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Consumption, Saving and Asset Accumulation

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Personal-consumption expenditures account for almost 64 percent of U.S. gross national product. Hence the collective decisions of the nation's consumers whether to spend or to save have a powerful impact on its economic health. High and rising levels of consumption translate into prosperity for the nation's retailers, and through them into higher output and more jobs in the industries producing consumer goods. On the other hand, economists worry that if too many of the nation's resources are channeled into current consumption, capital formation will be slighted, so that productivity growth will slow and future living standards will be hurt. In recent years there has, in fact, been a marked decrease in the rate of growth of overall productivity. At the same time, households have been saving a smaller proportion of their incomes than they used to. Although economists do not fully understand all the reasons for the productivity slowdown, the simultaneous decline in the saving rate probably has been a contributing cause. In any event, a key objective of the Administration's economic program is to boost productivity growth by encouraging personal saving.

This article investigates the aggregate consumption-saving decision in the United States. Although the determinants of household consumption have been studied intensively, the present study differs from most others in that its primary focus is on *saving* rather than on consumption. The act of saving is treated as a *demand* for various kinds of assets which are expected to yield returns in the future, so that total saving depends on all the factors which influence the public's purchases of assets. In addition, we consider "saving" to include purchases not only of financial assets but also of all types of tangible assets, including homes and consumer durables.[1] Thus, the term "consumption" refers only to household purchases of non-durable goods and services.

The study pays particular attention to the effects of changes in inflation and unemployment on saving decisions, in order to discover whether the faster inflation and higher unemployment experienced in recent years can explain the observed reduction in saving rates. It also examines the effect of changes in tax rates and finds that these have a significant impact on the saving-consumption decision.

In Section I, the accounting relations between the household's saving-consumption decisions and its balance sheet are described. It is argued that because of these accounting relationships, decisions to spend on current consumption and to purchase various kinds of assets are likely to be interdependent. Section II examines the main factors influencing saving decisions, with particular emphasis on the role of changes in tax rates and in the rate of inflation. In Section III the ideas of the preceding sections are developed into a formal model suitable for econometric estimation. Sections IV and V take up some technical econometric issues and describe the data used in the empirical work. Section VI presents the empirical results and their policy implications, and Section VII provides a summary and conclusions.

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I. Saving and Asset Accumulation

The approach to saving behavior developed in this article begins with the household's balance sheet, which shows its assets, liabilities and net worth on a particular date. Assets include not only financial assets such as bank accounts, securities and life-insurance policies, but also tangibles such as homes, cars and household durables. Net worth is defined as the difference between total assets and total liabilities. To illustrate these concepts, Table 1 shows the aggregate balance sheet of the household sector at the beginning of 1980.

During any period a household may use its current income either for current consumption or for saving. In turn, the portion of its income devoted to saving may be used either to add to its assets or to reduce its liabilities. If the household saves but makes no explicit asset purchase or debt repayment, its holdings of money—the medium of exchange—will rise. Table 2 thus shows that the total income of the household sector during 1980 was equal to its consumption expenditures plus additions to its holdings of tangible and financial assets minus additions to its liabilities.

Because of this *accounting* relation, a household's decisions to consume or to save will be influenced by the stocks of assets which it presently owns relative to the stocks which it wishes to own, given its current and prospective future income. If a household wants to add to its net stock of assets, it must spend less on current consumption, while if it wants to increase its consumption, it must hold fewer assets or incur more debts.

Moreover, saving-consumption decisions depend not only on the *total* stock of assets but also on the amounts of each *kind* of asset which a household owns relative to the amounts which it wishes to own. The *composition*, as well as the total value, of its asset-portfolio influences its saving decisions. This is because there are costs involved in buying and selling assets, and these costs differ as between different types of assets. Holdings of money, for example, may be promptly increased or decreased at no cost since money is the medium of exchange, whereas altering one's holdings of real estate frequently is costly and time-consuming.

The relevance of this second consideration may be illustrated by an example. Suppose a household experiences an unexpected reduction in its disposable income but wants to maintain its level of consumption spending. For this to be possible, the household must either reduce its asset-holdings or increase its liabilities. Alternatively, suppose it wants to buy a new car but would prefer not to lower its regular consumption outlays. In this case, the household must reduce its holdings of other assets or go into debt. In the first case the household's *total* stock of assets is reduced, while in the second case its total stock remains unchanged but the *types* of assets in that stock are altered. However, in either case, the required changes in its asset-holdings will be relatively easy to accomplish if the household has large holdings of money or other liquid assets, but will be more difficult and costly if its assets are mostly illiquid (such as a home) or if it has substantial debts outstanding. Thus the household's ability

Table 1: Household Balance Sheet: January 1, 1980 ($ Billions)

Total Tangible Assets	3,760	Total Liabilities	1,494
Total Financial Assets	6,237	Net Worth	8,503
Total Assets	9,997	Total Liabilities and Net Worth	9,997

SOURCE: Board of Governors of the Federal Reserve System

Table 2: Disposition of Household Income: 1980 ($ Billions)

	Gross Disposable Income	1911.4
=	Expenditures on Nondurables and Services	1508.5
+	Purchases of Tangible Assets	313.1
+	Purchases of Financial Assets	279.5
−	Additions to Liabilities	110.1
+	Statistical Discrepancy*	−79.6

*Separate data on consumption and saving do not precisely sum to income. The discrepancy item is added to close the identity.

SOURCE: Board of Governors of the Federal Reserve System.

to finance a given spending plan depends not only on the total value of its assets but also on whether these assets may be sold easily and cheaply. Indeed, if the household holds only relatively illiquid assets, it may prefer to reduce its current consumption temporarily rather than dispose of those holdings.

Because of these considerations, most households make their consumption and asset-purchase decisions simultaneously rather than sequentially. In deciding how much to spend on consumption, a household must pay attention to the implications of these decisions for its balance-sheet position. Conversely, household decisions to add to holdings of particular assets may have *short-run* implications for its consumption expenditures, even though in the *long run* it plans only to rearrange its asset-portfolio and does not contemplate any permanent increase in its *total* asset-holdings.

II. Determinants of Asset Demand

According to the basic hypothesis of modern consumer theory, the main determinant of a household's consumption level is its long-run expected income. In other words, the household plans its consumption over a relatively long time horizon, on the basis of the after-tax income it expects to receive over that period and the opportunities it has to delay or accelerate consumption by the purchase and sale of assets. By using more of its current income to purchase assets, the household is able to delay consumption into the future. If it buys financial assets it can use them later to purchase consumer goods, while if it buys real assets such as a car or a house, it receives a future flow of consumption services from those assets. Conversely, by buying fewer assets in the present, the household can enjoy more current consumption at the expense of less future consumption.

Household decisions on the allocation of their resources between present and future consumption depend on their preferences and on the asset prices and yields which they face. If the prices of assets fall—which means that asset yields rise—a household can obtain more future consumption for each dollar's worth of present consumption which it gives up. However, the resultant effect on saving cannot be predicted *a priori* on the basis of economic theory alone. At higher yields, every dollar which is saved in the present and used to buy assets produces a larger addition to future consumption. This effect tends to encourage households to save more and consume less. On the other hand, an increase in asset yields makes it possible for a household to save somewhat less today (and consume somewhat more) and still be able to enjoy the same level of consumption in the future. This is so because the effect of the lower level of current savings is offset by the higher rate of return earned by those savings. This effect tends to encourage households to save less and consume more now. There appears to be no consensus among economists as to which of these two effects—the substitution effect and the income effect—will dominate household behavior. If the substitution effect dominates, an increase in asset yields will serve to increase saving and reduce current consumption, whereas the opposite will be true if the income effect is dominant.

Other factors also affect returns on assets and thus household saving-consumption decisions. Reductions in tax rates increase the after-tax returns on financial assets as well as the net costs of going into debt. However, they do not change the returns on tangible assets since those returns—being in the form of services—are not subject to taxation. Thus tax-rate decreases are likely to encourage financial savings and to discourage the purchase of consumer durables and homes financed by borrowing. As in the case of nominal-yield changes, however, the effect of tax-rate changes on total saving and consumption depends on the relative strength of the substitution and income effects.

Changes in the inflation rate also influence the returns yielded by various kinds of assets. In this case, however, people's responses generally differ according to whether or not the inflation-rate change was expected. Given the *nominal* rate of interest, an increase in the *expected* rate of inflation implies a decline in the expected *real* rate of return on financial assets. Tangible assets such as cars and homes provide their return in the form of consumption services, which are not influenced by a change

Table 3
Expected Effects on Saving and Consumption of Changes in Independent Variables

Independent Variables	Total Consumption	Dependent Variables Net Purchases of Tangible Assets	Net Purchases of Financial Assets	Net Additions to Liabilities
General Increase in After-Tax Real Yields on Assets	?	?	?	?
Decrease in Tax Rates	?	−	+	−
Expected Increase in Inflation	?	+	−	+
Unexpected Increase in Inflation	−?	+	+?	−?
Increase in Unemployment	?	?	+	−

in the rate of inflation. Hence, the expectation of more rapid inflation will tend to encourage the accumulation of tangible assets at the expense of financial assets. In other words, an increase in the expected inflation rate with no change in the nominal rate of interest makes it more attractive to sell financial assets or to borrow in order to buy tangible assets which yield consumer services. Conversely, an expectation of decelerating inflation will tend to discourage purchases of tangibles. Again, the existence of substitution and income effects means that the effect of expected inflation on *aggregate* saving cannot be predicted unambiguously.

So much for changes in the *expected* rate of inflation. But what of *unexpected* inflation? Juster and Wachtel (1972) and Bisignano (1977) have argued that when prices increase unexpectedly, households become more uncertain about their future real incomes. Wage earners become concerned about their wage rates keeping up with the cost of living, while older persons begin to worry about their retirement savings being eroded by inflation. Since most households are risk averse,[2] this greater uncertainty about future real incomes may lead households to consume less in the present in order to accumulate assets for the future. Thus, according to these writers, unexpected inflation will encourage personal saving.

However, unexpected inflation not only makes households more uncertain about the real value of their future incomes but also increases the difficulty of predicting the real rate of return on financial assets. The additional consumption obtained in the future by giving up a dollar's worth of consumption now becomes less predictable if future consumer-goods prices are made more uncertain by inflation. The effect of this type of uncertainty on current saving cannot be predicted unambiguously because, like the effects of changes in asset yields, it involves both a substitution effect and an income effect.[3] When future consumer-goods prices become more uncertain, the household may choose to consume more in the present, when prices are known, and less in the uncertain future. This substitution effect thus tends to *decrease* current saving. On the other hand, greater uncertainty encourages households to save more and accumulate more assets to protect themselves against the possibility of sharply rising consumer-goods prices. This income effect thus tends to *increase* current saving.

Economic theory thus provides no way of predicting the "uncertainty effects" of unexpected inflation on purchases of financial assets. With regard to purchases of tangible assets, theory provides more guidance. Since the consumption services provided by a house or a car do not depend on the rate of inflation, the uncertainty effect does not affect their real rates of return but only household real incomes. In this case, therefore, theory predicts that unexpected inflation will cause households to stock up on tangible assets against the possibility of even faster price rises in the future.

Apart from the effects of inflation and taxes, we expect saving behavior also to be influenced by the rate of unemployment. High jobless rates, like unexpected inflation, tend to increase uncertainty about future real incomes. Such uncertainty will cause households to reduce the share of their current incomes allocated to consumption expenditures in order to accumulate more financial assets and to draw down debt. This "uncertainty effect" of unemployment is separate from the effect coming via current income. Higher levels of unemployment will generally be associated with decreases in current income relative to long-term expected income. Such decreases tend to cause households to reduce their savings in order to maintain their accustomed consumption levels. The income and uncertainty effects on savings decisions thus are opposite in sign. In our estimating equations, however, the income effect will be captured by a current-income variable. Hence we expect higher levels of unemployment to be associated with larger purchases of financial assets and smaller additions to debt.

III. Model of Consumption and Asset Purchases

In this section we develop these various concepts into a theoretical model suitable for empirical testing. This model consists of a set of equations which describe purchases of each type of asset and expenditures on current consumption, in terms of the factors influencing the desired stock of each asset and the rate at which actual stocks are adjusted to desired levels. These equations appear as Equations (7) and (8) below. The non-technical reader may, with no loss of continuity, proceed directly to those equations.

Suppose there are M classes of assets which households may purchase and hold. These classes include financial assets[4] such as money or securities, as well as tangible assets such as homes and consumer durables. The household may use its current income, Y, either to buy consumer goods or to add to its holdings of assets. Thus, if consumption expenditure is denoted c and purchases of the m^{th} asset q_m,

$$Y = c + q_1 + \ldots + q_m + \ldots + q_M \tag{1}$$

As was argued earlier, the household's desired stock of each asset, S^*_m, depends on its long-run expected income, YE, and on K other variables, $x_1, \ldots, x_k, \ldots, x_K$. These x_k variables include the expected and unexpected inflation rates, the tax rate, the unemployment rate and the real interest rate. It is convenient to assume that the desired stocks are proportional to expected income with this proportion depending on the x_k variables:

$$S^*_m/YE = a_{m1}x_1 + \ldots + a_{mk}x_k + \ldots + a_{mK}x_K \tag{2}$$

$$(m = 1, 2, \ldots, M)$$

Between any two dates, say t and t+1, the value of a household's actual stock of any asset may change for one of three reasons. First, the household may purchase more of the asset; second, the price of the asset may rise so that the household receives a capital gain; third, previous holdings may depreciate. Hence the asset stock at date t+1 is equal to the stock at date t plus new purchases and capital gains minus depreciation. Assuming that depreciation is a constant proportion of the stock, this accounting identity may be written:

$$\begin{aligned} S_{mt+1} &= S_{mt} + q_{mt} + g_{mt}S_{mt} - \delta_m(1 + g_{mt})S_{mt} \\ &= q_{mt} + (1 + g_{mt})(1 - \delta_m)S_{mt} \qquad (3) \end{aligned}$$

$$(m = 1, 2, \ldots, M)$$

where q_{mt} represents new purchases in the period between t and t+1, and g_{mt} is the rate of capital gains. For assets (such as money) with fixed prices, g_{mt} is identically zero. δ_m is the depreciation rate; for physical assets this represents physical deterioration and obsolescence, while for financial assets it may be interpreted as representing the change in market value associated with the approach of the maturity date. For irredeemable and deposit-type financial assets, δ_m is identically zero.

The household makes its consumption and asset-purchase decisions simultaneously. In deciding how much to buy or sell of any asset, the household compares the stock it desires to hold with the amount it has inherited from the past—after taking account of depreciation and capital gains. However, as was argued earlier, the inherited stocks of *other* assets may also influence this decision, since assets differ in the ease and cost with which they can be bought and sold. Further, as Equation (1) makes clear, asset purchases must compete not only with each other but also with consumption for a share of current income. This income constraint implies that current income influences expenditures on each asset class, and conversely implies that current-consumption expenditures depend not only on current and expected income but also on the inherited stocks of each class of asset relative to the amounts desired.

The preceding argument implies that asset purchases and consumption expenditures may be written

$$q_{mt} = \sum_{i=1}^{M} e_{mi}\left[S^*_{it+1} - S_{it}(1 + g_{it})(1 - \delta_i)\right] + f_m Y_t \quad (m = 1, 2, \ldots, M) \quad (4)$$

$$c_t = \sum_{i=1}^{M} e_i\left[S^*_{it+1} - S_{it}(1 + g_{it})(1 - \delta_i)\right] + fY_t \quad (5)$$

In each of these M + 1 equations, the terms in square brackets represent the differences between the targeted and actual stocks of the M assets. Since consumption plus total asset purchases are necessarily equal to current income,[5] Equation (5) also may be written as

$$c_t = Y_t - \sum_{m=1}^{M} q_{mt}$$

$$= -\sum_{i=1}^{M}\sum_{m=1}^{M} e_{mi}\left[S^*_{it+1} - S_{it}(1 + g_{it})(1 - \delta_i)\right] + \left(1 - \sum_{m=1}^{M} f_m\right)Y_t \quad (6)$$

The formal derivation of this stock-adjustment model is due to Purvis (1978), but earlier versions may be found in Motley (1968) and Wachtel (1972).

To estimate the parameters of Equations (4) and (6), the unobservable S^*_i variables, which represent the desired asset stocks, must be eliminated. This is done by substituting Equations (2) into (4) and (6). This yields a system of equations in which consumption and asset purchases (each expressed as a proportion of expected income) depend on the x_k variables in Equation (2), on current income, and on the inherited stocks of assets. Systems of equations of this type have been estimated by a number of researchers.[6]

This approach suffers, however, from the weakness of the data on stocks of assets—particularly tangible assets. Hence, in this study, the equations were further transformed so as to eliminate the inherited asset-stocks. The details of this transformation are provided in Appendix A. Essentially, the method[7] involves taking the first differences of Equation (4) and then using Equation (3) to replace the terms representing the lagged first differences of the asset stocks by the lagged asset purchases. This yields a system of equations in which consumption and purchases of each asset class depend on the current *and lagged* values of income and of the x_k variables, and on the lagged *purchases* (rather than the lagged stocks) of each asset class. Thus:

$$\frac{q_{mt}}{YE_t} = \sum_{k=1}^{K}\alpha_{mk}x_{kt} + \sum_{k=1}^{K}\beta_{mk}x_{kt-1}\frac{YE_{t-1}}{YE_t} + \phi_m\frac{Y_t}{YE_t} + \psi_m\frac{Y_{t-1}}{YE_t} + \sum_{j=1}^{M}\mu_{mj}\frac{g_{jt}S_{jt}}{YE_t} + (1 - \lambda_{mm})\frac{q_{mt-1}}{YE_t} - \sum_{\substack{j=1\\ j\neq m}}^{M}\lambda_{mj}\frac{q_{jt-1}}{YE_t} \quad (7)$$

$$(m = 1,2,\ldots,M)$$

$$\frac{c_t}{YE_t} = \sum_{k=1}^{K}\alpha_k x_{kt} + \sum_{k=1}^{K}\beta_k x_{kt-1}\frac{YE_{t-1}}{YE_t} + (1 - \phi)\frac{Y_t}{YE_t} + \psi\frac{Y_{t-1}}{YE_t} + \sum_{j=1}^{M}\mu_j\frac{g_{jt}S_{jt}}{YE_t} - \sum_{j=1}^{M}(1 - \lambda_j)\frac{q_{jt-1}}{YE_t} \quad (8)$$

Equations (7) and (8) represent a system of M + 1 equations to be estimated.[8] However, the fact that in every period consumption plus total asset purchases completely exhaust current income implies that the coefficients of these equations are not independent of one another. The coefficients on current income sum to one across the M + 1 equations, because if current income increases by one dollar, the sum of consumption plus asset purchases must also rise by one dollar. The coefficients on each of the other variables sum to zero across equations, because if current income is constant, a change in any one of the dependent variables must be matched by equal and opposite changes in the others. Thus the coefficients of Equations (7) and (8) must satisfy the following "adding-up" restrictions.

$$\sum_{m=1}^{M} \alpha_{mk} = -\alpha_k \qquad \sum_{m=1}^{M} \beta_{mk} = -\beta_k$$

$$\sum_{m=1}^{M} \phi_m = \phi \qquad \sum_{m=1}^{M} \psi_m = -\psi$$

$$\sum_{m=1}^{M} \mu_{mj} = -\mu_j \qquad \sum_{m=1}^{M} \lambda_{mj} = \lambda_j$$

IV. Estimation Problems[9]

The adding-up restrictions on Equations (7) and (8) imply that the coefficients of any one equation may be deduced from those of the other M equations. As long as the same independent variables appear in each equation, single-equation ordinary least-squares estimation preserves these adding-up restrictions. Hence the estimated parameters of any one equation may be derived from the parameters of the others, and the results do not depend on which M out of the M + 1 equations the researcher chooses to estimate. If all M + 1 equations are estimated by ordinary least squares, their residuals sum to zero at each observation, and hence the sums of the actual and fitted values of the dependent variables are equal. Thus the fitted values of the dependent variables satisfy the same accounting identity [Equation (1)] as do the actual values.

Preliminary least-squares estimates indicated the presence of significant serial correlation in the residuals from the regression equations. The usual method of dealing with this problem is to use these residuals to estimate ρ, the autocorrelation coefficient, to transform the dependent and each of the independent variables to the form $y_t - \rho y_{t-1}$, and to apply least-squares estimation to the transformed equations. However, when this technique is applied to a set of equations such as (7) and (8), it yields a set of estimated parameters which do not, in general, obey the adding-up restrictions. This is because, when transformed, the independent variables are no longer the same in each equation. This means that the estimated coefficients will differ according to which M out of the M + 1 equations we choose to estimate. The problem can be avoided only if the autocorrelation coefficients are the same in each of the M + 1 equations, but the preliminary estimates suggested that in fact these coefficients differed significantly across equations.[10]

To avoid this difficulty, the M + 1 equations were estimated simultaneously rather than singly. A distinct autocorrelation coefficient was estimated for each equation, but the parameter estimates were constrained to satisfy the adding-up restrictions across equations. These restrictions ensure that the untransformed fitted values of the dependent variables satisfy the accounting identity, although the residuals in the transformed equations do not sum to zero across equations. Appendix B explains how these constraints were imposed.

V. Data Sources

The flow-of-funds accounts provide the basic source of data for the dependent variables. Four balance-sheet categories were distinguished for this study: financial assets, financial liabilities, residential capital[11] and consumer durables. Gross additions to these four categories[12] plus expenditures on nondurables and services in principle sum to gross income after tax.

In the flow-of-funds accounts, the consumption and asset-purchase series do not exactly sum to measured income. For econometric estimation purposes, however, the data should satisfy the theoretical accounting identities. To deal with this problem, we assumed that each of the dependent variables is measured with error and that the sum of these errors is the statistical discrepancy shown in the accounts. The variables q_m and c in equations (4) and (6) are replaced by $q_m + \gamma_m d$ and $c + \gamma_{M+1} d$, respectively, where d represents the discrepancy and the γ's are the proportions of the discrepancy representing errors in each of the M + 1 dependent variables. When the arithmetic operations of Appendix A are applied to these modified variables, the result is a system of equations in which the current and lagged values of the discrepancy enter as additional independent variables.[13]

As for the independent variables, we derive expected income from gross current disposable income using a method[14] suggested by Michael Darby (1972). Expected inflation comes from the series derived by Carlson (1977) from the Livingston price-expectations data. Unexpected inflation is simply the difference between the actual and expected rates of inflation. We used a six months' unit of observation because that represented the frequency of the expectations data.

We computed the real after-tax interest rate by first multiplying the long-term Treasury-bond rate by one minus the average personal-income tax rate, and then subtracting the Carlson expected-inflation series. This method implies that the interest-rate variable measures the expected real return rather than that which actually materialized.

The average tax rate[15] represents the ratio of total personal-tax payments to total personal income. We entered this tax rate as a distinct independent variable, as well as using it to construct the after-tax bond rate, because household decisions respond to a whole series of after-tax rates of return and not only to the bond rate. Inclusion of the tax rate as a separate variable captures its effects via these other rates.

VI. Empirical Results

The results of estimating equations (7) and (8), shown in Table 4, are based on a sample of 48 semi-annual observations over the 1955-79 period. The discussion of these results focuses first on the factors thought to influence households' long-run consumption and asset-holding decisions, and then turns to the adjustment of asset portfolios in the short run.

Our previous argument suggested that long-run decisions depend primarily on real tax-adjusted rates of return—and also on uncertainty about both future real income and future asset yields. In the estimating equations, these effects are captured by five principal variables.[16] The real after-tax yield on long-term Treasury bonds proxies for the terms on which households can substitute between present and future consumption through marketable-securities purchases. Although this yield incorporates both the expected inflation rate and the average tax rate, these two variables also are entered into the equations as separate variables because households may hold their savings in other forms besides securities. During the sample period, for example, Regulation Q rate ceilings effectively limited the yields on money and other depository-institution liabilities, so that changes in their real yields mainly reflected changes in the expected rate of inflation. Similarly, the real costs of borrowing for the financing of consumer-durable and home purchases varied in response to tax-rate changes, reflecting the tax-deductibility feature of nominal borrowing costs.

In interpreting the results, one should be aware that the distinction between the effects of expected and unexpected inflation (a proxy for uncertainty) may be less clear-cut in practice than in theory. This is because the expected-inflation series measures the public's inflation expectations at the beginning of each six-month period, which are then probably modified in the light of actual inflation during the period.

Consider first the effects of the three variables which represent the real rates of return on financial assets: the real after-tax interest rate on securities, the expected inflation rate (representing the negative of the real return on money), and the average tax rate (which influences the real cost of household debt). Each of these variables has a significant effect on consumption and asset-purchase decisions, corresponding in most cases with theoretical expectations.

An increase in the real after-tax yield on securities and a decrease in the expected rate of inflation[17]—which corresponds to a rise in the real yield on money and other fixed-rate financial assets—both have the effect of significantly increasing current consumption and reducing total saving. This result implies that the income effects outweigh the substitution effects: the same amount of future consumption requires less current savings when real rates of return are high, so that current consumption increases and saving decreases. Correspondingly, this negative effect on saving of higher bond rates and lower inflation expectations also shows up in the form of a statistically-significant reduction in purchases of financial assets. An increase in the after-tax real rate of return on securities also significantly reduces saving through the purchase of consumer durables; this is what theory would predict.

Economic theory also predicts that expectations of higher inflation will be associated with increased purchases of homes and consumer durables and with a corresponding expansion of debt. This would be expected because more rapid inflation does not affect the real services provided by these tangible assets but reduces the real cost of borrowing to finance their purchase. The results support these predictions, though the relevant coefficients are not statistically significant. This may be because the effects of changes in inflation expectations are confounded with those of changes in average tax rates. When inflation accelerates, households are pushed into higher tax brackets so that the average tax rate rises at the same time.[18] Increases in tax rates and faster inflation both act to reduce the after-tax real interest rate on those financial assets and liabilities which have institutionally fixed nominal interest rates, and hence would be expected to have similar effects on asset purchases.

The results discussed so far have important implications for the current economic situation. Any success achieved by the Administration and Federal Reserve in reducing the current high level of real interest rates would tend to reduce current consumption and increase saving, as households would find they must accumulate more financial assets to achieve given targets for future consumption. Although this effect would be partly offset by increased demand for household durables, the results suggest that there should be a significant increase in the supply of savings available to purchase financial assets and thus to finance both business investment and government deficits.

On the other hand, any success by policy-makers in reducing the rate of inflation could also tend to reduce the supply of financial savings, since households would no longer have to set aside resources to counter the effect of future increases in living costs. However, with inflation slowing, this negative effect could be at least partially offset by the reduced tendency for households to be driven into higher tax brackets through bracket creep. In fact, the effects on consumption and asset purchases of changes in average tax rates—whether brought about by legislation or by inflation—are perhaps the most dramatic of this study's results. As Table 4 shows—and as theory suggests—a higher average tax rate leads to significant increases in debt-financed purchases of homes and consumer durables. This is because higher tax rates reduce the effective cost of borrowing but do not change the real returns to household capital goods which accrue in the form of untaxed consumption services.

Consequently, *reductions* in tax rates should significantly reduce the household sector's claims on the nation's resources for capital in the form of homes, cars and other durables. The corresponding reduction in the demand for consumer and mortgage credit should release funds to finance both business plant-and-equipment purchases and government deficits. This "supply-side" argument for the President's tax-reduction program thus receives strong support from these results.

The equation describing household consumption implies that a reduction in the average tax rate—which increases the real cost of borrowing—also would significantly reduce total consumption and thus increase total savings. This means that a tax cut's tendency to reduce saving in the form of tangible assets would be more than offset by its tendency to discourage household additions to debt liabilities, so that *total* saving would rise. This result suggests that the tax deductibility of interest payments operates as a powerful incentive to both current consumption and tangible-asset purchases, so that lower tax rates would reduce expenditures both on current consumption and on tangible assets. As pointed out earlier, the consumption equation also implies that an increase in the real return on securities would increase consumption and reduce total saving. The difference between the effects of an increase in the real return on securities and a decrease in the average tax rate (i.e., an increase in the real cost of borrowing) apparently can be explained by the fact that tax changes significantly affect household decisions with respect to debt-financed purchases of tangible assets, whereas

Table 4
Regression Results

Independent Variables	Consumption of Nondurables and Services	Purchases of Household Durable Goods	Purchases of Residences	Net Purchases of Financial Assets	Net Increase in Liabilities
	Dependent Variables / Expected Income				
CONTEMPORANEOUS VARIABLES					
Constant	- 0.780	0.308	0.026	2.168	1.723
	(1.838)	(1.502)	(0.122)	(2.436)	(2.088)
Expected Inflation	- 0.326	0.579	0.078	0.577	0.387
	(2.408)	(0.899)	(1.174)	(2.100)	(1.508)
Unexpected Inflation	- 0.260	0.273	0.021	0.360	0.148
	(5.067)	(1.119)	(0.812)	(3.447)	(1.519)
Real After-Tax Interest Rate	0.120	- 0.042	0.024	- 0.144	- 0.042
	(3.669)	(2.711)	(1.490)	(2.208)	(0.693)
Average Tax Rate	0.778	1.192	1.811	- 0.059	3.721
	(2.062)	(6.405)	(9.459)	(0.072)	(4.938)
Unemployment Rate	- 0.00003	- 0.0019	0.002	0.0072	0.007
	(0.024)	(2.828)	(2.868)	(2.428)	(2.665)
LAGGED VARIABLES					
Constant	0.695	- 0.173	- 0.018	- 2.130	- 1.626
	(1.849)	(0.950)	(0.097)	(2.690)	(2.219)
Expected Inflation	0.075	0.063	- 0.140	- 0.317	- 0.320
	(0.593)	(1.049)	(2.243)	(1.228)	(1.329)
Unexpected Inflation	- 0.048	- 0.045	- 0.006	- 0.082	- 0.181
	(0.874)	(1.730)	(0.204)	(0.738)	(1.741)
Real After-Tax Interest Rate	- 0.084	0.014	- 0.0031	0.118	0.046
	(2.522)	(0.906)	(0.188)	(1.713)	(0.715)
Average Tax Rate	- 1.063	0.394	- 0.900	3.418	1.848
	(0.845)	(0.636)	(1.413)	(1.254)	(0.739)
Unemployment Rate	- 0.0011	0.0002	- 0.0002	0.0027	0.0015
	(0.864)	(0.249)	(0.343)	(0.955)	(0.570)
INCOME VARIABLES					
Disposable Income	0.233	0.138	0.038	0.608	0.016
	(3.261)	(3.897)	(1.056)	(3.903)	(0.114)
Lagged Disposable Income	0.802	- 0.070	- 0.004	- 0.363	0.364
	(7.982)	(1.385)	(0.082)	(1.569)	(1.739)
LAGGED DEPENDENT VARIABLES					
Purchases of Household Durables	- 0.702	0.205	0.007	- 0.734	- 1.224
	(1.804)	(4.144)	(0.033)	(0.867)	(1.576)
Purchases of Residences	- 0.754	- 0.471	0.790	- 1.483	- 1.918
	(2.083)	(2.624)	(1.140)	(1,863)	(2.637)
Net Purchases of Financial Assets	- 0.865	0.019	- 0.009	0.377	- 0.478
	(9.031)	(0.402)	(0.176)	(2.996)	(2.504)
Net Increase in Liabilities	1.033	- 0.035	- 0.017	- 0.023	0.958
	(13.44)	(0.906)	(0.430)	(0.128)	(0.263)
DISCREPANCY VARIABLES					
Statistical Discrepancy	1.994	- 0.056	0.039	- 0.957	0.020
	(20.25)	(1.175)	(0.793)	(4.670)	(0.107)
Lagged Statistical Discrepancy	- 0.868	- 0.022	0.043	0.425	0.422
	(6.733)	(0.344)	(0.657)	(1.520)	(1.646)

changes in security yields do not.

We turn now to the effects of unexpected inflation, which (as we argued) should influence behavior by making households more uncertain of their future real incomes and of the real yields on financial assets. The results indicate that unexpected inflation reduces current consumption and increases purchases of financial assets. Concern about the erosion of real incomes and savings by inflation apparently induces households to reduce current consumption in order to accumulate more financial assets for the future. This occurs in spite of the fact that the real return on those assets is also made more uncertain by inflation. There is also some evidence that unexpected inflation encourages households to accept more debt to build up their stocks of consumer durables and homes. This is what economic theory would predict, though these results are not significant at conventional confidence levels.

Although the theoretical distinction between expected and unexpected inflation is difficult to make in practice, both appear to affect household decisions in the same direction. Hence we can conclude with a fair degree of confidence that more rapid inflation discourages current consumption and encourages asset accumulation and debt accumulation. A slowing of inflation should have the opposite effect.

We should consider also the second variable used to capture the effects of uncertainty—the unemployment rate. The empirical results support the premise that more joblessness would make households concerned about their future incomes and thus induce greater saving—although this effect appears to be intertwined with other kinds of effects of higher unemployment levels.

The coefficient on the unemployment rate is negative in the consumer-durable equation and positive in the financial-asset equation, which suggests that unemployment-caused uncertainty induces households to delay purchases of consumer durables and to build up their holdings of financial assets. However, the positive coefficient on unemployment in the residential-capital equation implies, contrary to expectation, that higher unemployment is associated with increased purchases of residences. This effect probably reflects the countercyclical movement of residential construction, which reflects the tendency of market interest rates to decline during recessions, so that mortgage-financing institutions find it easier at such times to attract funds and thus to lower mortgage rates.

We turn now to the evidence with regard to the adjustment of asset-holdings in the short run. This evidence is contained in the coefficients on the variables representing lagged asset purchases. The estimated equations provide support for the basic hypothesis that households do not fully adjust their asset-holdings within a single observation period, which in this study was six months. However, there is less evidence for the additional hypothesis regarding the interdependence of spending decisions among various classes of assets. This may be because the six-month observation period is too long to pick up these short-run considerations.

If households adjusted their asset-holdings instantaneously, each of the "own-adjustment" coefficients would be unity, implying that the coefficients on past purchases [which represent $(1 - \lambda_{mm})$ in Equation (7)] would be zero.[19] Hence, the hypothesis of incomplete adjustment implies that the coefficients on lagged asset purchases would be significantly greater than zero. The hypothesis also implies that the level of current income relative to its expected level will influence asset-purchase decisions: higher-than-expected income levels will induce households to add to their assets or reduce their debts more rapidly than otherwise. The results bear out both of these implications.

Since the own-adjustment coefficients enter the estimated equations in the form $(1 - \lambda_{mm})$, the implied values of λ_{mm} are 0.623 for financial assets,

TABLE 4 (continued)

NOTES

(1) Figures in parentheses are t-statistics. In case of "own-adjustment" coefficients, these test the hypothesis that parameter is different from one. In all other cases, that parameter is different from zero.

(2) Both Current and Lagged Disposable Income are expressed as ratios to current expected income.

(3) All lagged variables, including lagged discrepancy, are multiplied by YE_{t-1} / YE_t

(4) All lagged dependent variables are expressed as ratios to current expected income.

0.042 for financial liabilities, 0.795 for consumer durables and 0.210 for residential capital. These coefficients are of the expected order of magnitude, with stocks of consumer durables and financial assets being adjusted most rapidly, and the residential-capital adjustment taking longer.

In the household-debt equation, the own-adjustment coefficient is small (0.042) and not statistically significant. This suggests that households' debt holdings are essentially a residual item between current income and total outlays, since it implies that changes in debt in any period are unaffected by the events of the preceding period. This interpretation is supported by the fact that the "cross-adjustment" coefficients on lagged purchases of *other* assets are large, negative and statistically significant in the debt equation. These coefficients imply that substantial acquisitions of tangible or financial assets in the preceding six-month period will encourage households to reduce their debt liabilities in the current period. Clearly this is a very plausible result, and strikingly illustrates the interdependence of asset and liability decisions.

However, the only other statistically significant cross-adjustment coefficients in the asset-purchase equations are the negative coefficients on lagged home purchases in the consumer-durable and financial-asset equations. This result—in conjunction with that on the effect of past home purchases on household debt—may mean that households seek to reduce their debt in the period following high levels of home purchases—and hence delay purchases of consumer durables and acquisitions of financial assets.

The lack of instantaneous adjustment of asset-stocks to target levels also implies that asset purchases will depend on the level of current income relative to its expected level. If assets were adjusted instantaneously, variations in current income relative to its long-run expected level would necessitate corresponding variations in current consumption. But the empirical results find that current income significantly affects asset purchases. The large and significant coefficient (0.61) on current income in the financial-asset equation implies that greater-than-expected increases in income are primarily channelled into financial assets. Significant shares also flow into consumer durables (0.14) and current consumption (0.23). Unexpected income changes do not influence decisions to increase or decrease debt liabilities. The large and significant positive coefficient on *lagged* income in the consumption equation implies that unexpected receipts invested in financial assets later find their way into consumption expenditures. The negative coefficient on lagged income in the durables equation suggests that unexpected income gains increase durable-goods expenditures only temporarily: that is, unexpected increases in income lead only to a change in the *timing* of such purchases as households take advantage of higher incomes to make up deficiencies in their tangible-asset stocks more rapidly.

VII. Summary and Conclusions

This article has investigated the effects of inflation, interest rates and taxes on the saving and consumption behavior of households. In our model, the household determines its purchases of various (tangible and financial) assets and consumption goods simultaneously, subject to an overall income constraint. The empirical results suggest that this is a useful way of viewing household behavior, and provide valuable information on the determinants of such purchases, and thus of aggregate saving.

Economic theory suggests that decisions to consume or to save are likely to be influenced by changes in interest rates, inflation and tax rates, but frequently it cannot predict which way these effects will go. The results tell us that increases in real after-tax interest rates on securities tend to encourage current consumption and to discourage purchases of financial assets. Thus, if real interest rates can be brought down from their current high levels, the flow of financial savings available to finance business investment and government deficits should expand.

The direct effect of a reduction in the inflation rate would be an increase in current consumption and a reduction in total saving, because households would not have to set aside funds to offset the ravages of inflation. This impact would be reduced, however, by the fact that fewer households would be driven into higher tax brackets by inflation.

A major finding of the study was a strong association between saving behavior and the personal-tax rate. During the sample period, tax-rate increases stimulated current consumption as well as purchases of homes and consumer durables, and led households to assume more debt to finance these outlays. This finding was predictable: interest payments on household debt are tax deductible, so that higher tax rates reduce the net cost of borrowing to finance both tangible-goods purchases and current consumption. Lower tax rates, whether brought about by legislation or by a slower movement of families into higher tax brackets, conversely should reduce the demands which households make on the nation's resources, both real and financial—and thus should release funds for the financing of business investment and government deficits.

Appendix A

The complete model represented in Equations (7) and (8) is derived in this Appendix. For this derivation it is convenient to write Equations (2), (3), and (4) in matrix form.

$$\frac{S^*_{t+1}}{YE_t} = Ax_t \tag{A1}$$

$$\frac{S_{t+1}}{YE_t} = \frac{q_t}{YE_t} + (I + G_t)(I - \Delta)\frac{S_t}{YE_t} \tag{A2}$$

$$\frac{q_t}{YE_t} = E\left[\frac{S^*_{t+1}}{YE_t} - (I + G_t)(I - \Delta)\frac{S_t}{YE_t}\right] + F\frac{Y_t}{YE_t} \tag{A3}$$

The terms on the left sides of these equations are (M x 1) vectors, x_t is a (K x 1) vector and Y_t/YE_t is a scalar. A, E, and F are respectively (M x K), (M x M) and (M x 1) matrices of coefficients. Finally, G_t and Δ are (M x M) diagonal matrices of capital gains and depreciation rates and I is the (M x M) identity matrix.

By substituting Equation (A1) into Equation (A3) one obtains

$$\frac{q_t}{YE_t} = EAx_t - E(I + G_t)(I - \Delta)\frac{S_t}{YE_t} + F\frac{Y_t}{YE_t} \tag{A4}$$

This is the equation to be estimated after the lagged asset-stock variables have been eliminated. To do this, one begins by taking first differences of this equation:

$$\begin{aligned}\frac{q_t - q_{t-1}}{YE_t} = {} & EAx_t - EAx_{t-1}\frac{YE_{t-1}}{YE_t} \\ & - E(I - \Delta)\left[(I + G_t)\frac{S_t}{YE_t} - (I + G_{t-1})\frac{S_{t-1}}{YE_t}\right] \\ & + F\,\frac{Y_t - Y_{t-1}}{YE_t}\end{aligned} \tag{A5}$$

Lagging (A2) one period, rearranging terms, and adding G_tS_t/YE_t to both sides yields:

$$(I + G_t)\frac{S_t}{YE_t} - (I + G_{t-1})\frac{S_{t-1}}{YE_t} = \frac{q_{t-1}}{YE_t} + \frac{G_tS_t}{YE_t} - (I + G_{t-1})\Delta\frac{S_{t-1}}{YE_t} \tag{A6}$$

Notice that the left side of this equation appeared in the second term on the right side of Equation (A5). Also, by lagging (A4) one period and solving for S_{t-1}/YE_t one obtains

$$\frac{S_{t-1}}{YE_t} = (I + G_t)^{-1}(I - \Delta)^{-1}E^{-1}\left[EAx_{t-1}\frac{YE_{t-1}}{YE_t} + F\frac{Y_{t-1}}{YE_t} - \frac{q_{t-1}}{YE_t}\right] \tag{A7}$$

When (A7) is substituted into the last term on the right side of (A6) and the result into the second term on the right side of (A5), one finally obtains

$$\begin{aligned}\frac{q_t - q_{t-1}}{YE_t} &= EAx_t + (E\Delta A - EA)x_{t-1}\frac{YE_{t-1}}{YE_t} \\ &+ F\frac{Y_t}{YE_t} + (E\Delta E^{-1}F - F)\frac{Y_{t-1}}{YE_t} \\ &- E(I - \Delta)\frac{G_tS_t}{YE_t} - \left[E(I - \Delta) + E\Delta E^{-1}\right]\frac{q_{t-1}}{YE_t}\end{aligned} \tag{A8}$$

The first component of the vectors x_t and x_{t-1} in Equation (A8) represents the constant term. It is convenient to show this component separately and to write (A8) in slightly different form:

$$\begin{aligned}\frac{q_t}{YE_t} &= Ea + (E\Delta a - Ea)\frac{YE_{t-1}}{YE_t} \\ &+ E\bar{A}\bar{x}_t + (E\Delta\bar{A} - E\bar{A})\bar{x}_{t-1}\frac{YE_{t-1}}{YE_t} \\ &+ F\frac{Y_t}{YE_t} + (E\Delta E^{-1}F - F)\frac{Y_{t-1}}{YE_t} \\ &- E(I - \Delta)\frac{G_tS_t}{YE_t} \\ &+ \left[I - E(I - \Delta) - E\Delta E^{-1}\right]\frac{q_{t-1}}{YE_t}\end{aligned} \tag{A9}$$

where a is the first column of the matrix A, $\bar{A}$ is the matrix A with the first column omitted, and $\bar{x}$ is the vector x with the first component omitted. This matrix equation corresponds to the system of equations (7) in the text of this article.

The corresponding equation for consumption is now readily derived. Since all income not used to acquire assets necessarily is allocated to consumption:

$$\frac{C_t}{YE_t} = \frac{Y_t}{YE_t} - u'\frac{q_t}{YE_t} \tag{A10}$$

where u is a (M x 1) vector of 1's.

Hence, the consumption equation is obtained by substituting (A9) into (A10) which yields, after some rearranging of terms,

$$
\begin{aligned}
\frac{C_t}{YE_t} = & - u'Ea - u'(E\Delta a - Ea)\frac{YE_{t-1}}{YE_t} \\
& - u'E\bar{A}\bar{x}_t - u'(E\Delta\bar{A} - E\bar{A})\bar{x}_{t-1}\frac{YE_{t-1}}{YE_t} \\
& + (1 - u'F)\frac{Y_t}{YE_t} + u'(F - E\Delta E^{-1}F)\frac{Y_{t-1}}{YE_t} \\
& + u'E(I - \Delta)\frac{G_tS_t}{YE_t} \\
& - u'\left[I - E(I - \Delta) - E\Delta E^{-1}\right]\frac{q_{t-1}}{YE_t}
\end{aligned}
\qquad \text{(A11)}
$$

The coefficients on the current-income terms in Equations (A9) and (A11) sum to one, and all other coefficients sum to zero. These accounting restrictions must be satisfied by the estimated coefficients.

Appendix B

The theoretical derivation of the model implies that the estimated coefficients satisfy certain "adding up" restrictions (Appendix A). Single-equation ordinary least-squares estimation satisfies these restrictions automatically. However, if the data are transformed to cope with autocorrelation, the restrictions must be imposed on the estimation process. This was achieved by an iterative process.

First the M + 1 equations were estimated by single-equation ordinary least squares and the residuals used to compute initial estimates of the autocorrelation coefficient for each equation, ρ_m $(m=1,\ldots, M+1)$. These coefficients were used to transform both the dependent and each of the independent variables to the form $y_t - \rho_m y_{t-1}$. After this transformation of variables, a typical equation appears thus:

$$
v_m = \sum_{i=1}^{I} \zeta_{mi} z_{mi} + \sum_{j=1}^{J} \theta_{mj} w_{mj} \qquad (m = 1, 2, \ldots, M+1) \qquad \text{(B1)}
$$

In these equations v_m represents the m^{th} dependent variable after autoregressive transformation, while z_{mi} and w_{mj} represent the similarly transformed independent variables in the m^{th} equation. Since the autocorrelation coefficients are different between equations, these transformed independent variables also differ. The coefficients on each of the z_{mi} sum to one across equations while those on each of the w_{mj} sum to zero. Thus:

$$
\sum_{m=1}^{M+1} \zeta_{mi} = 1, \quad \sum_{m=1}^{M+1} \theta_{mj} = 0 \qquad \begin{matrix}(i=1, 2, \ldots, I)\\(j=1, 2, \ldots, J)\end{matrix} \qquad \text{(B2)}
$$

Using these restrictions, the $(M + 1)^{th}$ equation may be written as

$$
v_{M+1} = \sum_{i=1}^{I} \left[1 - \sum_{m=1}^{M} \zeta_{mi}\right] z_{M+1i} - \sum_{j=1}^{J} \sum_{m=1}^{M} \theta_{mj} w_{M+1j} \qquad \text{(B3)}
$$

Rearranging terms and multiplying by -1 transforms this last equation thus:

$$\sum_{i=1}^{I} z_{M+1i} - v_{M+1} = \sum_{i=1}^{I}\sum_{m=1}^{M}\zeta_{mi}z_{M+1i} + \sum_{j=1}^{J}\sum_{m=1}^{M}\theta_{mj}w_{M+1i} \tag{B4}$$

Notice that when written in this form, the coefficients of this $(M + 1)^{th}$ equation are the sums of the coefficients of the other M equations.

The complete system of M + 1 equations consisting of B1 and B4 may be written in matrix form as:

$$\begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_m \\ \vdots \\ v_M \\ z_{M+1}u - v_{M+1} \end{bmatrix} = \begin{bmatrix} z_1 & 0 & \cdots & 0 & \cdots & 0 & w_1 & 0 & \cdots & 0 & \cdots & 0 \\ 0 & z_2 & \cdots & 0 & \cdots & 0 & 0 & w_2 & \cdots & 0 & \cdots & 0 \\ \vdots & \vdots & & \vdots & & \vdots & \vdots & \vdots & & \vdots & & \vdots \\ 0 & 0 & \cdots & z_m & \cdots & 0 & 0 & 0 & \cdots & w_m & \cdots & 0 \\ \vdots & \vdots & & \vdots & & \vdots & \vdots & \vdots & & \vdots & & \vdots \\ 0 & 0 & \cdots & 0 & \cdots & z_M & 0 & 0 & \cdots & 0 & \cdots & w_M \\ z_{M+1} & z_{M+1} & \cdots & z_{M+1} & \cdots & z_{M+1} & w_{M+1} & w_{M+1} & \cdots & w_{M+1} & \cdots & w_{M+1} \end{bmatrix} \begin{bmatrix} \zeta_1 \\ \zeta_2 \\ \vdots \\ \zeta_m \\ \vdots \\ \zeta_M \\ \theta_1 \\ \theta_2 \\ \vdots \\ \theta_m \\ \vdots \\ \theta_M \end{bmatrix}$$

where z_m and w_m represent the vectors of transformed independent variables in the m^{th} equation, ζ_m and θ_m the corresponding vectors of coefficients, the 0's represent appropriately-dimensioned vectors of zeros, and u is a (I x 1) vector of 1's.

This matrix equation represents one observation for each of M + 1 separate equations, each having (I + J) independent variables. However, it also may be interpreted as representing M + 1 observations for a single equation having M x (I + J) independent variables. Hence the method of ordinary least squares may be applied to the complete system to generate new estimates of the parameters. Since the adding-up restrictions are incorporated in the form of the equations, the estimated parameters will satisfy those restrictions. Moreover, these parameter estimates do not depend on which equation in the original system is treated as the $(M + 1)^{th}$.

Having generated these new parameter estimates, the equation residuals were used to obtain revised estimates of the autocorrelation coefficients. A new set of transformed variables was constructed and the process repeated until the parameter estimates stabilized.

FOOTNOTES

1. This corresponds to the concept of saving used in the flow-of-funds accounts, rather than to that in the national income and product accounts, in which purchases of consumer durables are treated as part of consumption but purchases of houses as part of saving.

2. As it happens, the assumption that the household is averse to risk is necessary but not sufficient to demonstrate that greater uncertainty with regard to its future income will cause the rational household to save more. For a discussion of a sufficient condition—in the context of a complete analysis of the effects of various kinds of uncertainty on saving decisions—the reader is referred to Sandmo (1970).

3. For a complete analysis see Sandmo (op. cit.) p. 357.

4. In the following discussion, liabilities will be regarded as negative assets and hence not separately distinguished.

5. Since expenditures on assets are defined gross of depreciation, income must also be defined gross in order to preserve this identity. This is done in the flow-of-funds accounts, but in the national income accounts personal income is defined net of depreciation on owner-occupied housing.

6. See, for example, David Backus and Douglas Purvis (1980).

7. The method used is an adaptation of one originally suggested by Houthakker and Taylor (1966).

8. In Equations (7) and (8), the term $g_{jt}S_{jt}$ represents capital gains accruing on the j^{th} asset. Only in the case of equities are data available on these gains. Preliminary tests disclosed that this variable had no significant effect on consumption or on asset purchases. The economic interpretation of this result would be that—at least initially—households leave capital gains invested in the assets in which they accrue. Hence this variable was excluded from the remaining analysis.

9. The reader not interested in econometric and data issues may skip this and the following section and proceed directly to the empirical results in Section VI.

10. Since the adding-up conditions imply that the autocorrelation coefficient should be the same in each of the M + 1 equations, this finding suggests that the "true" autocorrelation process is more complex than the simple first-order one assumed here.

11. The household sector includes non-profit institutions, and the "residential capital" category also includes a small amount of plant and equipment owned by these institutions.

12. With liabilities treated as negative assets.

13. This definition implies another restriction on the parameters, namely

$$\sum_{m=1}^{M+1} \gamma_m = 1$$

14. In this method expected income in period t is defined by the equation

$$YE_t = bY_t + (1 - b)(1 + \beta_2 + 2\beta_3 t)YE_{t-1}$$

The value of b is estimated by Darby to be 0.1 using quarterly data. The values of β_2 and β_3 are derived from the regression

$$\text{Log } Y_t = \beta_1 + \beta_2 t + \beta_3 t^2$$

The initial value of YE_t is $\exp(\beta_1)$. For complete details the reader is referred to Darby (1972).

15. A more appropriate variable would be the *marginal* rather than the average tax rate, but data on this variable were not readily available.

16. The method of eliminating the asset stocks from the equations means that the lagged values of these five variables also enter the estimating equations. However, the coefficients on these lagged values represent complicated transformations of the contemporaneous coefficients with no obvious economic interpretation. In Table 4, these coefficients are separated from those of primary concern.

17. The coefficients on expected inflation represent the effects of a change in inflation on the dependent variables, assuming that all other independent variables remain unchanged. One of these other variables is the real interest rate, so that this assumption implies that changes in the inflation rate induce corresponding changes in *nominal* interest rates on bonds so that *real* rates remain unchanged. Over an observation period as long as six months, this assumption appears highly plausible. However, the reader who prefers not to make this assumption may compute the effect of a change in the expected rate of inflation as the coefficient on expected inflation minus the coefficient on the interest rate. In no case does this procedure alter the conclusions of this section. Similar considerations apply to the effects of changes in tax rates.

18. The effects of tax-rate changes—which may be caused by legislation or by inflation-induced bracket creep—are discussed below.

19. This ignores the effect of the depreciation rate, but is approximately true if that rate is small. See Appendix A.

REFERENCES

Backus, David and Purvis, Douglas. "An Integrated Model of Household Flow-of-Funds Allocations," **Journal of Money, Credit and Banking**, Volume 12, Number 2 (May 1980).

Bisignano, Joseph. "The Effect of Inflation on Savings Behavior," **Economic Review**, Federal Reserve Bank of San Francisco (December 1975).

Board of Governors of the Federal Reserve System, **Flow of Funds Accounts**, various issues.

Carlson, John A. "A Study of Price Forecasts," **Annals of Economic and Social Measurement**, Volume 6, Number 1 (Winter 1977).

Darby, Michael R. "The Allocation of Transitory Income Among Consumers' Assets," **American Economic Review**, Volume LXII, Number 5 (December 1972).

Houthakker, H. S. and Taylor, Lester D. **Consumer Demand in the United States, 1929-1970**, Cambridge, Mass: Harvard University Press (1966).

Juster, F. Thomas and Wachtel, Paul. "Inflation and the Consumer," **Brookings Papers on Economic Activity**, Number 1 (1972).

Motley, Brian. "Household Demand for Assets: A Model of Short-Run Adjustments," **The Review of Economics and Statistics**, Volume LII, Number 3 (August 1970).

Purvis, Douglas D. "Dynamic Models of Portfolio Behavior: More on Pitfalls in Financial Model Building," **American Economic Review**,. Volume 68, Number 3 (June 1978).

Sandmo, A. "The Effect of Uncertainty on Savings Decisions," **Review of Economic Studies**, Volume 37 (1970).

Wachtel, Paul. "A Model of Interrelated Demand for Assets by Households," **Annals of Economic and Social Measurement**, Volume 1, Number 1 (April 1972).