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AN EXPLANATION OF THE BEHAVIOR OF PERSONAL SAVINGS IN THE UNITED STATES IN RECENT YEARS

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ABSTRACT

A sharp increase in the real interest rates in the U.S. in the 1980s was expected to induce a higher personal saving rate. Actually, between 1981 and 1983 the personal saving rate fell from 7.5 percent to 5.4 percent and for the 1985-1988 period it had averaged only 4 percent even though real interest rates have remained high. We argue that one possible explanation for this negative relation between interest rates and the personal saving rate is the large fraction of wealth, especially financial wealth, held by persons over 65 years old (this group has received more than 50 percent of all interest income in the U.S. during this period). Life cycle theory suggests, as we demonstrate, that the wealth effect created by an increase in the rate of interest reduces the savings of old persons and raises savings of the young and hence the effect on aggregate savings depends on the age distribution in the population.

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1. Introduction

One of the puzzles in U.S. economic policy in the 1980s has been the behavior of the personal saving rate, that is of the share of after-tax personal income that individuals choose not to consume. When the Reagan Administration introduced a far-reaching and dramatic change in economic policy in 1981, which led to a sharp fall in the inflation rate and an equally sharp increase in real interest rates, it had been generally anticipated that those changes would induce individuals to increase their saving rate by substantial amounts. Some observers had in fact predicted that the increase in the rate of personal saving would be as high as 3 percentage points. Actually, the expected increase in the impersonal saving rate did not occur. On the contrary, between 1981 and 1983 the personal saving rate fell substantially (from 7.5 percent to 5.4 percent, respectively). Furthermore, the personal saving rate continued to fall and for the 1985-88 period it has averaged only about 4 percent even though real interest rates have remained high.

In this paper we argue that one possible explanation for this negative relation between interest rates and the personal saving rate is the large fraction of wealth, and especially of financial wealth, held by persons over 65 years old. Economic theory suggests that while an increase in the rate of interest raises the savings of young, working persons, it typically reduces the savings of older and retired persons. It seems plausible that for the U.S. the latter effect could be a major explanation for the observed decrease in aggregate savings.

The relationship between saving and the rate of interest is one of the most important in economics. It is, for example, fundamental to the analysis

role in the determination of saving in the classical system, that role was downgraded to a definitely secondary one by the Keynesian revolution. In fact, in may textbook versions of the consumption function, the rate of interest did not even appear as a determinant of consumption. The recent popularity of so-called supply side economics has made the rate of interest important once more, and many of the policy decisions introduced in recent years in the United States and elsewhere have definitely been influenced by the belief that a change in the rate of interest can have significant effects on the propensity to save of individuals. However, in spite of the repeated statements made in recent years, that an increase in the real after-tax rate of return to saving would increase the rate of saving in the economy, the relationship between the rate of saving and the rate of return is not as straightforward as those statements imply. The usual assumption is that when the rate of return increases, there will be a tendency for people to save more as present consumption becomes more expensive than future consumption. This is the well-known substitution effect. On the other hand, it is generally recognized that a working individual may have some target amount of wealth that he wishes to accumulate by the time he retires, so that he can support his desired level of consumption through his retirement years. An increase in the rate of return to saving out of current income implies that that target can be achieved with a lower current rate of saving. Therefore, the individual may react to the increase in the rate of return by saving less. Theory tells us that a priori one cannot tell whether the substitution effect or the target effect will prevail. Empirical studies have done no better.[1]

There is one important element in these discussions that has generally been ignored. The theoretical discussions have implicitly emphasized the

behavior of individuals in the preretirement age and the rate of return to "saving" rather than to "savings". However, an increase in the rate of return affects not just the return to current saving (that is, saving out of current income) but it affects also the return to all stock of existing financial wealth. In other words, it affects the return to the past accumulated savings held in interest-bearing forms.

There is considerable evidence that a large share of this financial wealth is in the hands of older, retired individuals who, as the life-cycle theory of consumer behavior tells us, have a much higher propensity to consume out of additional income than younger individuals in their active age. In fact, this theory tells us that the older is an individual the higher will be his/her propensity to consume, ceteris paribus. A change in the real rate of return to financial assets will disproportionately increase the income of those very people who are likely to spend more. Once this consideration is taken into account, it becomes obvious that the relative strength of the income and the substitution effect depends on the age distribution of the population as well as on the distribution of financial assets by age group.[2]

About 11 percent of the U.S. population is in the 65 and over age bracket with an average age of around 74 years. These are individuals who have an average life expectancy of somewhere around 10 years and who can be expected to have a very high marginal propensity to consume. Therefore, an increase in interest rates that resulted in higher incomes to those older individuals could substantially increase their consumption, which in turn could easily neutralize or even overwhelm whatever increase in saving might come from those in the preretirement age.

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In Section 2 we provide the evidence of the decrease in savings in the U.S. during the 1981–1988 period. Section 3 evaluates the role of wealth and income held by the elderly. Section 4 presents a simple lifecycle model that exhibits the opposite effects that an increase in the rate of interest has on young and old persons. Assuming a steady population growth rate, some calculations demonstrate the possibility of a negative response of aggregate savings to an increase in the real rate of interest. The detailed model and some comparative statistics are given in the Appendix.

2. The Savings Rate in the 1981–1988 Period

In 1981 the Reagan administration introduced some major policy changes that were expected to increase aggregate savings. The elements that would induce the higher saving rate were several: first, there were the substantial cuts in marginal tax rates for all taxpayers brought about by the 1981 Kemp-Roth tax-cut legislation; these cuts would be spread over a three-year period. Second, there was the immediate reduction in the marginal tax rate on unearned incomes from 70 to 50 percent. Third, there were the additional savings incentives (IRAs, etc.) also introduced by the 1981 tax package. All of these guaranteed that the rewards to saving would increase for any given real rate of interest. However, these rewards were raised even more dramatically when the sharp fall in the inflation rate was accompanied by an equally sharp increase in real interest rates. For a variety of reasons on which economists are not in complete agreement (energy crisis, Mundell-Tobin effect, OPEC surpluses, etc.), the generally increasing inflation rate from the early to

a reversal of this behavior had taken place and real rates became sharply positive. Furthermore, the fiscal deficit also increased sharply after 1981. According to the Ricardian equivalence hypothesis, as reformulated by Barro, private saving should also have risen because of this.

Did this unusually propitious combination of circumstances lead, as expected, to a sharply rising personal saving rate? The measurement of the saving rate is fraught with difficulties; however, the official statistics prepared by the U.S. Department of Commerce and reported in Table 1 indicate that the expected increase in the saving rate did not occur. On the contrary, the share of personal saving in disposable (i.e., after-tax) personal income fell from 7.5 percent in 1981 to as low as 3.2 percent in 1987 which was the lowest saving rate for the whole 1970-88 period shown in the table. The saving rates in the table are shown also in Figure 1.

A slightly different picture is obtained if one adds undistributed corporate profits to personal saving (see Table 1 and Figure 1). A justification for doing this would be that individuals do not distinguish between their own saving and that of the enterprises in which they own shares. As a consequence, saving by the latter, in the form of undistributed corporate profits, replaces the individuals' own saving. Net private saving is the summation of personal saving and undistributed corporate profits. The last column of Table 1 gives net private saving as a percentage of disposable personal income. The yearly data show that net private saving as a share of disposable income was around 11 percent in the 1976-78 period. It fell afterward and it was relatively low for the 1982-83 period. It increased again to almost 10 percent in 1984 but it fell to around 6 percent by 1987-88. Thus, the basic conclusion that one gets from the available official

statistics is that the saving rate fell in the post-1981 period in spite of the sharp increase in the real rate of return. This is not what one would have expected from economic theory. Thus, the behavior of the saving rate constitutes a puzzle.

3. Income and Wealth of the Elderly

What do we know about the financial assets of older individuals relative to the rest of the population? Not as much as we would like but what we do know clearly supports the contention that this group shares disproportionately in any benefits associated with increasing rates of returns to financial assets. For example, it will certainly come as a surprise to many that in 1985, the latest year for which this information is available, taxpayers aged 65 and over received almost 53 percent of all interest income reported to the Internal Revenue Service (see Table 2 below) and close to a third of all the capital gains reported to the IRS. Furthermore, the 1977 Wealth Survey by the Federal Reserve System shows the predominance of this group in holding financial assets. For example, in that year a far higher proportion of individuals 65 years and over than any other age group owned more than $10,000 in certificates of deposits, more than $25,000 in liquid asset holdings, and more than $25,000 in savings accounts. The Survey of Consumer Finance of 1983 reported in the Federal Reserve Bulletin of September 1984 shows that mean liquid asset holdings were $30,666 for families headed by persons between 65 and 74 years of age and $26,481 for those headed by persons aged 75 and older, compared with an average for all families of only $14,695. Alternatively, median liquid asset holdings were $9,676 for families headed by persons aged 65-74 and $7,885 for families headed by persons aged 75 and older, but only

$2,850 for all families combined. If instead of liquid assets we take total financial assets, the differences are even greater. Finally, the Consumer Expenditure Survey Series for 1972-73 published in 1977 by the U.S. Department of Labor Bureau of Labor Statistics reports (Table 5) sources of income classified by age of family head. These figures are also very interesting. "Incomes from interest, dividends, estates and trusts" rose from less than $200 for individuals less than 44 years of age, to $340 for individuals between 45 and 54, to $702 for individuals between 55 and 64 and to $933 for individuals over 65.

Figure 2 shows interest income received by individuals 65 and over as a share of total personal saving for various years. That chart shows a strong upward trend in this share and gives a hint of how easily an increase in interest rate that resulted in higher incomes, and thus in higher consumption for these older individuals, could reduce the rate of saving.

Let us summarize the empirical evidence presented above. Between 1980 and 1981 the real rate of interest on both 3-month Treasury bills and 20-year Treasury bonds rose by about 6 percentage points. This increase was the result of a sharp fall in the inflation rate and of a significant increase in the nominal rate of interest. Between 1981 and 1983 short-term real rates did not change much while real rates on 10-year bonds rose further. This increase was mainly the result of a sharp deceleration of the inflation rate. In fact, nominal rates fell by about 5 percentage points for 3-month bills and by about 3 percentage points for 10-year bonds. The increase in nominal rates between 1980 and 1981 must have brought about considerable capital losses on the part of those who held long-term financial assets and these losses may have reduced or eliminated the gains associated with higher real rates. However, the sharp

fall in nominal rates between 1981 and 1983 gave those holding long-term financial assets considerable capital gains that were additional to the gains associated with high real rates. In other words, the capital gains reinforced the effect associated with higher real rates at least in the earlier years of the 1980s. The net result is that the resources available to older individuals, who more than other groups hold financial assets, increased sharply and so did their consumption. This may explain the saving puzzle. In more recent years real interest rates have fallen below the levels of the early 1980s but they have remained very high compared to earlier periods. Furthermore, the proportion of the elderly in the total population has been rising.

We shall now demonstrate that this explanation of the observed negative relation between aggregate savings and the real interest rate can be supported by means of a simple lifecycle model of individual behavior.

4. The Interest-Rate in Lifecycle and in Aggregate Savings

Consider an individual who chooses his optimum path of consumption and labor supply so as to maximize his/her lifetime utility over a finite horizon. The rate of interest is assumed to be fixed and, for simplicity, the wage rate is invariant with age. Assume further that there is no initial endowment and no bequest of capital.

It is shown in the Appendix that for a logarithmic instantaneous utility function, the optimum consumption function, c_t^*, and capital accumulation, k_t^*, and labor supply, l_t^*, derived explicitly:

$$c_t^* = c_0 e^{(r-\delta)t}, \quad c_0 = \frac{w\delta}{(1+a)r} \cdot \frac{1 - e^{-rT}}{1 - e^{-\delta T}} \tag{1}$$

$$k_t^* = \frac{w}{r} \frac{e^{rt}}{1 - e^{-\delta T}} [(1-e^{-rt})(1-e^{-\delta t}) - (1-e^{-rT})(1-e^{-\delta T})] \tag{2}$$

$$l_t^* = 1 - \frac{a}{w} c_t^* \tag{3}$$

where:

- T = lifetime horizon,
- t = age $(0 \leq t \leq T)$,
- c_t = consumption at age t,
- k_t = capital (assets) at age t,
- r = real (fixed) rate of interest,
- δ = (fixed) rate of time preference,
- w = (fixed) wage rate,
- a = a positive constant (that measures the subjective weight of leisure in utility).

Optimum consumption is seen to increase (decrease) over time as $r-\delta >$ $(<)0$. When $r-\delta > 0$, the optimum capital stock is positive for all $0 < t < T$, first increasing reaching a maximum and decreasing afterwards. The opposite pattern holds when $r-\delta < 0$.

It is easy to verify (see Appendix) that an increase in the rate of

interest increases the capital stock at all ages: $\frac{\partial k_t^*}{\partial r} > 0$, all $0 < t < T$. On the other hand, an increase in the rate of interest always decreases consumption at early ages and increase consumption at later ages (Figure 2):

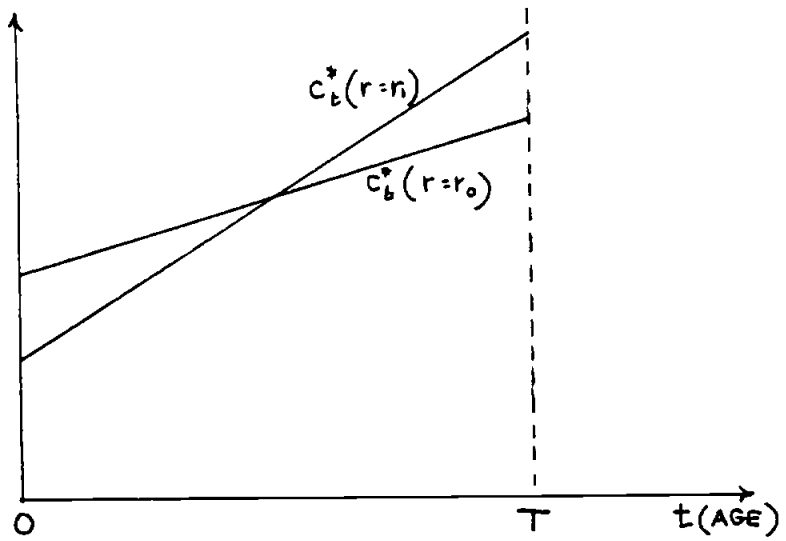

Figure 2

$$\frac{\partial c_t^*}{\partial r} \gtreqless 0 \quad \text{as} \quad t \gtreqless t^* \tag{4}$$

for some $0 < t^* < T$. The opposite response of optimum consumption at different ages to an increase in the rate of interest is the basis for our explanation of the negative response of aggregate savings in the U.S. to the increase in real interest rates during 1981-84. Clearly, the aggregate response depends on the age distribution in the population. The higher the

proportion of older persons the more likely is a negative impact on savings and vice-versa.

To get some intuition on magnitudes, we can use (1) to calculate the elasticity of c_t^* w.r.t. at t=0 and at t=T:

$$\frac{r}{c_t^*}\frac{\partial c_t^*}{\partial r}\Big|_{t=0} = \frac{rT}{e^{rT}-1} - 1; \quad \frac{r}{c_t^*}\frac{\partial c_t^*}{\partial r}\Big|_{t=T} = \frac{rT}{e^{rT}-1}e^{rT} - 1 \tag{5}$$

With r=.1 and T=50, the elasticity of optimum consumption w.r.t. r is -1.03 at t=0 and 4.04 at t=50. Thus, the impact at older age is significantly larger (in absolute terms) than at younger age!

More generally, from (2) and (3), one can derive optimum income, y_t^*, $Y_t^* = rk_t^* + wl_t^*$. Suppose that population grows at a constant rate, g. The ratio of the number of people at age t to the number of newborn is thus e^{-gt}.

Total income, Y, and consumption, G (relative to the number of newborn), is, by (1) - (3),

$$Y = \int_0^T e^{-gt} y_t^* dt = \frac{w}{1 - e^{-\delta T}} \left\{ (1-e^{-\delta T}) \left[\frac{1}{r - g} (e^{(r-g)T} - 1) - \right. \right. \tag{6}$$

$$\left. - \frac{1}{g} (1-e^{-gt}) \right] - (1-e^{-rT}) \left[\frac{1}{r - g} (e^{(r-g)T} - 1) - \right.$$

$$\left. - \frac{1}{r - g - \delta} (e^{(r-g-\delta)T} - 1) \right] -$$

$$\left. - \frac{a\delta}{(1+a)r} (1-e^{-rT}) \frac{1}{r - g - \delta} (e^{(r-g-\delta)T} - 1) \right\} + \frac{w}{g} (1-e^{-gT}) \quad .$$

$$G = \int_0^T e^{-gt} c_t^* dt = \frac{w\delta}{(1+a)r} \frac{1 - e}{1 - e^{-\delta T}} \frac{1}{r - g - \delta} (e^{-(r-g-\delta)T} - 1) \quad , \tag{7}$$

(assuming that $r-g-\delta \neq 0$).

It is straightforward to show that aggregate savings, $S = Y-C$, or the aggregate savings rate, $s = \frac{S}{Y}$, increase (decrease) as the rate of interest increases, provided g is high (low).

Appendix

Consider an individual's lifetime maximization problem:

$$\underset{c(\cdot),l(\cdot)}{\text{Max}} \int_0^T e^{-\delta t} u(c_t, l_t)\,dt \tag{A.1}$$

subject to

$$c_t + \dot{k}_t = y_t = rk_t + wl_t \tag{A.2}$$

and

$$k_0 = k_T = 0 \tag{A.3}$$

where:

- t = age (time) $0 \le t \le T$
- c_t = consumption at age t $(c_t \ge 0)$,
- l_t = labor supply at age t $(0 \le l_t \le 1)$,
- k_t = assets at age t $(k_t \ge 0)$,
- $\dot{k}_t = \frac{dk_t}{dt}$ = savings (= investment)
- r = real (fixed) rate of interest $(r>0)$
- δ = (fixed) rate of time preference $(\delta \ge 0)$
- w = (fixed) wage rate
- $y_t = rk_t + wl_t$ = income at age t

In order to obtain explicit solutions, we assume

$$u(c,l) = \log c + a \log (1-l). \tag{A.4}$$

It is now easy to derive (by means of the calculus of variations) the solution to (A.1) - (A.3), denoted c_t^*, k_t^* and l_t^*. These are given in the text, equations (1) - (3). Obvious modifications to these solutions obtain if one assumes $k_0>0$ or/and $k_T>0$. Some restrictions have to be imposed to have $0 < l_t^* < 1$ (i.e., positive labor supply) for <u>all</u> $0 \le t \le T$.

Given k_t^* and l_t^* we can calculate the optimum income path, y_t^*:

$$y_t^* = rk_t^* + wl_t^* = \frac{we^{rt}}{1 - e^{-\delta T}} [(1-e^{-rt})(1-e^{-\delta T}) - \tag{A.5}$$

$$- (1-e^{-rT})(1-e^{-\delta t}) - \frac{a\delta}{(1+a)r} e^{-\delta t}(1-e^{-rT})] + w .$$

From equation (2) in the text:

$$\frac{\partial k_t^*}{\partial r} = \frac{w}{r^2}\frac{e^{rt}}{1-e^{-\delta T}}\left\{(rt-1)[(1-e^{-rt})(1-e^{-\delta T}) - (1-e^{-rT})(1-e^{-\delta t})] + \right. \tag{A.6}$$

$$\left. + rte^{-rt}(1-e^{-\delta T}) - rTe^{-rT}(1-e^{-\delta t})\right\} =$$

$$= -\frac{w}{r^2}\frac{e^{rt}}{1-e^{-\delta T}}\left\{(e^{-\delta t}-e^{-\delta T})(rt-1+e^{-rt}) - \right.$$

$$\left. - (1-e^{-\delta t})(r(T-t)e^{-rT} + e^{-rT} - e^{-rt})\right\} > 0$$

for all $0 < t < T$. To see that the sign of (A.6) is positive, note that the first term is positive, while the last term in brackets is $=0$ at $t=T$, strictly increasing in t and hence negative for $0 < t < T$.

From (1) in the text:

$$\frac{\partial c_t^*}{\partial r} = \frac{c_0}{r}e^{(r-\delta)t}\left[rt-1 + \frac{rT}{e^{rT}-1}\right] \tag{A.7}$$

Clearly, $\frac{\partial c_t^*}{\partial r} < 0$ at $t=0$, while $\frac{\partial c_t^*}{\partial r} > 0$ at $t=T$.

Footnotes

1. For example, while an often cited and influential study by Boskin (1978) had found a substantive sensitivity of saving to the rate of return, a study by Friend and Hasbrouck (1983) found no relationship.

2. The life-cycle theory of consumer behavior has been questioned in some recent empirical studies. Some cross-secttional data show that the wealth of indviduals increases with age. However, Bernheim (1987) and Hurd (1987) using panel data have demonstrated that the propensity to consume rises with age and that the elderly do dissave during retirement.

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Table 1

Income from Interest Reported by Individuals
Over 65 and Its Relation to Personal Saving
(Billions of dollars or percent)

	Personal Saving (1)	Disposable Personal Income (2)	(1)/(2)	Undistributed Corporate Profits Units ZVA and CIADT (3)	Net Private Saving (4)=(1)+(2)	(4)/(2)
	(Billions of dollars)		(%)	(Billions of dollars)		(%)
1970	57.7	715.6	8.1	17.9	75.6	10.6
1971	66.3	776.8	8.5	26.4	92.7	11.9
1972	61.4	839.6	7.3	34.4	95.8	11.4
1973	89.0	949.8	9.4	37.0	126.0	13.3
1974	96.7	1,038.4	9.3	20.2	116.9	11.3
1975	104.6	1,142.8	9.2	37.1	141.7	12.4
1976	95.8	1,252.6	7.6	46.4	142.2	11.4
1977	90.7	1,379.3	6.6	62.3	153.0	11.1
1978	110.2	1,551.2	7.1	69.0	179.2	11.6
1979	118.1	1,729.3	6.8	62.0	180.1	10.4
1980	136.9	1,918.0	7.1	37.7	174.6	9.1
1981	159.4	2,127.6	7.5	43.2	202.6	9.5
1982	153.9	2,261.4	6.8	20.0	173.9	7.7
1983	130.6	2,428.1	5.4	65.0	195.6	8.1
1984	164.1	2,668.6	6.1	94.0	258.1	9.7
1985	125.4	2,838.7	4.4	102.6	228.0	8.0
1986	121.7	3,019.6	4.0	104.1	225.8	7.5
1987	104.2	3,209.7	3.2	81.1	185.3	5.8
1988	144.3	3,471.8	4.2	81.1	225.4	6.5

Source: U.S. Department of Commerce, Survey of Current Business.

Note: Quarterly data are at seasonally adjusted annual rates.

Table 2

Income from Interest Reported by Individuals Over 65
and Its Relation to Personal Saving
(Billions of dollars or percent)

	Interest Received[1]						
	Taxpayers Aged 65 or Over (1)	All Taxpayers (2)	(1)/(2)	Personal Saving (3)	Disposable Personal Income (4)	(3)/(4)	Interest Received by Taxpayer Aged 65 or Over as Percent of Personal Saving (1)/(3)
	(Billions of dollars)		(%)	(Billions of dollars)		(%)	(%)
1970	9.7	22.0	44.1	57.7	715.6	8.1	16.8
1971	10.8	24.7	43.7	66.3	776.8	8.5	16.3
1972	12.1	27.4	44.2	61.4	839.6	7.3	19.7
1973	14.2	32.2	44.1	89.0	949.8	9.4	16.0
1974	17.5	39.5	44.3	96.7	1,038.4	9.3	18.1
1975	19.6	43.4	45.2	104.6	1,142.8	9.2	18.7
1976	21.9	48.6	45.1	95.8	1,252.6	7.6	22.9
1977	25.6	54.6	46.9	90.7	1,379.3	6.6	28.2
1978	28.5	61.2	46.6	110.2	1,551.2	7.1	25.9
1979	34.1	73.9	46.1	118.1	1,729.3	6.8	28.9
1980	47.9	102.0	47.0	136.9	1,918.0	7.1	35.0
1981	68.3	140.6	48.6	159.4	2,127.6	7.5	42.8
1982	79.9	157.0	50.9	153.9	2,261.4	6.8	51.9
1983	79.9	153.8	52.0	130.6	2,428.1	5.4	61.2
1984	92.0	176.4	52.2	164.1	2,668.1	6.1	56.1
1985	95.9	182.1	52.7	125.4	2,838.7	4.4	76.5
1986	—	168.2	—	121.7	3,019.6	4.0	—
1987	—	—	—	104.2	3,209.7	3.2	—
1988	—	—	—	144.3	3,471.8	4.2	—

[1] Based on all returns.

Sources: U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts of United States, 1970–88. Department of Treasury, Statistics of Income...Individual Income Tax Returns.

UNITED STATES : PERSONAL SAVING AND NET PRIVATE SAVING, 1970-88

(IN PERCENT OF DISPOSABLE PERSONAL INCOME)

FIGURE 1