Effect of Social Security on Saving: Review of Studies Using U.S. Time-Series Data

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The past several years have seen a continuing debate on whether the social security system reduces private saving and capital formation In an earlier BULLETIN *article, Selig D Lesnoy and John C Hambor discuss some of the conceptual issues involved in this debate[1] Reviewed here are the four major empirical studies that have investigated the effect of social security on aggregate private saving, using U S time-series data The major conclusion of the review is that the empirical results of the four studies do not support the hypothesis that social security decreases private saving It is argued, moreover, that further analysis of this question with the use of U S time-series data is unlikely to yield results that differ from those discussed here If this is in fact true, then one is faced with either of two conclusions Analysis of U S time series data cannot isolate the effect of social security on saving or the social security system does not have a significant effect on private saving*

EVER SINCE the publication of a 1974 study by Martin Feldstein the effects of social security on private saving have been the subject of continuing debate Feldstein claimed that his empirical analysis of U S time-series data for the period 1929-71 suggests that the social security program reduced private saving by 38 percent in 1971 This rather startling conclusion stimulated much discussion and research—theoretical and empirical—on the economic effects of the social security system

Three other studies (by Munnell, Barro, and Darby) have used time-series data to investigate how private saving in this country has been affected by the social security program, and this article reviews the empirical content of the four studies[2] The empirical results and the authors' interpretations of those results are presented in chronological order for each study to demonstrate the evolution of the debate The theoretical models underlying the estimated regression equations are not discussed in detail This article does not deal with the issue of what type of theoretical model is "best" for such an investigation

FELDSTEIN STUDY

Martin Feldstein's study uses aggregate U S time series data for the period 1929–71 His estimate of the consumer expenditure function is based on an extended life-cycle saving model

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[1] "Social Security, Saving, and Capital Formation," *Social Security Bulletin*, July 1975

[2] Martin Feldstein, "Social Security, Induced Retirement and Aggregate Capital Accumulation," *Journal of Political Economy*, September–October 1974, pages 905–926, Alicia Munnell, "The Impact of Social Security on Personal Saving," *National Tax Journal*, December 1974, pages 553–567, Robert J Barro, *Social Security and Private Saving—Evidence From the U S Time Series*, University of Rochester, April 1977, and Michael R Darby, *The Effects of Social Security on Income and the Capital Stock*, American Enterprise Institute, 1978 (forthcoming)

Other studies have investigated this issue, using (a) household survey data Larry Kotlikoff, Anthony Pellechio, and Christopher Chamley, *Social Security and Private Wealth Accumulation*, Harvard University, 1976, Alicia Munnell, "Private Pensions and Saving New Evidence," *Journal of Political Economy*, October 1976, pages 1013–1032, Martin Feldstein and Anthony Pellechio *Social Security and Household Wealth Accumulation New Microeconometric Evidence* (Discussion Paper No 530), Harvard Institute of Economic Research, January 1977, using (b) international data Henry J Aaron, "Social Security International Comparison," in *Studies in the Economics of Income Maintenance* (Otto Eckstein, ed), The Brookings Institution, 1967, pages 13–48, Martin Feldstein, "Social Security and Private Saving International Evidence in an Extended Life-Cycle Model," in *The Economics of Public Services* (Martin Feldstein and R Inman, eds), International Economic Association Conference Volume, 1977, and Robert J Barro and Glenn M MacDonald, *Social Security and Consumer Spending in an International Cross Section*, University of Rochester, August 1977

TABLE 1.—Feldstein's regression results relating consumer expenditures to social security wealth and unemployment rate [1]

Dependent variable	Regression coefficients and standard errors [2]	
	Gross social security wealth (SSWG1)	Unemployment (RU)
Consumer expenditures in—		
1929–40, 1947–71	0.021 (0.006)	- -
1929–40, 1947–71	0.010 (0.011)	1.170 (0.892)
1947–71	0.014 (0.070)	- -
1947–71	0.029 (0.035)	2.786 (3.237)

[1] The regression coefficients of YD_t, RE_t, and W_{t-1} have the expected signs and are significant in both sample periods. The regression coefficient on the lagged value of YD has the expected sign but is only significant for 1929–71.

[2] Standard errors of regression coefficients shown in parentheses.

The basic equation is

$$C_t = a + b_1 YD_t + b_2 YD_{t-1} + b_3 RE_t + b_4 W_{t-1} + b_5 RU_t + b_6 SSW_t + u_t$$

where C is consumer expenditures, YD is disposable personal income, RE is gross retained earnings, W is net worth of households, RU is the unemployment rate, SSW is social security wealth (gross or net), and u is the error term. All income and wealth variables are per capita and in 1958 dollars.

The effect of social security on consumer expenditures (and therefore personal saving) is captured by the social security wealth variable (SSW). Feldstein states that the effect of the social security program on personal saving is theoretically ambiguous. Saving is reduced because social security benefits reduce the need to accumulate assets for retirement. This relationship is referred to as the "benefit or asset substitution effect." On the other hand, saving is increased because of the "induced retirement effect" of the system. The social security benefit in conjunction with the earnings test encourages earlier retirement. Earlier retirement means a shorter working life and a longer retirement period. Thus for any given level of retirement income, a greater saving rate during the working years is required. The sign of the social security wealth variable therefore is ambiguous a priori. The "asset substitution effect" should increase consumption, and the "induced retirement effect" should decrease consumption.

Feldstein constructs two social security wealth variables. He defines gross social security wealth ($SSWG$) as the present discounted value of expected future social security benefits, taking into account the probability of receiving them. Net social security wealth ($SSWN$) is gross social security wealth minus the present discounted value of social security taxes to be paid by those currently in the work force.

Feldstein presents 10 estimated regression equations. They differ according to the period of estimation, the measure of social security wealth, and the inclusion or exclusion of the unemployment rate variable. His theoretical model does not include or discuss the unemployment variable. The initial discussion of the Feldstein empirical results thus contains no mention of the unemployment rate.

The basic equation is estimated for two different time periods: 1929–71 (excluding 1941–46) and 1947–71. The equation is also estimated by using gross social security and net social security wealth alternately. Each social security variable is specified in turn in different forms, depending on the assumptions made about the growth rate of real per capita income and the discount rate. Since the empirical results are essentially the same, irrespective of the particular social security wealth variable employed, the empirical results discussed here include only $SSWG1$—that is, gross social security wealth calculated by assuming 2 percent as the real growth rate of per capita income and 3 percent as the discount rate.[3]

Table 1 presents in lines 1 and 3 only the regression coefficients and standard errors of the social security wealth variable ($SSWG1$) generated when Feldstein's basic equation, excluding the unemployment rate variable, is estimated. The regression coefficient on $SSWG1$ for the entire period 1929–71 has a positive sign and is highly significant.

The regression coefficient on $SSWG1$ for the postwar period (1947–71) is not significant—that is, the standard error is twice the size of the estimated coefficient. Feldstein attributes the lack of significance of $SSWG1$ in the postwar period to a lack of variability in $SSWG1$ for this period. He concludes, on the basis of the size and sign

[3] Feldstein also states that "the gross social security wealth variable is probably the correct specification." See Martin Feldstein, *op. cit.*, 1974, page 911.

of the regression coefficients of *SSWG1*, that these results support the hypothesis that the social security program causes a decrease in saving

He then reestimates his basic equation, including the unemployment rate (*RU*) It is included "in the consumption function to adjust for the cyclical variation in the relation of consumption and income" The regression coefficients and standard errors for both the *SSWG1* and *RU* variables are shown in lines 2 and 4 when the basic equation is estimated to include the unemployment rate For both time periods the *SSWG1* and *RU* variables are insignificant For a variety of reasons, including the insignificance of the *RU* variable, Feldstein discounts this adverse result

The fact remains, however, that no theoretical reason is apparent for excluding the unemployment rate from the estimated equations Most economists agree that unemployment affects the consumption-income relationship Its inclusion in a consumer expenditure function is not disputed The only area of disagreement is the precise functional form in which the unemployment rate enters the consumer expenditure equation

In addition, no justification exists on empirical grounds for excluding the *RU* variable from the estimated equation The insignificance of the *SSWG1* variable when the unemployment rate is introduced into the estimated equation suggests a high degree of collinearity between these two variables The introduction of *RU* into the estimated equation has almost no effect on the regression coefficient and standard errors of the other variables in the equations

Feldstein recognizes the collinearity problem but argues that, in essence, the exclusion of *RU* is justified One might have some understanding of this approach if Feldstein's reestimation of his basic equation had excluded *SSWG1*, included *RU*, and found that *RU* was insignificant or at least substantially less significant than *SSWG1* He does not present such an equation In a reestimation of the Feldstein equation, excluding *SSWG1* and including *RU*, the regression coefficient on *RU* becomes significant at about the same level as *SSWG1* with *RU* excluded [4] Clearly as much justification exists empirically for excluding *SSWG1* as for excluding *RU* Unfortunately the high degree of collinearity between *SSWG1* and *RU*, at least for the period 1929–71, does not allow Feldstein to estimate the independent effects of *SSWG1* and *RU* on consumer expenditures

Feldstein's empirical results can be summarized in the following way The empirical results for the postwar period (1947–71) do not support the hypothesis that the social security system causes a decrease in private saving This finding holds true even when the unemployment rate is excluded from the estimated equation The empirical results for the period 1929–71 suggest that the social security program decreases saving but only when the unemployment rate is excluded from the equation Since no justification exists, either theoretically or empirically for excluding the unemployment variable, this result cannot be accepted as supporting the hypothesis that the program decreases saving On balance then, the empirical results of the Feldstein study do not support that hypothesis [5]

MUNNELL STUDY

Alicia Munnell investigated the impact of the social security system on personal saving, using U S time-series data for the period 1900–71 [6] She states that her estimated equations are based on the life-cycle saving model Her basic equation is

$$S_t = a + b_1 YD_t + b_2 W_{t-1} + b_3 RU_t + b_4 SS_t + b_5 YD{\cdot}LF65_t + u_t$$

where S is personal saving, YD is disposable personal income, W is net worth of households, RU is the unemployment rate, SS is a variable measuring the effect of social security, $YD{\cdot}LF65$ is the labor-participation rate of men aged 65 and

[4] The Feldstein equation was reestimated by Selig Lesnoy of the Division of Economic and Long-Range Studies, Office of Research and Statistics, Social Security Administration

[5] For concurring views, see Charles Upton, "Review of Alicia Munnell, The Effect of Social Security on Personal Saving," *Journal of Political Economy*, October 1975, pages 1090–1092; Robert J Barro, *op cit*, 1977, and Michael R Darby, *op cit*, 1978

[6] The results of the time-series analysis are summarized in Alicia Munnell, *op cit*, 1974 The complete analysis of the effects of social security on saving is in Alicia Munnell, *The Effect of Social Security on Personal Saving*, Ballinger Publishing Co, 1974

over multiplied by YD, and u is the error term All income and wealth variables are per capita and are in 1958 dollars

Munnell states that the effects of social security on personal saving are captured in two variables—SS and $YD \cdot LF65$ Two alternative measures are used for SS The first is combined employer-employee social security taxes (SS Taxes), this measure represents "the minimum amount [of benefits] that individuals can expect to receive in retirement " The second measure is social security wealth (SSW), developed in Feldstein's 1974 study Social security wealth is introduced into the estimated equations alternately as $SSWG$ (gross social security wealth) and $SSWN$ (net social security wealth) The social security variables (SS Taxes, $SSWG$, and $SSWN$) capture the "asset substitution effect" of social security and thus are expected to have a negative effect on personal saving

The variable $YD \cdot LF65$ is supposed to capture the "induced retirement effect" of social security Social security reduces labor-force participation of the aged and thus increases personal saving That variable, as structured, should be negatively related to personal saving

Munnell estimates her basic equation for various time periods and with alternative definitions of saving and social security benefits Presented first are her results using the social security tax variable and her two different saving concepts—personal saving and retirement saving[7]

Table 2 shows only the regression coefficients and t statistics for the variables that represent the influence of social security on saving, since that is the focus of this discussion What is immediately worth noting is that the social security variables (SS Taxes and $YD \cdot LF65$) are not significant in any time period when the dependent variable is personal saving For the equations in which the dependent variable is retirement saving, the regression coefficients for both the social security tax variable and the labor-force participation rate are significant at the 05 level or better for 1900–71 and 1929–71 For the postwar period

TABLE 2 —Munnell's regression results relating personal and retirement saving to social security taxes and labor-force participation for men aged 65 and over [1]

Dependent variable	Regression coefficients and t statistics [2]	
	Social security taxes (SS taxes)	Labor-force participation rate (YD LF65)
Personal saving in—		
1900–71	−0 326	−0 059
	(0 5)	(0 4)
1929–71	−0 390	−0 023
	(0 4)	(0 2)
1946–71	−1 465	−0 063
	(1 1)	(0 3)
Retirement saving in—		
1900–71	−0 390	−0 057
	(2 7)	(1 9)
1929–71	−0 531	−0 090
	(3 4)	(3 8)
1946–71	−0 217	−0 059
	(1 0)	(2 0)

[1] The regression coefficient of YD_t has the expected positive sign and is generally significant The regression coefficient of W_{t-1} has the expected negative sign, but its significance varies with the specification of the equation and the time period The sign and significance of the regression coefficient of RU_t varies with the specification of the equation and the time period

[2] The t statistics shown in parentheses

1946–71 the social security tax variable is insignificant and the labor-force participation rate variable is significant at the 05 level

Thus, the empirical evidence in table 2 is only consistent with the hypothesis that the social security system decreases private saving when the dependent variable is retirement saving This conclusion must be modified, however, to note that the evidence is not consistent with the hypothesis when the postwar period is analyzed separately The limited evidence supporting the depressing effect of the social security program on personal saving rests on the definition and measurement of retirement saving This variable is discussed later

Munnell also introduces social security into her estimated equations as a wealth variable Table 3 presents the regression coefficients on the social security wealth variables and the labor-force participation rate variable when these alternative social security variables are used

When personal saving is the dependent variable, only the net social security variable is significant at the 05 level during the 1946–69 period Gross social security wealth is never significant, and net social security wealth is not significant during the 1929–69 period The labor-force participation rate variable is never significant

When retirement saving is the dependent variable, the social security wealth variables are significant at the 05 level for the period 1929–69

[7] The saving data used by Munnell are from Raymond Goldsmith, *A Study of Saving in the United States*, vols 1–3, Princeton University Press, 1956, and the Securities and Exchange Commission, *Flow of Funds*, 1970 The consumption data used by Feldstein, Barro, and Darby are from the National Income and Product Accounts of the United States Department of Commerce

They are not significant for the postwar period 1945–69 The labor-force participation rate variable is always significant at the 05 level

In general, the empirical results presented in table 3 are reasonably consistent with the results in table 2 For the postwar period, little if any evidence supports the hypothesis that the social security system decreases saving, whatever saving measure is used For periods longer than the postwar period, the evidence supporting a negative effect of the social security system on saving is limited to the empirical results that use retirement saving as the measure of saving

The use of retirement saving is justified by Munnell on the grounds that several motives underlie saving and that particular assets are used for each type of saving Individuals save for reasons other than retirement They save to educate their children, to buy a house, or to meet unforeseen contingencies Munnell argues that the introduction of a social security program would be expected to affect retirement saving It should have little if any effect on other types of saving Thus, to isolate the effect of the social security program, Munnell finds it useful to separate retirement saving from aggregate personal saving

The retirement saving series is defined to include the net annual increase in assets of life insurance companies (net of policy loans), private pension plans, and government insurance and pension plans She acknowledges that retirement saving may also take the form of investments in stocks, bonds, and real estate Her retirement saving series, however, approximates "the retirement saving of the lower part of the income distribution—the group whose saving was most likely to be affected by the introduction of social security"

Unfortunately, the significant negative effect of the social security program on retirement saving does not necessarily imply a decrease in total personal saving In fact, the significant negative effect on retirement saving, coupled with the insignificant effect on total personal saving suggests that the system affects the form of financial investments but does not affect aggregate personal saving [8] Thus the empirical results, based on the use of the retirement saving series, cannot be used to support the hypothesis that the social security program decreases personal saving

TABLE 3 —Munnell's regression results relating personal and retirement saving to social security wealth and labor-force participation for men aged 65 and over

Dependent variable	Regression coefficients and t statistics [1]		
	Social security wealth		Labor force participation rate (YD LF65)
	Gross (SSWG)	Net (SSWN)	
Personal saving in—			
1929–69	−0 030 (1 6)		−0 150 (1 2)
1929–69		−0 033 (1 1)	−0 144 (1 1)
1946–69	−0 038 (1 4)		−0 129 (0 8)
1946–69		−0 117 (2 3)	−0 198 (1 4)
Retirement saving in—			
1929–69	−0 008 (2 1)		−0 061 (2 4)
1929–69		−0 012 (2 0)	−0 063 (2 5)
1946–69	−0 011 (1 5)		−0 066 (2 5)
1946–69		−0 006 (0 6)	−0 056 (2 0)

[1] The t statistics shown in parentheses

On balance, the empirical results of the study offer little or no evidence to support the hypothesis that the social security program results in decreased personal saving Three specific results of Munnell's empirical analysis support this conclusion First, the variables measuring social security wealth or benefits are not significant in explaining aggregate personal saving, irrespective of the time period [9] Second, the variables measuring social security wealth or benefits are never significant in explaining saving in the postwar period, regardless of the saving measure used Third, the significant relationship between saving and social security wealth or benefits obtained when the retirement saving measure is used cannot be used to support the hypothesis that the social security program causes a decline in aggregate personal saving [10] In addition, Munnell does not report the Durbin-Watson statistics for her estimated equations The existence of autocorrelation would bias her t statistics Lacking knowl-

[8] For a review of Munnell's empirical work, see Charles Upton, *op cit*, 1975, and Michael R Darby, *op cit*, 1978

[9] The one exception is the regression coefficient of *SSWN* for 1946–69, which is 117 Since it implies a 1969 decrease in personal saving of about $90 billion in 1958 dollars—and total saving in 1969 was about $35 billion—it is clearly implausible and is not noted by Munnell

[10] Since Munnell's estimated equation contains only a measure of current disposable income rather than a variable (or variables) measuring permanent or "normal" income, the social security variable may serve as a proxy for permanent income in the estimated equations See Charles Upton, *op cit*, page 1092

edge of whether autocorrelation is present in her estimated equations, one can place little value on the significance tests

BARRO STUDY

Robert J Barro investigates the effect of the social security system on saving by using U S time-series data for the period 1929–74 Barro analyzes the same basic data as Feldstein, with the following differences (1) The time period for the analysis is extended to 1974, (2) some variables are added to the consumer expenditure function, (3) the forms and definitions of some variables differ, and (4) Barro's equations are estimated both with and without a constant term and some are estimated with all the variables divided by disposable income

The basic equation estimated by Barro is

$$C_t = a + b_1 YD_t + b_2 YD_{t-1} + b_3 RE_t + b_4 W_t + b_5 (RU \cdot YD)_t + b_6 SS_t + b_7 SUR_t + b_8 DUR_t + u_t$$

where C is consumer expenditures, YD is disposable personal income, RE is net retained earnings, W is net worth of households, RU is the unemployment rate, SS is a variable measuring the effect of social security, SUR is surplus of the total government sector, DUR is the net stocks of household durables, exclusive of housing, and u is the error term All income and wealth variables are per capita and in 1958 dollars

The basic equation is estimated with alternative measures of the effect of social security One measure is Feldstein's gross social security wealth variable (*SSWG1*) The other variable is the product of current benefits per recipient multiplied by the ratio of currently covered workers to the total labor force, but this variable is never significant in the estimated equations The discussion here focuses therefore on the equations using gross social security wealth (*SSWG1*) [11] The basic equation is estimated for two different time periods—1929–74 (excluding 1941–46) and 1947–74

[11] Barro also uses an alternative measure of net worth —the net stocks of fixed, nonresidential business capital and net stocks of nongovernmental residential housing— that is significant only when the constant is excluded

TABLE 4 —Barro's regression results relating consumer expenditures to social security wealth and unemployment rate[1]

Dependent variable	Regression coefficients and standard errors [2]: Gross social security wealth (SSWG1)	Regression coefficients and standard errors [2]: Unemployment rate/disposable personal income (RU YD)
	Constant included	
Consumer expenditures in—		
1929–40, 1947–74	0 028	
	(0 009)	
1929–40, 1947–74	0 014	0 270
	(0 010)	(0 110)
1947–74	0 017	
	(0 040)	
1947–74	0 014	0 260
	(0 036)	(0 150)
	Constant excluded	
Consumer expenditures in—		
1929–40, 1947–74	0 005	
	(0 008)	
1929–40, 1947–74	0	0 390
	(0 007)	(0 090)
1947–74	−0 012	
	(0 011)	
1947–74	−0 005	0 370
	(0 010)	(0 150)

[1] YD_t, YD_{t-1}, SUR_t, and $(RU \cdot YD)_t$ have the expected positive sign and are significant, regardless of the specification of the estimated equation The signs and/or significance of all the other variables are highly sensitive to the specification of the estimated equation, especially to the inclusion or exclusion of the constant term

[2] Standard errors of regression coefficients shown in parentheses

Table 4 presents Barro's major empirical results Lines 1 and 3 show the regression coefficients and standard errors for the social security wealth variable (*SSWG1*) generated when the basic equation is estimated with the unemployment variable excluded but the constant term included The regression coefficient on *SSWG1* for the period 1929–74 has a positive sign and is highly significant, it is insignificant for the postwar period These results are identical with Feldstein's This similarity is not surprising since the basic data and the basic estimated equation are similar for both studies

Barro then estimates (lines 2 and 4 of table 4) his basic equation with the unemployment variable included Again the results are like those of Feldstein for the regression coefficient on *SSWG1*, which is insignificant in both time periods The unemployment rate, however, unlike the rate in the Feldstein study, is significant—that is, the regression coefficient on $RU \cdot YD$ is about two and one-half times larger than its standard error

This difference in results with respect to the significance of the unemployment variable, as

Barro points out, may reflect the difference between the two studies in the form and measurement of this variable [12] The first difference is that Feldstein uses as his measure of unemployment (RU) the unemployment rate for the entire labor force Barro's measure is the unemployment rate for the entire labor force adjusted to reflect Darby's counting of government emergency workers during the depression as employed persons [13] A second difference is that Barro's unemployment rate enters the equation as a composite variable ($RU \cdot YD$) and Feldstein's rate enters simply as RU Barro argues that the $RU \cdot YD$ specification is more reasonable than the simple linear specification of RU This is based on his view that "the unemployment rate (relative to the natural rate) would seem to be a proportional measure of the deviation of income from its 'normal' position"

According to Barro, when the unemployment rate is excluded from the equation, "social security wealth serves as a positive proxy" for this variable during the 1929–74 period He adds that, with the significance of the unemployment variable in both time periods, no justification exists for excluding this variable from the consumer expenditure equation [14] Barro thus finds no evidence to support the hypothesis that the social security system has a significant effect on consumer expenditures

Barro also estimates his basic equation with the constant excluded Lines 5–8 in table 4 present the regression coefficients and standard errors of the $SSWG1$ and $YD \cdot RU$ variables when the basic equation is estimated with the constant excluded The regression coefficient of the $SSWG1$ variable is not significant, even when the unemployment rate variable is excluded from the equation The unemployment rate variable is significant in both time periods

The justification for forcing the constant term to zero is that the underlying utility functions for households may be homothetic If this relationship exists, then one would expect consumer expenditures to double when income and wealth are doubled The homotheticity property requires the constant to be zero Since this property is plausible, Barro estimated his equation with the constant excluded as well as included

In summary, the empirical results of Barro's study offer no support for the hypothesis that the social security program depresses saving Interpreted in a narrow sense, the study reaffirms the conclusions reached after a careful interpretation of Feldstein's empirical results—that is, an analysis and interpretation of the evidence based on U S time-series data offers no support for the hypothesis that the social security program decreases private saving

DARBY STUDY

Michael Darby's 1978 study is the latest investigation into the effect of the social security system on saving [15] Darby estimates a consumer expenditure equation using U S time-series data for 1929–74 He analyzes the same basic data as do Feldstein and Barro, with some differences The basic form of his consumer expenditure function differs significantly, however, from previous studies Darby estimates a permanent-income consumption function In the other three studies discussed here the basic regression equations were based on life-cycle saving (or consumption) models Darby's basic equation is derived from a permanent-income consumption function He points out that the basic difference between permanent income and life-cycle models is primarily differences in techniques of estimating wealth [16]

Darby's basic equation is

$$C = a + b_1 YP_t + b_2 YT_t + b_3 M_t + b_4 D_{t-1} + b_5 (PD/PND)_t + b_6 e_t + b_7 SS_t + u_t$$

where C is consumer expenditures, P is permanent

[12] According to Barro, the difference may be in the wealth variable, since the net worth series he uses is not the same as that used by Feldstein

[13] Michael R Darby, "Three-and a Half Million U S Employees Have Been Mislaid Or An Explanation of Unemployment, 1934–41," *Journal of Political Economy*, February 1976, pages 1–16

[14] When SUR is excluded the unemployment rate variable is insignificant Thus it is not the definition or specification of Barro's unemployment rate variable that accounts for its significance but rather the inclusion of SUR The Barro equation was reestimated by Selig Lesnoy of the Division of Economic and Long-Range Studies, Office of Research and Statistics, Social Security Administration

[15] Michael R Darby, *op cit*, 1978

[16] See Michael R Darby, "Postwar U S Consumption, Consumer Expenditures and Saving," *American Economic Review, Papers and Proceedings*, May 1975, page 218

income, YT is transitory income, M is real money balances, D is the stock of consumers' durable goods, PD is the price of consumers' durable goods, PND is the price of consumers' nondurable goods, i is the market rate of interest, SS is the social security variable, and u is the error term All variables except PD/PND and i are in 1958 dollars The variables, unlike those in the previous studies discussed here, are not per capita YP, permanent income, is computed by the exponentially declining weight method as

$$YP_t = BY_t + (1 - B)\ (1 + g)YP_{t-1}$$

where B is 0 1, g is the period trend growth rate of 0 0386 per year, $YP_{1929} = Y_{1929}$, and Y is real private-sector income adjusted for the imputed yield on the stock of consumers' durable goods YT, transitory income, is simply Y minus YP

Darby estimates his basic equation for two different time periods—1929–74 (excluding 1941–46) and 1947–74 These time periods are identical to those used by Barro Darby employs four measures for the effects of social security (1) net social security wealth (*SSWN1*), (2) gross social security wealth (*SSWG1*), (3) social security taxes (*SS* Tax), and (4) a benefit-coverage variable

Darby's results for the first three variables are presented here The statistical performance of the benefit-coverage variable is clearly inferior, and those results are not presented here

Darby employs two measures of real money balances—*M1* (currency plus demand deposits) and *M2* (*M1* plus bank time deposits) *M1* has performed better than *M2* in postwar consumer expenditure functions, according to Darby Classification of demand deposits before the Banking Acts of 1933 and 1935 (which prohibited interest payments on demand deposits) was highly arbitrary Thus, Darby uses *M2* as an imperfect proxy for the medium of exchange for the period 1929–74 His equations for both time periods, however, are alternately estimated, first with *M1* used as the measure of real money balances and then with *M2* used as the measure of money balances

As noted, *M*2 does not do nearly as well as *M*1 in the postwar regressions For the entire period, *M*2 does better than *M*1 because, Darby says, "of the inconsistency in economic meaning [of *M*1] in the early part of the period" Thus Darby's discussion emphasizes the regression results using *M*2 for the 1929–74 period and *M*1 for the 1947–74 period

TABLE 5 —Darby's regression results relating consumer expenditures to social security wealth, taxes, and real money balances [1]

Dependent variable	Regression coefficients and *t* statistics [2]				
	Social security wealth		Social security taxes (SS taxes)	Real money balances	
	Gross (SSWG1)	Net (SSWN1)		M1	M2
Consumer expenditures in—					
1929–40, 1947–74		0 025			0 039
		(1 33)			(0 079)
1929–40, 1947–74	0 017				0 042
	(1 31)				(0 086)
1929–40, 1947–74			0 803		0 063
			(1 42)		(1 55)
1929–40, 1947–74		0 033		0 164	
		(2 20)		(0 27)	
1929–40, 1947–74	0 024			0 005	
	(2 13)			(0 09)	
1929–40, 1947–74			1 407	0 052	
			(1 98)	(0 87)	
1947–74		0 003			0 010
		(0 09)			(1 15)
1947–74	0 015				0 074
	(0 50)				(0 89)
1947–74			0 152		0 101
			(0 19)		(1 72)
1947–74		−0 017		0 726	
		(0 79)		(4 31)	
1947–74	−0 011			0 711	
	(0 59)			(4,08)	
1947–74			0 096	0 641	
			(0 17)	(4 49)	

[1] The regression coefficients of YP_t, YT_t, and D_{t-1} have the expected signs and are significant The regression coefficients on $(PD/PND)_t$ and i_t are generally insignificant

[2] The *t* statistics shown in parentheses

Table 5 presents the regression coefficients and the *t* statistics for the social security variables generated when Darby's basic equation is estimated Lines 1–3 present the results when *M*2 is used in the estimated equations for the entire period 1929–74 The regression coefficients of the social security variables are all mutually consistent with respect to their size, and they imply about a 20-percent reduction in the 1971 saving-income ratio The *t* statistics for the three regression coefficients of the social security variable range from 1 31 to 1 42 With the appropriate two-tail test applied, the regression coefficients are not significantly different from zero at the 05 level They are only significantly different from zero at the 20 level Since the usual significance level used in econometric analysis is the 05 level or better, the hypotheses that the regression coefficients of the social security variables are significantly different from zero must be rejected

In lines 4–6, Darby's empirical results are shown for 1929–74, using the *M*1 concept of real

money balances The regression coefficients on all three social security variables are significant at the 05 level, using a two-tail t test Unfortunately, little or no importance can be attached to these results since the equation is estimated by using a real money balance variable ($M1$) whose economic meaning, as Darby states, is inconsistent during the early part of the period 1929–74 Darby himself appears to attach little importance to these results since he relegates the discussion of them to a footnote

The empirical results for the postwar period are presented in lines 7–12, the bottom half of table 5 The regression coefficients of all three social security variables are not significant, regardless of the measure of real money balances used As Darby correctly points out, no evidence exists that the social security program has affected personal saving during the postwar period In summary, it is clear that Darby's empirical results do not support the hypothesis that the social security program results in decreased saving

SUMMARY AND CONCLUSIONS

The empirical results of the four major studies that investigate the effect of the social security program on personal saving by using U S. time-series data have been reviewed here Table 6 summarizes these results It presents the regression coefficient and t statistics for the social security wealth variable using a representative equation from each of the studies [17] In lines 1–4 the results for the post-1929 period are presented None of the regression coefficients are statistically significant at the 05 level with a two-tail t test applied In fact, none of them are significant at the 10 level Lines 5–8 present the results for the postwar period 1946–74 Again none of the regression coefficients are statistically significant with a two-tail t test applied at the 10 level The conclusion that seems incontestable is that the empirical results do not support the hypothesis that the social security program decreases private saving

Although the empirical analysis of the U S time-series data has not produced any evidence

[17] "Representative" here means an estimated equation that in this author's judgment has the strongest justification on both empirical and theoretical grounds

TABLE 6.—Representative empirical results from the four studies using U S time series data

Dependent variable	Investigator	Regression coefficients and t statistics of social security wealth [1] (SSWG)
Personal saving in 1929–69	Munnell	−0 030 (1 60)
Consumer expenditures in—		
1929–40, 1947–71	Feldstein	0 010 (0 91)
1929–40, 1947–74	Barro	0 014 (1 40)
1929–40, 1947–74	Darby	0 017 (1 31)
Personal saving in 1946–69	Munnell	−0 058 (1 40)
Consumer expenditures in—		
1947–71	Feldstein	0 029 (0 83)
1947–74	Barro	0 014 (0 39)
1947–74	Darby	0 011 (0 59)

[1] The t statistics shown in parentheses Feldstein and Barro used the standard errors rather than the t statistics For ease in comparison, the standard errors were replaced with the appropriate t statistics for their results

that the social security system has a significant effect on saving, it does not necessarily mean that such an effect does not exist If such an effect does exist, then, for whatever reasons (limitation of the basic data, inadequacies in the construction of particular variables, or problems with the estimation techniques), the empirical analysis of U S time-series data has not been able to isolate or capture this effect

It should be noted, however, that the studies reviewed here have used different time periods and various functional forms of the consumer expenditure and saving functions These functional forms have included a rather wide range of explanatory variables Among these variables are income, permanent income, transitory income, retained earnings, household wealth, the unemployment rate, the labor-force participation rate of the aged, the stock of household durables, the ratio of the price of consumer durables to the price of consumer nondurables, real money balances, the market rate of interest, and four different social security variables

Given these efforts, one is not encouraged that further analysis of U S time-series data will yield results that differ from those discussed If this fact is true, one is faced with either of two conclusions (1) The analysis of U S time-series data cannot isolate the effect of the social security program on private saving or (2) the program does not have a significant effect on private saving