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HOUSEHOLD SAVING: AN ECONOMETRIC INVESTIGATION

Patric H. Hendershott

Joe Peek

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Household Saving: An Econometric Investigation

ABSTRACT

Household or personal saving is recomputed to include net purchases of consumer durables, net contributions to government life insurance and pension reserves, and an adjustment for the inflation premium component in interest income. These adjustments raise the measured household saving rate by nearly 5 percentage points in the 1965-75 period but result in an extremely sharp 7 percentage point decline in the rate between 1975 and the early 1980s.

A model of household saving behavior is then presented and estimated using annual data from the 1952-82 period. While saving responds to numerous influences, major swings in the adjusted saving rate -- a significant decline in the 1950s and rebound in the early 1960s, as well as the decline since 1975 -- are largely explained by two variables: the wealth/income ratio and the growth rate of real income.

Patric H. Hendershott
321 Hagerty Hall
1775 College Road
Ohio State University
Columbus, OH 43210
(614) 422-0552

Joe Peek
Department of Economics
Boston College
Chestnut Hill, MA 02167
(617) 552-3686

CHAPTER 4: HOUSEHOLD SAVING: AN ECONOMETRIC INVESTIGATION

INTRODUCTION

By official government accounts, the U.S. saves a substantially smaller fraction of income than do other industrialized countries. Reasons for the small fraction and the implications of it for America's future well-being are widely discussed (Feldstein 1977; Boskin 1983). Contributing to the low national rate is a low, and apparently declining (Auerbach 1985), personal or household saving rate. The measurement and determinants of household saving are the subject of this chapter.

Major problems in measuring saving rates (Auerbach 1985; Blades and Sturm 1982) raise questions as to just how low the U.S. household saving rate is and how much it has declined recently. We consider the sources of measurement error in the following section and compute an adjusted household saving series that includes net purchases of consumer durables, net contributions to government life insurance and pension reserves, and an adjustment for the inflation premium component in interest income. These adjustments raise the measured household saving rate by nearly 5 percentage points in the 1965-75 period but result in an extremely sharp 7 percentage point decline in the rate between 1975 and the early 1980s.

We then present a model of household saving behavior and estimate it using annual data from the 1952-82 period. While saving responds to numerous influences, major swings in the saving rate -- a significant decline in the 1950s and rebound in the early 1960s, as well as the decline since 1975 -- are largely explained by two variables: the wealth/income ratio and the growth rate of real income. A detailed interpretation of the empirical estimates is provided in the text and summarized in the concluding section.

THE MEASUREMENT OF PERSONAL SAVING

Personal saving is calculated in the National Income and Product Accounts (NIPA) as:

$$SNIA = YPERS - CEXP - TXPERS - INTPD, \quad (1)$$

where SNIA, YPERS, CEXP, TXPERS, and INTPD represent personal saving, income, consumption expenditures, tax payments, and interest paid to business,[1] respectively. Thus, measurement errors in any of the terms netted from personal income, as well in personal income itself, will be embedded in SNIA dollar for dollar.[2] Below we discuss important measurement errors in each of these terms and describe the adjustments we make to correct the errors.

Consumption (CEXP) and Tax (TXPERS) Adjustments

Theoretical models of consumption and saving behavior (for example, the Life Cycle Hypothesis, the Permanent Income Hypothesis, and their derivatives) are stated in terms of the consumption of service flows. These flows, rather than consumption expenditures, are an argument in the utility function. To be consistent with this theory, the component of consumer expenditures representing net investment in consumer durable goods should properly be considered personal saving. The NIPA measure of personal saving, however, is constructed on an expenditures rather than a service flow basis. Consequently, we adjust SNIA by the difference between the value of expenditures and the value of the consumption of services (CON) to arrive at the theoretically appropriate personal saving measure (SAV):

$$SAV = SNIA + SDUR = SNIA + (CEXP - CON), \tag{2}$$

where SDUR is net investment in consumer durable goods. SDUR has risen, erratically, from 15 billion 1972 dollars in the early 1950s to 35 billion in the middle 1970s. Consumer durable goods are distinguished from nondurables and services because they need not be consumed in the same period that they are purchased. To the extent that net new purchases of consumer durable goods are carried over to the next period, current net purchases will be a poor measure of actual consumption in the period.

There are two measurement problems associated with tax liabilities. The first concerns the treatment of government life insurance and employees' retirement fund activities. In the NIPA, these transactions are treated as social insurance contributions (taxes) and payments (transfers). The flow of funds treatment of the net contributions as household claims analogous to private life insurance and pension reserves is more appropriate. Thus the net contributions, denoted by SGPEN, must be added to household saving (and subtracted from government saving).[3] This variable rose from 3 billion 1972 dollars in the early 1950s to 20 billion in the early 1980s.

The second problem associated with the NIPA measurement of personal taxes occurs because personal income taxes are measured on a cash payment rather than a liability accrual basis. If individuals plan consumption and saving over a long period of time, the relevant income tax variable will be the one that represents their actual tax liabilities (see Peek 1982, 1983). The tax adjustment (STAX) is constructed as:

$$STAX = TXPERS - TXLIAB, \qquad (3)$$

where TXLIAB is tax accruals taken from annual issues of Statistics of Income, Individual Income Tax Returns (SOI). Most of the difference between tax payments and accruals (which has fluctuated between -2 and +10 billion 1972 dollars) arises because the net refund for tax year t is included in the liabilities of year t and in the cash payments of year t+1. The major fluctuations in the net refunds series are largely due to differences in the timing and magnitude of the changes in income tax rates and the corresponding withholding schedules.

Expected Inflation and Personal Income (YPERS)

The final proposed personal saving adjustment is due to distortions in the measurement of interest income (and payments) and capital losses (and gains) during inflationary periods. The expectation of net capital losses on fixed-dollar financial assets leads to the incorporation of an inflation premium in nominal interest rates to compensate investors for the losses. Part of the household stock of fixed-dollar assets is being converted into a flow (the inflation premium component) that is recorded inappropriately as income received and capital losses incurred. Because saving is computed as income less consumption and taxes, an extended period of anticipated inflation would result in a substantial overstatement of the personal saving rate.

Three categories of interest payments are incorporated in personal income: (1) monetary interest paid to persons, (2) imputed interest paid to persons by depository institutions, and (3) imputed interest paid to persons by life insurance companies and private noninsured pension funds. The second category is also imputed to consumption expenditures. Consequently, if it is mismeasured, the error [being added to and subtracted from the right hand side of (1)] is not included in measured personal saving. However, an overstatement of the other two categories will lead to a dollar for dollar overstatement of SNIA. Similarly, an overstatement of interest paid by consumers to business (INTPD) will result in a dollar for dollar understatement of SNIA.

Jump (1980) proposed that an inflation premium equal to the product of the anticipated inflation rate and the stock of net household fixed-income assets be subtracted from the official saving measure.[4] Because this premium implies immediate, complete adjustment of interest income to the current anticipated inflation rate, it would substantially overstate, and be more volatile than, the inflation premium component of NIPA interest income included in personal saving during a period of rising inflation for three reasons. First, binding interest rate ceilings on at least some demand and savings accounts existed in the U.S. for the 1965-79 period. Once these nominal interest rate ceilings were reached, the monetary interest payments on such assets could incorporate an additional inflation premium only as rapidly as ceiling interest rates were raised. Second, while additional interest from financial institutions is imputed to individuals when interest rates (inflation) rise, imputed interest generally responds sluggishly to interest rate changes. Third, a significant part of fixed-valued household assets and liabilities are long-term. For these instruments, coupon receipts/payments adjust to an increase in inflation expectations only over time as new bonds are issued to replace maturing bonds. (Yields adjust immediately via a decline in the market price of the instruments.) This analysis suggests that there will be a lagged adjustment of the inflation component of NIPA interest income and expenses to an increase in the anticipated inflation rate. (The adjustment to a decrease in inflation will occur more rapidly to the extent that high coupons are replaced by lower coupons as long-term debt is refinanced at the lower market rate.) A final problem with Jump's adjustment is that it ignores the tax liabilities incurred on monetary interest income: only the net-of-tax inflation premium component can be used to maintain the real value of net financial assets.

We have constructed inflation adjustments for both personal saving and personal income that are based on the actual NIPA interest income measure. The inflation component incorporated in personal saving is calculated as:

$$SPREM = (1 - TXINT)(RINTSAV - RINTSAV50)ASAV, \quad (4)$$

where ASAV represents the stock of net household fixed-income assets at the beginning of the period,[5] RINTSAV represents the ratio of the relevant personal interest income to ASAV, RINTSAV50 is the 1950 value of RINTSAV, and TXINT is the assumed tax rate on interest income.[6] This procedure allocates any increase in interest income (adjusted for the growth in net financial assets) to our inflation component measure. It is likely that the inflation component in 1950, if any, was extremely small. To the extent that it was nonzero, our measure differs from the true component by a small constant but still accurately reflects its movements. We have implicitly assumed that the real interest rate built into interest income was constant during the 1950-82 period.[7] The inflation-component adjustment to saving reaches 59 billion real 1972 dollars by 1981.

The calculation of the inflation premium embedded in NIPA disposable income is similarly calculated:

$$YPREM = (1 - TXINT)(RINTYD - RINTYD50)AYD, \quad (5)$$

where RINTYD is now the ratio of the sum of the two interest income categories used to calculate SPREM and the imputed interest paid to persons by financial institutions to AYD. RINTYD50 is its 1950 value, and AYD is all fixed-income assets. AYD differs from ASAV in that we do not subtract nonmortgage fixed-income liabilities of individuals because the inflation component in INTPD is relevant only to the calculation of SPREM. TXINT may slightly overstate the tax liabilities on interest income because it includes nontaxable imputed interest paid to persons by depository institutions, life insurance companies and private noninsured pension funds, as well as monetary interest payments to persons. However, the imputed component is small relative to the total and probably accounts for a less than proportionate share of the inflation premium. Moreover, TXINT does not reflect state and local taxes. The adjusted personal saving rate can then be calculated as:

$$RSAVADJTX = \frac{SNIA - SPREM}{YD - YPREM}. \qquad (6)$$

Table 4-1 contains four personal saving rates. RSAVNIA is conventional NIPA personal saving, RSAVADJ is our adjusted saving rate with TXINT = 0,

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RSAVADJTX includes the tax adjustment, and RSAVJUMP represents the personal saving rate using Jump's method.[8] Our tax-adjusted personal saving rate is relatively stable through 1975. It does not rise in the late 1960s and early 1970s as does the official rate. While it does decline substantially after 1975, it remains positive. In sharp contrast, Jump's measure begins to decline after 1967, becomes negative after 1975, and is sharply negative in the early 1980s. The decline from 1967 to 1980 is 13 percentage points, 8 more than the decline in our series. About one-third of the excess decline can be attributed to the overstatement of the inflation premia and two-thirds to the ignoring of taxes.

Adjusted Personal Saving Rates

We can now calculate our adjusted personal saving series. This series incorporates the four adjustments to NIPA personal saving described above: (1) net investment in consumer durable goods, (2) the treatment of contributions

Table 4.1. Alternative Measures of the Saving Rate
(percentage points)

YEAR		RSAVNIA	RSAVADJ	RSAVADSTX	RSAVJUMP
1950	.	5.76843	5.76842	5.76842	7.84374
1951	.	7.10597	6.97230	7.01235	3.27981
1952	.	7.31012	7.22025	7.24944	5.49026
1953	.	7.34243	7.30657	7.31787	8.02852
1954	.	6.60524	6.41666	6.47051	7.59933
1955	.	5.98055	5.84711	5.88539	5.97705
1956	.	7.28341	7.15404	7.19211	6.81876
1957	.	7.22075	6.80651	6.92746	6.19601
1958	.	7.38723	6.74928	6.93351	7.15338
1959	.	6.24525	5.55527	5.75595	5.42763
1960	.	5.58961	4.77814	5.00811	4.48076
1961	.	6.29063	5.38848	5.64608	5.59962
1962	.	6.02211	4.88565	5.20146	4.68071
1963	.	5.39397	4.10091	4.45602	4.14388
1964	.	6.70878	5.31995	5.67082	5.60687
1965	.	7.07492	5.57791	5.94609	5.68440
1966	.	6.99877	5.32927	5.74579	5.12639
1967	.	8.08726	6.26222	6.73504	5.67345
1968	.	7.06703	5.20368	5.73228	3.83008
1969	.	6.35246	4.18201	4.82659	2.95362
1970	.	8.02329	5.51523	6.22551	3.95547
1971	.	8.06796	5.45416	6.19629	3.76237
1972	.	6.49248	3.92487	4.67713	2.69766
1973	.	8.63448	5.57911	6.78296	4.64404
1974	.	8.52583	4.97054	6.09439	2.20916
1975	.	8.60211	4.90974	6.06756	-0.0343324
1976	.	6.90672	3.29275	4.45353	-0.464840
1977	.	5.93561	1.95203	3.24758	-0.931653
1978	.	6.06326	1.91218	3.32748	-1.84926
1979	.	5.85945	0.854904	2.64357	-3.19310
1980	.	6.02514	-0.493919	1.99266	-7.10561
1981	.	6.60620	-2.61375	1.07713	-7.77195
1982	.	5.76324	-3.38158	0.309396	-4.22336

Data Sources: NIPA, Balance Sheet Accounts, Federal Reserve Bank of Philadelphia provided Lingston Survey expected inflation rate, SOI calculations described in text.

to government insurance and pensions as household saving, not taxes, (3) the conversion of household taxes to an accrual basis, and (4) the inflation component incorporated in interest income. The first three adjustments are added to NIPA saving, while the inflation component is subtracted. The adjusted personal saving measure is thus:

$$SADJ = SNIA + SDUR + SGPEN + STAX - SPREM. \qquad (7)$$

Table 4-2 presents this measure and its components. Table 4-3 lists the same

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variables as a percent of disposable labor income. Disposable labor income is used rather than total disposable income because the former avoids the serious

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measurement problems associated with property income during inflationary periods.

The saving rate including all adjustments was in the 13 to 16 percent range in the early to middle 1950s before sliding into the 10 to 12 percent range in the 1958-63 span. For the years 1965 to 1975, the rate again assumed the high values of the middle 1950s. From there, the rate fell to the 11 to 13 percent range in the second half of the 1970s and then down to the 7 to 8½ percent level in the early 1980s.

THE MODEL[9]

The model is developed in three parts. We begin with planned wealth accumulation, then consider actual accumulation and its implication for the saving relation, and finally consider the likely impact of different capital gains components.

Table 4-2. Various Saving Adjustments
(billions of 1972 dollars)

YEAR		SNIA	SGPEN	SDUR	STAX	SPREM	SADJ
1952	.	23030.7	3270.97	13925.8	3738.70	294.348	48671.8
1953	.	29302.2	3050.63	16034.8	2914.55	208.401	51093.3
1954	.	26659.4	2522.76	11166.4	2136.58	689.052	41796.0
1955	.	25534.2	2838.51	18925.5	1250.00	567.964	47980.2
1956	.	32522.9	3719.51	13006.1	1699.70	657.157	50291.0
1957	.	32870.2	3240.41	11340.7	2274.34	1655.66	48070.0
1958	.	34054.9	3988.44	5179.19	1552.02	2467.74	42306.8
1959	.	29939.1	4134.56	10383.9	-253.540	2711.03	41493.0
1960	.	27364.4	4394.99	9791.38	3310.14	3227.21	41633.7
1961	.	31691.5	4669.42	5900.82	666.666	3699.25	39229.1
1962	.	31605.2	4713.70	11564.5	2208.96	4787.04	45305.3
1963	.	29268.7	5149.73	15783.4	1311.50	5585.01	45928.3
1964	.	38943.4	5787.88	19786.6	-1517.79	6760.00	56240.0
1965	.	43602.3	6143.78	26123.1	2007.77	7842.86	70034.1
1966	.	45279.6	7035.27	29102.0	3167.50	9072.91	75511.4
1967	.	54436.1	6742.02	25934.9	1757.99	10339.6	78531.3
1968	.	49570.9	7260.05	31883.0	-173.759	10451.8	78088.3
1969	.	45914.0	8001.13	29727.4	5566.74	12083.2	77126.0
1970	.	60308.1	9600.00	21626.0	5463.77	15115.8	81882.1
1971	.	62850.8	9811.40	26924.4	426.942	16268.1	83745.4
1972	.	52610.0	11636.0	35213.0	9352.99	16001.2	92810.7
1973	.	74703.9	11154.2	38236.5	1495.74	18098.5	107492.
1974	.	73125.5	10782.7	24421.0	2478.52	23021.5	87786.1
1975	.	75247.5	12053.5	21116.5	3773.34	24468.1	87722.6
1976	.	62635.6	13407.8	30346.3	-195.141	23906.2	82288.1
1977	.	55990.8	16176.6	35606.7	2103.38	26695.9	83181.4
1978	.	59941.0	18711.0	38009.4	600.939	28584.4	88677.9
1979	.	59501.6	15014.8	32312.7	6824.61	34076.9	79576.8
1980	.	61559.3	19708.4	18126.8	1373.19	42390.2	58377.3
1981	.	69690.9	19312.2	19670.3	3685.21	59137.4	53221.1
1982	.	61100.4	21090.1	16096.5	7276.18	58052.8	47510.3

Data Sources: NIPA, Balance Sheet Accounts, SOI, SGPEN furnished by FOF section of Board of Governors. Calculations described in text.

Table 4-3. Various Saving Rate Adjustments
(percentage points)

YEAR		RSNIA	RSGPEN	RSDUR	RSTAX	RSPREM	RSADJ
1952	.	9.05085	1.05617	4.49651	1.20719	0.095042	15.7157
1953	.	9.11936	0.949410	4.99031	0.907059	0.064858	15.9013
1954	.	8.35071	0.790225	3.49773	0.669257	0.215837	13.0921
1955	.	7.56550	0.841020	5.60742	0.370361	0.168282	14.2160
1956	.	9.17006	1.04874	3.66716	0.479241	0.185290	14.1799
1957	.	9.18309	0.905288	3.16829	0.635391	0.462550	13.4295
1958	.	9.60742	1.12520	1.46113	0.437850	0.696187	11.9354
1959	.	8.10608	1.11944	2.81147	-0.068647	0.734017	11.2343
1960	.	7.25988	1.16601	2.59769	0.878193	0.856191	11.0456
1961	.	8.28033	1.22002	1.54176	0.174186	0.966537	10.2498
1962	.	7.90591	1.17911	2.89281	0.552562	1.19746	11.3329
1963	.	7.12944	1.25440	3.84461	0.319462	1.36043	11.1875
1964	.	8.86480	1.31751	4.50408	-0.345498	1.53880	12.8021
1965	.	9.29611	1.30987	5.56949	0.428061	1.67211	14.9314
1966	.	9.17009	1.42479	5.89378	0.641486	1.83746	15.2927
1967	.	10.6945	1.32454	5.09517	0.345374	2.03133	15.4282
1968	.	9.35423	1.37000	6.01644	-0.032789	1.97230	14.7356
1969	.	8.37658	1.45973	5.42348	1.01560	2.20447	14.0709
1970	.	10.7510	1.71136	3.85520	0.974011	2.69465	14.5969
1971	.	10.9799	1.71402	4.70362	0.074586	2.84199	14.6301
1972	.	8.71575	1.92770	5.83364	1.54948	2.65087	15.3757
1973	.	11.9028	1.77724	6.09235	0.238322	2.88370	17.1270
1974	.	11.9678	1.76470	3.99677	0.405638	3.76772	14.3672
1975	.	12.3453	1.97753	3.46444	0.619066	4.01431	14.3920
1976	.	9.89736	2.11862	4.79517	-0.030835	3.77754	13.0028
1977	.	8.45042	2.44146	5.37395	0.317453	4.02909	12.5542
1978	.	8.69608	2.71453	5.51429	0.087182	4.14694	12.8651
1979	.	8.39678	2.11886	4.55992	0.963079	4.80888	11.2298
1980	.	8.93914	2.86189	2.63223	0.199403	6.15557	8.47708
1981	.	10.1553	2.81416	2.86634	0.537006	8.61747	7.75535
1982	.	9.02270	3.11438	2.37697	1.07447	8.57266	7.01584

Data Sources: NIPA, Balance Sheet Accounts, SOI, SGPEN furnished by FOF section of Board of Governors.
Calculations described in text.

Planned Wealth Accumulation

Planned wealth accumulation is assumed to arise from the desires of individuals to smooth their pattern of consumption over their lifetime and to leave bequests. Because human capital cannot be carried over into retirement years, some of it must be transformed into nonhuman wealth to allow consumption after retirement or to permit bequests. In addition, a precautionary motive arising from the existence of unforeseen fluctuations in income (and perhaps needs) would lead to the holding of a nonzero stock of nonhuman wealth by individuals even if anticipated future consumption and income were equal.

Given an intertemporal utility function with current and future levels of consumption (as well as any final bequest) as arguments, an individual determines a desired consumption path by maximizing utility subject to his perceived lifetime resources. Given an expected labor income path, the interest rate, and the length of the retirement span, this desired consumption path implies an associated wealth accumulation path. At any given time, the end-of-period wealth required would be the level that would just allow the individual to meet his future planned consumption path, assuming his expectations of the future are realized. Consistency requires that each period's desired wealth level must be attainable if expectations about the other variables are realized. Thus, the planned change in wealth in any period is simply the difference between the level of desired end-of-period household nonhuman wealth consistent with the desired consumption path, W^d, and actual household nonhuman wealth at the end of period t-1 (beginning of period t), W_{t-1}. The simultaneous determination of the desired wealth and consumption paths requires this complete adjustment of actual to desired wealth within the period because failure to attain the desired wealth stock by the end of the period means that the future planned consumption path cannot be realized.

Desired wealth is assumed to depend on total resources [proxied by expected disposable labor income (YDL_t^e), expected transfer payments (YTR_t^e), beginning-of-period nonhuman wealth (W_{t-1}), and expected capital gains (G_t^e)], the gap between potential and actual real GNP (GAP), the real after-tax interest rate ($RRAT_t$), and the share of the population that is over age 65 (AGE), where the last two variables are scaled by YDL_t^e to allow their real dollar impacts to grow with the level of real economic activity.

$$W_t^d = w_0 + w_1 YDL_t^e + w_2 YTR_t^e + w_3 W_{t-1} + w_4 G_t^e + w_5 GAP_t + w_6 RRAT_t YDL_t^e + w_7 AGE_t YDL_t^e. \qquad (8)$$

The resources coefficients w_1 through w_4 should be positive.[10] We would expect w_5, the coefficient on GAP, also to be positive because a cyclical increase in expected labor income would represent a smaller rise in perceived total resources (and hence W^d) than would an increase representing an upward shift in the time path of expected labor income. Thus, w_1 would represent the effect on desired wealth of such a noncyclical rise in YDL^e (that is, unaccompanied by a decline in GAP). Owing to offsetting income and substitution effects, w_6 could have either sign. The age composition variable is intended to reflect any changes over time in the proportion of individuals in the retirement (dissaving) stage of their lifetimes; thus w_7 should be negative.

DERIVATION OF THE SAVING RELATION

Actual wealth accumulation, ΔW_t, is the sum of planned, $W_t^d - W_{t-1}$, and unplanned, ΔW_t^u, accumulation:

$$\Delta W_t \equiv W_t^d - W_{t-1} + \Delta W_t^u. \qquad (9)$$

The latter is assumed to be related to the unexpected components of disposable labor income (YDL_t^u), transfer income (YTR_t^u), and capital gains (G_t^u):

$$\Delta W_t^u = b_1 YDL_t^u + b_2 YTR_t^u + b_3 G_t^u. \qquad (10)$$

The fractions of the unexpected components that are saved, b_1, b_2 and b_3, are assumed to be near unity. Virtually all of any unexpected increments to purchasing power would be added to wealth during the period in which they occur because individuals are unable to incorporate these unknown increments into their current expenditure plans. However, the longer the length of the time period taken as the unit of analysis, the more opportunity there is to adjust expenditure behavior within the current period and, therefore, the smaller would be the b's.

As emphasized in the previous chapter, there are two ways in which household nonhuman wealth can change: (1) net purchases of assets by individuals (personal saving) and (2) the net change in the real value of household assets previously held (capital gains). We can state this identity as:

$$\Delta W_t \equiv S_t + G_t. \tag{11}$$

With respect to current wealth, the source of its value is unimportant. Accrued capital gains embedded in an asset (less any accrued income tax liability)[11] are indistinguishable from an equal amount of personal saving that has been invested in a similar asset. Recognizing that accrued capital gains in (11) are composed of expected and unexpected components,

$$G_t \equiv G_t^e + G_t^u, \tag{12}$$

we can substitute (10) into (9), the result and (12) into (11), and solve for saving as:

$$S_t = W_t^d - W_{t-1} + b_1 YDL_t^u + b_2 YTR_t^u + (1 - b_3) G_t^u - G_t^e. \tag{11'}$$

The final term ($-G_t^e$) represents a displacement, or deflection, effect of expected capital gains on personal saving.[12] The extent to which the displacement effect of expected capital gains on planned saving will be less than one-for-one depends on the magnitude of the response of total planned wealth accumulation to expected capital gains [w_4 in equation (8)].

Disaggregation of Capital Gains

The detailed discussion on capital gains in the previous chapter suggests that there are theoretical reasons to disaggregate total capital gains by asset groups. We can write total real capital gains as:

$$G_t = \lambda_1 GHLN_t + \lambda_2 GDUR_t + GSTK_t + GNFAP_t + \lambda_3 GNFAB_t, \qquad (13)$$

where GHLN represents real capital gains on owner-occupied housing, land and noncorporate equity; GDUR represents real capital gains on consumer durable goods; and GSTK represents real capital gains on corporate equities. Real capital gains on net financial assets have been separated into two components: GNFAP (real capital gains on net financial assets due to changes in the general price level)[13] and GNFAB (real capital gains on net financial assets due to nominal bond price changes). As discussed in the previous chapter, we would expect the λ's to be between zero and unity, with λ_1 larger than λ_2 because housing and land are longer-lived than consumer durable goods. We would expect λ_3 to be closer to zero the longer the intended holding period of bond owners. A strict Hicks' prospective-income view would imply a value of zero for λ_3.

Each of the gains components in (13) can be partitioned into expected and unexpected components, where the expected component affects desired wealth accumulation through the w_4 coefficient in (8) and the unexpected component influences the unexpected change in wealth through b_3 in (10). However, the values of w_4 and b_3 could vary across asset categories. The effect of an expected capital gain on desired wealth would depend on its informational content, that is, the magnitude of its effect on the perceived value of total resources. This is related to how certain one is of the expected gain actually occurring and the extent to which current gains provide information about future gains. A capital gain expected to recur in the future would represent a larger increase in perceived total resources (and hence a higher level of current and future consumption) than a one time gain. Thus, a nonrecurring gain would raise current consumption less and end-of-period desired wealth level more. If we let w_{41} through w_{45} represent the w_4's for $GHLN^e$, $GDUR^e$, $GSTK^e$, $GNFAP^e$ and $GNFAB^e$, in that order, then we might expect w_{43} and w_{45} to be largest because stock and bond prices are more volatile than goods prices. For example, the standard deviations of $GSTK^e$ and $GNFAB^e$ are five and a half and four and a half times as large as their respective means. At the same time, the standard deviations of $GDUR^e$ and $GNFAP^e$ are roughly half and ~~three quarters~~ nine-tenths of their respective means. The standard deviation of $GHLN^e$ is just under one and a half times its mean. Based on relative volatility, we would expect to find $w_{43}>w_{45}>w_{41}>w_{44}>w_{42}$.

The b_3's, on the other hand, will tend to be smaller the quicker that individuals learn of unexpected gains and losses and can incorporate such information into their behavioral decisions. Because people trade houses, land and durables less often than stocks and bonds (for which we have daily price quotes), we would expect b_{31} and b_{32} to exceed b_{33} and b_{35}. Moreover, while much attention is given to trades of comparable houses by others because houses constitute so much of one's wealth, little attention is apparently accorded durable trades. Because changes in general price indices are published with relatively short lags, b_{34} should lie between the two extremes.

Combining (8), (11'), and (13) -- after restating the latter in terms of expected and unexpected components -- we obtain:

$$\begin{aligned} S_t = {} & A_0 + A_1 YDL_t^e + A_2 YTR_t^e + A_3 W_{t-1} + A_4 GAP_t + A_5 RRAT_t YDL_t^e + \\ & A_6 AGE_t YDL_t^e + A_7 YDL_t^u + A_8 YTR_t^u + A_9 GHLN_t^e + A_{10} GDUR_t^e + A_{11} GSTK_t^e + \\ & A_{12} GNFAP_t^e + A_{13} GNFAB_t^e + A_{14} GHLN_t^u + A_{15} GDUR_t^u + A_{16} GSTK_t^u + \\ & A_{17} GNFAP_t^u + A_{18} GNFAB_t^u, \end{aligned} \tag{14}$$

where

$$A_0 = w_0 \qquad A_6 = w_7 \qquad A_{13} = \lambda_3(w_{45} - 1)$$

$$A_1 = w_1 \qquad A_7 = b_1 \qquad A_{14} = -\lambda_1(1-b_{31})$$

$$A_2 = w_2 \qquad A_8 = b_2 \qquad A_{15} = -\lambda_2(1-b_{32})$$

$$A_3 = w_3 - 1 \qquad A_9 = \lambda_1(w_{41} - 1) \qquad A_{16} = -(1-b_{33})$$

$$A_4 = w_5 \qquad A_{10} = \lambda_2(w_{42} - 1) \qquad A_{17} = -(1-b_{34})$$

$$A_5 = w_6 \qquad A_{11} = w_{43} - 1 \qquad A_{18} = -\lambda_3(1-b_{35}).$$

$$A_{12} = w_{44} - 1$$

We would expect to find $A_3<0$ and $1>A_7 \sim A_8>A_1>A_2$. While we expect A_7, A_8, and A_1 to be positive, as discussed earlier, A_2 could take on a small negative value. Similarly, we would expect A_4 to be positive, A_6 to be negative, and are uncertain about the sign of A_5 a priori. Given the preceding analysis, we would expect all ten capital gains coefficients to be negative.

An important characteristic of the expected capital gains coefficients is that the larger the effect of an increase in expected capital gains on desired wealth, the smaller the expected capital gains coefficient in the saving equation. This is related to the deflection effect discussed earlier. The more the expected capital gain raises desired wealth, and thus planned wealth accumulation, the less it deflects (or reduces) saving. Consequently, a large behavioral effect on desired wealth would be associated with a relatively small effect on personal saving. However, the interpretation of the expected capital gains coefficients is complicated by the presence of the λ's in A_9, A_{10}, and A_{13}. A value of λ less than unity, indicating that the capital gains are only partially viewed as additions to wealth, would further reduce (in absolute value) the expected capital gains coefficients. In fact, the less the capital gains are viewed as additions to wealth, the nearer to zero are the values of A_9, A_{10}, and A_{13}. Thus, relatively large effects on desired wealth or relatively small effects on the perceived actual change in wealth will both result in values of A_9, A_{10} and A_{13} very near zero. Of the unexpected capital gains coefficients, we would expect to find A_{14} and A_{15} very near zero, and A_{16}, A_{17}, and A_{18} having values between zero and A_{11}, A_{12}, and A_{13}, respectively.

EMPIRICAL ANALYSIS

This section is divided into four parts. After discussing the data, we present estimates of the basic model and of an extended model. An interpretation of the preferred estimated relationship concludes the section.

Data Specification

Estimation of the saving equation requires proxies for each of the relevant variables. The saving, income, wealth, and capital gains variables are all per capita constant 1972 dollar magnitudes. The dependent variable, SAV, is the sum of the NIPA personal saving measure (SNIA) and net investment in consumer durable goods (SDUR). This is consistent with the theoretically appropriate measurement of consumption as service flows rather than as expenditures. The measurement error terms (SGPEN, STAX, and SPREM) have been described above. They, too, are divided by population. Population and the share aged 65 or older (AGE) are from the Economic Report of the President.

The beginning-of-period value of household wealth (W) is taken from the Balance Sheet Accounts. Thus it does not include the real value of unfunded pension wealth, a series that rose markedly during the 1950-80 period. Our measure of the GNP gap (GAP), potential less actual GNP, relies on the potential GNP series calculated by the President's Council of Economic Advisors and the NIPA GNP measure. It is lagged one period to avoid simultaneity problems. The real after-tax interest rate (RRAT) is calculated as the after-tax yield on one-year Treasury bills less the Livingston survey measure of the one-year expected inflation rate. The Treasury bill yield is the average for the preceding December. The effective marginal tax rate is the TXINT series.

The income measures are based on NIPA data. To calculate disposable labor income, total personal tax liabilities must be allocated between labor and property income. Personal labor income is the sum of the NIPA measures of wages and salaries, other labor income, and a proportion of proprietor's income. Using SOI data on federal income tax liabilities and wage income and extending a series on federal income tax liabilities on wages and salaries provided by Charles Steindel, we were able to allocate SOI federal and NIPA state and local income tax liabilities between labor and property income. Personal social security contributions were included in labor's share of tax liabilities.

The calculation of the capital gains proxies from balance sheet account data and the decomposition of the capital gains series into their expected and unexpected elements were described in the previous chapter. Disposable labor income and transfer payments are divided into their expected and unexpected components by a similar regression procedure.[14]

The mean, high, and low values for the variables and their scale are listed in Table 4-4. The saving, income, capital gains, wealth and gap

--Place Table 4-4 Near Here--

variables are all 1972 dollars per capita. Both AGE and RRAT are measured in decimals (in the equations they are measured as deviations from their means). The minutes-to-midnight series will be discussed below.

Table 4-4. Data Summary

Saving and Adjustments To It	Mean	Low	High	Std. Dev.
SAV (personal saving)	341.3	204.6	533.0	88.9
SADJ (adjusted personal saving)	326.7	204.8	507.3	78.1
STAX (tax adjustment)	12.7	-7.9	44.6	11.1
SGPEN (government pension adjustment)	42.7	15.5	90.9	22.7
SPREM (inflation premium adjustment)	70.0	1.3	257.3	68.0
Income Variables				
YDLE (expected disposable labor income)	2515	1955	3096	402
YTRE (expected transfer payments)	397.8	131.5	807.4	213.1
YDLU (unexpected disposable labor income)	-0.53	-66.4	64.3	29.3
YTRU (unexpected transfer payments)	0.44	-25.8	53.8	13.4
Expected Capital Gains Variables				
GHLNE (land, housing and noncorporate equity)	133.3	-297.7	604.5	188.8
GDURE (consumer durable goods)	-52.6	-111.1	-2.1	29.3
GSTKE (corporate equities)	87.2	-1363.0	911.0	482.9
GNFAPE (bonds due to general price level changes plus SPREM)	-53.8	-141.8	45.2	47.9
GNFABE (bonds due to nominal bond price changes)	4.1	-33.4	48.1	18.4
Unexpected Capital Gains Variables				
GHLNU (land, housing and noncorporate equity)	-2.1	-265.6	245.0	116.9
GDURU (consumer durable goods)	-0.31	-33.1	29.3	14.5
GSTKU (corporate equities)	-11.4	-911.6	719.8	349.1
GNFAPU (bonds due to general price level changes)	-2.4	-61.0	45.3	23.6
GNFABU (bonds due to nominal bond price changes)	0.5	-64.7	34.7	18.3
Other Variables				
W (beginning-of-period wealth)	14798	10524	19499	2586
GAP (GNP gap lagged one period)	82.3	-131.5	412.1	148.9
AGE (share of population aged 65 or older)	.0979	.0838	.1155	.0088
RRAT (real after-tax one-year interest rate)	.0045	-.0269	.0250	.0152
MINMID (minutes to midnight)	7.24	2	12	3.64

Data Sources: NIPA, Balance Sheet Account, SOI, Economic Report of the President, potential real GNP furnished by Council of Economic Advisors, MINMID furnished by Joel Slemrod. The calculation of the actual and expected capital gains measured are described in Chapter 3. The calculations of the remaining variables are described in the text.

Estimates for the Basic Model

Table 4-5 presents estimates of variants of equation (14). Although the specification differs somewhat, the estimates presented in column 1 are

--Place Table 4-5 Near Here--

consistent with the general findings of Peek (1983). As predicted by our measurement error discussion, the tax liabilities adjustment (STAX) has an estimated coefficient that does not differ significantly from minus one (t-statistic = 0.69). The relative magnitudes of the income coefficients are as predicted. The YTRE coefficient does not exceed its estimated standard error. The unreasonably large estimated effect of YTRU may be related to several retroactive increases in social security benefit levels [see Modigliani and Steindel (1977)]. Because NIPA saving is measured as a residual, any retroactive and unexpected increase in disposable income is automatically forced into measured saving leading to an overstatement of the marginal response of saving to unexpected transfer payments. The coefficients on wealth and population over 65 have the predicted negative sign. The GNP-gap coefficient has the incorrect sign, but does not differ significantly from zero. The interest-rate coefficient is negative and statistically insignificant.

Initially all ten capital gains proxies were included in the saving equation. To reduce the number of explanatory variables to a more manageable size, the capital gains proxies with estimated coefficients having t-statistics below unity were eliminated from the equation. Because there were a number of strong simple correlations between pairs of capital gains variables making it very difficult to pinpoint individual effects, the proxies were eliminated sequentially. First, GHLNU and GDURU (with t-statistics of -0.17 and -0.49, respectively) were eliminated. Their near zero effects are

Table 4-5: Estimated Saving Equations, Period: 1952-82
(standard errors in parentheses)

	(1)[a]	(2)	(3)	(4)	(5)	(6)	(7)
Dependent VAR	SAV	SAV	SAV	SADJ	SADJ	SADJ	SADJ
Constant	-379 (125)	-	-	-	-6.9 (5.1)	-10.8[b] (4.7)	-10.0[b]
STAX	-1.338 (0.489)	-.989 (.456)	-.896 (.267)	-	-	-	-
SGPEN	-	-	-1.054 (.402)	-	-	-	-
SPREM	-	-	1.337 (0.252)	-	-	-	-
W	-.0197 (.0147)	-.0261 (.0163)	-.0441 (.0105)	-.0374 (.0081)	-.0314 (.0077)	-.0322 (.0066)	-.0383 (.0061)
YOLE	.374 (.170)	.574 (.159)	.604 (.094)	.587 (.089)	.597 (.052)	.641 (.053)	.615 (.045)
YTRE	.196 (.350)	-.123 (.403)	-.120 (.238)	-.093 (.225)	-	-	-
YDLU	.572 (.138)	.623 (.124)	.597 (.074)	.602 (.065)	.597	.641	.615
YTRU	1.165 (0.443)	.735 (.426)	.765 (.264)	.807 (.240)	.948 (.178)	.922 (.161)	.877 (.166)
AGE	-3.41 (1.69)	-3.39 (2.66)	-4.57 (1.59)	-4.29 (1.47)	-3.59 (1.36)	-3.05 (1.17)	-1.50
GAP	-.0729 (.1029)	.1047 (.1056)	.0724 (.0619)	.0747 (.0568)	.0900 (.0330)	.0942 (.0297)	.0773 (.0284)
RRAT	-.039 (.276)	-.154 (.281)	.097 (.172)	.079 (.135)	.090 (.112)	.081 (.103)	.085 (.107)
GHLNE	-.0928 (.0669)	-.1118 (.0552)	-.0168 (.0363)	-.0344 (.0305)	-.0530 (.0215)	-.0509 (.0189)	-.0408 (.0187)
GDURE	-.777 (.282)	-.277 (.315)	-.430 (.186)	-.380 (.175)	-.397 (.121)	-.352 (.114)	-.397 (.112)
GSTKE	-.0164 (.0120)	-.0211 (.0123)	-.0272 (.0073)	-.0247 (.0060)	-.0215 (.0044)	-.0210 (.0041)	-.0241 (.0038)
GSTKU	-.0357 (.0128)	-.0228 (.0125)	-.0176 (.0074)	-.0201 (.0063)	-.0215	-.0210	-.0241
GNFAPU	.128 (.217)	-.039 (.190)	-.157 (.113)	-.119 (.088)	-.164 (.074)	-.177 (.069)	-.154 (.069)
GNFABU	-.061 (.264)	-.041 (.243)	-.183 (.145)	-.183 (.117)	-.164	-.177	-.154
MINMID	-	-	-	-	.00073 (.00061)	.00088 (.00057)	.00088 (.00057)
R^2	.979	.830	.949	.939	.942	.951	.941
SEE	18.60	22.54	13.16	12.71	11.74	10.83	11.25
D.W.	1.96	1.98	2.05	1.90	1.94	2.00	1.91

[a] This equation is in level form; the others are in changes.

[b] Truncated constant (zero after 1979).

Data Sources: See Table 4-4

consistent with our expectations. Next, GNFABE (with a t-statistic of 1.45) and then GNFAPE (with a t-statistic of 2.07) were eliminated. Although we were using a rule that estimated coefficients should exceed their estimated standard errors for retention of the capital gains variables in the equations, we eliminated GNFAPE and GNFABE because they had the wrong sign and always had t-statistics below unity (with the appropriate negative signs) in later specifications. Similarly, we retained GNFAPU and GNFABU for comparison purposes because they meet the criterion in our later key equations. Of the six remaining capital gains coefficients, two (GDURE and GSTKU) differ significantly from zero. Contrary to our predictions, however, unexpected capital gains on corporate equities have a larger (although not significantly so) effect on saving than do their expected counterpart. Furthermore, the coefficient on unexpected gains on net financial assets due to changes in the general price level has the wrong sign but is much less than its estimated standard error.

The rather high correlations between pairs of explanatory variables make it very difficult to pinpoint the individual effects of the explanatory variables on personal saving. For example, the pairwise correlations between W, YDLE, YTRE, and AGE range (in absolute value) between 0.89 and 0.98. Furthermore, the pairwise correlations of RRAT and GDURE with these variables range from 0.61 to 0.79. First-differencing the data substantially reduces the collinearity between pairs of explanatory variables, thereby making it easier to disentangle the separate influences of each explanatory variable.[15] Column 2 presents the results of reestimating the basic saving equation using changes rather than levels of the data. While many of the estimated coefficients are little changed from their column 1 values, there are a number of notable exceptions.

The point estimate of the income-tax-liabilities-adjustment coefficient (-0.989) is now much nearer minus unity (t-statistic = 0.02). The effects of beginning-of-period wealth, expected disposable labor income, and unexpected disposable labor income have all increased. The estimated wealth effect is now slightly closer to the -0.03 to -0.05 value typically obtained. On the other hand, the 0.57 YDLE coefficient is somewhat larger than the 0.3 to 0.5 expected coefficient on disposable income cited in the literature.[16] However, because disposable labor income is only about 75 percent of total disposable income, an estimated coefficient in the range of 0.4 to 0.67 would be consistent with a disposable income coefficient in the range of 0.3 to 0.5. In fact, Juster and Taylor (1975), using a disposable labor income measure, found effects consistent with an estimate in the range of 0.4 to 0.5 in our specification.[17]

The estimated coefficient on expected transfer payments now has a small (statistically insignificant) negative value, while the estimated effect of unexpected transfer payments is now below unity as our theory predicts. The GNP gap coefficient has the predicted positive sign, although it is still statistically insignificant, and the real after-tax interest rate has a larger (and still statistically insignificant) negative effect. With respect to the capital gains coefficients, the GNFAPU coefficient now has the correct sign (although both GNFAPU and GNFABU still have estimated coefficients exceeded by their estimated standard errors). The estimated effects of expected capital gains on durables and unexpected gains on both corporate equities and on net financial assets due to nominal bond price changes have each declined, causing GDURE and GSTKU to lose their statistical significance. The effect of expected capital gains on housing, land and noncorporate equity has increased and now differs significantly from zero. Due to the slight increase in the effect of GSTKE and the sharp decline in the GSTKU effect, the two effects are now almost identical.

As noted in the development of our model, the interpretation of the capital gains coefficients is rather complicated. The magnitude of the estimated coefficients represents a combination of effects: one related to the effect of capital gains on desired wealth (the w_{4i}'s) or on unplanned wealth accumulation (the b_{3i}'s) and one related to the extent to which the capital gains are perceived as additions to wealth (the λ_i's). Our earlier analysis suggested relative sizes for the w_{4i}'s and b_{3i}'s as well as the λ_i's. Based on the w_{4i}'s alone, we would expect to find GDURE and GNFAPE with the largest effects and GSTKE and GNFABE with the smallest. To the extent that the λ_i's are below unity, the effects of GHLNE, GDURE, and GNFABE would be reduced somewhat. In fact, we do find a relatively large effect of expected capital gains on durables due to their relatively small effect on desired wealth, even after incorporating the λ_2 effect which tends to reduce the extent of deflection. However, its estimated standard error is even larger. The much smaller estimated effects on saving of the other expected capital gains proxies are probably related to their relatively larger effects on desired wealth (and hence smaller deflection effects). This is certainly the case with GHLNE relative to GDURE because our theoretical analysis suggests that $\lambda_1 > \lambda_2$. Again, the relatively smaller effect of GSTKE is consistent with our theory. The combination of a relatively large value of w_{45} and a value of $\lambda_3 < 1$ probably accounts for the absence of GNFABE.

The absence of unexpected gains on housing, land and noncorporate equity and on consumer durables is consistent with our prior analysis suggesting values of b_{31} and b_{32} very near unity. This is reinforced to the extent that

λ_1 and λ_2 are below unity. Small negative effects of GSTKU, GNFAPU, and GNFABU would be consistent with the relatively smaller values of b_{33}, b_{34}, and b_{35}. None of the three unexpected capital gains effects, however, differs significantly from zero.

We now turn to a consideration of the remaining two measurement error terms, SGPEN and SPREM. Column 3 presents the results of reestimating the column 2 equation with these two additional explanatory variables. We retain the first-differenced specification because the levels of both these variables are highly correlated with the other explanatory variables. The standard error of the equation drops dramatically (over 40 percent) from 22.54 to only 13.16. Most of this decline is due to the introduction of SPREM.[18] All three of the measurement error terms have coefficients that differ significantly from zero, but not from their predicted values. The t-statistic for the null hypothesis that the STAX coefficient is minus one is only 0.39. Similarly, the t-statistics for the SGPEN coefficient differing from minus one and for the SPREM coefficient differing from plus one are 0.13 and 1.34, respectively. Thus, we can not reject any of the hypothesized restrictions.

The primary differences between the coefficients on the other variables are: the wealth and AGE coefficients increase substantially, the RRAT coefficient becomes positive (but is still less than its standard error), the GHLNE coefficient drops sharply and loses its significance, and the coefficients on both GDURE and GSTKE increase and become significant. The GSTKE effect now exceeds that of GSTKU as our theory predicts. The coefficients on unexpected capital gains on net financial assets due to nominal bond price changes and due to changes in the general price level both rise (in absolute value) and exceed their estimated standard errors.

Column 4 imposes the hypothesized plus or minus unity restrictions on the measurement error terms. That is, the dependent variable is now our adjusted saving measure, SADJ. The standard error of the equation is reduced slightly from 13.16 to 12.71. Except for the doubling of the GHLNE effect, the estimated coefficients on the capital gains proxies are only slightly altered. The wealth and expected transfer payments effects also decline somewhat. (These reactions to the imposition of the coefficient restrictions may be related to the strong trend elements contained in SGPEN, SPREM, W, and YTRE).

The estimated effects of expected and unexpected capital gains on corporate equity are very similar to each other in each specification we have considered. This could be due to problems in separating total corporate equity capital gains into expected and unexpected components. Consequently, we also considered an alternative measure of expected gains on corporate equity based on the Livingston survey expectations of Standard and Poor's Industrial Stock Price index. The expected percentage increase (or decrease) was multiplied by the beginning-of-period value of household corporate equity holdings to calculate GSTKE. The difference between this measure and the actual stock market capital gains was taken as the unexpected component. Because the Livingston data are available only after 1952, the sample period for this regression is 1954-82. The results are very similar to those obtained when the specification in column 4 is reestimated over the same sample period, indicating that our results are robust with respect to quite different measures of expected stock market capital gains. The SEE of the equation with the alternative GSTKE measure is 12.19, slightly lower than our original specification when estimated over the same sample period (12.52). The Livingston GSTKE and GSTKU estimated coefficients are -0.0401 and -0.0214 with standard errors of 0.0191 and 0.0048, respectively. The similarity in the magnitudes of the effects may be due to individuals reacting similarly to both the expected and unexpected components because information on actual stock market capital gains and losses is available on a next day basis. If that is the case, we lose very little by considering total stock market capital gains because the particular decomposition of total stock market capital gains is irrelevant.

Further Estimates

The one unappealing aspect of the coefficients in column 4 is the implied response of saving to changes in the age distribution of the population. The three percentage point increase in the share of population over age 65, together with the -4.29 coefficient, yields a decline in the personal saving ratio in the last 30 years of over 13 percentage points! One might contend that this response is 5 to 10 times too great. On the other hand, one might argue that older households were not only growing in relative importance but that each was saving relatively less, possibly owing to a sharp rise in social security wealth and the certainty of this wealth (due to indexation in 1972).[19] Further, an increased tendency toward early retirement has occurred concurrently with the aging of the population; between 1954 and 1980, the labor force participation rate of males between the ages of 55 and 64 declined from 0.88 to 0.72. This could make a coefficient as large, in absolute magnitude, as -1.5 plausible. The remaining columns in Table 4-5 reflect attempts to reduce the age coefficient to a more reasonable value without losing the appealing aspects of column 4.

The major additions in column 5 are a constant term in our difference equation and Slemrod's (1984) minutes-to-midnight or nuclear fear variable (scaled by expected labor income). In Slemrod's view, increased fear of a nuclear holocaust (decreased expected life span and ability to leave a bequest) would likely reduce the propensity to save. The equation also combines some like variables with similar impacts (expected and unexpected labor income, expected and unexpected stock market gains, and unexpected gains on net financial assets due to changes in the general price level and to changes in nominal bond prices) and deletes some variables with negligible impacts (expected transfer income and expected gains on net financial assets due to changes in the general price level). As can be seen, the constant and fear variable have t-ratios slightly above unity and reduce the age coefficient by nearly 20 percent. The coefficient on the nuclear fear variable suggests that a ten minute increase in the clock, the largest observed variation, would raise the saving rate by almost a full percentage point.[20]

Not only is the constant term insignificantly different from zero, but it is difficult to interpret. One general interpretation is the negative impact of the growth in social security (and other unfunded pension) wealth on saving; this would be consistent with the large and significant negative impact of real nonhuman wealth (t ratios over 4 in columns 4 and 5). However, social security wealth certainty has not been growing in the 1980s. To account for this, the constant in column 5 was replaced, in turn, by constants that were truncated (became zero) in 1974, 1977, and 1980. The best fit was obtained with the latter variable and is reported as column 6 in the table. As can be seen, this truncated constant is significantly different from zero. Also, the AGE coefficient exhibits a further decline, although it is still at least double what we would consider a plausible magnitude.

While the truncated constant may reflect something other than the impact of unfunded pensions, we shall accept this interpretation. Because Feldstein (1982) is the most visible and vocal advocate of the negative unfunded-pensions effect, we compare our results with his. He concludes that personal saving was reduced by $58 billion in 1976, his last year of analysis, when NIA personal saving was $69 billion (p. 636). Moreover, three-quarters of this reduction was due to the increase in social security wealth since 1951, the year our analysis begins; that is, the growth in social security wealth between 1951 and 1976 reduced personal saving in 1976 by $43.5 billion. To obtain our 1976 impact on the level of personal saving per capita, we multiply the 10.8 coefficient in our change equation by 25. The result of $270 is then compared with the 1976 NIA measure of personal saving per capita of $426. This ratio, 0.63, is the same as that computed by dividing Feldstein's $43.5 by $69. The two estimates, then, are capatible, suggesting both specifications may be capturing the same phenomenon.[21]

In our final estimates, we arbitrarily halved the age coefficient to -1.5, its maximum plausible value. The result was a sharp increase in the coefficient on the truncated constant to -15 (t ratio of 4). In order not to overstate the unfunded-pensions effect, we then constrained the constant to -10, roughly the value in column 6. Column 7 contains the estimates of such a relation. Note the small decline in the overall explanatory power from column 6 and the general correspondence between the coefficients in column 7 and those in columns 4, 5 and 6. In addition to the enormous significance of labor income, coefficients on wealth, stock market gains, and unexpected transfer income have t-ratios above 5, and those on expected housing et. al. and durable gains, unexpected net financial asset gains, and temporary economic slack (the GNP gap) are in the 2 to 3½ range. The nuclear fear variable has a t of 1½. The real after-tax interest rate continues to have a small, insignificant positive coefficient.

Interpretation of the Estimates

In the absence of permanent changes in expected capital gains, unexpected transfer payments and the GNP gap, these variables have only a temporary impact on household saving. The largest stock market losses occurred in 1973-74, sandwiched in between relatively large gains in both 1971-72 and 1975-76. As a result, household saving was about 10 percent higher in 1973-74 than in the surrounding years. Large expected gains on housing, land and noncorporate equity in 1977-78 reduced personal saving by over 5 percent; systematic large losses on durables raised saving by a like amount in the late 1970s and early 1980s. More generally, the GAP variable and its coefficient suggest that household saving is about 10 percent greater in the early stages of economic recoveries than in the late stages of economic booms. Finally, unexpected transfers only rarely have affected saving by 5 percent, although a large jump in government unemployment insurance benefits in 1975 associated with legislation to extend both the duration and coverage of benefits increased saving by over 10 percent.

Determinants of longer-term, major shifts in the saving ratio are probably of more interest. The adjusted saving rate, as computed in Table 4-3, is reproduced at roughly 7 year intervals in the top row of Table 4-6. The ratio fell sharply in the 1950s, reversed itself in the 1960s, held

--Place Table 4-6 Near Here--

Table 4-6. Explanation of Broad Swings in the Saving Ratio

	1953-54		1960-61		1968		1974-75		1981-82
Saving Rate (%)	14.5		10.6		14.7		14.4		7.4
W/Y	5.36		6.21		5.95		5.60		6.55
%ΔW		21.8		21.4		1.3		21.7	
%ΔY		6.5		26.6		7.6		4.0	
Saving Rate		-3.9		4.1		-0.3		-7.0	
Due to									
W/Y		-3.2		1.0		1.3		-3.7	
Age		-1.0		-0.6		-1.2		-1.6	
Minutes to Midnight		0.1		0.7		0.0		-0.5	
Total		-4.1		1.1		0.1		-5.8	
Other factors		0.2		3.0		-0.4		-1.2	

Data Sources: NIPA, Balance Sheet Account, SOI, Economic Report of the President, potential real GNP furnished by Council of Economic Advisors, MINMID furnished by Joel Slemrod. The calculation of the actual and expected capital gains measured are described in Chapter 3. The calculations of the remaining variables are described in the text.

constant through the middle 1970s and has since plummeted. The second row contains the major determinant of changes in the saving ratio, the wealth-income ratio. The general inverse relationship between the two rows is obvious. The remainder of the Table refers to changes between the periods. The next two rows contain the percentage changes in real income and wealth per capita. In three of the four intervals, real wealth grew at a roughly 21 percent rate, the first two being dominated by equity gains and the last by the land-housing surge; the negligible real gains in the 1968-74 period were the result of equity losses offsetting land-housing gains (see Chapter 3 for a full discussion of these real wealth changes). Real income grew less rapidly on average and was more volatile, with enormous real growth in the 1960s and minimal growth since the middle 1970s. The wealth-income ratio rose in the first and last intervals owing to large wealth growth and declined in the middle two intervals, first because of the incredibly large income growth and then because of the stock market debacle.

The remainder of the Table indicates the change in the saving ratio between periods and the source of the change. The dominant role of the wealth-income ratio in the major declines in the saving ratio in the 1950s and late 1970s is obvious; also contributing to these declines, especially the latter, was the aging of the population. In the intervening two intervals, these two influences were roughly offsetting. Some of the rise in the saving ratio in the 1960s is explained by the relaxation of international tensions following solution of the Cuban missile crisis and passage of the Partial Test Ban Treaty in the early 1960s, and part of the recent decline in the rate owes to increased tensions between the U.S. and the Soviets. The sharp rise in the saving rate in the 1960s was due to the above-noted enormous growth in real income; because the marginal propensity to save is greater than the average, increases in income raise the average saving rate.[21]

While the real-after-tax interest rate has a negligible direct impact on household saving, this variable appears to have a major indirect effect. As one might expect, real cumulated gains on housing, land and noncorporate equity (which are related to land) and the real after-tax interest rate exhibit a statistically significant negative correlation. An increase in the interest rate leads to a downward revaluation of the assets and a decrease to an upward revaluation. These gains (or losses) then feed into the level of household wealth which has a negative influence on personal saving.

The real after-tax interest rate (RRAT) declined from 0.0183 in 1970 to -0.0210 in 1980-81. To obtain an impact of this decline on wealth (and then on saving), we estimated a relationship between cumulated real gains on housing, land and noncorporate equity (TGHLN) and RRAT over the 1952-82 period, obtaining (standard errors in parentheses):

$$\underset{}{TGHLN} = \underset{(38)}{438} - \underset{(2419)}{17489}\ RRAT \qquad R^2 = .643$$

$$DW = 0.88$$

$$SEE = 204$$

$$\text{Mean} = \$359 \text{ billion.}$$

Multiplying 17489 by 0.0393 (the change in RRAT) gives an induced increase in TGHLN (and hence wealth at the beginning of the 1981-82 period) of $688 billion or 2992 per capita 1972 dollars. Using the estimated wealth coefficient of -0.0383 from column 7 of Table 4-5, we obtain a reduction in saving between 1970 and 1981-82 of 114.6 per capita 1972 dollars. Thus, in the absence of the sharp reduction in RRAT (and the associated surge in TGHLN and wealth), the average value of our adjusted personal saving measure in

1981-82 would have been 332.8 rather than 218.2 per capita 1972 dollars. The 1981-82 saving rate then would have been 11.27 percent, or 50 percent more than the observed 7.39 percent value. This calculation overstates the effect because a lower level of wealth in the earlier years due to the absence of cumulated gains on housing, land and noncorporate equity would have induced additional saving. Allowing for this feedback, the 1980-81 saving ratio still would have been about 10 percent or 2½ percentage points higher than the observed ratio.

SUMMARY

The NIPA measurement of personal saving is incorrect in a number of important respects. These include the treatment of net purchases of consumer durables as consumption instead of saving, the treatment of net contributions to government life insurance and retirement funds as taxes instead of saving, and the measurement of personal taxes on a cash-payment rather than liability-accrual basis. Finally, because inflation converts part of fixed-income wealth into an interest income flow (some of the inflation premium in new issue interest rates is built into recorded after-tax interest income), the NIPA measure overstates saving in an inflationary period. We have computed an adjusted saving variable to correct for all of these errors, and we have obtained empirical support for the validity of our corrections.

Our adjusted saving rate exhibits some major movements in the 1951-82 period. The rate declines from over 15 percent in the early 1950s to around 11 percent in the early 1960s and then rebounds to over 14 percent by the middle 1960s. After approximately a decade of relative stability, the rate plummets in the second half of the 1970s to under 8 percent in the early 1980s.

The most important variables explaining longer-run swings in the saving rate are real wealth and income. Large real gains on equities and on housing and land in the second halves of the 1950s and 1970s, respectively, account for most of the sharp declines in the saving ratio in these periods. While wealth also grew rapidly during most of the 1960s, again owing largely to stock-market gains, the saving ratio actually increased because of unparalleled real income growth. This growth raised the saving ratio both directly, because the marginal propensity to save out of income exceeds the average propensity, and indirectly, because the wealth-income ratio is lowered.

Acting almost continuously to depress the saving-ratio throughout the 1951-80 period was a marked increase in the retired portion of the population and rapid growth in unfunded pension wealth (both social security and pensions for government employees). The former resulted from both a three percentage point increase in the share of the population over age 65 (from 8 percent to 11) and a doubling of males below age 65 choosing early retirement. The precise role of these two factors is uncertain, but together they would have reduced the saving rate to zero in the absence of real income growth (the marginal greater than average phenomenon).

The real after-tax interest rate (which obviously measures the returns to savers with some imprecision) does not have a direct influence on the saving ratio. However, an indirect channel of influence exists, namely a strong significant negative relationship between the market value of housing, land and noncorporate equity and the real after-tax interest rate. In fact, the sharp decline in this rate underlies the fall in the saving ratio attributable to the housing and land boom in the second half of the 1970s.

Short-run movements in the saving ratio are caused by the volatility of the stock market and of economic activity generally. Apparently owing to income uncertainty asociated with unemployment, the saving rate is higher in the early stages of an upswing than in the late stages. Finally, there is some weak evidence that heightened fear of nuclear war lowers the saving ratio and relaxation of international tensions raises the ratio.

NOTES 4

1. Interest payments on mortgage and home improvement loans are not included in interest paid by consumers to business. Because homeowners are treated as business operators in the NIPA, these payments are counted as interest paid by business to business and are not included in personal income.

2. Net personal transfer payments to foreigners is also subtracted from personal income in calculating SNIA. We have ignored this term in our theoretical analysis because of its relatively small magnitude and because it is not central to our analysis.

3. For a discussion of the flow of funds treatment, see Board of Governors of the Federal Reserve System, (1975): 31-33. The data on SGPEN were supplied by their flow of funds section.

4. The inflation adjustment was first addressed by Poole (1972). His measure of the inflation premium in disposable income was constructed as:

$$YPREM = \frac{\pi}{RCB} YINT,$$

where π, RCB, and YINT represent the anticipated inflation rate, the corporate bond rate, and net interest income.

5. Fixed-income assets are measured net of consumer credit, but mortgage debt is not subtracted. This is because interest payments on consumer credit are subtracted from personal income in constructing personal saving while interest payments on mortgages are not (see footnote 1).

6. The TXINT series is constructed from the SOI data supplemented with tables provided by Charles Hicks. Following Wright (1969), the tax rate is calculated as a weighted average of the marginal personal income tax rate for each adjusted gross income class. The weight for each class is equal to its share of the total interest received by all income classes.

7. This is not meant to suggest that we think the real interest rate was constant over this period. In fact, there is ample empirical evidence that the real rate has varied cyclically (Hendershott and Huang, 1984, for example). However, that variation has been on the order of only two percentage points. Moreover, the variation in the rate built into interest income is substantially less given the lags with which this income reflects rate movements. In contrast, interest income incorporated a major (6 to 8 percentage point) trend increase in expected inflation between 1950 and 1981.

8. This series is calculated as $(SNIA - \pi ASAV)/(YD - \pi AYD)$, where π is the one-year expected inflation rate at the end of the previous year from the Livingston survey data supplied by the Federal Reserve Bank of Philadelphia.

9. The model is similar to that of Peek (1983).

10. While an increase in expected transfer payments would tend to raise W^d by increasing the perceived value of total lifetime resources, it would at the same time discourage the accumulation of wealth for retirement to the extent that it leads to the expectation of a higher retirement income (e.g., social security benefits). Similarly, an increase in unemployment benefits could reduce the need for precautionary wealth held to carry an individual through a period of less than normal earnings. If these influences more than offset the positive total resources effect, w_2 would be negative.

11. We will ignore any accrued income tax liabilities on accrued capital gains. Such taxes are paid only upon realization, if ever, and are based on nominal rather than real capital gains. Bailey (1969) found that the effective tax rate on accrued capital gains was very small, perhaps as low as 5 to 10 percent.

12. Nichols (1970) investigates some implications of this deflection issue whereby real capital gains crowd out asset accumulation in satisfying wealth accumulation motives.

13. The estimated equation for disposable labor income is (estimated standard errors in parentheses):

$$\underset{}{YDL} = \underset{(270)}{980} + \underset{(.141)}{.908YDL1} - \underset{(.139)}{.373YDL2} + \underset{(.195)}{.870G} + \underset{(.0603)}{.0955GAP}$$

$$- 45.3RNT - 1091.2TXRT + 106.1DKW - .818DSCR$$
$$(8.4) \quad (357.1) \quad (43.4) \quad (.757)$$

$R^2 = .995$ SEE 34.16 Durbin h = -1.374.

Annual observations for 1951-82 are used. The explanatory variables are (in addition to two own lagged values) one lagged value each of government expenditures (G), the GNP gap (GAP), the one-year after-tax nominal Treasury bill yield (RNT), and an index of marginal personal income tax rates (TXRT). The equation also includes dummy variables for the Korean War period (DKW) and the 1968-70 temporary personal income tax surcharge and the 1975 income tax rebate (DSCR). The transfer payments equation is:

$$YTR = 238 + .802YTR1 + .124G + .0565GAP + 14.7RNT + .134M$$
$$(115) \quad (.055) \quad (.038) \quad (.0407) \quad (4.1) \quad (.083)$$

$R^2 = .996$ SEE = 14.89 Durbin h = .271

where M represents the lagged value of the M1 definition of the money supply.

14. Recall that adjustment to personal saving for the inflation premium component in interest income requires a compensating adjustment to (the expected component of) GNFAP. Consequently, in the equations that follow our measure of the expected component of GNFAP will be the sum of our original (Chapter 3) measure of GNFAPE and SPREM. This is equivalent to reducing expected capital losses by the inflation premium component in net interest income.

15. Plosser and Schwert (1978) suggest differencing as a crude test of model specification. The results from the levels regression of a correctly specified model should be confirmed by the results from the reestimation of the equation using the first differences of the data.

16. Tobin and Dolde (1971: 101) suggest that a consumption function specification containing disposable income and wealth would have coefficients on these variables in the ranges of 0.5 to 0.7 and 0.03 to 0.05, respectively. This implies a disposable income coefficient between 0.3 and 0.5 for the corresponding saving equation.

17. When the equation is reestimated omitting some of the variables that are highly correlated with YDLE (W, AGE, and GHLNE), as well as GAP, the estimated coefficient on YDLE drops to only 0.28, while the estimated coefficient on YDLU (0.59) is little affected.

18. When only SPREM was added to the specification in column 2, its estimated coefficient was 1.28 (S.E. = 0.30) and the SEE was reduced from 22.54 to 15.51.

19. Kane (1985) suggests this effect.

20. This estimate, which is obviously measured with some imprecision, is slightly less than half the impact on the NIA private saving rate obtained by Slemrod (1984). We obtained a much larger impact when the NIA personal saving rate, rather than our corrected rate, was employed as the dependent variable.

21. A similar estimate, again employing a different data set and methodology, was recently obtained by Carmichael (1984). See Feldstein (1982) for references to numerous studies, micro and macro, on the saving impact of social security.

22. There is an implicit constant term in the saving-levels equation of -400. Given the -10 on the truncated constant in the changes equation, the "constant" in the levels equation rises, in absolute value, by 10 each year through 1979. If expected real labor income per capita were to increase by 2½ percent the first year and then by slightly decreasing amounts in later years, the unfunded pensions effect on the average saving rate would precisely offset the effect of real income growth (higher marginal than average rate) leaving the average saving rate unchanged. Of course, real income per capita grew by far less than 2 percent per year except in the 1960s when the growth rate was nearly 3 percent.

REFERENCES 4

Auerbach, Alan J. 1985. "Saving in the U.S.: Some Conceptual Issues." In The Level and Composition of Household Saving, edited by Patric H. Hendershott, pp. 00-00. Cambridge, Mass.: Ballinger Publishing Company.

Bailey, Martin J. 1969. "Capital Gains and Income Taxation." In The Taxation of Income from Capital, edited by Arnold C. Harberger and Martin J. Bailey, pp. 11-49. Washington, D.C.: The Brookings Institution.

Blades, Derek W. and Peter H. Sturm. 1982. "The Concept and Measurement of Savings: The United States and Other Industrialized Countries." In Saving and Government Policy, Conference Series No. 25. Boston, Mass.: Federal Reserve Bank of Boston, pp. 1-30.

Board of Governors of the Federal Reserve System. 1975. Introduction to Flow of Funds, Washington, D.C.: U.S. Government Printing Office, (February).

Board of Governors of the Federal Reserve System. 1983. Balance Sheets for the U.S. Economy 1945-82. Washington, D.C.: U.S. Government Printing Office, (May).

__________. Federal Reserve Bulletin, various issues.

Boskin, Michael J. 1983. "Saving Incentives: The Role of Tax Policy." In New Directions in Federal Tax Policy for the 1980s, edited by Charls E. Walker and Mark A. Bloomfield, pp. 93-111. Cambridge, Mass.: Ballinger Publishing Company.

Carmichael, Jeffrey. 1984. "Pitfalls in Testing the Ricardian Equivalence Theory." Mimeo.

Feldstein, Martin S. 1977. "National Saving in the United States." In Capital for Productivity and Jobs, pp. 124-154. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

__________. 1982. "Social Security and Saving: A Reply." Journal of Political Economy 90 (June): 630-642.

Hendershott, Patric H. and Roger Huang. 1984. "Debt and Equity Yield: 1926-80." In Corporate Capital Structure in the United States, edited by Benjamin Friedman, pp. 00-00. Chicago: University of Chicago Press.

Jump, Gregory V. 1980. "Interest Rates, Inflation Expectations, and Spurious Elements in Measured Real Income and Saving." American Economic Review 70 (December): 990-1004.

Juster, F. Thomas, and Lester D. Taylor. 1975. "Towards a Theory of Saving Behavior." American Economic Review 65 (May): 203-09.

Kane, Edward J. 1985. "Microeconomic Evidence on the Composition of Household Savings in Recent Years." In The Level and Composition of Household Saving," edited by Patric H. Hendershott, pp. 00-00. Cambridge, Mass.: Ballinger Publishing Company.

Modigliani, Franco, and Charles Steindel. 1977. "Is a Tax Rebate an Effective Tool for Stabilization Policy?" Brookings Papers on Economic Activity, No. 1, pp. 175-203.

Nichols, Donald A. 1970. "Land and Economic Growth." American Economic Review 60 (June): 332-40.

Peek, Joe. 1982. "Personal Saving and the Measurement of Income Tax Liabilities." The Review of Economics and Statistics 64 (February): 143-47.

__________. 1983. "Capital Gains and Personal Saving Behavior." Journal of Money, Credit and Banking 15 (February): 1-23.

Plosser, Charles I. and G. William Schwert. 1978. "Money, Income, and Sunspots: Measuring Economic Relationships and the Effects of Differencing." Journal of Monetary Economics 4 (November): 637-60.

Poole, William. 1972. "The Role of Interest Rates and Inflation in the Consumption Function." Brookings Papers on Economic Activity, No. 1, 211-20.

Slemrod, Joel. 1984. "Saving and the Fear of Nuclear War." Mimeo (February).

Tobin, James, and Walter C. Dolde. 1971. "Wealth, Liquidity and Consumption." In Consumer Spending and Monetary Policy: The Linkages, Conference Series No. 5, Boston, Mass.: Federal Reserve Bank of Boston, pp. 99-146.

U.S. Bureau of Economic Analysis. 1981. The National Income and Product Accounts of the United States, 1929-76. Washington, D.C.: U.S. Government Printing Office.

________. Survey of Current Business. Washington, D.C.: U.S. Government Printing Office, various issues.

U.S. Council of Economic Advisors. 1983. Economic Report of the President. Washington, D.C.: U.S. Government Printing Office.

U.S. Internal Revenue Service. Statistics of Income, Individual Income Tax Returns. Washington, D.C.: U.S. Government Printing Office, various years.

Wright, Colin. 1969. "Saving and the Rate of Interest." In The Taxation of Income from Capital, edited by Arnold C. Harberger and Martin J. Bailey, pp. 275-300. Washington, D.C.: The Brookings Institution.