Use of Survey Data to Check Behavioral Parameters in Econometric Models

by

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The basic difficulty with all large-scale econometric models based on aggregate time-series data is the small number of independent observations available for determining the appropriate parameters in a model with a large number of structural equations and a large number of alternative forms to select among for each equation.[1] With the use of increasingly complex lag structures, the number of alternative forms to choose from for each structural equation has proliferated greatly. Survey data, covering a large cross-section of consumers or business organizations, provide a basis for correcting this deficiency. This does not mean that such data do not have deficiencies of their own, but simply that the paucity of independent observations characterizing time-series, compounded by temporal changes in the economic structure, cannot be remedied without the use of cross-section information. The more serious deficiencies in survey or other cross-section data can be corrected with the availabil-

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[1]For a model of 100 equations with say ten forms to choose from for each equation, the theoretical number of combinations is 10^{100}, The number of time-series observations available for choosing among these combinations is extremely limited, even abstracting from problems of serial correlation and changes in the economic structure.

ity of sufficient resources.

This paper will use two illustrations to indicate how survey data can be used for checking and improving the parameters in econometric models. The first of these is in the area of business investment, and is based on data already available; the second is in the area of consumption and is based on preliminary information presented here for the first time. In both cases, the econometric model some of whose parameters will be checked against independent survey data will be the MIT-Pennsylvania-SSRC (MPS) model,which is in my opinion the best of the existing large-scale models in the United States.[1]

Business Investment.[2] To illustrate the problem of relying on time-series data in the area of business investment, producers' equipment expenditures in the MPS model are a complicated distributed lag of current and past orders, new orders

[1]The latest published version of the MPS model appears in Franco Modigliani, "Monetary Policy and Consumption," Consumer Spending and Monetary Policy: The Linkages, Federal Reserve of Boston Monetary Conference, June 1971, but a more recent version is available in Albert Ando and Robert Rasche, Equations in the MIT-Penn-SSRC Econometric Model of the United States (Mimeographed), October 1971.

An evaluation of the forecasting ability of the MPS model compared with the well-known Wharton model, which indicates a relatively favorable record for the MPS model, is contained in Koji Shinjo, "Predictive Ability and Dynamic Multiplier Properties of Alternative Treatment of the Monetary Mechanism," Journal of Finance, May 1962. An evaluation of the forecasting ability of the MPS model compared with the best auto-regressive models mechanically derived from historical data is less favorable to the MPS model (C.R. Nelson, "The Prediction Performance of the FRB-MIT-Penn Model of the U.S. Economy," The American Economic Review, December 1972).

[2]This discussion is based on Irwin Friend, "Mythodology in Finance," Journal of Finance, May 1973.

are an even more complex distributed lag of the product of the equilibrium capital-output ratio and output, and the equilibrium capital-output ratio is a simple function of the user cost of capital which assumes a Cobb-Douglas production function and assumes also that the cost of capital is a linear function of the real corporate bond rate and the stock dividend yield. The cost of capital is not measured directly but is that linear combination of the bond and dividend yields which gives the best fit in the demand for new orders of producers' durable equipment.

The dangers of curve fitting in an estimation procedure of this type are obvious. Thus, it has been shown that small differences in the regression coefficients of the lagged variables in the type of plant and equipment investment relations used in the MPS model have very little effect on the goodness of fit of the equation but can change dramatically the distributed lag pattern. In one example, changing the coefficient of a lagged variable (in this case investment two quarters earlier) by three-fourths of its standard error implied that 90 percent of the impact of monetary policy on net investment in plant and equipment occurred within an eight quarter period whereas without this change only about one-third of the impact took place within this time interval.[1]

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[1] Zvi Griliches and N. Wallace, "The Determinants of Investment Revisited," International Economic Review, September 1965.

The point might legitimately be raised that it is easy enough to criticize current procedures but the relevant question is what can be done about them. One obvious but perhaps not too helpful implication of these deficiencies is that the model results should be presented and used with appropriate rather than perfunctory qualification. However, it is possible to considerably improve our current procedures by using what are for economists somewhat less orthodox sources of data. Significant improvement in the estimation of lag structures among plans, orders and expenditures on business investment should be made possible by careful surveys of a stratified sample of business firms on their actual experience. More important, the direct impact of changes in monetary variables on business investment can be and have on occasion been analyzed from such surveys.

In my opinion, though I am a biased observer since I played a role in initiating this work, the best estimates of the impact of monetary policy on business investment have been obtained from the special surveys conducted by the U.S. Government in conjunction with the regular surveys of actual and anticipated investment in plant and equipment and in inventories.[1] These

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[1] Jean Crockett, Irwin Friend and Henry Shavell, "The Impact of Monetary Stringency on Business Investment," Survey of Current Business, August 1967; and Henry Shavell and John T. Woodward, "The Impact of the 1969-70 Monetary Stringency on Business Investment," Survey of Current Business, December 1971.

special surveys, covering two periods of the greatest monetary stringency in U.S. history, collected detailed information on the timing and magnitude of the direct impact of 1966 financial market developments on plant and equipment and inventory investment in 1966 and anticipated fixed investment in 1967, and of 1969-70 financial market developments on business investment in 1970 and anticipated fixed investment in 1971.

On the basis of these data, it was estimated that the direct impact of financial market developments during 1966 resulted in a reduction of only about $500 million in plant and equipment expenditures and approximately the same amount in inventory investment during that year and a planned reduction of somewhat under $1 billion in plant and equipment outlays in 1967. (Comparable data for inventories in 1967 were not available.) Not until the third quarter of 1966 -- more than six months after the decision to implement significant monetary restrictions -- were even the small average 1966 effects on plant and equipment and inventory investment achieved. The later survey found that the direct impact of financial market developments during 1969 and 1970 reduced actual plant and equipment expenditures by $1 billion in 1970 and planned expenditures by $1.4 billion in 1971 and inventory investment by $900 million in 1970. Both surveys indicated that the direct impact of stringent monetary policy on business investment was generally light in the first

two years after initiation of that policy and that the impact gradually increased over the two year time interval.

A rough comparison of these results with those implied by the MPS model is of considerable interest. If the two interest rates which are assumed to affect business plant and equipment outlays (i.e., the corporate bond yield and the stock dividend yield) are kept at their 1st quarter of 1966 levels but all other relevant explanatory variables take on their actual values, this model implies that expenditures on plant and equipment would have been reduced by not much over $500 million in 1966 but by $4 billion in 1967.[1] The 1966 figure is very close to that indicated by the survey but the 1967 figure is four times as large, with the monetary impact implied by the MPS model already twice that indicated by the survey in the first quarter of 1967. A similar analysis of the MPS results for the 1969-71 period, where the two relevant interest rates are kept at their 1st quarter of 1969 levels, implies very little direct effect of monetary policies on plant and equipment outlays in 1969, a $3.8 billion reduction in such outlays in 1970 and a $9.8 billion reduction in 1971, compared with the much

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[1] These figures are based on computer runs kindly supplied to me by Professor Albert Ando of the University of Pennsylvania. The use of 1st quarter rather than beginning of year levels of interest rates tends to understate somewhat the comparative impact of monetary stringency implied by the MPS model.

smaller figures of $1.0 billion and $1.4 billion in 1970 and 1971 indicated by the survey findings.

It is possible of course that holding interest rates constant at their beginning of period values represents easier monetary conditions, at least in real terms, than those assumed by businessmen in their survey responses to the effect of financial developments on their investment expenditures. If the real instead of the nominal costs of capital are kept constant at their 1st quarter of 1966 and 1969 levels, which presumably represented tighter monetary conditions in nominal terms than those assumed by businessmen, over three-fourths of the implied reduction in plant and equipment outlays in 1967 specified above would disappear, while those in 1970 and 1971 would be approximately halved. The result for 1967 becomes indistinguishable from the survey figure. However, the reductions in 1970 and especially in 1971 outlays are still considerably above those indicated by the survey data. Moreover, an alternative measure of the impact of monetary stringency on business investment provided in the second U.S. Government survey, which explicitly assumed significantly easier credit conditions than those prevailing during 1969 and 1970, indicated that even the more severe credit tightening implied by this assumption would have been associated with only a moderately larger reduction in investment ($1.4 billion instead of $1.0 billion) in the second year of this

period.[1]

To recapitulate, the survey findings agree with the MPS results on relatively little initial effect of monetary variables on plant and equipment, but seem to evidence less direct impact for the second year -- especially in the second of the two periods tested -- and substantially less impact in the third year. Unlike the MPS model, the survey data indicate a significant impact for inventory investment as well. Presumably, the MPS model is deficient in its inability to detect financial effects on inventory investment. These effects are clearly indicated by the survey data which suggest that the effects are about as large for inventory investment as for plant and equipment at least in the first year or two following changesin monetary policy. There is of course no similar theoretical presumption that the MPS model is inferior to the survey results in its implications for more substantial second and third year effects on plant and equipment. However, given the choice of assumptions and procedures necessary for the solution of the MPS model, I feel that the survey findings are more credible. In any event, it is clear that not much confidence can be placed in the MPS findings (other than the small effect on plant and equipment outlays in the first year after changes in monetary

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[1] Survey of Current Business, December 1971, pp. 19-21.

policy) in view of this apparent conflict of results. It does not appear likely that as much is to be gained by continued re-specification and re-estimation of the MPS (or any similar) model as by additional and more careful survey analysis and by other procedures which make use of cross-section data.

Thus, the equations in the business investment sector of the MPS and other models might be significantly improved by the use of continuous cross-section data (i.e., data available for each of a number of economic units for each of a number of time periods). Such information is readily available on tapes for all sizeable corporations in the United States. Deriving investment and related functions for each of 1000 or more corporations, as against a single aggregate time-series, greatly expands the number of independent observations and should provide a useful test of the validity of the equations in the MPS business investment sector.[1] For a small sample of large corporations, it should be especially valuable to combine the derivation of ex post investment functions with the collection of relevant survey data so that any implied discrepancies between the two approaches could be resolved.

Consumption expenditures. One of the most important chan-

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[1] There is no increase in the number of independent observations for the pure interest rate, but there is for the overall cost of capital as estimated by the MPS model as well as for all the other relevant explanatory variables in that model.

nels of transmission of monetary policy in the MPS model is the wealth effect on consumption. Monetary policy affects short-term and long-term interest rates, dividend yields and hence the value of assets, and -- of particular importance in view of its magnitude and volatility -- the value of common stock holdings. Qualitatively, there can be little question that assets affect consumption, and on the assumption of a life-cycle saving theory it is possible to apply some rough checks of reasonableness to the MPS estimate of the long-run effect on consumption of a change in the value of assets. However, the magnitude and, even more so, the time-sequence of this effect is extremely difficult to determine from time-series data.

The consumption function in the MPS model represents a refinement of earlier work by Professors Ando and Modigliani published in The American Economic Review.[1] In that work, which relates aggregate annual U.S. consumption to disposable labor income and beginning of year personal assets or wealth in a single equation model covering the period 1929-56 exclusive of 1941-46, the estimated asset coefficients in different forms of the equation tested were consistently significant. They ranged from .04 to .08 as compared with "theoretically expected" coefficients ranging from .11 to .13 on the basis of

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[1] See Albert Ando and Franco Modigliani, "The Life Cycle Hypothesis of Saving," The American Economic Review, March 1963 and "The Life Cycle Hypothesis of Saving: A Correction," March 1964.

the life-cycle hypothesis (if yields on assets vary between three percent and five percent and the annual rate of growth of aggregate income between 0 and four percent). If the consumption function is assumed homogeneous in income and assets, as Ando and Modigliani recommend, most of the asset coefficients ranged from about .06 to .08. A subsequent time-series analysis by Michael Evans based on quarterly U.S. data for 1947-62 concluded, in contrast, that in the post-war period covered there was no significant effect of initial assets on consumption.[1]

The updated version of the Ando-Modigliani consumption function in the MPS model, which is homogeneous in disposable income and assets but now breaks down assets into stocks and all other assets and makes use of distributed lags in the asset variables, implies a long-run stock coefficient of .054,[2] taking eight quarters to achieve, with 30.2 percent of the total impact achieved in the first quarter, 53.6 percent in the first half and 83.6 percent in the first year. The long-run stock coefficient is constrained to be equal to the other assets coeffi-

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[1] Michael Evans, "The Importance of Wealth in the Consumption Function," The Journal of Political Economy, August 1967, Part I.

[2] This updated version represents revisions incorporated as late as January 1973. As compared with the estimates in the June 1971 paper by Modigliani, which did not break down wealth into stocks and other assets, the long-run asset coefficient (assumed to be the same for both forms of assets) did not change appreciably from the earlier estimate. However, a very much lower proportion of the effect on consumption of changes in the value of stock and a moderately higher proportion of the impact of changes in the value of other assets took place in the first three months.

cient but no lag is allowed for in the other assets variable in which a change is assumed to achieve its ultimate effect on consumption in the same quarter. It is noteworthy that the long-run effect of stock assets on consumption in the most recent version of the MPS model is lower than in the preferred versions of the earlier Ando-Modigliani equations which in turn were lower than the values implied by their theory. It is also interesting that the time pattern of the total impact of changes in stock and other assets is quite different in the most recent version of the MPS model compared with earlier versions of that model, with a slower effect of changes in the value of stocks held and a faster impact of changes in the value of other assets.

Perhaps enough has been said to indicate the very large margin of indeterminancy in estimating the pattern of asset effects on consumption from time-series data even though, if the MPS model is correct, asset effects in general and stock values in particular play a critical role in the effectuation of monetary policy. To obtain reasonably definitive insights into the timing and magnitude of the wealth effect on consumption, it will probably be necessary to collect new data through surveys which compile continuous cross-section information on household savings, income and assets and on realized and unrealized capital gains. Survey information on how households

say they react in their consumption behavior to changes in the stock market level may also be useful, but are not likely to be as reliable as businessmen's answers to questions about the effect of financial developments on their investment. However, even with the information already available, it may be possible to improve substantially on our present knowledge of asset effects of consumption. Thus, I have initiated an analysis of the relationship among saving, income, assets and capital gains from household data for 1963 (with income data for 1962 as well as 1963) collected by the Federal Reserve Board in their surveys of the Financial Characteristics of Consumers and Changes in Family Finances.[1] Saving in these surveys is measured from data on changes in assets and liabilities but is, of course, conceptually equal to income minus consumption expenditures. The surveys, which oversampled upper income groups, collected detailed information for more than 2,100 households in all income classes not only for income, saving and the values of major categories of assets held at the beginning and end of the year but also for the amounts of individual stocks held. As a result, the effect on saving of capital gains during the year can be studied on the basis of a large number rather than a handful of observations.

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[1] I am carrying out a detailed analysis of these data with the collaboration of Charles Lieberman. This paper presents some preliminary results.

There are several difficulties in extending to the corresponding time series relationships the result of an analysis of survey data on personal saving, income and assets derived from a single cross-section of households. First, since transitory components of these variables are likely to be relatively more important in cross-section data, there is the problem of separating out normal from transitory components, and this will be attempted in the subsequent analysis. Second, since we are interested in drawing intertemporal conclusions from interpersonal data, tastes effects must be considered. (This tastes problem is probably the most serious limitation of single cross-section analysis, but could be handled much more satisfactorily by continuous cross-section or panel data.) Third, measurement errors are generally larger for household cross-section than for aggregate time-series data, reflected both in larger random errors and in substantial survey under-estimation of savings.[1] However, there is reason to believe that the survey under-estimation of savings is not likely to affect seriously the shape of the saving-income relationship.[2] Moreover, for the value of stock assets held by households, the Federal Reserve surveys are likely to be more accu-

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[1] Irwin Friend and Stanley Shor, "Who Saves," The Review of Economics and Statistics, May 1959.

[2] Ibid.

rate than the time-series data in the U.S. -- at least for those respondents who report the number of shares owned in each stock in their portfolios.[1]

A number of cross-section regressions were estimated from the FRB survey results of the general form

$$S = a + bY_N + cY_T + dX + eZ + fV_{-1} + gO_{-1} + hAge + i\ Fam\ Size + j\ Occu,$$

where S is saving for 1963; Y_N, normal income defined except where otherwise noted as the average of 1963 and 1962 disposable incomes; $Y_T = Y_N - Y_{63}$; X, 1963 realized capital gains on securities,[2] Z, 1963 unrealized capital gains on stocks;[3] V_{-1} and O_{-1} are the market values of stocks and other assets, respectively, held at

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[1] A fairly close correspondence between reported and actual ownership for respondents who give the number of shares owned is indicated in validation tests discussed in R. Ferber, J. Forsythe, H.W. Guthrie and E.S. Maynes, "Validation of Consumer Financial Characteristics: Common Stock," Journal of the American Statistical Association, June 1969. In contrast a recent revision of the estimated market value of outstanding stocks in the U.S. made as part of the SEC Institutional Investor Study showed very little difference between the earlier SEC figures and the revised figures for the early 1960's but a $283 billion or 37 percent upward revision by 1968, most of the discrepancy occurring after 1964. (Supplementary Volume 1, 92nd Congress, 1st Session, House Document No. 92-64, Part 6, March 10, 1971.) The implications for an MPS type of consumption function are obvious. Unfortunately, even the revised series is suspect since it is based on fragmentary data (on dividend yields) for over-the-counter stocks.

[2] Realized capital gains generally represent unrealized gains in earlier years. Data were not available for stock and other securities separately.

[3] Unrealized gains in 1963 are gains reflecting the price changes during that year.

the end of 1962; and Age and Fam Size are continuous variables while Occu is represented by a dummy variable taking on the value 1 for households with self-employed heads and 0 for all other households. No variable was introduced for unrealized capital gains on assets other than stocks since such data were not available in the FRB survey.[1] This is unfortunate since in analysis based on a single cross-section the coefficient of unrealized capital gains is indispensable for estimating the time pattern of saving (or consumption) response to a change in the value of assets. As a result, we were not able to check the intuitively implausible MPS result that the effect of a change in value of homes, bonds and other non-equity assets on household consumption takes place immediately (i.e., in the same quarter). We were, however, able to check the implications of the MPS model for the timing pattern of consumption effects flowing from changes in the market value of stock owned.

The first regression presented below (1) covers all 2,159 households in the sample with data for each household weighted by the appropriate sampling ratio.

$$
\begin{aligned}
(1)\quad S = {} & \underset{(.766)}{-.147} + \underset{(.042)}{.234}\, Y_N + \underset{(.132)}{.184}\, Y_T - \underset{(.156)}{.275}\, X - \underset{(.013)}{.010}\, Z \\
& - \underset{(.002)}{.022}\, V - \underset{(.003)}{.001}\, O - \underset{(.011)}{.005}\, Age - \underset{(.091)}{.118}\, Fam\ Size + \underset{(.705)}{.569}\, Occu \\
& \qquad \bar{R}^2 = .052
\end{aligned}
$$

[1] It might be noted that the survey data confirm external sources indicating that realized capital gains on stock are a small fraction of unrealized gains. For a given level of initial assets, there is very little correlation between unrealized and realized gains.

The saving, income, capital gains and asset variables[1] are measured in thousands of dollars, with the numbers in parentheses below the regression coefficients representing their standard errors. Only the Y_N and V coefficients are statistically significant by the usual standards (with the X coefficient close to significance), and the $\bar{R}^2$ for the equation as a whole is quite low even for un-grouped cross-section data.

In order to minimize the errors associated with reporting the value of stock held (V) and the resulting estimates of unrealized capital gains on stock (Z), the two variables in which we are particularly interested, a second regression (2) was based on a sample of 1,770 households. This second sample excluded those respondents reporting stock ownership who did not stipulate the amounts of individual stocks held accounting for at least 90 percent of the value of all stock reported owned by the household. The exclusion was designed to ensure a reasonable correspondence between reported and actual ownership of stock.[2]

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[1] The definitions of saving and disposable income are the same as those presented in the Federal Reserve Board Survey of Changes in Family Finances by Dorothy S. Projector, November 1968. Unrealized capital gains on stocks are estimated from the prices at the beginning and end of the year for individual stocks held at the beginning of the year. Where adequate pricing information on individual stocks was not available, the Standard and Poor's composite stock price index was used.

[2] See "Validation of Consumer Financial Characteristics: Common Stock," supra. Even for respondents giving the number of shares of all stock reported owned, there is some tendency to overstate the size of very small holdings and understate very large holdings, and thus to bias upward (in absolute value) the coefficient of Z.

$$(2)\quad S = \underset{(.842)}{-.161} + \underset{(.048)}{.189}\, Y_N + \underset{(.151)}{.412}\, Y_T - \underset{(.161)}{.669}\, X - \underset{(.011)}{.032}\, Z - \underset{(.002)}{.019}\, V + \underset{(.003)}{.001}\, O - \underset{(.012)}{.004}\, Age - \underset{(.099)}{.080}\, Fam\ Size + \underset{(.787)}{.485}\, Occu$$

$$\bar{R}^2 = .094$$

The results of Eq. (2) represent an improvement over Eq. (1), with a moderately higher overall correlation, and with more generally satisfactory regression coefficients. Thus the coefficient of Y_T is now statistically significant and, as would be expected, is higher than that of Y_N and, of special importance for our analysis, the coefficient of Z not only has the theoretically anticipated sign but is significant as well. Of the other economically important variables, the coefficient of O has the wrong sign but is insignificant. The coefficient of X, realized capital gains on securities, is now significant, but it should be pointed out that while the sign is in accord with behavioral preconceptions, economic theory does not provide a clear indication of the direction of the expected effect. (In both samples of households referred to above, the weighted unrealized capital gains on stock over 1963 were over 15 times the realized capital gains on all securities.) It is interesting to note, therefore, that if the sample covered in Eq. (2) is further reduced to cover only households (1,503) with employed heads (eliminating the retired and not-gainfully-employed),

the X coefficient becomes positive and significant, the Z coefficient remains negative but is insignificantly different from zero, the V coefficient is reduced (in absolute value) to -.012 but remains significant, and the O coefficient is increased to -.017 and is now significant.

To eliminate the only other significant source of error associated with measuring V and to reduce the errors affecting Z and the other variables in these regressions, households which reported owning no stock or which did not pass a number of quality checks[1] were excluded from the sample for purposes of estimating Eq. (3). The reason for excluding those reporting no stock is that validation checks suggest that a number of such households do in fact own stock[2] and treating them incorrectly would tend to bias downward towards zero the estimates of the Y and Z coefficients.

$$
\begin{aligned}
(3)\quad S = {} & .515 + .064\,Y_N + .272\,Y_T - .057\,X - .032\,Z + .006\,V \\
& (.939) \quad (.035) \quad (.041) \quad (.093) \quad (.014) \quad (.003) \\
& -.007\,O - .006\,\text{Age} + .011\,\text{Fam Size} + 1.823\,\text{Occu} \\
& (.003) \quad (.012) \quad (.117) \quad (.629) \\
& \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \bar{R}^2 = .335
\end{aligned}
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[1] Households were excluded if normal income was less than $1,000; the absolute level of saving was greater than normal income; net worth was negative; stock assets at the beginning of year had a market value of less than $200,000 and either realized or unrealized capital gains were in excess of the value of stocks held; or stock assets had a market value of $200,000 or more and realized or unrealized capital gains were in excess of half the value of stock held.

[2] "Validation of Consumer Financial Characteristics: Common Stock," supra.

While the quality of the sample is further improved and the correlation is now reasonably high for ungrouped cross-section data, the size of the sample is greatly reduced to 305 and, more important, the resulting sample is biased in favor of households which have a propensity for saving in the form of stock so that the V variable, previously negative, now is positive. There are other interesting changes in the regression but for our purposes the important finding is that the coefficient of Z, -.034, is not changed from its value in Eq. (2).

The estimation of other mathematical forms among the variables in Eqs. (1) - (3), the substitution of another measure of Y_N (and hence Y_T), and various attempts to hold constant household asset tastes did not change the range of Z coefficients from the 0 to -.032 indicated above. The mathematical forms included dividing all variables (and the constant term) by Y_N, and, separately, adding square terms in some of the independent variables. Alternative measures of Y_N were obtained by regressing 1963 household income (Y) on the average incomes associated with each of a number of socio-economic-demographic groups to which the household belonged, and in one regression also on the measure of normal income used in Eqs. (1) - (3). An attempt was made to hold household asset tastes constant either by adding a $A - A_n$ variable to the regression, where A_n is obtained by regressing A on the average assets associated with each of a number

of socio-economic-demographic groups to which the household belonged and on Y_N, [1] or by regressing the average 1963 savings for each of a number of groups of households classified both by occupation and education on the average values of Y_N, Y_T, X, Z, A, O, Age, Fam Size and Occu for that group.

The question that remains to be answered is how the survey results on asset effects and especially on stock asset effects compare with the MPS results. There are three relevant comparisons that can be made at least in theory; these relate to the coefficients of Z, V and O. However, the regression coefficients of V and O are likely to be biased downward (in absolute value) towards zero as a result of the impact of taste effects on the results of a single cross-section analysis. Specifically, a household with a high propensity to save would have high saving and high assets so that the asset effect on saving would be biased downward unless some way is found to hold tastes constant. For this and other reasons, the fact that the long-run coefficient of V and O in the MPS model are substantially larger than those provided by the analysis of survey results is not strong evidence that the MPS results are biased upward. (Such evidence could only be provided by panel cross-section data which can hold tastes constant.)

The coefficient of Z in the survey results is likely to be

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[1] This procedure might be expected crudely to hold constant not only tastes but also initial (beginning of year) disequilibrium effects. The two effects should be opposite in sign.

much less biased by tastes effects than the asset coefficients. A high proportion of the variance in Z within a year (for given initial V) is probably unanticipated and therefore not affected appreciably by tastes effects, and since tastes are likely to be more highly correlated generally with V than with Z, holding V constant should eliminate much of the problem for Z. The Z coefficient estimated from the survey regressions, ranging from close to zero to -.032,may be compared with a corresponding figure of -.035 derived from the MPS model.[1] Thus, the FRB survey results suggest that the MPS estimate of the first year's effect of a change in the value of stock assets on saving and consumption is likely to be around the upper limit of the range bracketing the true effect and that the correct figure may very well be lower.[2] To obtain a more definitive figure would require panel survey data.

[1]The MPS figure is obtained by assuming that the proportion of Z applicable to each quarter of the year is the ratio of the change during that quarter in the Standard and Poor's composite index to the change over the year in that index and then applying the ratio for the first quarter to the sum of the coefficients of the stock asset variables in the MPS model for the first four quarters, the ratio of the second quarter to the sum of the MPS coefficients for the first three quarters, etc. A more precise result from the FRB survey analysis will be possible at a later date when Z will be computed not for the year as a whole but for the first and second halves of the year separately.

[2]It is interesting to note that, after rejection of a model which indicates no effect of unrealized capital gains on consumption, a recent application of an Ando-Modigliani type of consumption function to annual 1948-64 time series data implies a -.014 same year effect of a dollar of unrealized capital gains, which is close to the midpoint of our range; in contrast, the long-run effect, realized over five years, is .052, not too different from the MPS result. (K.B. Bhatia, "Capital Gains and the Aggregate Consumption Function," American Economic Review, December 1972.)

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The basic difficulty with all large-scale econometric models based on aggregate time-series data is the small number of independent observations available for determining the appropriate parameters in a model with a large number of structural equations and a large number of alternative forms to select among for each equation.[1] With the use of increasingly complex lag structures, the number of alternative forms to choose from for each structural equation has proliferated greatly. Survey data, covering a large cross-section of consumers or business organizations, provide a basis for correcting this deficiency. This does not mean that such data do not have deficiencies of their own, but simply that the paucity of independent observations characterizing time-series, compounded by temporal changes in the economic structure, cannot be remedied without the use of cross-section information. The more serious deficiencies in survey or other cross-section data can be corrected with the availabil-

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