monetary restraint extend from peaks to troughs.[4]

A less common interpretation--at least equally defensible in my judgment -- is to focus on the *levels* of the growth rates. These levels are not entirely arbitrary. If we ignore for the moment the problem of trends in monetary velocity, then a rate of growth in the aggregates equal to the growth rate in full employment real GNP

[2]See Appendix II of their *"An Alternative Approach to the Monetary Mechanism,"* a report prepared for the Subcommittee on Domestic Finance of the House Committee on Banking and Currency, August 17, 1964. This publication covers the period through 1962. Allan Meltzer has provided a similar index for the period 1964-68 in "The Appropriate Indicators of Monetary Policy, Part I," in *Savings and Residential Financing, 1969 Conference Proceedings* (Chicago: United States Savings and Loan League, 1969). The missing piece, 1963, was supplied by the author.

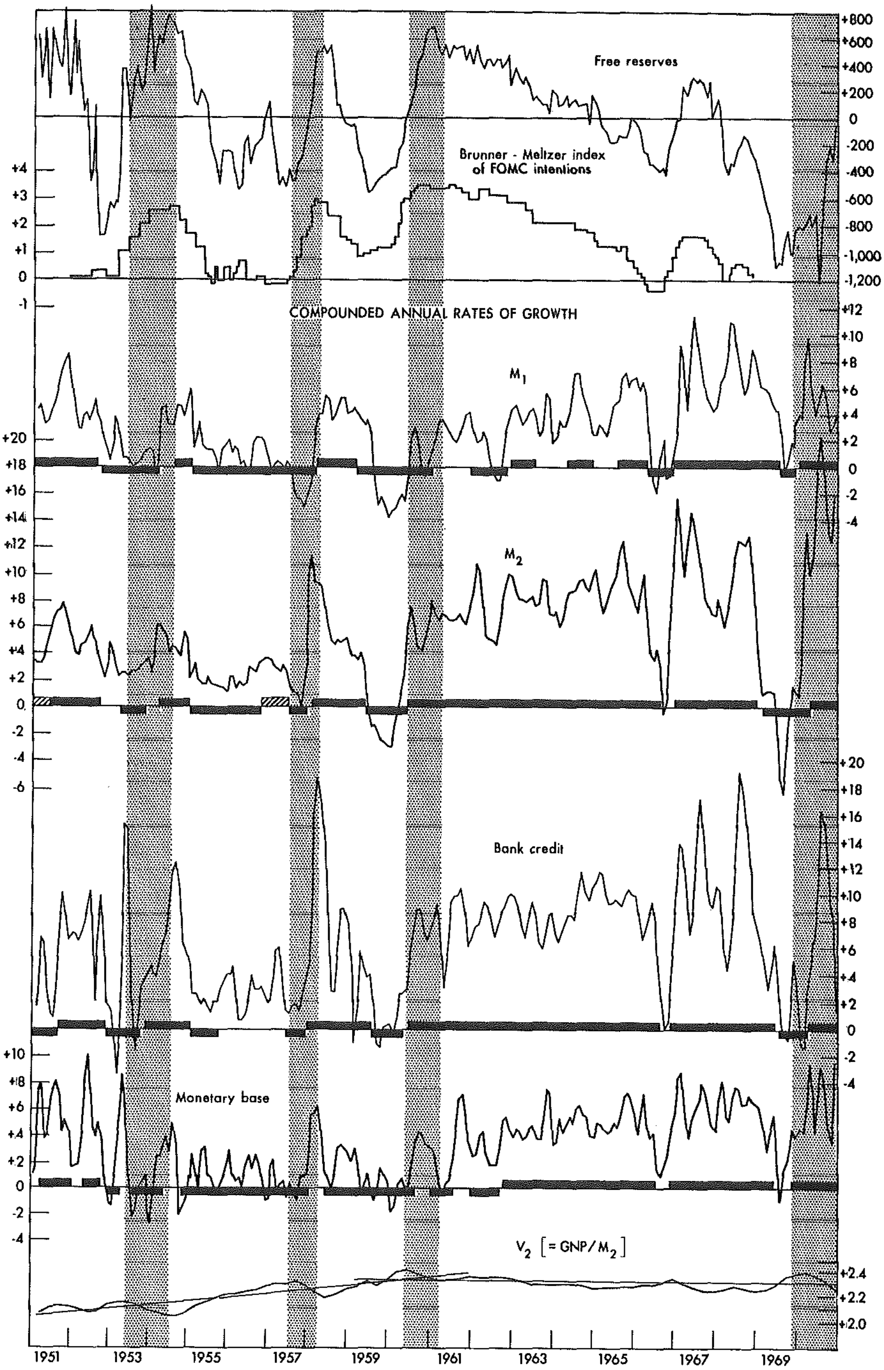
Perhaps it should be indicated that the series plotted in Chart I is a cumulation of the Brunner-Meltzer series, taking early 1952 as zero.

[3]The series plotted in Chart I have been smoothed by use of a centered three-term moving average, with a 1-2-1 weighting pattern. Classification of periods also was based on the smoothed series.

[4]Among the many works of Friedman that could be cited in this regard, see his "The Monetary Studies of the National Bureau," in *The Optimum Quantity of Money and Other Essays* (Chicago: Aldine, 1969).

CHART 1

SELECTED INDICATORS OF MONETARY POLICY, 1951 - 1970



would be consistent with long-run price stability. A higher rate of growth of the aggregates over a sufficiently long time interval-could then be regarded as "easy money," while a lower rate of growth could be regarded as "monetary restraint." The black bars along the zero lines in Chart I depict monetary policy phases in accordance with this idea. Periods of monetary restraint are time intervals of at least five months in which the growth rate of a particular aggregate was less than 3 percent per year; such periods are marked by bars below the zero lines. To avoid a "razor's edge" situation, periods of monetary ease were defined as those with aggregates growth rates of more than 3.75 percent; they are marked by bars above the zero lines.[5]

The results, not surprisingly, depend on which aggregate one looks at. All of them indicate monetary restraint in 1953, lasting well into the recession. Similarly, 1955 (after the opening months), late 1957, and late 1959 and the first half of 1960 were periods of restraint according to all four aggregates. In 1956 money was tight if one looks at M_1, M_2, and base money; however, bank credit behaved too erratically to permit classification. The year 1962 was one of slow growth in M_1 and in the base but a year of rapid growth in both M_2 and bank credit. A major suprise is that only one aggregate, M_1, classifies the famous 1966 "credit crunch" as a period of restraint on our rules; the episode was too brief to qualify in terms of the other aggregates. It should also be noted that the monetary base did not signal a restraint period in late 1969 and early 1970, in contrast to the other aggregates.

My preference among these aggregates is for M_2, followed closely by M_1. Using M_2 as the basis of classification, periods of monetary restraint since 1951 were:

June 1953 to December 1953
March 1955 to November 1956
August 1957 to December 1957
July 1959 to June 1960
February 1969 to February 1970

[5]In the case of M_2 two periods, marked with crosshatching (early 1951 and early 1957), are regarded as "neutral" policy periods since the growth rate stayed within the bounds set (i.e. between 3.0 and 3.75) for at least five months. It is rather striking that only these two brief periods, for only one of the four growth rate series, were able to qualify as neutral periods. Unmarked periods, such as 1961 in the M_1 series, were characterized by too much monetary instability to permit classification in terms of the rules proposed.

In applying the rules I permitted certain exceptions where, for example, a period of slow growth in bank credit, as in 1953, is interrupted momentarily by a month or two of very rapid growth.

Strictly speaking, one ought to allow for velocity trends in applying a definition of monetary restraint based on growth rates of the aggregates. The bottom line in Chart I shows the income velocity of broad money, V_2. It rose fairly steadily up to 1960 at an annual rate of 1.38 percent, except for brief cyclical interruptions. Since then the trend has been downward at a rate of 0.19 percent per year; only in 1966 and 1969-70 was V_2 above its trend line.[6] In view of these trends a case can be made that monetary growth rates on the order of 1.6 percent or less per year corresponded to periods of monetary restraint during the 1950s rather than the 3 percent threshold we have used. Similarly, a case could be made for a 3.2 percent threshold in the 1960s. The result would be to reduce the frequency of restraint during the 1950s and to increase the frequency slightly during the 1960s.

It would delay us unduly to pursue such refinements further. As a final thought along these lines, however, attention is called to still another approach to the definition of monetary restraint: it may be regarded as a period in which money is working unusually hard, as indicated by the relationship of velocity to its trend. In Chart I, V_2 was above trend in pretty much the same periods we have already identified by reference to growth rates in M_2--a fact that lends support to the reasonableness of the growth rate approach.

II. Institutional Setting of Instalment Credit Markets

Consumer instalment credit in the United States consists of auto paper, other consumer goods paper, repair and modernization loans, and personal loans. The suppliers of such credit are commercial banks, finance companies, credit unions, various other financial institutions, and retailers. Until recently a distinction was made between sales finance and consumer finance companies, the former consisting of firms that purchase instalment paper from retailers, the latter of firms that grant direct cash loans to households. Increasingly, during the 1960s, this distinction became less meaningful, both as a result of sales finance entry into cash lending and because of consumer finance company entry into retailing through acquisitions of retail chains. Consequently, the Federal Reserve no longer publishes separate statistics by type of finance company. Much of the empirical analysis that follows will nevertheless make use of this now-outmoded distinction.

[6]The trend lines shown in Chart I were calculated by overlapping the periods. The rising line was based on 1951-1 to 1961-4, while the falling line was based on 1959-1 to 1970-4.

Sales finance companies are of two basic types: those that are owned by manufacturers or retailers and those that are not. The former are often called "captive finance companies"--I shall use the less deprecatory term "finance subsidiaries"--while the latter are known as "independents." There is a real question whether a wholly-owned subsidiary of a retailer (a leading example is Sears Roebuck Acceptance Corporation) should be classified as a finance company or as part of a retail establishment, since the instalment paper it holds comes solely from its parent. In its most recent revision of instalment credit statistics,[7] the Federal Reserve has reached the sensible conclusion that such finance subsidiaries are not finance companies, and Federal Reserve data back to 1956 now reflect this decision. The case of manufacturer-owned subsidiaries is somewhat different. The largest of these, for example--General Motors Acceptance Corporation--holds a significant amount of retail paper from the sale of non-GM products since General Motors does not exercise complete control over the product lines of its dealers.

Breakdown of the Instalment Credit Market

Table I gives instalment credit breakdowns for the end of 1956 and 1968, both years of high prosperity. A number of points should be noted. First, commercial banks were the leading instalment lenders in 1968, as in 1956. However, banks gradually had expanded their share of instalment credit markets to an impressive 41 percent of the total by 1968. Banks are now the leading holders of auto paper, repair and modernization loans, and personal loans, and they are second only to retailers as holders of other consumer goods paper. Second, sales finance companies have greatly diminished their specialization in auto paper in recent years. Indeed, it appears that independent finance companies will abandon new car financing altogether before much longer, leaving this business to banks and finance subsidiaries. Third, between 1956 and 1968 there was a dramatic rise in the credit union share of instalment credit. Fourth, auto dealers have become distinctly minor holders of instalment credit in recent years, and retailers as a group have declined in importance since the mid-1950s despite the vigorous promotion of "revolving credit" by department stores.

Although instalment credit markets are less than perfectly competitive, significant competition does exist. For example, in a typical city of medium size a prospective purchaser of a new car has

[7] Federal Reserve Bulletin, December 1968.

TABLE 1

CONSUMER INSTALMENT CREDIT OUTSTANDING
END OF 1956 AND 1968
(MILLIONS OF DOLLARS)

Type of Paper Holder	Auto Paper	Other Consumer Goods Paper	Repair and Modernization Loans	Personal Loans	Total
A. 1956					
Commercial Banks	5,726	2,464	1,469	2,118	11,777
Sales Finance Companies	7,238	1,159	32	570	8,999
Credit Unions	—	—	—	—	2,014
Consumer Finance Companies	954	624	404	4,101	2,940
Other Financial Institutions	—	—	—	—	1,129
Retail Outlets	502	4,359	—	—	4,861
All Holders	14,420	8,606	1,905	6,789	31,720
B. 1968					
Commercial Banks	19,318	6,060	2,719	8,855	36,952
Sales Finance Companies	9,986	4,849	74	3,310	18,219
Credit Unions	—	—	—	—	10,178
Consumer Finance Companies	4,506	1,877	1,132	14,771	8,913
Other Financial Institutions	—	—	—	—	3,195
Retail Outlets	320	12,113	—	—	12,433
All Holders	34,130	24,899	3,925	26,936	89,890

Source: Federal Reserve Bulletin, December 1968, pp. 987-93, and March 1969, pp. A52-3.

a number of financial alternatives: he can finance through the auto dealer, which means that a sales finance company or a local bank is the ultimate source of funds; he can borrow cash directly from one of the four or five banks with offices in the city; or he can borrow from one of several consumer finance companies with local offices, or from a local credit union if he belongs to one. In practice there is a certain amount of specialization among lenders--for example, banks tend to concentrate on low-risk paper--so the amount of effective competition is undoubtedly less than one might think. There are also legal constraints. Most instalment credit is now subject to strict regulation by the states. Regulated aspects include rates, loan size, location of place of business, and methods of rate quotation. With adoption of the Truth in Lending Act in 1968 rate quotation has come under federal regulation as well. The effect of this law, which requires all instalment finance charges to be quoted in terms of simple annual interest, may have been to intensify competition since presumably it has made it easier for borrowers to compare credit costs between lenders.

Channels of Fund Flows into Consumer Credit

In this paper we have particular interest in the channels through which funds flow into consumer instalment credit. Directly or indirectly a large portion of these funds flows through the banking system. Not only are banks the leading consumer instalment lenders, but also they support nonbank instalment lending in at least three important ways. First, they extend loans, mainly short-term, to finance companies. Usually such lending is done under formal loan agreements that define the size of the credit line, compensating balance requirements, and the relationship of the interest rate to the bank's prime rate. Second, the lines of credit extended to finance companies facilitate borrowing by the latter on the commercial paper market. Third, short-term bank loans are an important source of funds supporting instalment credit extended by retailers. Indeed, the only important segment of instalment credit that is more or less insulated from the vagaries of the banking system is that furnished by credit unions. Their funds come almost entirely from savings of individual members.

An increased flow of bank funds in support of instalment credit may reflect (a) an increase in bank deposits resulting from an improvement in the reserve position of the banking system, (b) an increase in non-deposit borrowings of banks, or (c) a decrease in other types of bank credit. Only the first of these possibilities is subject to direct influence by U.S. monetary authorities.

An increased flow of finance company funds into instalment credit may reflect, in addition to an increase in bank loans or commercial paper debt, any of the following: (a) an increase in long-term borrowings from such capital market participants as life insurance companies, bank-administered trusts, and pension funds; (b) a reduction in cash or other liquid asset holdings; or (c) a reduction in other types of credit held by finance companies. From a practical standpoint, however, only the first possibility is likely to be important. While finance companies hold large amounts of cash, these holdings consist mainly of compensating balances in support of bank lines; hence they are not available to finance any sizable expansion of instalment credit. Finance companies (especially sales finance companies) also hold large amounts of credit other than consumer instalment credit. However, much of this consists of "wholesale" credit or other loans that are basically complementary to consumer instalment credit.

With this theoretical and institutional background let us now turn to some empirical evidence on the responsiveness of instalment credit to monetary restraint.

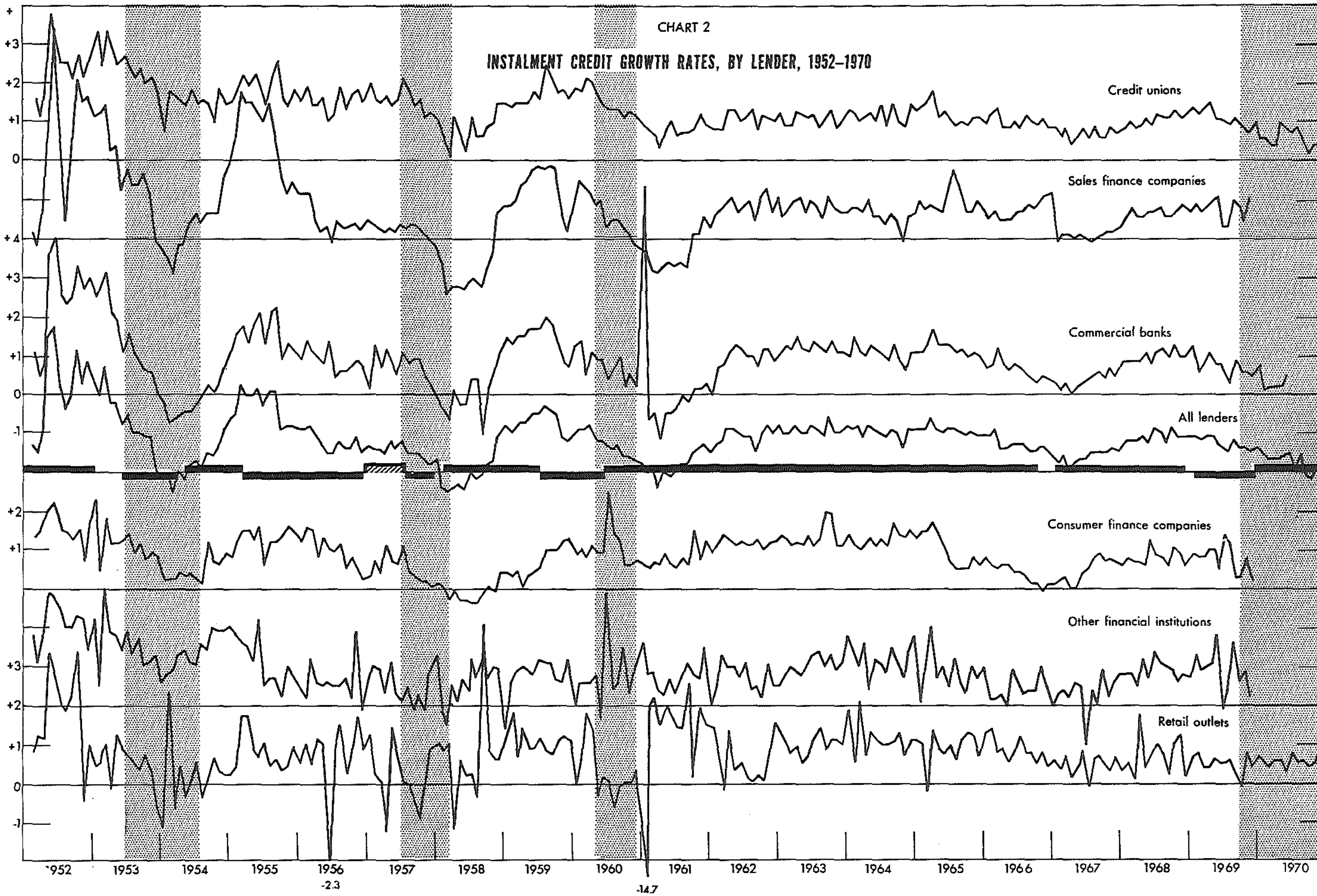
III. Alternative Measures of Instalment Credit

We are still not quite out of the woods, conceptually. Although we formed some tentative notions in Section I of how to identify periods of monetary restraint, we must now consider how to measure instalment credit behavior. Like the money supply and many other time series in economics, instalment credit outstanding has had a pronounced uptrend which disguises its short-run movements. These movements can be perceived more readily by looking at either net changes in outstanding credit or extensions of new credit. However, both of the latter series suffer from the fact that absolute dollar changes are less meaningful, for many purposes, than relative changes. This is especially so when we are interested in comparing lenders of substantially different size (e.g. commercial banks and credit unions). In this paper we shall focus on month-to-month growth rates in seasonally adjusted outstanding credit.

The time span to be investigated, 1952-70, was selected for two reasons. First, instalment credit downpayments and maturities were controlled by the Federal Reserve's Regulation W during much of the period from August 1941 to May 1952, when the regulation finally

CHART 2

INSTALMENT CREDIT GROWTH RATES, BY LENDER, 1952–1970



was revoked. This type of selective control, which undoubtedly did influence instalment credit growth rates, does not fall within the scope of "monetary restraint" as it is usually understood in this country. Second, from the early 1930s through the Treasury-Federal Reserve Accord of March 1951 there was only one brief episode of monetary restraint, in 1937. Moreover, prior to 1940 only year-end data on instalment credit are available.

Monetary Restraint and Instalment Credit

Chart 2 shows month-to-month percent changes in total instalment credit outstanding (middle line) and instalment credit held by each of the six main types of lenders. From the total line it can be seen that the rate of growth fell during each of the five periods of monetary restraint. In 1953, 1957, and 1969-70 the growth rates already were falling prior to the onset of the restraint period, as defined earlier. However, the rates did fall faster after restraint began than they did before, suggesting that there was some responsiveness to the tightening of policy. The restraint period of 1955-56 was rather different. Instalment credit expansion had been accelerating since early 1954, and after the switch to restraint the rate of acceleration quickened for the next five months. Instalment credit growth continued at a rapid rate for another six months before entering a long, drawn out period of receding growth rates. While it cannot be said that the restrictive policy initiated in 1955 had immediate effects on instalment credit, nevertheless one can argue that the expected effects did emerge after a lag of about half a year. The 1959-60 episode was more consistent with the view that policy affects instalment credit growth promptly. On that occasion the growth rate peaked in the third month of restraint. On the whole, then, the aggregate data seem to support the notion that instalment credit is quite responsive to monetary restraint.[8]

[8]Since the Nantucket Conference I have been experimenting with regressions of growth rates in instalment credit on lagged values of growth rates in the various monetary aggregates. This work was still in progress at press time, so the detailed results will have to be presented elsewhere. On the basis of preliminary results, however, it can be stated that statistically significant R^2 values can be obtained for equations of the form:

$$\ln C_t - \ln C_{t-1} = a_1 + a_2 (\ln M_{t-n} - \ln M_{t-n-1}),$$

where the C_1 denote seasonally adjusted levels of consumer instalment credit outstanding and M_{t-n} seasonally adjusted levels of a given aggregate n months earlier. For the particular aggregate M_1 it appears that the closest fit is obtained when $n = 7$; i.e., changes in M_1 appear to influence instalment credit with a lag of about six to eight months.

The data for commercial banks, sales finance companies, credit unions, and consumer finance companies--together they have accounted for over 95 percent of instalment credit held by financial institutions and for more than 80 percent of total instalment credit in recent years--are quite consistent with the aggregate data. In fact, it is remarkable how similar these four institutions were in the behavior of their growth rates when one considers the heterogeneity of their instalment paper holdings. Sales finance companies, for example, run heavily to auto paper, while consumer finance companies concentrate on personal loans, yet their cyclical undulations are really quite similar. Even the other two holders, other financial institutions and retail outlets, have tended to move in step with the aggregate movements if one ignores the sizable erratic components in their data.

To compare institutions one should correct for differences in credit mix. This can be done very simply by examining the behavior of a given type of paper at each holder. Chart 3 shows auto paper growth rates for commercial banks, sales finance companies, and all other financial institutions. The similarity between banks and sales finance companies is very close, except in 1960 and, to a lesser extent, in 1969. These two institutions accounted for about five-sixths of outstanding auto paper in the late 1960s. The peaks and troughs for "other financial institutions" are also highly similar to those of banks and sales finance companies; however, since the mid-1950s their growth rates have been somewhat less volatile than those of the two major holders.

I cannot take time here to display comparable charts for the other types of instalment paper.[9] Suffice it to say that they tend to support the same conclusion that the auto paper data suggest: interinstitutional differences in instalment credit behavior largely disappear when one takes account of differences in credit mix. On the other hand, when one compares the movements of total auto paper with those of the other three types of instalment paper, one finds that auto paper consistently reached growth peaks ahead of personal loans; auto paper also led both other consumer goods paper and repair and modernization paper on three occasions and peaked simultaneously with the other categories on three of the four remaining comparisons (see Table 2).

[9]The results reported here are part of the findings of research conducted at the National Bureau of Economic Research which will be published in the near future. For additional results (based, however, on unrevised data) see my chapter in Murray E. Polakoff and others, *Financial Institutions and Markets* (Boston: Houghton Mifflin, 1970), Ch. 10.

CHART 3

AUTO PAPER GROWTH RATES, BY LENDER, 1952-1970

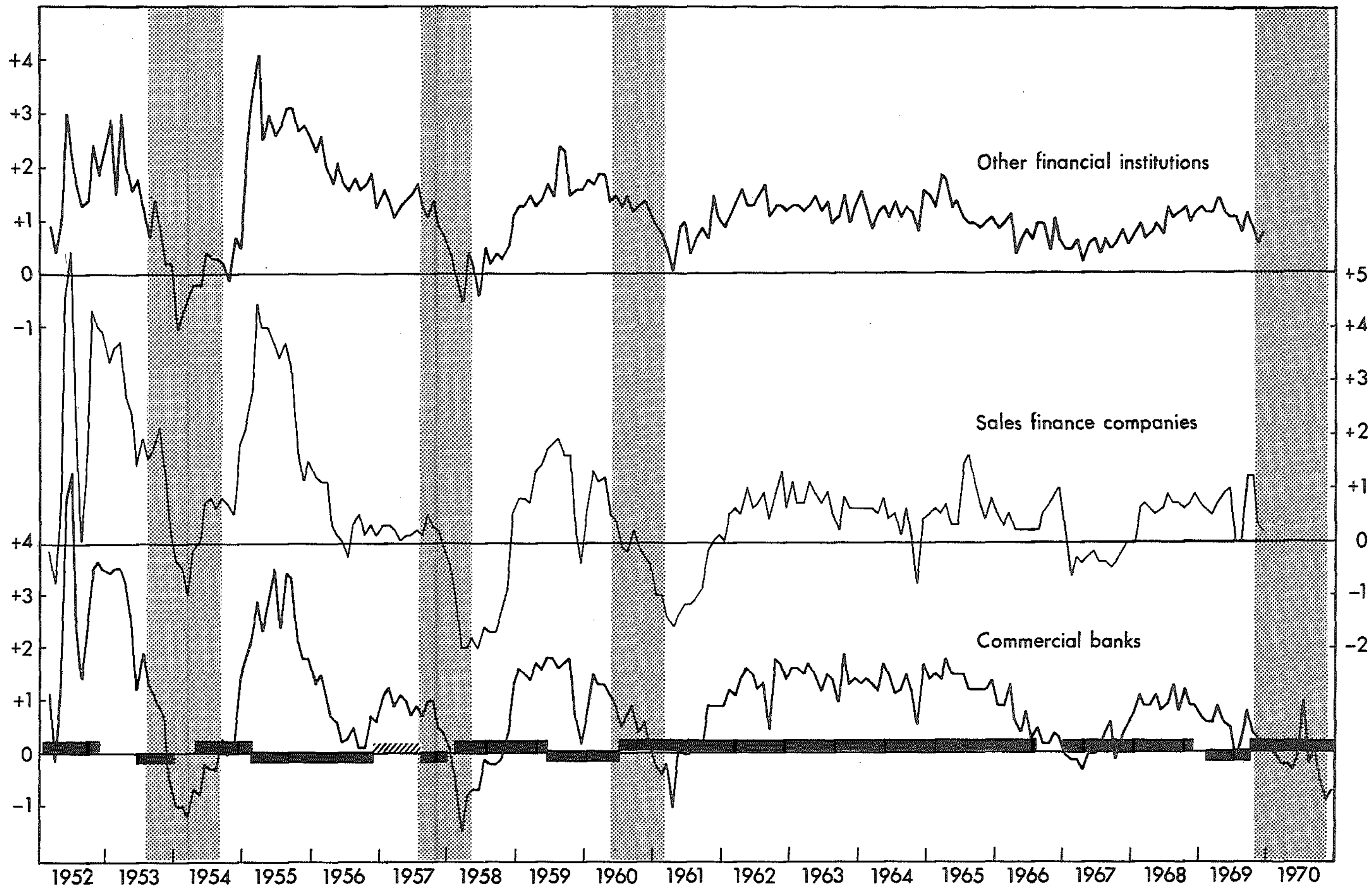


TABLE 2

GROWTH RATE PEAKS IN INSTALMENT CREDIT, 1952 TO 1970

Auto Paper	Other Consumer Goods Paper	Repair and Modernization Loans	Personal Loans
10/52	10/52	10/52	1/53
3/55	11/56	6/56	4/55
7/59	8/59	7/59	9/59
10/63	3/64	1/65	4/65
7/68	4/68	6/69	4/69

The policy implications of these findings are important. They suggest that there is hardly any difference in responsiveness to monetary restraint between the "regulated" lender, commercial banks, and the various unregulated lenders. Moreover, the general similarity among the latter institutions is especially significant when one recalls that these lenders differ widely in their sources of funds. It is unlikely that inability to obtain funds can explain the responsiveness of nonbank lenders to monetary restraint. The fact (not documented here but supported by related work for another study) that one finds systematic lag patterns among the various types of paper--similar for all types of lenders--suggests that the driving forces behind instalment credit movements come from the side of demand rather than supply. Demand conditions are likely to be different for each type of credit, but similar for a given type for all lenders. If this interpretation is correct then the responsiveness of instalment credit to monetary restraint must come about for reasons quite different from those assumed by the standard theory of monetary policy. If this is not the case, then the strong correlation between periods of monetary restraint and those of falling instalment credit growth rates must be regarded as a spurious relationship.

Instalment Credit vs. Other Types of Credit

Let us briefly compare instalment credit with other types of credit. One comparison that can readily be made is that between bank-held instalment credit, shown in Chart 2, and total bank credit, shown in Chart 1.[10] We are interested especially in the timing of the peaks in these series. The results are as follows:[11]

Instalment Credit		*Total Bank Credit*	
October	1952	July	1952
September	1955	October	1954
August	1959	April	1958
April	1965	September	1964
January	1969	August	1968

Clearly, instalment credit of banks responds to monetary restraint more sluggishly than total bank credit. A more relevant comparison, however, is between instalment credit and all other bank loans. This is shown in Chart 4. Since the "other bank loans" series was subject to much more pronounced irregularities than the "bank-held instalment credit" series, I have elected to compare them after removal of both seasonal and irregular movements--in other words, in terms of what the Census Bureau calls "Henderson curves."[12] The most striking feature of the chart is the general similarity of these two time series, particularly in the timing of responses to monetary restraint. Noninstalment bank credit growth rates peaked ahead of instalment credit growth rates on four of five comparisons, but the average lead was only 2.2 months and the range was only zero to five months.[13] The instalment credit series experienced wider swings, at least during the 1950's, and was considerably slower to snap back after the ending of restraint. From this point of view, therefore, it could be argued that instalment credit is more responsive to tight money than other types of bank loans.

[10]Note the differences in the scales ot these charts, as well as the fact that the instalment credit series has not been smoothed.

[11]The peak in instalment credit in June 1952 was ignored since it surely reflects the suspension of Regulation W in the preceding month.

[12]The Census X-11 method was used for removal of seasonal and irregular movements. For a description of this method see Julius Shiskin, Allan H. Young, and John C. Msgrave, *The X-11 Variant of the Census Method II Seasonal Adjustment Program* (Bureau of the Census, Technical Paper No. 15, February 1967).

[13]This calculation is based on a choice of F ebruary 1953 rather than July 1952 as a peak month for instalment credit growth. The earlier peak represents an abnormal adjustment to suspension of Regulation W controls in May 1952.

TABLE 3

GROWTH RATE PEAKS AND TROUGHS, INSTALMENT CREDIT AND OTHER CREDIT 1952 TO 1970

Type of Credit	Peaks (Percentages)				Troughs (Percentages)			
A. Sales finance company consumer instalment credit (monthly)*	Jan.		1953	(3.4)	Feb.		1954	(-0.6)
	May		1955	(3.4)	May		1958	(-1.2)
	July		1959	(1.9)	May		1961	(-0.8)
	Aug.		1965	(1.2)	Aug.		1967	(0.0)
	Jan.		1969	(0.8)				
B. Sales finance company business credit (monthly)*	Oct.		1952	(4.2)	Jan.		1954	(-3.4)
	Feb.		1955	(5.6)	Apr.		1958	(-2.2)
	May		1959	(4.4)	Feb.		1961	(-2.7)
	Apr.		1965	(1.8)	Feb.		1967	(-0.8)
	Nov.		1968	(3.9)				
C. Total consumer instalment credit (quarterly)	4th	Q,	1952	(8.6)	1st	Q,	1954	(-0.7)
	2nd	Q,	1955	(6.4)	2nd	Q,	1958	(-1.1)
	3rd	Q,	1959	(4.9)	2nd	Q,	1961	(-0.3)
	2nd	Q,	1965	(3.6)	2nd	Q,	1967	(0.5)
	4th	Q,	1968	(3.0)				
D. Total domestic non-financial nonfederal credit (quarterly)	3rd	Q,	1952	(2.6)	4th	Q,	1953	(1.7)
	4th	Q,	1955	(3.1)	2nd	Q,	1958	(1.5)
	2nd	Q,	1959	(2.7)	1st	Q,	1961	(1.5)
	1st	Q,	1966	(2.5)	4th	Q,	1966	(1.5)
	4th	Q,	1968	(2.7)				

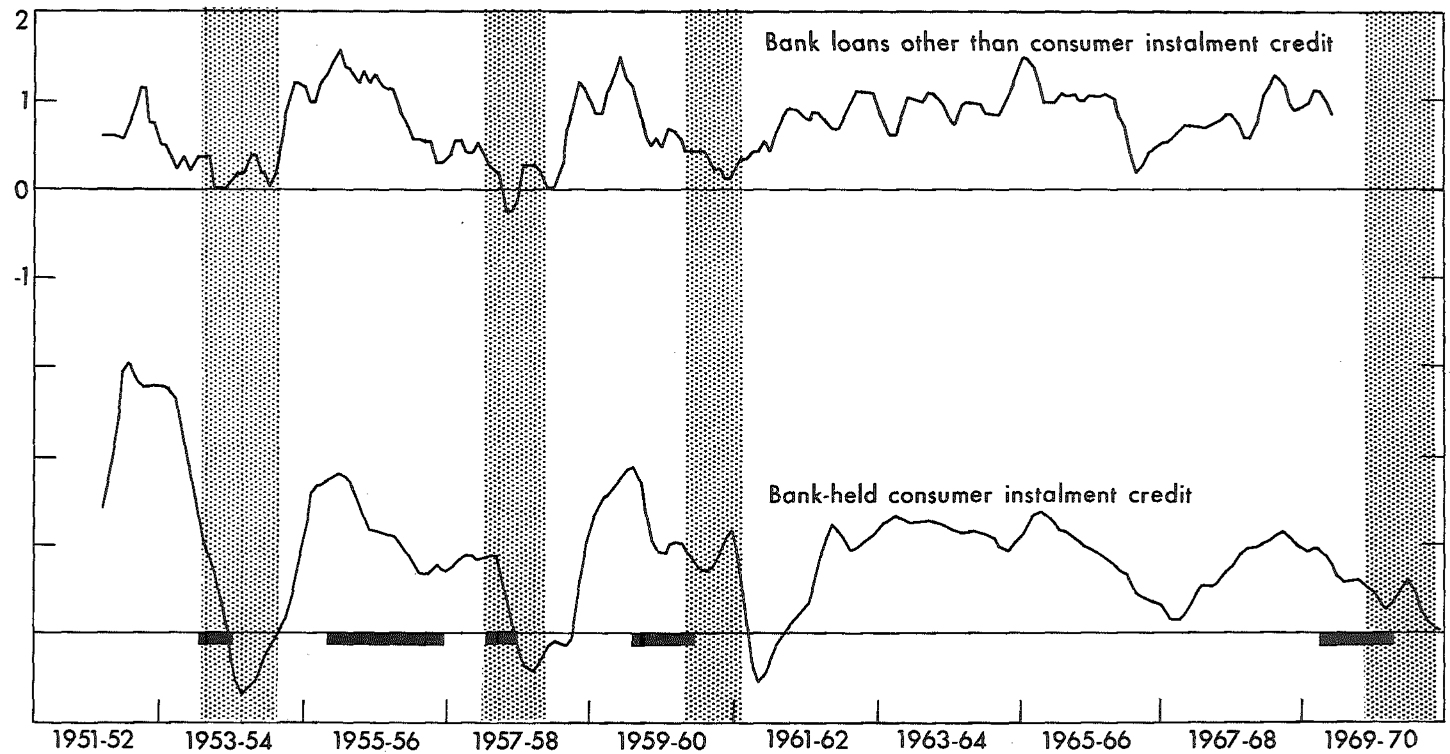
Mean lags at peaks:

A behind B: 2.8 months
C behind D: -0.6 quarters

***Both seasonal and irregular movements were eliminated prior to calculation of growth rates for sales finance company consumer instalment and business credit. The series shown on lines C and D, on the other hand, were seasonally adjusted but were not smoothed to eliminate irregular movements.**

CHART 4

GROWTH RATES OF COMMERCIAL BANK INSTALMENT CREDIT AND OTHER LOANS
1952-1970, ADJUSTED FOR SEASONAL AND IRREGULAR MOVEMENTS



Shaded areas represent business recessions. Black bars lying along instalment credit base line denote periods of monetary restraint according to M2 growth rate criterion(see text, section 1)

Finally, two additional comparisons can be made on the basis of the data in Table 3. Lines A and B of the table show the dates and levels of growth rate peaks in two types of sales finance company credit: consumer instalment and business. It can be seen that business credit was a great deal more volatile than consumer instalment credit, and that business credit consistently peaked first--a little less than three months ahead of instalment credit, on the average. Thus sales finance company data are consistent with bank data in pointing to a slight tendency for instalment credit to lag behind other credit in responding to monetary restraint.

Lines C and D of Table 3 offer what is probably the most meaningful comparison of the responsiveness of consumer instalment and other types of credit to monetary restraint. The peaks and troughs shown on line C are for quarter-to-quarter percent changes in total consumer instalment credit, seasonally adjusted. The information on line D pertains to percent changes in total debt, also seasonally adjusted, of the domestic nonfinancial nonfederal government sector; consumer credit was deducted from this total. From the figures in parentheses it can readily be seen that consumer instalment credit growth rates were much more volatile over alternating periods of monetary restraint and ease than other domestic nonfinancial nonfederal credit. As was suggested earlier, this can be interpreted as signifying that consumer instalment credit responds to monetary restraint and ease more strongly than other credit in the aggregate. The timing data are even more interesting. In 1952 and 1959 the growth rate of instalment credit peaked one quarter after that of other credit; in 1968 the peaks were simultaneous; and in 1955 and 1965 the instalment credit growth rate peaked ahead of that of other credit. Thus the median lag of instalment credit was zero, while the mean lag was -0.6 quarters.

One could use historical data to explore many other dimensions of the responsiveness of instalment credit to monetary restraint, and undoubtedly one would find the evidence somewhat mixed, as we have. However, we have reviewed enough evidence to feel confident that the differences between instalment and other credit in *promptness* of response to monetary restraint are not substantial. In terms of *degree* of response, on the other hand, it seems likely that consumer instalment credit is one of the more highly responsive types of credit.

IV. Instalment Credit at Sales Finance Companies

Our final task is to look more closely at sales finance companies, the most important nonbank provider of instalment credit. The data examined are quarterly figures compiled from individual company reports. Depending on the period covered, from 13 to 15 companies (not always the same firms) were included, ranging in size from small companies (consumer receivables under $5 million in 1953) to very large firms ($100 million or more receivables in 1953). Together these companies held about 75 percent of all sales finance company debt in 1960. Unfortunately, it has not been possible to extend the series beyond the end of 1961 because of mergers and other structural changes that limit comparability over time. The discussion is organized chronologically.

1952-54

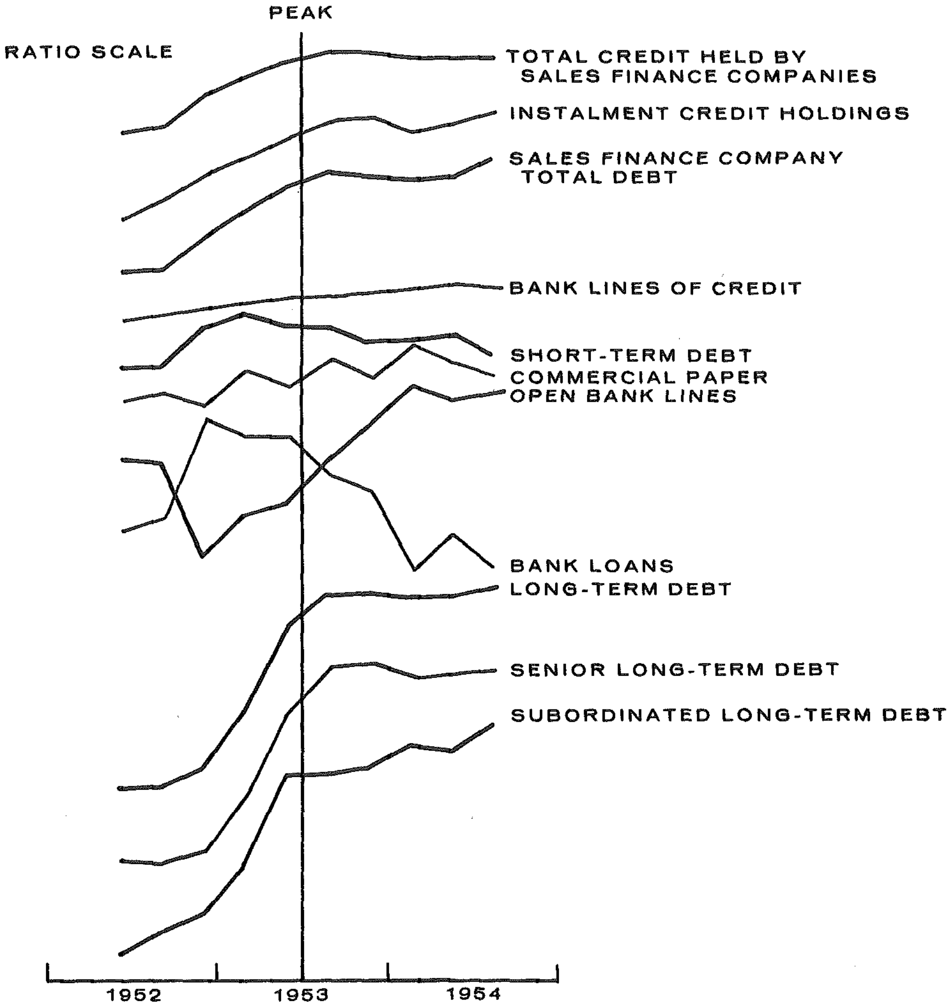
From Chart 5 it can be seen that from mid-1952 through the 1953-54 recession there was a very close correspondence between total credit, both consumer instalment and other types, held by all sales finance companies and total debt of our sample companies. This implies that variations in holdings of cash or securities did not play a significant role in instalment credit movements of sales finance companies in this period. Furthermore, except in the final two quarters of this period instalment credit moved roughly parallel to total credit, implying that sales finance companies did not finance instalment credit growth by slowing down expansion of other credit. In other words, we must look at the liability side of sales finance company balance sheets if we are to understand instalment credit movements.

The lower part of the chart shows several categories of debt, as well as bank lines of credit and open bank lines. It can be seen that short-term borrowings peaked in the first quarter of 1953. Since the commercial paper component of this debt followed a zig-zag upward course throughout the period, the decline resulted wholly from the downward trend of bank loans after the end of 1952. Long-term debt, both senior and subordinated, rose very sharply during the first three quarters of 1953. During the rest of the period long-term debt was essentially stable.

Earlier I argued, from the instalment credit growth rate information of Chart 2, that sales finance companies did respond to monetary restraint in 1953-54. Since the total debt of our sample of

CHART 5

SALES FINANCE COMPANY FINANCIAL DATA, SECOND QUARTER 1952 TO THIRD QUARTER 1954



Note: Levels are arbitrary; data not seasonally adjusted.

Sources: Top two lines, Board of Governors of the Federal Reserve System; All other lines, National Bureau of Economic Research, Finance Company Sample.

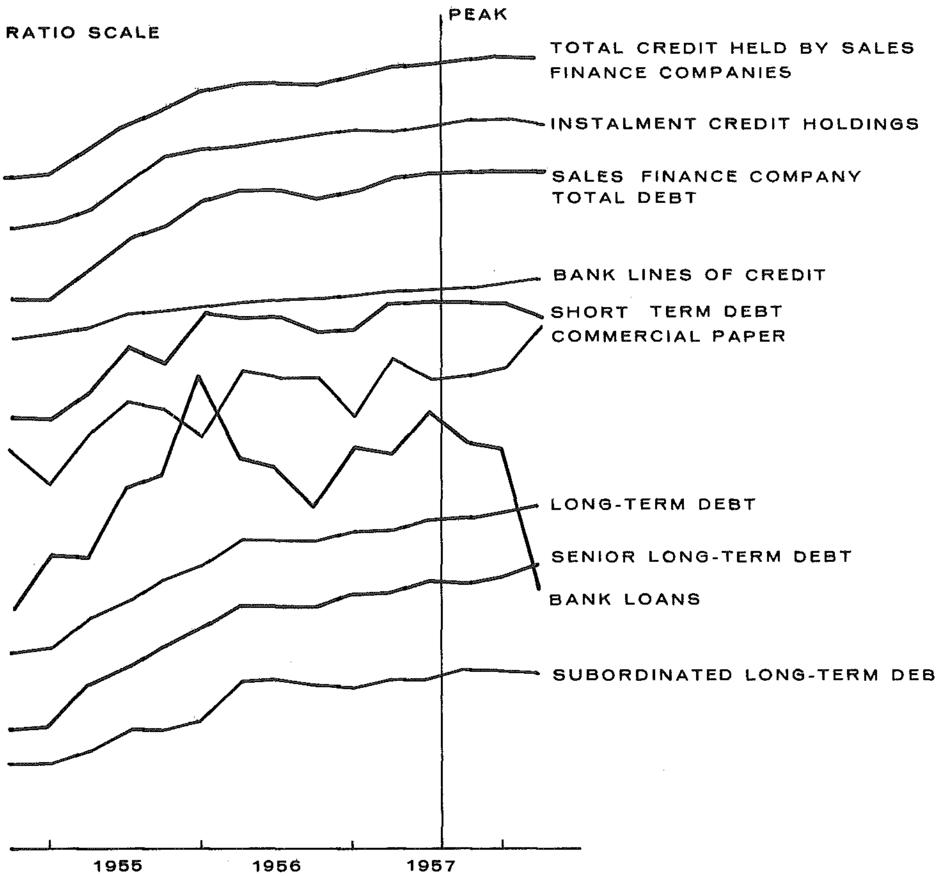
companies behaved very much like the aggregate instalment credit series for sales finance companies, it is clear that the same conclusion would have to be reached from an analysis of growth rates in their borrowings. Still, it is not at all clear from these data that sales finance company growth was inhibited by difficulties in raising funds. Particularly significant is the fact that these companies were able to acquire new bank lines right through the tight money period, with only the faintest sign of any retardation. *Open* bank lines, it is true, did fall sharply in the last quarter of 1952, probably more than the normal year-end decline associated with repayment of commercial paper for window-dressing purposes. Conceivably this development drove companies into the capital market in the first three quarters of 1953. A more plausible interpretation, I believe, is that sales finance companies revised upward their estimates of long-run growth prospects for their industry and decided to seek permanent funding as a cheaper means of finance than bank credit over the long haul. The proceeds of new debt issues were used in part to pay off bank loans.

My belief that monetary restraint did relatively little to choke off the flow of funds into sales finance companies is bolstered by comparison of data for smaller and larger companies--data which unfortunately cannot be presented here. The general expectation would probably be that small firms tend to be more responsive to restraint than the giant firms that dominate industry statistics. To some extent this was true during 1952-54: very large firms had a faster rate of expansion than large firms (those with $25 million to $100 million consumer receivables in 1953) or small-medium firms, and their growth continued longer into the tight money period, ending only in September 1953, compared with June 1953 for the small-medium companies. However, movements of the small-medium and large categories were quite similar. Moreover, data for a few small firms indicate that they were able to expand bank lines as rapidly as the nation's largest sales finance companies.

Finally, how about finance subsidiaries? Data for two very large subsidiaries indicate total debt peaks in September 1953 and March 1954. Three very large independents, on the other hand, peaked in May, October, and December 1953. Although firm conclusions cannot be based on such slim evidence, this hardly suggests a major difference between subsidiaries and independents in degree of responsiveness.

CHART 6

SALES FINANCE COMPANY FINANCIAL DATA, THIRD QUARTER 1954 TO FIRST QUARTER 1958



Note: Levels are arbitrary; data not seasonally adjusted.

Sources: Top two lines, Board of Governors of the Federal Reserve System; all other lines, National Bureau of Economic Research, Finance Company Sample.

1954-58

From Chart 6 it is clear once again that the drawing down of liquid assets or noninstalment credit played at most a negligible part in the growth of sales finance company instalment credit from the third quarter of 1954 to the first quarter of 1958. On this occasion short-term debt grew, albeit slowly, through the second quarter of 1957 and then fell only slightly. Bank loans, as before, peaked early in this expansion while commercial paper followed an irregular upward path again. Bank lines continued to push ahead steadily. Long-term debt behaved more sedately than in 1952-54, increasing at a fairly steady pace. During this period small-medium companies followed a course almost identical to that of the industry's giants in short-term borrowings; their long-term debt grew substantially faster than that of the very large companies. In terms of total debt the evidence suggests the largest and smallest companies were equally responsive to monetary restraint.

The evidence on finance subsidiaries was mixed again: their debt peaks were in August 1957 and March 1958, compared with August 1957, December 1957, and February 1958 for the three very large independents.

1958-61

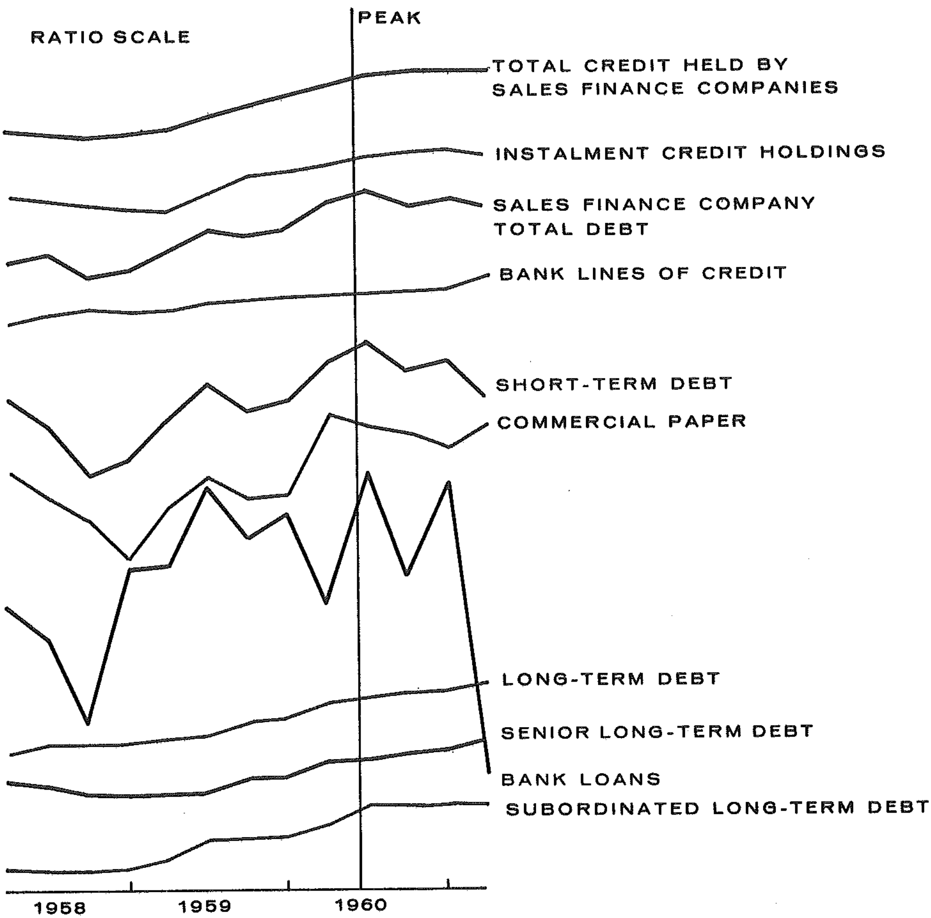
Data for the final period are plotted in Chart 7. The contours of the total debt and total credit lines do not match quite as closely as before. However, for the period as a whole it is clear that changes in non-credit assets such as cash made only a negligible contribution to growth of instalment and other credit. Bank loans again went through wide swings, peaking at the cycle peak, in contrast to bank lines, which rose steadily. Commercial paper followed a mildly cyclical path this time, with the peak coming one quarter ahead of the bank loan peak. Long-term debt again expanded steadily throughout the cycle.

During 1958-61 movements in total debt were almost identical for the small-medium and very large sales finance companies. Firms of intermediate size (large firms) peaked several months ahead of the others. Thus it appears that the largest companies responded to monetary restraint just as promptly as much smaller companies did. Bank lines of two small companies grew faster than those of three firms that were more than 70 times as large.

The two finance subsidiaries reached their maximum total debt in April and July 1960, while the very large independents peaked in August 1959 and June 1960 (two firms).

CHART 7

SALES FINANCE COMPANY FINANCIAL DATA, FIRST QUARTER 1958 TO FIRST QUARTER 1961



Note: Levels are arbitrary; data not seasonally adjusted.

Sources: top two lines, Board of Governors of the Federal Reserve System; all other lines, National Bureau of Economic Research, Finance Company Sample.

In summary, it seems fair to conclude from this evidence, as well as much further evidence that will be published elsewhere, that monetary restraint of the degree experienced between 1952 and 1961 did not have a substantial effect on the flow of funds into sales finance companies. Even tiny companies managed to find new bank lines during restraint periods, and only rarely were compensating balance requirements raised. One high executive of a major firm confided proudly to me that his firm had never been forced to limit its operations for lack of funds on reasonable terms. This may be discounted as idle boasting. However, the evidence I have seen shows relatively few indications of financial stringency, even among far smaller firms.

Thus the evidence from our sales finance company sample during 1952-61 is broadly consistent with the aggregate results of Section III--instalment credit does seem to respond to monetary policy, but not in the way that is usually assumed.

V. Summary

This paper has been concerned with the question of whether general monetary restraint does in fact restrain instalment credit. From the standpoint of conventional theory our results are somewhat paradoxical. On the one hand it is clear that instalment credit growth does slow down during periods of restraint--at least if we measure the latter as periods in which the money supply grows at a slower rate than potential real GNP. On the other hand, the ability of sales finance companies, large and small alike, to activate their massive bank lines, to obtain new lines, and to tap the open credit markets during even the most restrictive periods strongly suggests that these companies are not highly sensitive to the tightening of policy.

The resolution of the "paradox" lies in recognizing that the standard theory of monetary policy is inadequate. Through some mechanism such as the portfolio adjustments by firms and households that were set forth in the Friedman-Meiselman and Friedman-Schwartz studies,[14] it appears that a prolonged reduction of the rate of monetary growth below the economy's potential real growth rate leads directly to a decline in the demand for autos and other durable goods, independently of credit availability or interest rate effects. Since the demand for instalment credit is largely derived

[14] See the citations in f.n. 1.

from the demand for consumer durables, this means that instalment credit demand also falls. Finance companies, faced with a reduced volume of instalment paper being generated by retail outlets and by fewer customers for cash loans, cut back their borrowings. Bank credit is usually more expensive, at the margin, than commercial paper, so not surprisingly this is the debt component that is cut back first.

Auto Paper Leads in Responding to Monetary Restraint

In addition to the debt statistics of sales finance companies we found support for this portfolio balance theory of monetary policy in the behavior of instalment credit growth rates, classified by type of lender and type of paper. We found a broad similarity among banks, sales finance companies, and other financial institutions in their auto paper growth rate movements--a similarity that holds for other types of instalment paper as well. Yet at every lender auto paper tends to lead the other types of paper in "responding" to monetary restraint. In view of the differences in supply conditions facing the various lenders, this is a surprising result. One would expect monetary restraint to impinge first on the lenders that are heavily dependent on borrowed funds--specifically, finance companies. Credit unions, on the other hand, are almost completely insulated from the banking system and open credit markets, so one might expect them to respond only sluggishly to monetary restraint. However, such has not been the case. Moreover, it seems surprising that a lender who is reducing his rate of expansion of auto paper during a period of restraint because of borrowing difficulties will nevertheless continue to increase the growth rate of his personal loans. If reduced availability or increased cost of funds is responsible for retardation of auto paper growth why does it not produce simultaneous retardation of growth of other types of instalment credit? The simple answer, it seems, is that demand fluctuations are the main explanation of variations in instalment credit growth rates, and these are linked to policy changes in ways that are still only dimly understood.

For a time in the 1950s and early 1960s a favorite topic of discussion among monetary specialists was the nonbank financial intermediary question. Does the existence of unregulated intermediaries constitute a serious leakage for conventional monetary policy? Should the Federal Reserve's conventional tools such as cash reserve requirements be applied to nonbank intermediaries? Should the Fed be armed with selective controls that would apply to all providers of given types of credit? The present study does not provide conclusive answers to these questions. However, it does document one important exception to the leakage hypothesis. Further, there seems to be no valid case whatever for extending cash reserve requirements to any of the intermediaries that participate in instalment credit markets. As for selective controls, these have been advocated from time to time for a variety of reasons, and this study does not pretend to be relevant to all of them. However, insofar as the call for selective controls over instalment credit has been based on the leakage assumption, in the hope that monetary policy could be strengthened at one of its weakest points, it seems to have been without basis. Instalment credit and the institutions that provide it are highly responsive to monetary restraint, even if in a manner that has not generally been recognized.

DISCUSSION

DANIEL H. BRILL

Professor Selden's paper does provide some comfort to central bankers and ex-central bankers. He finds that monetary restraint does indeed get reflected in a reduction in the growth of consumer instalment credit, and usually fairly promptly. I am sure the Fed is happy to be able to add the scalp of the consumer to that of the home buyer and the municipal finance officer on its list of victims of restraint.

But Professor Selden has more important things to do than test the overall efficacy of monetary restraint. The important question to which his paper is addressed is the path through which this impulse of restraint is transmitted, because, as he indicates, the alternative paths one might visualize can lead to different longer-run policy considerations. Two major alternative routes are considered. The first is the traditional view emphasizing constraints on the funds available to consumer credit lenders and therefore on the ability of consumers to obtain financing of the durable goods they still wish to acquire. The alternative is one in which the changes in monetary policy operate directly on consumer portfolio preferences, with restraint resulting in the reduction of consumer demands for nonfinancial assets and therefore in a reduction of demands for instalment credit. Professor Selden admits, and all reasonable men must agree, that these alternatives are not mutually exclusive, and that likely some of both forces are operative. But he concludes that the credit availability argument is not well supported by the evidence he can induce.

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As I see the paper, the principal evidence indicates that after adjusting for differences in product-mix among different types of lenders, all of the major categories of lenders seem to have been equally responsive to monetary restraint. Given major differences in fund sources -- the availability of funds to these different categories of lenders -- it appears unlikely that the inability of lenders to obtain funds can explain the consistency and timing of their response. Therefore the driving force must be the shift in consumer demand for goods induced by reduced rates of monetary growth, rather than a change in the supply of funds available for instalment credit.

The second category of evidence cited is in effect an elaboration of the first, with particular reference to sales finance companies. Professor Selden finds that monetary restraint does not appear to have had substantial effect on availability of funds to sales finance companies, a lender group accounting for over a fifth of all the instalment credit outstanding. Since he finds no signs of significant limitation on the access these companies had to traditional funds sources, he again concludes that demand factors rather than supply elements dominated.

In responding to these arguments, I must confess immediately that my information base is limited in both scope and time. I see the problem from the vantage point of only one lender, and that a large lender with alternatives in the use of funds. Further, I have had first hand experience in only one cycle and this happens to be a cycle which Professor Selden doesn't deal with extensively. So it may be that differences in the structure and practices in the industry between the earlier time periods he is examining and the most recent example might indeed be significant. I think, however, that there is a difference of some substance that might not easily be explained away in terms of structural shifts.

I think Professor Selden has overlooked or at least underemphasized two very important considerations in the credit extending process -- prices and costs. He recognizes that instalment credit is largely a price-fixed business. I quote from his paper: "Most instalment credit is now subject to strict regulation by the states. Regulated aspects include rates, loan size, location of place of business, and methods of rate quotation." That very definitely accords with the limited experience I have had. There is not very much downward deviation in rates from state imposed ceilings, even in periods of monetary ease. Also there is not much tendency among state regulatory bodies to increase the ceilings during periods of monetary restraint. Thus, profit margins on consumer lending swing widely and cyclically. For finance companies with options for allocating funds away from the consumer area -- and this includes banks and many of the large and diversified sales finance companies, which together probably account for 50 to 60 percent of instalment credit outstanding -- rising money costs become the signal to look for other areas in which to employ funds. Increasingly, attention is focused on lending where the rates of return can be adjusted rapidly to increases in money costs. This includes variable rate business loans and leasing, which to an increasing extent are now tied to the prime rate for nonbank lenders, and also lending in areas where terms can include equity participation. Thus, there is a rationing effect by lenders who can move funds out of the consumer area.

Even within the consumer area, the area of instalment credit, there are options for rationing. Dick points out that he finds simultaneity of response within each of the major categories of credit. Auto paper tends to respond to restraint simultaneously at different classes of lenders, personal loans tend to respond with roughly the same timing, etc. Again, I would submit that this can be partly explained on a rationing basis. Auto lending is less profitable than other types of consumer credit lending. When money costs go up, the first reaction is to try to employ funds in areas where the margins can still be maintained, such as in personal loans.

I must admit that such cyclically-induced shifts in the use of funds tend to be marginal. Major changes in business, such as the massive withdrawal of independent finance companies from wholesale auto financing, are structural shifts taken only after profitability trends become overwhelmingly evident to management. Such massive shifts are not undertaken lightly. After all, there are structures to be maintained and skills to be preserved, pressure of customer relationships to be accommodated, and of course, internal competitive pressures to be considered. Moreover, management must be convinced that the consequences of monetary restraint will likely persist for some time and perhaps become accentuated before it becomes worthwhile to shift resources on a significant scale. But it does happen; there is rationing and the mechanisms for rationing are pretty well developed. Many banks and many finance companies have developed scoring systems for the determination of eligibility of customers for credit. These are systems which can be applied to purchased paper or direct loans; the minimum qualifying score for borrowers can be adjusted in order to bring lending volume closer to desired levels. I conclude that rationing of credit by lenders is feasible and is practiced, and it can occur without any rationing of credit to financial organizations.

I agree that the availability of traditional sources of funds to the finance companies tends to be maintained during periods of monetary restraint. The commercial paper market has continued to function -- at least before the Penn Central development. It has been my observation, too, that bank line availability does not tend to change markedly, and with good reason. Finance companies are banks' good customers. They pay handsomely for a banking service that is used only sparingly, for the name of the game is to have a large volume of bank lines (paid for by compensating balances) but to use high cost bank money only at seasonal peaks. So if there is a drive to ration, it is not principally in response to contractions of credit availability to finance companies. I wouldn't look for it in the data, and I am not surprised that Professor Selden didn't find it. It is merely a change in the relative profitability of different types of business.

Rationing can also take place not only for diversion to other forms of lending but also sometimes simply to cut back on gross growth. I realize that the growth syndrome is supposed to dominate business considerations, but sometimes one can make a rational business decision, at certain points in the cycle and under certain forecasts of the future, that it is not wise to expand any price-fixed category of loan. For example, during a period of monetary ease, if the prospects are for a significant rebound in money costs within the time period which would cover the life of loans put on the books today, it may be more profitable over the longer run to let the volume of price-fixed assets run down, rather than to compete for business at declining rates or else lower the quality standards. This observation isn't directly germane to the thrust of Professor Selden's investigation, which is focused on restraint effects. But I do note it because I think it reflects another instance of price and cost considerations resulting in rationing, a development which I think was pretty much ruled out in Dick's terms by his own observations.

I will repeat my apology for not being able to quantify the rationing effect of price and cost considerations. It may be that these are too recent developments, or too localized to a few alert banks or diversified finance companies, to be of sufficient magnitude to refute Dick's findings. But at least conceptually, it does provide an alternative explanation for some aspects of the cyclical behavior he has observed.

Nor would I deny that at certain stages of the cycle, demand influences become dominant in determining the growth of instalment credit. I would have thought that this would have been more likely to occur after the peak of monetary restraint had passed. Here, since

Dick doesn't reach this conclusion, I must question whether he has given the supply theory a fair shake in his analysis.

In two of the five periods he characterizes as those of restraint, there is almost a precise coincidence with the beginning of what the NBER terms a shaded area, an economic downturn. In 1953, Selden dates the beginning of monetary restraint in June while the NBER dates the beginning of the downturn in July. In 1957, he dates the beginning of restraint in August; the NBER downturn begins in July. This could be subject to many interpretations. One is that there has been almost instantaneous response of the economy to monetary restraint, but I think that sort of theorizing would out-Laffer Laffer. The other alternative is that the Fed has managed to choose the wrong time to begin monetary restraint in each cycle, and that I can't accept if for no other reason than institutional loyalties. I feel that if one tries to accept both the NBER cyclical dating and Dick's restraint dating, it might support the role of demand influences on consumer credit but it leaves us quite unclear as to whether demand is being driven by income or wealth effects of a downturn, or whether the dominant influence is the portfolio balance theory that Dick has suggested. This is the problem I find in two of the five periods examined.

In a third period, 1959-60, I don't think that adequate attention has been given to the impact of the extended steel strike -- the unavailability of some types of automobiles before that period was over -- and its effects on instalment credit. If you try to exclude the steel strike period from the analysis, then again I think you have the problem of a downturn coinciding with what Selden classes as monetary restraint. So I wind up feeling that the portfolio balance theory has not very strong statistical support -- it doesn't seem valid for two out of the five periods identified and I am a little suspicious about its validity in the third.

Professor Selden concludes that since monetary restraint operates directly on consumers' demands for durable goods and therefore on their demands for credit, there is no need to consider selective controls, either in the form of extending cash reserve requirements to nonbank intermediaries, or by fixing maximum terms and conditions of instalment credit.

I am not sure that my own analysis of his findings come to that happy conclusion. If the growth rates of consumer credit decline under restraint because some portion of the funds usually allocated to consumer credit is diverted to business lending, then I think the question of selective controls -- perhaps selective controls over business lending -- still remains an issue of some moment for the Fed to consider. Obviously as an entrepreneur in the field I am not asking for selective controls, but I don't think the arguments advanced in this paper obviate the need for them.

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