Volume Title: Explorations in Economic Research, Volume 4, number 4

Volume Author/Editor: Victor Zarnowitz and Geoffrey H. Moore

Volume Publisher: NBER

Volume URL: http://www.nber.org/books/zarn77-1

Publication Date: October 1977

Chapter Title: Inflation, Uncertainty, and Saving Behavior

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Chapter URL: http://www.nber.org/chapters/c9102

Chapter pages in book: (p. 558 - 578)

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Inflation, Uncertainty, and Saving Behavior since the Mid-1950s

ABSTRACT: In this paper I investigate the relationship between inflation and uncertainty and saving behavior. My findings confirm the hypothesis that the high saving rates observed in the United States since the mid-1960s are related to inflation and uncertainty. ¶ Three basic results emerge from the study: (1) the measurement of inflation effects is very sensitive to the choice of data source; (2) the major impact of inflation uncertainty is to increase saving through a reduced propensity to incur liabilities; (3) evidence of an uncertainty effect on financial asset acquisitions was not found, a surprising result that points to the need for further research in this area. ¶ The paper extends previous investigations by examining both flow of funds and national income and product account data. In addition, saving components from the flow of funds are examined.

NOTE: An earlier version of this paper, "Inflation, Uncertainty and the Composition of Personal Saving," will appear in Sametz and Wachtel, eds. (1977). Research support was received from American Council of Life Insurance grants to the Salomon Brothers Center at New York University and the NBER. I am grateful for the able research assistance of Thomas Urich and for helpful comments by Patric Hendershott, Robert Lipsey, and Arnold Sametz; the members of the staff reading committee—Philip Cagan, Sherman Maisel, and Lester Taylor; and the members of the Directors reading committee—David L. Grove, James C. Van Horne, and Paul W. McCracken.

It is well known that the American inflationary experience since the mid-1960s has been accompanied by high personal saving rates. A number of recent studies of saving functions have indicated that this relationship is more than coincidental (Juster and Wachtel 1972a and 1972b; Wachtel 1977; Taylor 1974; Juster and Taylor 1975; Juster 1975; Burch and Werneke 1975). Although the evidence that inflation is a major cause of increased personal saving is strong, there are a number of gaps in the existing literature. First of all, previous studies rely primarily upon the personal saving data from the national income accounts. Secondly, very little has been determined about which components of saving are affected by inflation.[1] In this paper, I address these issues by estimating saving functions for various definitions of aggregate saving and its major components.

A disaggregation of saving is desirable since saving is the sum of three different activities; that is, increased saving can be the result of an increase in purchases of financial assets, a reduction in the net increase in liabilities, or an increase in purchases of durable assets. Up to this time, researchers have avoided discussing the effects of inflation on the allocation of saving because of the difficulty of defining saving and the poor quality of the available disaggregated data. Skirting both these issues, researchers have relied instead upon the most popular definition and data source—personal saving in the national income and product accounts (NIPA). In this paper I use disaggregated saving data for the household sector from the flow-of-funds (FOF) accounts.

In section 1, I outline the reasons for expecting an effect on saving because of uncertainty about inflation. In section 2, the saving data are discussed. The Houthakker-Taylor (1970) model used here is presented in section 3. The empirical results, presented in section 4, pertain to aggregates and their components. Section 4 also contains a discussion of the inconsistencies among data sources and some alternative specifications of the model.

Two basic results emerge from this study. First, the measurement of inflation effects is very sensitive to the choice of data. This is not surprising; Taubman (1968) reached the same conclusion in an analysis of the saving-income relationship.[2] Secondly, the major impact of inflation uncertainty is to increase saving through a reduced propensity to incur liabilities. Closely linked to this phenomenon is the negative effect of uncertainty on net investment in physical assets. There is little firm evidence of any effect on the acquisition of financial assets, although the results in this area are unclear and further research is needed.

[1] THE EFFECT OF INFLATION ON SAVING

The basic question to be discussed in this section is, "Why should inflation affect a household's saving-consumption decision?" For the most part, econometric research on aggregate saving behavior has ignored inflation effects. Traditionally, economists have assumed that overall real spending decisions are unaffected by the general price level. In addition, until recently, the rate of inflation was small enough to be ignored in empirical research. This is no longer the case, and there is mounting evidence that the traditional approach is no longer valid.

The assumption of neutrality is valid if all prices throughout the economy go up at the same rate. In that case, inflation does not alter real income or relative prices, and it is reasonable to assume that inflation has no real effects. Although in the long run inflation may be anticipated and neutral, the stringency of these assumptions for the short run is often overlooked.[3] Alternatively, there are several ways by which inflation may affect consumer behavior, some of which reduce saving but most of which increase it. Several of these are briefly discussed—money illusion, intertemporal substitution, uncertainty, and indirect effects that operate through interest rates and wealth.

The Money Illusion Effect

Money illusion has a long history in the macroeconomic literature on consumption. Money illusion occurs when inflation is not recognized. Consumers overestimate the purchasing power of their nominal income and decide to raise real consumption levels. Consequently, real consumption expenditure is increased, and saving is reduced.

Money illusion is contingent upon consumer ignorance. However, the consumer sector is not necessarily always ignorant of the current inflation rate.[4] Whether money illusion of this type affects consumption behavior is an empirical question. It was originally explored by Branson and Klevorick (1969) and more recently by Wachtel (1977). Branson and Klevorick found a very large money illusion effect. Their results suggested that a 1 percent price increase leads to an increase of 0.4 percent in real consumption, rather too large to be believed. Wachtel suggests that the degree of money illusion has decreased substantially in recent years. In periods of little overall inflation, errors in perception are likely to be small in magnitude and of little consequence, and there is little incentive to invest in price information. Although money illusion is observed in periods of low inflation, the money illusion phenomenon has tended to disappear as inflation has become more severe.

The Intertemporal Substitution Effect

It is often argued that when price increases are expected, expenditures are advanced in time. If the expenditures are on investment goods, measured saving will increase; otherwise, consumption increases. Intertemporal substitution is relatively rare because rational behavior requires that the expected price increases be sufficiently large and certain to make it worthwhile to maintain goods inventories (which may entail substantial opportunity costs). In a relatively stable economy this is not likely to be true very often, and buying sprees, though observed on occasion, are relatively rare in the United States.

The Uncertainty Effect

The term "uncertainty effect" refers to a set of hypotheses which suggest that inflation leads to increased saving. My contention is that these hypotheses describe the main effect of inflation on saving.

One such hypothesis is based on Katona's finding that the public has a strong distaste for inflation. Inflation is viewed as an undesirable phenomenon, and its presence is associated with increased pessimism about economic conditions, which may lead to increased saving for precautionary reasons. Thus, inflation is a proxy for attitudes about economic conditions, particularly uncertainty. This hypothesis is unsatisfactory, however, because it relies upon a tenuous psychological link between inflation and uncertainty to explain the increase in saving in inflationary times.

There are more specific reasons for relating inflation to uncertainty. Both time series and cross-sectional observations suggest that inflation tends to be more variable as it increases (see Okun 1971). Therefore, inflation forecasts deteriorate, forecast errors become more prevalent, and the dispersion of inflation forecasts also increases. Consequently, the uncertainty of real income expectations increases with inflation. It can be argued that increased saving is a precautionary response to the increase in uncertainty. Saving is determined by both the expected level of real income and the certainty with which those expectations are held. The greater the uncertainty of expectations, the greater will be saving.

In specifying a saving function, I include a direct measure of inflation uncertainty. The appropriate measure would be the variance (or higher moments) of the average individual's subjective probability distribution of the expected rate of inflation. Although a time series of the mean expected rate of inflation is available from the quarterly surveys conducted by the Survey Research Center, the variance cannot be readily measured. Therefore, the proxy I use is the variance among individuals in their inflation expectations. The construction of the mean and variance from the survey responses is discussed in Wachtel (1977).

There are other sources of real income uncertainty that increase saving. The most frequently cited is the effect of unemployment or general economic conditions on money income expectations. When economic conditions worsen, the employed save more in order to be able to maintain their consumption if they become unemployed. This effect is offset by the dissaving of those already unemployed. Clearly, nominal income expectations and their dispersion (there is greater downside risk in a recession) will also affect aggregate saving behavior. Juster has shown that the unemployment rate has a strong negative influence and the change in unemployment a strong positive influence on saving rates, reflecting these two effects.[5]

Indirect Effects

Inflation also affects saving behavior indirectly through its effect on other determinants of saving. In particular, inflation will affect interest rates and the real wealth of households. The real value of household financial wealth is often eroded in inflationary periods, and an attempt by individuals to maintain the purchasing power of their stock of financial assets will lead to higher saving.[6] Inflation reduces real financial wealth and thus induces saving only when rates of return fail to incorporate an inflation premium. In the long run, rates of return either adjust to include an inflation premium or consumers reallocate their portfolios. Any long-run inflation effect on saving is likely to reflect uncertainty rather than a wealth effect. Furthermore, the wealth effect should apply primarily to financial assets and not to other forms of saving, since the real value of the flow of services from the stock of durables is unchanged. In my empirical investigation of inflation effects on the components of saving, I show the importance of inflation, presumably because of its uncertainty, on nonfinancial saving.

The effect of interest rate movements on saving has always been difficult to assess. Saving is not necessarily sensitive to interest rate changes, because the income and substitution effects are offsetting. Inflation obscures this effect since interest rates, particularly on those assets held by individuals, do not always adjust to changes in inflation rates. At the very least, relative returns on different assets will change with the rate of inflation.

As the above discussion indicates I view the uncertainty effect as the most important source of the observed relationship between saving and inflation. A model to test for the presence of this effect is specified in section 3, following a discussion of the data in section 2.

[2] SAVING DATA

The difficulties in working with saving data are well known to researchers. There are a variety of definitions and data sources available, with large and variable discrepancies among them. Saving by individuals is determined residually in both the flow of funds and national income and product accounts. Consequently, there is a serious problem of errors in measurement.

Although there are a large number of alternative saving measures, I restrict my analysis to personal saving as defined in NIPA and saving as defined in the FOF household account. The NIPA definition is the most common measure used: saving there is determined residually as personal income less personal outlays and tax and nontax payments for government services. The data represent the saving of individuals (including proprietors), nonprofit institutions, private noninsured welfare funds, and private trust funds. FOF, however, defines saving as the sum of sectoral fund flows into various assets. The FOF household account covers households, nonprofit organizations, and personal trusts but excludes the farm and nonfarm noncorporate business sectors. Unfortunately, with the exception of plant and equipment investments of the nonprofit sector, it is not possible to further isolate the saving flows of households.[7]

The conceptual definitions of saving in the official accounts are not entirely satisfactory. In particular, in both published data sources, capital gains on financial and physical assets are ignored. Although difficult to estimate, they are sometimes considered as components of saving and can be expected to affect saving in other forms. In addition, the recent improvements in NIPA, to provide, among other things, a better economic definition of depreciation, had not yet been incorporated in the FOF data used here.

Given the large number of independent data sources (income and product or flow-of-funds bases), the discrepancies among consistently defined saving figures are remarkably small. But given the accuracy that researchers have come to expect in the aggregate data, it is appalling to find discrepancies that often exceed $10 billion (at annual rates). Since there is very little that can be done to rectify this confusing situation, it has been the overwhelming tendency of both research economists and the more practically inclined to ignore the problem. Given our interest here in disaggregating saving, this will not be possible.

In Table 1 I summarize the saving data and notation used in this study. The table contains a simple aggregation of the household sector table published by FOF. The two basic saving aggregates—PS and NS—are shown in Chart 1. The two measures tend to move in the same general direction, but their quarterly movements are erratic and different. Large differences between the two (e.g., in 1955 and 1965) are associated with automobile booms, which increase the liabilities component of both as well as the expenditure component of NS. Both series reveal an upward trend in recent years, although it seems to have started around 1964, before the acceleration of the inflation rate. In addition, high saving rates have been observed before, in 1955–1958. Clearly, the association between inflation and saving should not be exaggerated.

Chart 2 shows ratios to disposable income of the major components of NS, our saving definition with the FOF household data. The strong upward trend in financial asset acquisitions derives particularly from the movement of the deposit component. Inflation effects are less evident for increases in liabilities and net physical investment.

[3] THE SAVING MODEL

While most models of consumer behavior are highly aggregated and concen-

TABLE 1 Saving Data

	Mean Saving 1955–1974[a]
Flow of funds household account (FOF)	
FA = net acquisitions of financial assets	$1,141.6
Demand deposits and currency	102.5
Time and savings deposits	567.0
Credit market instruments other than equities (corporate and govt. bonds, etc.) and miscellaneous assets (including net investment in noncorporate business)	144.5
Equities (corporate and investment company shares)	−34.3
Life insurance and pension fund reserves	361.9
NIL = net increase in liabilities	583.1
Home mortgages	339.0
Consumer credit	157.6
Other loans	86.4
PI = net physical investment	492.2
Residential construction	328.6
Consumer durables	163.6
NFI = *FA* − *NIL* = net financial investment	558.6
NS = *FA* − *NIL* + *PI* = net saving[b]	1,050.7
PS = NIPA personal saving[c]	665.3
Statistical discrepancy between FOF household account and NIPA	−133.5

[a] Mean flow per household in 1972 dollars.

[b] This definition of net saving differs from that in the FOF household account because I exclude net physical investment by nonprofit institutions (no data are available to segregate their financial investments).

[c] FOF net saving (*NS*) and NIPA personal saving (*PS*) differ because *NS* includes net investment in durables; *PS* includes the 1976 statistical and conceptual revisions, including important changes in the treatment of mobile homes and trailers and the new economic definition of depreciation; and there are statistical discrepancies and differences in sectoral coverage.

trate on a single consumption-saving decision, in some models the components of consumption and saving are disaggregated. With disaggregation it is necessary to take account of the institutional structure and relative price phenomena that affect each of the components. This latter task is a difficult one for saving components and beyond the scope of this paper. We cannot distinguish between the gross effects of inflation and its indirect effects through other determinants. Since our interest here is to identify the existence of gross inflation and uncertainty effects, it is preferable to use a model that provides a uniform framework for estimation of both an aggregate saving function and its components. Of course such a general model cannot take account of all the diverse factors that might affect aggregate saving.

CHART 1 Ratio of Personal Saving and Net Saving to Disposable Income, 1952-1975

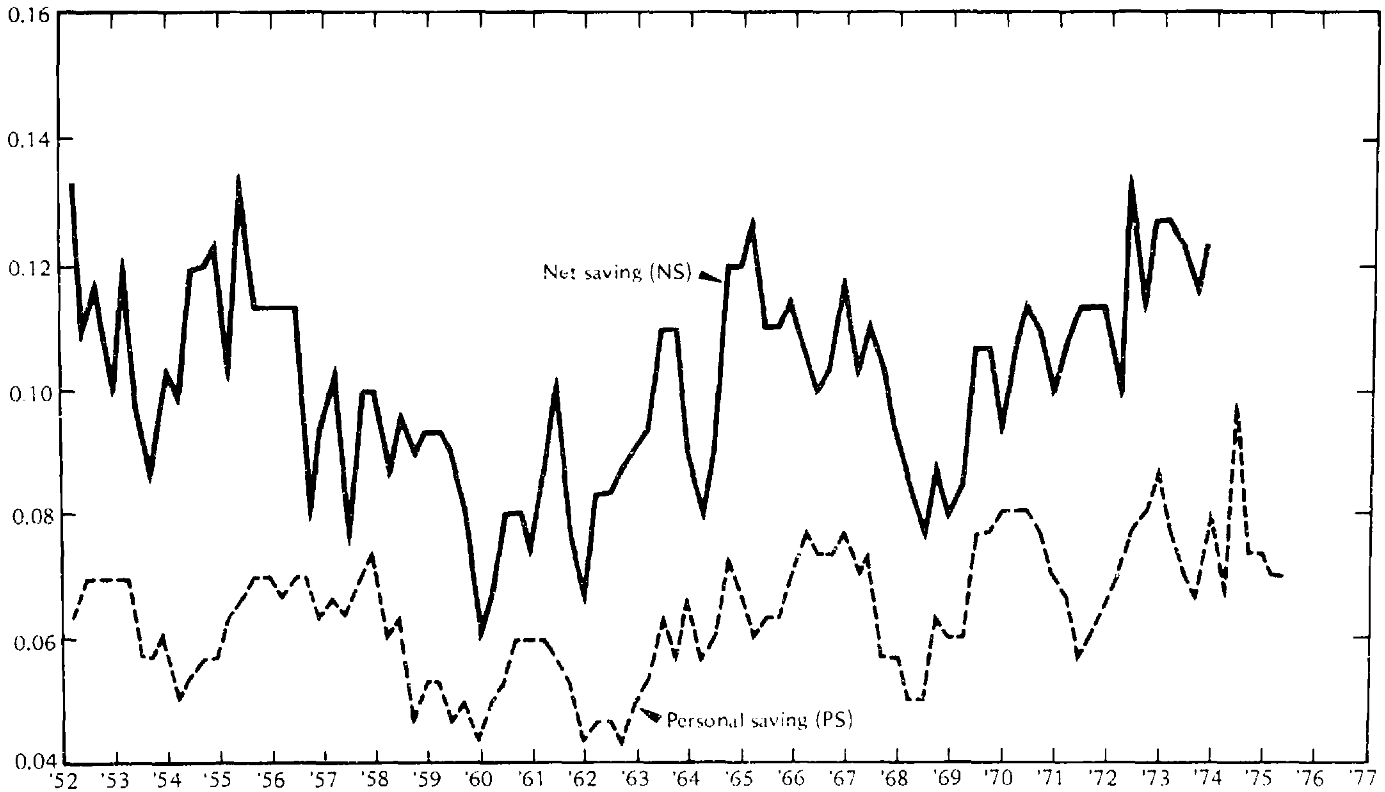
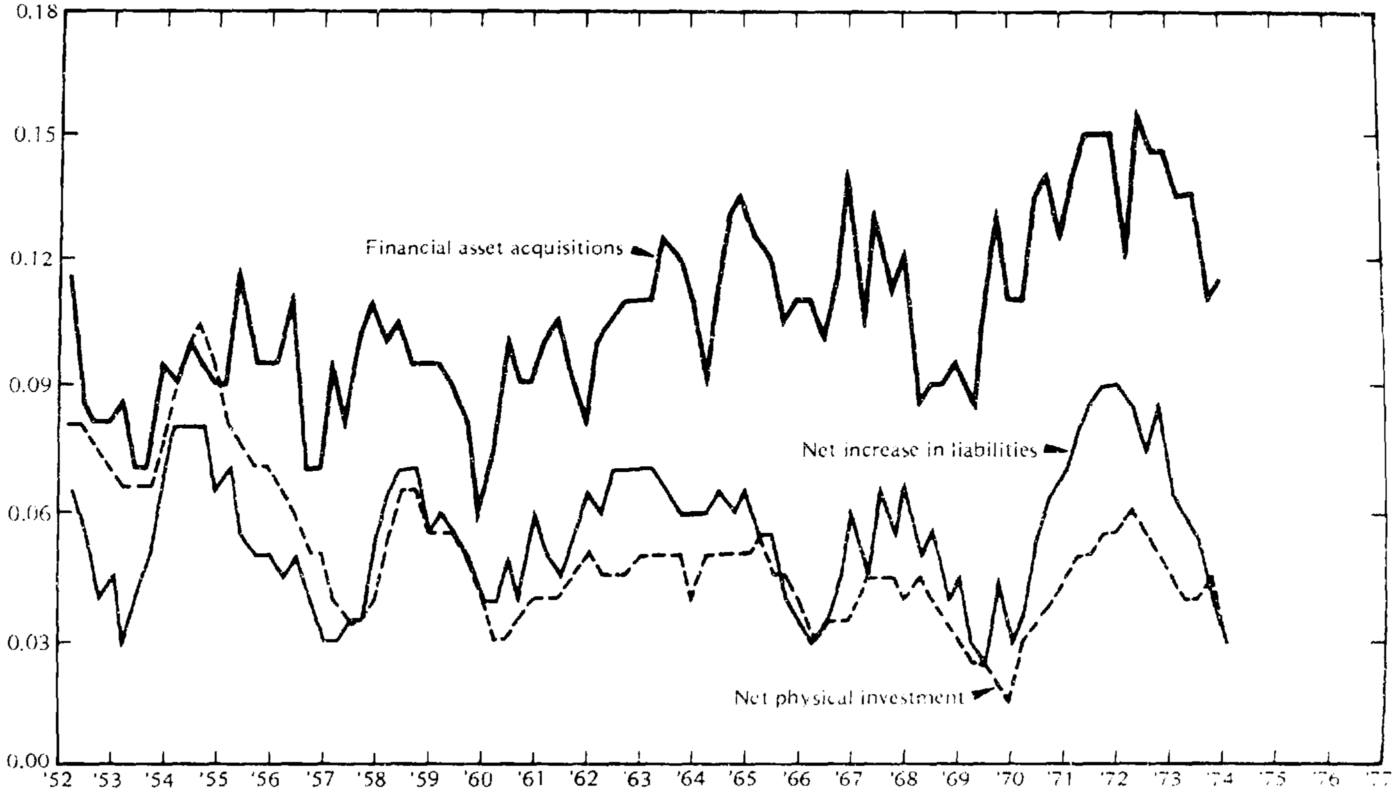


CHART 2 Ratio of Net Saving (NS) Components to Disposable Income, 1952–1974



A frequently used general framework is provided by Houthakker and Taylor (1970). Their model for consumer expenditure embodies a dynamic adjustment approach that is also applicable to any saving component. Since they do not attempt to specify a complete explanatory model for each component, their model is well suited to the needs of this investigation. I use the model to examine inflation effects on saving components without specifying models of supply and demand in each asset market. The model has been used to estimate saving functions by Juster and Wachtel (1972a and 1972b) and Juster and Taylor (1975), as well as Houthakker and Taylor (1970).

The model states that a saving flow (q) is a function of a stock variable (s), income (y), and a measure of inflation uncertainty (x): $q = \alpha + \beta s + \gamma_y y + \gamma_x x$. The stock variable represents either a physical or psychological stock of the asset and in Model I is assumed to follow a proportional depreciation scheme: $\dot{s} = q - \delta s$, where δ is the rate of depreciation. Alternatively, in Model II, the stock is assumed not to depreciate (which may be more appropriate for financial assets and liabilities): $\dot{s} = q$. The reduced forms of the two models are:

Model I

$$q = b_0 + b_1 q_{-1} + b_{2y} \Delta y + b_{3y} y_{-1} + b_{2x} \Delta x + b_{3x} x_{-1}$$

Model II

$$q = c_1 q_{-1} + c_{2y} \Delta y + c_{2x} \Delta x$$

Model I, which includes a constant term, will generally provide a better fit. However, least squares estimates of the reduced form of Model I overidentify the structural parameters δ and β.[8]

Although the γ's can be identified from the Model I reduced form, they are not shown because of the identification problem. Instead, the long-run effect is used to measure the impact of changes in income and uncertainty on saving. The long-run effect is determined by setting $q = q_{-1}$, $x = x_{-1}$, and $y = y_{-1}$ in the Model I reduced form and taking the derivative of saving with respect to income or inflation. For the effect of income on saving, the long-run effect is $\phi_y = b_{3y}/(1 - b_1)$. Similarly, the long-run uncertainty effect is given by $\phi_x = b_{3x}/(1 - b_1)$.

For Model II, the long-run effect is undefined, but the structural parameters are exactly identified:

$$\gamma_x = 2c_{2x}/(c_1 + 1)$$

$$\gamma_y = 2c_{2y}/(c_1 + 1)$$

and

$$\beta = 2(c_1 - 1)/(c_1 + 1)$$

TABLE 2 Estimates of Model I for Aggregate Saving[a] (figures in parentheses are t statistics)

	PS	*NS*	*FA*	*NIL*	*PI*	*NFI*
Constant	−59.59	−229.6	−769.9	−109.8	−9.7	−588.6
	(1.0)	(1.7)	(3.4)	(1.0)	(0.2)	(3.3)
Lagged dependent variable	0.8304	0.6675	0.4663	0.6973	0.8976	0.4646
	(11.5)	(7.4)	(4.2)	(8.1)	(18.0)	(4.4)
ΔY	0.4991	0.4434	0.4751	0.2204	0.1778	0.2726
	(6.8)	(2.6)	(2.4)	(1.6)	(2.3)	(1.6)
Y_{-1}	0.0081	0.0545	0.1366	0.0038	0.0078	0.0731
	(0.9)	(2.7)	(3.9)	(2.1)	(1.2)	(3.5)
ΔV	18.54	13.28	−1.4	−20.64	−15.13	24.61
	(3.9)	(1.2)	(0.1)	(2.1)	(3.0)	(2.2)
V_{-1}	11.66	−0.21	−9.3	−12.31	−4.75	15.18
	(3.4)	(0.0)	(1.0)	(1.6)	(1.3)	(2.0)
$\bar{R}^2$	0.9094	0.7565	0.8149	0.7112	0.8484	0.7535
DW	2.14	2.18	2.09	2.23	1.22	1.98
SE	51.4	121.1	142.5	102.1	54.9	122.8
Mean	665.3	1050.7	1141.6	583.1	492.2	558.6
Long-run uncertainty effect (ϕ_V)	68.75	−0.63	−17.43	−40.67	−46.39	28.35

[a]Model I:

$$q_t = b_0 + b_1 q_{t-1} + b_{2Y}\Delta Y_t + b_{3Y}Y_{t-1} + b_{2V}\Delta V_t + b_{3V}V_{t-1}$$

Variables are defined at the beginning of section 4 and in Table 1.

[4] ESTIMATION OF THE MODEL

Aggregate Saving Functions

Model I was estimated by ordinary least squares with quarterly saving flows and income deflated by the implicit price deflator for personal consumption expenditures and number of households. The sample period is Q1 1955 to Q3 1974. The various concepts of saving are defined in Table 1.

The equation for saving aggregates, shown in Table 2, includes two determinants of saving—an income variable (Y) and a measure of inflation uncertainty (V). Y is real disposable income per household. As discussed earlier, my hypothesis is that inflation induces uncertainty, which affects saving behavior.

Uncertainty is measured here by the variance among households in the expected rate of inflation derived from the Survey Research Center surveys. *V* is the average variance in the surveys conducted during the two quarters prior to the current period.

The strongest results are found in the first column, for the NIPA measure of personal saving (*PS*). The long-run effect of an increase in *V* of one percentage point is an increase in *PS* of about $69 per household or about 10 percent of its mean value. For the FOF definition of saving (*NS*), the long-run effect is negligible. The variance terms are highly significant in the *PS* equation but not in the *NS* one. The probable reasons for this discrepancy are explored below.

NS can be divided into three components: acquisitions of financial assets (*FA*), increases in liabilities (*NIL*), and net physical investment (*PI*). The addition of the inflation-uncertainty variables adds significantly to the explained variance of *NIL* and *PI* only: uncertainty has a strong negative effect on both. While reduced *NIL* represents an increase in saving, reduced *PI* reduces saving. The uncertainty effect on *FA* is small and insignificant. The last column of the table shows estimates of the model for net financial investment (*NFI* = *FA* − *NIL*). The long-run effect is large and positive, about 5 percent of the mean.

These results indicate that uncertainty increases saving by reducing the household sector's propensity to borrow. There is a pronounced tendency to reduce future commitments in the face of uncertainty. As expected, net physical investment is also reduced, since it is closely linked to borrowing. Housing and durables, whose financing accounts for the bulk of borrowing, are often postponable discretionary expenditures. Furthermore, higher downpayments are required in inflationary periods, and in the face of uncertainty households will be unwilling to make such commitments. The usual argument is that inflation will lead to a preference for physical assets over financial assets because the former retain their real value. However, the evidence here indicates that the negative effect of uncertainty dominates.

The model was tested for stability by dividing the sample period in half. The first ten years (Q1 1955 to Q4 1964) were a period of relatively little inflation and the last ten years (Q1 1965 to Q3 1974) include the acceleration of inflation during the Vietnam War as well as the period of price controls and their inflationary aftermath. The long-run uncertainty effects in each subperiod (ϕ_V), from Model I, are summarized in the first two columns of the following tabulation, where the *F* statistic is for the null hypothesis of no structural change in the entire regression:

	Q1 1955 to Q4 1964	**Q1 1965 to Q3 1974**	**F(6,146)**
PS	45.4	92.4	1.30
NFI	48.4	29.1	1.13
NS	−26.4	−11.3	2.17

TABLE 3 Estimates of Model II for Saving Components[a]

	β	γ_V	t Statistic on c_{2V}
FA	−0.03	11.8	0.8
Demand deposits and currency	−1.01	−22.8	−1.2
Time deposits	−0.08	−52.6	−3.1
Credit market instruments and miscellaneous	−0.63	84.1	3.0
Life insurance and pension fund reserves	−0.002	4.8	1.0
Equities	−0.62	25.2	3.0
NIL	−0.04	−15.3	−1.6
Home mortgages	−0.02	−6.0	−1.6
Consumer credit	−0.06	−8.8	−2.1
Other	−0.44	−3.9	−0.5
Net physical investment (*PI*)	−0.02	−14.6	−3.0
NFI	−0.04	27.4	2.2
NS	−0.01	12.5	1.1
PS	−0.03	15.5	3.2

[a]Model II:

$$q_t = c_1 q_{t-1} + c_{2Y}\Delta Y_t + c_{2V}\Delta V_t$$

β is the structural stock coefficient and γ is the structural uncertainty coefficient; see text for explanation.

For personal saving (*PS*), ϕ_V is much larger in the later period. However, the *F* test for the overall stability of the model shows significant structural change at the 5 percent level for *NS* only. The generally more significant and stable coefficients for *PS* and *NFI* suggest that the uncertainty effect has operated in the same way throughout the sample period.

Components of Net Saving

Model II, in which it is assumed that the assets do not depreciate, was appropriate for estimating the components of saving examined in Table 1 which are all financial flows. A summary of these results is shown in Table 3. The structural coefficient on the uncertainty variable (*V*), the *t* statistic on the regression coefficient of *V*, and the structural stock coefficient are given. The model was also estimated with the saving aggregates shown in Table 2. The results in Table 3 are consistent with the earlier ones for Model I except for *FA* and, consequently, *NS*, for which the Model II results indicate that the uncertainty effect is positive, although insignificant. The magnitudes of these structural coefficients can be judged by looking at the predicted effects of uncertainty on saving. For example, from 1963–1964 to 1973–1975 the personal saving rate increased by 42 percent (from 5.3 percent to 7.6 percent). About two-thirds of this increase can be explained by the increase in V over the same period.

For the components of saving, the uncertainty effects are significant for time deposits, credit market instruments, equities, consumer credit, and net physical investment, with the largest effects, relative to mean flows, for the first two. The negative effects on the deposit categories probably reflect the frequent failure of full inflation premiums to be included in returns because of institutional constraints. As a result, the real return is reduced, and this reduction dominates the positive tendency to add to liquid assets as an uncertainty response. The large positive effect on credit market instruments could be due to both uncertainty and returns effects (e.g., the disintermediation that takes place when credit market rates are high).

These results help explain the puzzling results for FA. Total financial asset acquisitions are a composite of diverse asset types with very different patterns of household investment behavior. This may mean that inflation changes the relative attractiveness of different financial assets.[9] However, the overall rates of return may fully reflect inflation premiums, with the result that in the aggregate the attractiveness of financial asset holding is unchanged. Moreover, it seems that the principle reaction to inflation-induced uncertainty is to reduce future commitments rather than increase precautionary balances. Both net increases in liabilities and net physical investment involve financial commitments in the form of repayments or maintenance expenditures.

The largest and strongest effect on liabilities is found for consumer credit. The net increase in consumer credit is the difference between extensions and repayments. The hypothesis that uncertainty leads to a reduction of future commitments suggests that the major effect should be on extensions. It is not expected that uncertainty would affect repayments, which are largely fixed by prior contracts. However, insofar as uncertainty reduces the demand for new loans, it would also reduce early payments due to refinancing, which would produce a negative coefficient on repayments. This conjecture is tested with data for 1955–1974 on consumer installment credit (about 80 percent of total consumer credit) using Model II, as shown in the following tabulation, where γ_V is the structural uncertainty coefficient.

	γ_V	t Statistic on c_{2V}	Mean
Net increase	−9.6	−2.9	128.4
Extensions	−11.8	−3.5	1,632.4
Repayments	−1.8	−1.4	1,504.2

The results strongly confirm the uncertainty effect on future commitments: the negative effect on the net increase is primarily due to a large and strong effect

(t statistic of 3.5) on credit extensions.

Finally, the estimates of Model II identify the structural parameter β, the stock coefficient. Although the reduced form does not include an explicit variable to reflect a wealth effect, it is allowed for through the stock variable in the structural model. The wealth effect is important because it is an additional inflation-related reason for increased saving behavior, since inflation erodes the purchasing power of the existing stock of financial assets. This, of course, assumes that inflation reduces the real rate of return on financial assets while still unanticipated and before interest rates have fully adjusted. Given that returns on many of the financial assets purchased by individuals are relatively fixed, it is clear that this phenomenon is often important in inflationary periods.[10]

The estimates of β shown in Table 3 are mostly very small and negative. Hence, wealth effects are quite weak except for demand deposits and currency, credit market instruments, equities, and other loans. A real-balance effect might also be expected for time deposits, although the estimate of -0.08 is small. However, since the stock of these assets is very large, inflation, which erodes the purchasing power of savings accounts, will have a fairly large impact on saving flows. The stock coefficients for saving aggregates are all fairly small.

Differences between Definitions of Saving

The puzzling inconsistency between results with *PS* (personal saving as defined in the NIPA) and *NS* (using FOF data) is not easily resolved. Three possible explanations were suggested in the data section: statistical discrepancies, conceptual differences, and differences in sectoral coverage. As shown below, the first two contribute equally to the paradox and the third is unimportant.

As noted in section 2, the sectoral coverage of the NIPA and FOF household sectors does differ. The sectoral coverage of the FOF data can be expanded to that of *PS* from NIPA. Such data are found in the FOF individuals' savings account. However, when the model is estimated with these data, the results are the same as the FOF household account. The uncertainty effect on saving is weak, and there is no evidence of any effect on financial asset acquisitions with either the household or individuals' savings account data. Furthermore, the exclusion of the physical investment of nonprofit institutions from the household sector has little effect on the results.

The major conceptual difference between *NS* and *PS* is that the former includes net investment in durables. When net durables investment is subtracted from *NS* to provide a FOF household sector personal saving concept, the uncertainty effect becomes significant and fairly strong. The estimates of Model I, with $PS^1 = NS -$ net investment in durables, are

$$PS^1 = -114.0 + .5421\, PS^1_{-1} + .2588\, \Delta Y + .0434\, Y_{-1} + 22.95\, \Delta V + 10.11\, V_{-1}$$
$$(0.9) \quad (5.3) \quad (1.5) \quad (2.5) \quad (2.0) \quad (1.3)$$

$\bar{R}^2 = .6321$; $DW = 2.07$; $SE = 121.7$; mean of $PS^1 = 887.1$; $\phi = 22.09$

Similarly, when the amount of the statistical discrepancy between NIPA and the FOF household account saving definitions is added to NS, the uncertainty effect is significant and positive. This is shown in the following equation where $NS^1 = NS$ + discrepancy:

$$NS^1 = -167.0 + .8501\, NS^1 + .5645\, \Delta Y + .0243\, Y_{-1} + 6.48\, \Delta V + 5.63\, V_{-1}$$
$$(1.9) \quad (12.3) \quad (6.8) \quad (1.7) \quad (1.2) \quad (1.6)$$

$\bar{R}^2 = .9444$; $DW = 2.50$; $SE = 57.9$; mean of $NS^1 = 917.2$; $\phi_V = 37.57$

To summarize, the long-run effect of V on net saving (NS) as shown in Table 2 is negligible: −0.4 percent of mean saving. With a personal saving definition, it increases to 2.5 percent of the mean. With the discrepancy added to net saving, it is 4.1 percent of the mean. When both revisions are made to NS, the long-run effect is 6.0 percent of the mean (not shown). In this case the uncertainty coefficients have t statistics greater than 3.0, as in the PS equation in Table 2. The remaining differences are due to data revisions in NIPA but not in FOF and to some minor differences in sectoral coverage and definitions. An uncertainty effect on saving shows up in most of the equations, although the magnitude of the effect is difficult to pin down because it depends upon the choice of saving data.

Alternative Specifications

Two alternative specifications of the model are suggested and tested in this section. First, I conjecture that the rate of inflation itself is an adequate measure of uncertainty. Second, the rate of interest is added to the model, since it is influenced by the inflation rate. In both cases the results already discussed are fairly robust to these specification tests.

The hypothesis considered in this paper is that the uncertainty associated with inflation leads to increased saving. The measure of uncertainty used in the results already shown was the survey variance, V. Alternatively, the expected or actual rate of inflation could be used as a proxy for uncertainty insofar as uncertainty increases directly with inflation. Since the various proxy measures for uncertainty are highly correlated, it is difficult to distinguish their independent effects on saving. The variance measure tends to explain a larger fraction of the variance in saving than the actual or expected rate of inflation, although the results are basically similar. Results not shown here indicate that the actual rate of inflation leads to generally stronger results than the expected rate, but this is probably due to error in the survey data and the inclusion of some interpolations early in the sample period.

The survey variance, V, had a very weak effect on one of the saving aggregates, FOF net saving (NS). Much stronger results are obtained in the equation for NS when the rate of inflation (P) is used to measure uncertainty, where $P = 100\,[(CPI/CPI_{-4}) - 1]$, and CPI = average value of the seasonally adjusted consumer price index for the quarter:

$$\underset{(-0.8)}{NS_t = -132.5} + \underset{(6.9)}{.6186\,NS_{t-1}} + \underset{(3.4)}{.6068\,\Delta Y_t} + \underset{(2.1)}{.0467\,Y_{t-1}} + \underset{(2.6)}{73.37\,\Delta P_t} + \underset{(0.6)}{5.78\,P_{t-1}}$$

$$\bar{R}^2 = .7728; \quad DW = 2.19; \quad \phi_P = 15.2$$

With this specification, there is a large long-run inflation effect on net saving. Thus the result, shown earlier, that the uncertainty effect on net saving was insignificant, is sensitive to the measure used for uncertainty. When the direct impact of inflation is used to measure uncertainty, $\bar{R}^2$ increases and the inflation effects are as strong as those on PS. For PS and NFI, however, more significant inflation effects are obtained with the variance proxy V than with the rate of inflation.

The influence of interest rates on saving behavior has been extensively studied—with mixed results. There is theoretical and empirical evidence that indicates interest rates may—or may not—be an important saving determinant. This issue is too complicated to be settled here, but it is important to see whether the uncertainty effects are changed when interest rates are held constant. The model was therefore expanded to include interest rates. Since the saving flow is in real dollars, the relevant interest rate is a real rate of return, defined as $R_t = RB_{t-1} - P_t$, where RB is the quarterly average rate on Baa corporate bonds and P_t is the rate of inflation in the past year, defined earlier. The bond rate was chosen as a general measure of overall interest rate movements and lagged one quarter because saving flows are not likely to adjust at the same time as financial market conditions.

Results for saving aggregates are summarized in Table 4.[11] The $\bar{R}^2$'s for PS and NS increased when ΔR and R_{-1} were added to the basic model with income and uncertainty variables. Collinearity between P and V somewhat reduced the t statistics on the uncertainty coefficients. The long-run uncertainty effects are all positive, and the real interest rate effects are all negative. Given the simplified structural form of this quarterly model, it would be inappropriate to interpret these results as estimates of an interest elasticity. A negative elasticity contradicts the most recent work on this issue (see Boskin 1976) and seems unsatisfactory.

The major conclusion to be drawn here is that uncertainty has a positive effect on saving even when interest rates are held constant. To some extent it can be argued that inflation reduces real returns on the financial assets held by

TABLE 4 Results for Model I with Interest Rates

	PS	NFI	NS
ϕ_V	79.6	27.9	10.8
ϕ_R	−8.6	−28.6	−22.9
$\bar{R}^2$	.9162	.7555	.7690
$\bar{R}^2$ without V_t and V_{t-1}	.8967	.7485	.7764
$\bar{R}^2$ without R_t and R_{t-1}	.9094	.7565	.7535

[a]Model I with interest rates:

$$q_t = b_0 + b_1 q_{t-1} + b_{2Y}\Delta Y_t + b_{3Y}Y_{t-1} + b_{2V}\Delta V_t + b_{3V}V_{t-1} + b_{2R}\Delta R_t + b_{3R}R_{t-1}$$

ϕ_V is the long-run uncertainty effect, and ϕ_R is the long-run interest effect.

consumers. Even when inflation is anticipated, institutional and regulatory rigidities prevent the returns on assets such as savings deposits from adjusting. In this case, the interest rate coefficients can be viewed as the negative of an inflation effect. Thus, inflation has a doubly strong positive effect on saving through both the uncertainty and interest rate coefficients.

Comparison with Other Results

The results obtained are broadly consistent with the literature cited in the introduction. Most of those studies use some variant of personal saving and find significant positive inflation or uncertainty effects. The point estimates are very sensitive to differences in specification and sample period. This, however, is not surprising in light of our results with different saving data.

Taylor's (1974) is the only study in which saving components and the flow of funds data were examined. His price expectations variable is not comparable to my measure and his reduced form model includes a large number of additional saving determinants. He finds positive expectations effects for aggregate saving from both NIPA and FOF as well as for physical investment and net acquisitions of financial assets. The differences in results are not due to his shortened sample period,[12] but apparently are the consequences of specification differences. Taylor's specifications differ for each saving component. In order to compare inflation and uncertainty effects on each component, I adopted a simpler model with a common, simplified structure.

[5] CONCLUSIONS

The discussions in this paper confirmed that the hypothesis of a relationship between saving and inflation and uncertainty is well founded. However, it was also shown that some important issues remain to be investigated. In particular, a better understanding of the determinants of the disaggregated saving flows is needed. The implication of this study is that as economists formulate better models for the components of saving by individuals, inflation and uncertainty are likely to play an important role.

The results are sensitive to the sources of data used. This makes precise estimation of inflation effects on saving difficult. Although the discrepancy in results can be explained, it is not clear which data set should be viewed as correct. A better understanding of the relationship probably depends on improvements in the quality of the data.

Financial asset acquisitions are probably the weakest link in the data and also yield the most ambiguous results. There is very little evidence of precautionary saving leading to increased liquid asset holding. The hypothesis may be incorrect or the data and models may be inadequate; either is an equally plausible explanation, and the issue remains unsettled.

My evidence suggests that when households are uncertain about inflation, they reduce their borrowing. I conclude that this is the major source of the often observed inflation-saving relationship. A corollary is that inflation leads to reduced physical investment. Although this contradicts the usual notion that inflation produces a shift to real assets, the strength of the results for liabilities and physical investment is convincing. These results hold when interest rates are held constant and with either the inflation rate or the survey variance representing uncertainty.

NOTES

1. Taylor (1974) is the major exception and his results, which in some instances differ from mine, will be discussed in Section 4.
2. Taubman analyzed three measures of the same personal saving concept (two from the national income and product accounts and one from flow of funds) and concluded that the evaluation of income multipliers depends on the choice of data. He states that "the saving function...depends upon our choice of measurement of a given concept and we do not know which measurement is correct" (p. 129).
3. Neutrality requires that every price always rises at exactly the same rate. Otherwise, relative prices will be constantly changing (even if monthly or quarterly data do not reveal such changes), and any information about, say, the price advantage of a particular store is made less useful. In general, inflation increases the frequency of changes in prices (see Vining and Elwertowski 1976), and thereby increases the cost of obtaining price information. Similarly, if inflation is unanticipated, more resources must be devoted to keeping price information up to date.
4. Consumers may be very poor predictors of future inflation. Inflation is often unanticipated, but it is probably recognized once it is taking place. The money illusion argument requires that inflation be unrecognized and not just unanticipated as it occurs, and is thus a fairly stringent condition.

5. It is worth noting that if both inflation and unemployment induce uncertainty and increase saving, stagflation is likely to be characterized by very high saving rates.
6. This phenomenon has been particularly noticeable in the United Knigdom in recent years. Very high inflation rates have been accompanied by large inflows into savings institutions even though the real returns on these assets are negative.
7. The sectoral coverage of the FOF individuals' saving account is similar to that of NIPA personal saving. The empirical results are about the same whether FOF individuals' saving or FOF household data are used. However, the discrepancy between FOF and NIPA data is large, and the results show substantial differences.
8. The identifying restriction is $b_{3x}/b_{2x} = b_{3y}/b_{2y}$. The Model I reduced form can be estimated by nonlinear least squares, which imposes the restriction. Computational limitations of the estimation system used made this difficult. However, some comparisons of least squares and restricted estimates were made. Although coefficient estimates sometimes differed, the basic tenor of the results was unchanged; that is, the comparisons among various saving definitions were unchanged.
9. The inflation risk of different assets varies greatly because of institutional and legal constraints as well as market conditions.
10. Capital gains may also lead to wealth effects, but these are not considered here since they are excluded from the saving data.
11. Similar results were obtained with either a mortgage rate or deposit rate.
12. The results in this paper are essentially unchanged when the sample period ends in Q4 1970.

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