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SOCIAL SECURITY AND PRIVATE SAVING: A REEXAMINATION OF THE TIME SERIES EVIDENCE USING ALTERNATIVE SOCIAL SECURITY WEALTH VARIABLES

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1. Introduction

In an important article in the Journal of Political Economy [1974], Martin Feldstein estimated that the introduction of the social security system had reduced personal saving by 50 percent, with serious consequences for capital formation and output. His conclusion was based on a consumer expenditure function estimated with U.S. time series data and incorporating a social security wealth variable of his construction.

Publication of this article spawned a continuing controversy concerning the effect of social security on saving. Subsequent studies by Munnell [1974], Barro [1978], and Darby [1979] which used U.S. time series variously supported and contradicted Feldstein's conclusions. Although these studies employed different specifications of the consumer expenditure (or saving) function, all used the social security variable developed by Feldstein. In addition, Feldstein's social security wealth variable has been used by Burkhauser and Turner [1978] to estimate the effect of social security on hours worked by younger men, and by Pogue and Sgontz [1977] to estimate the effect of social security on investment in human capital.

The original intent of this paper was to examine the sensitivity of Feldstein's conclusions to certain assumptions underlying his construction of the social security variable. In particular, we wanted to examine the implication of his assumptions concerning how individuals perceive future benefits and taxes.

As we proceeded, we discovered that the social security wealth series constructed by Feldstein contained an error. Correction of this error dramatically changed the nature of the estimated relationship. Subsequently, we decided to expand the scope of our analysis to include an alternative construction of the social security wealth variable.

The paper is organized as follows: Section 2 presents a brief review of the Feldstein model along with a brief discussion of several related studies. The construction of the Feldstein social security wealth variable is discussed in Section 3; the results of our replication are presented in Section 4. In Section 5, we modify our replica of the Feldstein construction by incorporating alternative benefit and tax perceptions, and examine the effect on estimates of the consumer expenditure function. Section 6 presents an alternative algorithm for estimating social security wealth which again incorporates alternative benefit and tax perceptions. Consumer expenditure functions using our alternative social security wealth variable are estimated and their implications examined. Section 7 presents our conclusions.

2. Review of the Time Series Evidence

Feldstein [1976] refers to the theoretical basis of his analysis as the "extended life-cycle model." Private, voluntary intergenerational transfers are excluded, as is saving for contingencies.

All saving during the working years is for the purpose of providing consumption during the period of retirement.

Given these assumptions, Feldstein [1974] argues that social security affects an individual's saving through two opposing forces:

(1) Saving is reduced because the availability of benefits reduces the need to accumulate assets for the retirement period. This is referred to as the "asset substitution effect."

(2) Saving is increased because the social security benefit, in conjunction with the earnings test, induces earlier retirement. Earlier retirement means a shorter span of years of earnings and a longer period of retirement. This, in turn, requires a higher saving rate during the earnings years to realize any given level of retirement income. This effect is referred to as the "retirement effect."

The net effect on an individual's saving depends upon the relative strength of these offsetting forces. If the asset substitution effect is stronger than the retirement effect, individual saving will be reduced; if, on the other hand, the retirement effect is stronger, saving will be increased. Feldstein turns to an econometric analysis to resolve this *a priori* ambiguity concerning the net effect on saving.

The heart of Feldstein's study is the specification and estimation of an aggregate consumption function which includes a social security wealth (SSW) variable. The model is adapted from the life-cycle consumption function developed by Ando and Modigliani [1963]:

(i) $$C_t = \beta_0 + \beta_1 YP_t + \beta_1 HW_t$$

where C_t is consumer expenditure, YP_t is permanent income,[1/] and HW_t is the stock of household wealth (real and financial assets less liabilities) at the beginning of period t.

Feldstein introduces two new variables. The key variable is an estimate of social security wealth, SSW_t. Two definitions are used: gross social security wealth is the present value of the retirement benefits anticipated by individuals; net social security wealth is gross social security wealth minus the present value of the social security taxes anticipated by current workers. These series are constructed by estimating future benefits and taxes, assuming alternative real interest rates and growth rates of real per capita income.

The other novel variable used by Feldstein is corporate retained earnings, RE_t. In essence, this is a proxy for the permanent component of capital gains. The basic equation estimated is therefore

(ii) $$C_t = \beta_0 + \beta_1 YP_t + \beta_2 RE_t + \gamma_1 HW_t + \gamma_2 SSW_t \quad .$$

It may be noted that the equation does not include a variable that measures the retirement effect of social security. Feldstein argues that the SSW variable indirectly incorporates this effect.

The equation is estimated using aggregate U.S. data, deflated to constant 1958 dollars, and divided by population. Equations are estimated for two periods: 1929-71 excluding 1941-46; and 1947-71. The method of estimation is ordinary least squares.

Although several alternative models are presented, Feldstein prefers the following equation estimated for the period 1929-71 (excluding 1941-46):

$$\text{(iii)} \quad C = \underset{(7.3)}{228} + \underset{(11.3)}{.530YD} + \underset{(3.4)}{.120YD_{-1}} + \underset{(4.8)}{.356RE} + \underset{(3.4)}{.014HW} + \underset{(3.4)}{.021SSWG}$$

$\bar{R}^2 = .99$

D-W = 1.82

where C is consumer expenditures, YD is disposable income, RE is gross retained earnings, HW is household wealth, and SSWG is gross social security wealth estimated at a real discount rate of 3 percent. Permanent income is measured by current and lagged disposable income.

In separate replies to Barro [1978] and to Esposito [1978], Feldstein [1978, 1979] reestimated the equation for the period 1930-74 (excluding the years 1941-46) using different (net) retained earnings and household wealth variables. The resulting estimated consumer expenditure function

$$\text{(iv)} \quad C = \underset{(4.2)}{338} + \underset{(9.9)}{.604YD} + \underset{(2.8)}{.111YD_{-1}} + \underset{(2.6)}{.194RE} + \underset{(1.2)}{.006HW} + \underset{(2.7)}{.024SSWG}$$

$\bar{R}^2 = .99$

D-W = 1.45

is consistent with his earlier findings with respect to SSW.

The publication of Feldstein's article precipitated an ongoing research controversy. Alicia Munnell [1974] adopted a similar analytic framework, estimating a saving function whose specification included Feldstein's SSW variable and a variable to explicitly measure the retirement effect of social security.[2/] Munnell's empirical results, although somewhat weaker than Feldstein's, are generally consistent with his findings.

The strongest theoretical challenge has come from Robert Barro [1974, 1978]. Barro argues that the introduction of social security is likely to lead to offsetting changes in private intergenerational transfers so that the effect of social security on private saving is reduced or eliminated. His empirical evidence consists of a consumer expenditure function similar to that of Feldstein but with additional variables included in the specification (the government surplus, the unemployment rate, and the stock of durable goods). Barro finds that the coefficient of social security wealth is not significantly different from zero.

In another major contribution, Michael Darby [1979] extends his earlier research [1975, 1978] on the permanent income consumption function by incorporating Feldstein's social security wealth variable in the specification. Although his results vary depending upon the specification used and the periods covered, he concludes that the effect is probably smaller than that estimated by Feldstein.

3. Construction of Feldstein's SSW Variable

The studies cited above use different specifications to estimate the effect of social security on saving. However, all use the SSW variable developed by Feldstein. It is therefore important to understand the construction of this variable.[3/] Gross social security wealth, $SSWG_t$, is constructed by estimating the present value of retirement benefits anticipated by present and future OASI beneficiaries. Feldstein computes gross SSW annually for the U.S. by summing the wealth computed for six groups: working men, working women, wives and widows of working men, retired men, retired women, and wives and widows of retired men.

Net social security wealth, $SSWN_t$, is computed by subtracting from gross wealth the estimated present value of future social security taxes (or social security tax liability) anticipated by workers, $SSTX_t$. That is,

$$SSWN_t = SSWG_t - SSTX_t \quad .$$

Feldstein computes the social security tax liability for any year by summing the tax liability of current working men and working women.

The logic of the calculations can be illustrated by considering Feldstein's computation of SSW for young (aged less than 65) workers. Gross social security wealth for such workers is computed as

$$SSWG_{s,t} = \sum_{a=14}^{64} (W_{s,a,t}/P_{s,a}) \sum_{j=65}^{100} (B_{s,a,j} \; S_{s,a,j})/(1+r)^{j-a} \quad .$$

Similarly, social security tax liability is computed as

$$SSTX_{s,t} = \sum_{a=14}^{64} W_{s,a,t} \sum_{j=a}^{64} (T_{s,a,j}\ S_{s,a,j})/(1+r)^{j-a} \quad ,$$

where

$SSWG_{s,t}$ = gross social security wealth for young workers in year t by sex s,

$SSTX_{s,t}$ = social security tax liability for young workers in year t by sex s,

$W_{s,a,t}$ = number of workers with covered earnings by sex s and age a in year t,

$p_{s,a}$ = labor force participation adjustment factor by sex s and age a (constant over time),

$B_{s,a,j}$ = benefit anticipated at age j for person of sex s and current age a,

$T_{s,a,j}$ = OASI tax payment (employee plus employer) anticipated at age j by worker of sex s and current age a,

$S_{s,a,j}$ = probability of person age a surviving to age j by sex s, and

r = annual real interest rate (constant over time).

Feldstein estimates the number of persons who will eventually be entitled to a social security benefit by the number of current workers adjusted for labor force participation.[4/] Only current workers are assumed to pay future taxes, without adjustment for labor force participation.

The typical worker is assumed to project future benefits at age j based on (i) the expected ratio of benefits per beneficiary to per capita disposable income $b_{s,t+j-a}$; and (ii) expected per capita disposable income, y_{t+j-a}, where real disposable income is assumed to grow at rate g per year. Thus,

$$B_{s,a,j} = b_{s,t+j-a}\, y_{t+j-a} \text{ where } y_{t+j-a} = y_t(1+g)^{j-a} .$$

Future taxes at age j are projected similarly, based on the expected ratio of social security taxes per covered worker to per capita disposable income, $\Theta_{s,t+j-a}$. That is,

$$T_{s,a,j} = \Theta_{s,t+j-a}\, y_{t+j-a} \text{ where, again, } y_{t+j-a} = y_t(1+g)^{j-a} .$$

A critical assumption is how workers perceive $b_{s,t+j-a}$, the ratio of benefits to per capita disposable income, and $\Theta_{s,t+j-a}$, the ratio of taxes to per capita disposable income. For benefits, Feldstein assumes that the expected ratio is constant by sex, i.e., $b_{s,t+j-a} = b_s$. Based on the average relationship for 1940-71, b_s is set at .41 for men and .26 for women. Noting that the values of $\Theta_{s,t}$ have been rising in an irregular pattern since 1937, Feldstein assumes that workers correctly foresaw the changes in $\Theta_{s,t}$ before 1971 and assumed that after 1971, $\Theta_{s,t}$ would remain at 1971 levels.

The calculation of social security wealth for retirees and other workers is analogous. Gross wealth of wives and widows is based on the gross wealth of men. Feldstein assumes that one-third of the wives and widows of workers will receive benefits on own account which exceed the dependent wife or surviving widow benefit.[5/]

Feldstein's social security wealth variable is an estimate of potential wealth, conditional on retiring at age 65 (or for workers older than 65, at next birthday). Thus, the coefficient of social security wealth in the consumer expenditure function is intended to measure both the "asset substitution effect" and "retirement effect" of social security.

4. Replicating Feldstein's Social Security Wealth Series

The first step in our analysis was to replicate Feldstein's social security wealth series. Based on published and unpublished sources, we tried to reproduce Feldstein's algorithm as closely as possible. The results of this replication using a real interest rate of 3 percent are shown in Table 1. A complete description of the replication algorithm is given in Appendix A.

For gross wealth, we track Feldstein's series fairly well until 1956;[6/] but beginning in 1957, the Feldstein series grows much more rapidly, and by 1974 exceeds the replica series by $703 billion, or 37 percent. Our tax series is fairly close to Feldstein's but declines relatively over the period 1937 to 1974. As a result, the replica net wealth series tracks Feldstein's series fairly well until 1956, and beginning in 1957, the two series diverge considerably.

We believe that there is a reasonable explanation for the difference between the tax series. In constructing his tax series, Feldstein projected that the ratio of taxes to disposable income would level off after 1971. In extending the series we project that this tax ratio levels off after 1977. Since the tax ratio for 1977 is below the ratio for 1971, this tends to depress the replica tax series relative to the Feldstein tax series, with the importance of the effect growing over the 1937-77 period.

We could not initially identify the reason for the divergence between the two gross wealth series. Several months ago, we sent Professor Feldstein a detailed preliminary version of the algorithm and data described in Appendix A, with a request that he comment on the difference between the series. We were informed only recently that the difference was due to a programming error. Correction of this error results in a series which is quite close to our replica series. Appendix E, Table E.2, compares Feldstein's own corrected gross wealth series with our replica series.[7/]

Regression results comparing the Feldstein specification using our replica series with those using the original Feldstein series are shown in Table 2.[8/] The specification is the same as Feldstein [1978]. The dependent variable is consumer expenditure, C. Explanatory variables are current disposable income, YD, lagged disposable income, YD_{-1}, retained earnings (including capital consumption and inventory valuation adjustments), RE, household wealth, HW, and social security wealth, SSW. Appendix E, Table E.1, provides a description of variables other than SSW and a listing of their values.

The differences between regressions using the original and replica Feldstein series are dramatic. For the full period, 1930 to 1974 (excluding the war years), the coefficient for gross social security wealth falls from .026 to .011 and is insignificant. For net wealth, the coefficient drops from .037 to .009 and the t-ratio is only .5.

Even if we accept these statistically insignificant parameter estimates for the full period, the implied effect on personal saving would be considerably smaller than the effect alleged by Feldstein. Using Feldstein's original gross series, in 1974 personal saving would be reduced by $68.0 billion, or 52.6 percent of potential saving of $129.3 billion (actual saving of $61.3 billion plus $68.0 billion of foregone saving). Using our gross replica series, personal saving would be reduced by $21.0 billion, or 25.5 percent of potential saving of $82.3 billion. Using our net replica series, personal saving would be reduced by $8.5 billion or 12.2 percent of potential saving of $69.8 billion.

For the post-war period, 1947 to 1974, the results are more striking. Using the replica variable, the coefficients on both gross and net social security wealth are negative and significant.[9/] A negative coefficient is consistent with the extended life cycle hypothesis. That is, for this specification, the coefficient of SSW is intended to measure both the asset substitution and retirement effects of social security. If the retirement effect is larger than the asset substitution effect, then the SSW coefficient will be negative.

The absolute size of the estimated coefficient is, however, implausible. The coefficient of gross SSW implies that, in the absence of social security, real personal saving in 1974 would be $114.8 billion lower; the net wealth coefficient implies that saving would be reduced by $89.9 billion. This implies the absurd result that saving would be negative in the absence of social security. More likely, the SSW variable is measuring the effect of some omitted variable or a structural change in the post-war period. But clearly, the results using the Feldstein replica variables do not provide statistically significant support for the hypothesis that social security decreased personal saving.

5. Social Security Wealth Using Alternative Perceptions: Feldstein Replication Algorithm

We now turn to the original purpose of our paper--to see how the estimated effect of social security wealth on consumer expenditures is affected by substituting alternative benefit and tax perception assumptions in the Feldstein algorithm.

Feldstein [1974, p. 911] explains his benefit perception assumption as follows:

> "...In estimating the average value of future benefits for a single surviving annuitant, it would be wrong to assume that the schedule of benefits provided by law in year t would remain in effect. The history of social security shows continually rising benefit levels, a fact that individuals no doubt perceive when they contemplate the order of magnitude of their own benefits at retirement age. The ratio of annual benefits for retired workers (excluding dependents' benefits) to per capita disposable income has varied without any trend around a mean level of 0.41..."

Figure 1 plots the ratio of benefits per beneficiary to disposable income per capita for men and for women for the period 1940-

1977. Panel 1.1 shows benefits in current payment status; panel 1.2 shows new benefit awards. Whether or not one perceives a trend in the data, it is clear that the ratio shows considerable variation. Whether individuals adapted their benefit expectations to this variation, ignored it, or formed their expectations in entirely different ways is clearly open to speculation. Thus, it is important to examine the sensitivity of estimated social security wealth effects to the underlying perception assumptions.

Feldstein [1974, pp. 912-913] uses a different assumption for taxes:

> "...A worker who contemplates his future social security taxes recognizes that they will rise because of increases in both the tax rate and the level of taxable earnings. For simplicity, we combine these and assume that the individual forecasts the ratio of social security taxes per covered worker to per capita disposable income, Θ_t .... The value of Θ_t has been rising in an irregular pattern since the introduction of social security and in 1971 reached approximately 0.15 for males and 0.07 for females. The current calculations assume that the individuals correctly foresaw the changes in Θ_t before 1971 and assumed that after 1971 the Θ_t's would remain at the 1971 levels."

These assumptions are extremely questionable. Unlike benefits, workers have some current knowledge of the amount of social security taxes they are paying. How they project future taxes is difficult to guess. Do they assume that covered earnings and the tax rate will remain constant as they did from 1937 to 1951? Or do they forecast that there will be periodic increases in covered earnings and the tax rate? Are scheduled changes in contribution rates taken into consideration? It is evident that there are many reasonable assumptions that could be made. The sensitivity of coefficient estimates to alternative perception assumptions is an interesting and important question.

We now present a brief description of the benefit and tax perceptions that we examine.[10/] First, in computing gross social security wealth, we consider 10 benefit perceptions. Each describes a different method of determining the expected benefit ratio (benefit per beneficiary/disposable income per capita). Real disposable income per capita is assumed to grow at constant rate g in all cases, following the Feldstein assumption. For current non-beneficiaries aged a in year t, then, the expected benefit at entitlement age j is computed as the product of the expected benefit ratio and expected disposable income per capita, $y_t(1+g)^{j-a}$. The expected pattern of benefits after entitlement is discussed separately for each of the alternative perceptions.

Perception 1 is the Feldstein perception and assumes that individuals base the anticipated benefit ratio on some average over the period of analysis. Following Feldstein, we set the average benefit ratio, $\bar{b}$, equal to .41 for men and .256 for women. After entitlement, real benefits are assumed to grow at rate g. This series is the replica gross wealth series discussed in the previous section.

Perception 2 assumes that individuals expect the future benefit ratio to equal the current benefit ratio. Real benefits are assumed to grow at rate g after entitlement.

Perceptions 3, 4, and 5 assume that individuals consider both the past history and the current value of the benefit ratio, and that the formation of these perceptions is described by an adaptive expectations process. That is, the expected benefit ratio $\hat{b}_t$ is given by

$$\hat{b}_t = \delta\hat{b}_{t-1} + (1-\delta)b_t \quad .$$

We arbitrarily assume that for perception 3, $\delta = .25$; for perception 4, $\delta = .5$; and for perception 5, $\delta = .75$. After entitlement, real benefits are assumed to grow at rate g.

Perception 6 is a benefit perception analogous to Feldstein's tax perception. Workers are assumed to correctly anticipate changes in benefit ratios at retirement up to 1977 (the last year for which data are available) and, after 1977, anticipate that benefit ratios remain at 1977 levels. After retirement, individuals are assumed to correctly anticipate legislated and automatic increases in benefit levels up to 1980 (the last available year for data) and, after 1980, anticipate constant real benefit levels.

Perception 7 uses projections of benefits in current payment status made by the SSA Office of the Actuary to predict future benefit ratios. Periodically, generally following major changes in the Social Security Act, the Actuary publishes long-range cost estimates analyzing the effect of such changes. Since these estimates reflect a given law and are based on a level wage assumption, changes in benefits over time primarily reflect the interaction of the benefit formula with rising average lifetime earnings resulting from the increase in the maximum taxable wage.[11] Perception 7 uses the last available projection by the Actuary to adjust current benefit ratios;

i.e., current ratios for both workers and retirees are assumed to follow the same future pattern as the benefit ratios projected by the Actuary.

Perceptions 8, 9, and 10 are equivalent to perceptions 1, 2, and 4, respectively, except that workers and current beneficiaries are assumed to anticipate that post-entitlement benefits will simply be maintained in real terms and will not grow as productivity increases. Over much of the history of social security, post-entitlement benefit levels grew only a bit more than the price level. Perceptions 8-10, then, reflect cases where individuals expect currently anticipated benefit <u>ratios</u> at entitlement and real post-entitlement benefit <u>levels</u> to remain constant.

Perception 8 corresponds to perception 1, so that the benefit ratio at entitlement is expected to be .41 for men and .256 for women in all periods. Perception 9 corresponds to perception 2, so that the current benefit ratio is assumed to apply at all future dates of entitlement. Perception 10 corresponds to the adaptive expectations perception 4, so that the currently expected benefit ratio, $\hat{b}_t = .5\hat{b}_{t-1} + .5b_t$, is assumed to apply at all future dates of entitlement. (Corresponding adapative expectations cases with $\delta = .25$ and $\delta = .75$ were not calculated.) In the discussion below, benefit perceptions 8, 9, and 10 are referred to as "decoupled" variants of perceptions 1, 2, and 4, respectively.

We consider seven tax perceptions. Each describes a different method of determining the expected tax ratio (tax on median earnings by sex/disposable income per capita). As before, real disposable income per capita is assumed to grow at rate g. For a worker currently aged a in year t, then, expected tax payments at age j are computed as the product of the expected tax ratio and expected disposable income per capita, $y_t(1+g)^{j-a}$. The seven tax perceptions are analogous to benefit perceptions 1 to 7.

Under perception 1, workers project the tax ratio to be constant over time and equal to the average ratio over the period 1937-77. This corresponds to Feldstein's assumption for benefits. Under perception 2, the current tax ratio is assumed to apply to all future periods. This is consistent with workers assuming that taxable earnings per worker grow at the same rate as disposable income per capita, and that statutory tax rates will remain constant.

Perceptions 3 to 5 assume that workers form their expectations about future tax ratios adaptively. The expected tax ratio is given by $\hat{\Theta}_t = \delta\hat{\Theta}_{t-1} + (1-\delta)\Theta_t$. As before, δ = .25, .50, .75 for perceptions 3, 4, and 5 respectively.

Perception 6 corresponds to Feldstein's tax perception--workers correctly foresee changes in the tax ratio up to 1977, and after 1977 expect the tax ratio to remain constant at the 1977 level. This is the replica tax liability series discussed in the previous section.

Perception 7 uses an approach similar to the actuarial benefit perception 7. Instead of using ratios projected by the Actuary to adjust current tax ratios, however, tax perception 7 uses the currently legislated schedule of OASI statutory tax rate changes; i.e., current tax ratios are assumed to follow the same future pattern as currently legislated changes in statutory tax rates.

In constructing net wealth, we assume, with one important exception, that individuals use corresponding perceptions. For example, if they base their perception of future benefit ratios on current values, they similarly base their perception of future tax ratios on current values.[12/] The important exception is net wealth perception 11, which bases gross wealth on an average benefit ratio (perception 1) and the tax liability on perfectly forecast tax ratios (perception 6). This, of course, corresponds to Feldstein's construction of net social security wealth and is our replica net wealth series.

The perception of benefits and taxes is the only assumption from the Feldstein algorithm modified in estimating social security wealth. Otherwise, all assumptions correspond to our replicated version of Feldstein's social security wealth.

Gross social security wealth, tax liability, and net social security wealth constructed using these alternative perceptions are shown in Appendix A, Tables A.1-A.3. Selected series are plotted in Figure 2. Consumer expenditure functions estimated using these alternative variables appear in Tables 3.1, 3.2, 3.3, and 3.4. In this paper we limit our examination to the Feldstein specification for the periods 1930-74 (excluding 1941-46) and 1947-74.

Regressions using gross wealth for the period 1930-74 are found in Table 3.1. The most important inference is that regardless of which benefit perception is used, the coefficient of social security wealth is insignificant. For the Feldstein replica (perception 1), perfect foresight (perception 6), and decoupled Feldstein replica (perception 8) series, the coefficients are about .01 with t-ratios slightly larger than 1. The remaining perceptions yield coefficients close to zero with miniscule t-ratios. For all but one regression, the coefficient of household wealth is .01, and the t-ratios are in the range 1.2 to 1.8, which is not significant. The coefficients of current and lagged disposable income are significant, with the sum ranging from .78 to .83, which appears reasonable. Retained earnings, which is supposed to measure the permanent component of capital gains has a coefficient of less than .1 and is never significant.

Ignoring the fact that all the social security wealth coefficients are statistically insignificant, these coefficients imply reductions in saving in 1974 ranging from $0.5 to $28.0 billion. The results, however, are clustered. For perceptions 2-5, 7, 9 and 10, the reductions range from $0.5 to $8.3 billion; for perceptions 1, 6 and 8, the reductions range from $21.0 to $28.0 billion. Actual real saving in 1974 was $61.3 billion.

Results for gross social security wealth are changed if we shift to the period 1947-74 (Table 3.2). The coefficient of social security wealth is always negative, and for the Feldstein replica (perception 1), perfect foresight (perception 6), and decoupled Feldstein replica (perception 8) series, is large and significant. The coefficient for household wealth increases, ranging from .014 to .025, and is generally significant. Again, retained earnings has a small and insignificant coefficient in all regressions. Coefficients for current and lagged disposable income are significant, with their sum typically about .84. But for those regressions where social security wealth is negative, large, and significant, the sum of the coefficients of current and lagged disposable income is .96-.97, which is quite large. It appears that for these regressions, there is an inverse relationship between the coefficients of disposable income and social security wealth. The absolute value of these coefficients appears unreasonable.

The negative values for the coefficients of social security wealth in the remaining equations for the 1947-74 period are more difficult to interpret. If we ignore the fact that the coefficients are not significantly different from zero, are negative coefficients of the magnitude -.004 to -.012 meaningful? As noted above, the social security wealth variable was constructed conditional on workers retiring at age 65. The estimated coefficient is intended to measure both the asset substitution and retirement effect. Thus, if the retirement effect exceeds the asset substitution effect, the coefficient of social security wealth will be negative. If one accepts this interpretation, this range of coefficients implies an increase in personal saving in 1974 ranging from $12.2 billion for perception 7 to $33.0 billion for perception 5. Again, actual saving in 1974 was $61.3 billion in 1972 dollars.

Turning to Table 3.3, for the full period, 1930-74, the coefficient of net SSW is sometimes positive, sometimes negative, of small absolute magnitude with very small t-ratios. Ignoring the insignificance of the coefficients, the estimated impact on saving in 1974 ranges from a decrease of $19.0 billion for perception 6 to an increase of $4.0 billion for perception 2.

For the post-war period, 1947-74 (Table 3.4), the coefficient of net SSW is always negative. Absolute values of t-ratios are generally somewhat larger than in equations using gross SSW. Again, for perceptions using the average ratio (perceptions 1 and 8), perfect foresight (perception 6), and the Feldstein replica (perception 11), the coefficient of social security wealth is negative and significant. It is interesting to note that the coefficients for net wealth are generally (algebraically) smaller than those for gross wealth, contrary to Feldstein's original findings. (The Feldstein net wealth replica appears as equations 3.3.11 and 3.4.11.)

The estimated effect on saving in 1974 ranges from a modest increase of $8.0 billion for perception 7 to an unbelievable increase of $89.9 billion for perception 11. If we drop from consideration perceptions 1, 6, 8 and 11, which imply totally implausible increases in saving, the estimated increases range from $8.0 to $22.8 billion.

To summarize our results using the Feldstein construction: whatever perception we consider, for the total period, social security wealth has generally small but insignificant coefficients. For the post-war period, social security wealth generally has small, negative, and insignificant coefficients. (We reject the several large negative, significant coefficients found in the post-war as aberrations.) These findings hold whether we use gross social security wealth or net social security wealth. Clearly, based on wealth series using the Feldstein algorithm, the statistical evidence does not support the hypothesis that social security has reduced saving.

6. An Alternative SSW Algorithm

In trying to replicate the Feldstein social security wealth variable, we became aware of several shortcomings of the construction. We therefore decided to construct an improved algorithm. We were particularly concerned about resolving the following problems:

(1) Feldstein bases his estimate of the number of persons who will become insured for retired worker benefits on the number of covered workers, adjusted for labor force participation. Although sex- and age-specific, Feldstein's participation adjustment is assumed constant over time. This creates a problem, since the relationship between the probability of being in covered employment and the probability of being or becoming insured has changed significantly over time. This reflects changes in labor force participation patterns as well as program changes in coverage and requirements for insured status. Although important for males, the changes have been particularly dramatic for females over the

period of analysis. To take these factors into account, we estimate the number of persons who will be insured for retired worker benefits by multiplying the sex- and age-specific population in a given year by the proportion of such persons projected to be insured at age 65. We base these projections on studies by the Office of the Actuary.[13/] For workers beyond age 65 (age 62 beginning in 1956 for females and 1961 for males), we estimate the number of workers not yet retired as the number of fully insured persons who are not in current payment status. Feldstein bases his estimate on the number of workers of that age with taxable earnings. Since many of these workers are already retired, this results in a substantial overestimate of the amount of social security wealth held by such workers. In addition, the population subgroups used in our construction are adjusted to be consistent with the population used in the National Income and Product Accounts.

(2) Feldstein assumes that 60 percent of men are married with dependent wives, including wives who are eligible for a retired worker benefit but whose dependent wife benefit is larger than her retired worker benefit.[14/] Since 90 percent of men are married, this implies that 30 percent of men are married to wives who receive only retired worker benefits on their own account.

Somewhat surprisingly, there is no published information about the marital status of retired workers. But some data suggest that the proportion of women eligible for retired worker benefits has increased substantially over time.[15/] A corollary proposition is that the proportion of women receiving only a dependent wife benefit has decreased. Our algorithm takes account of these changes.

(3) The Feldstein algorithm bases dependent wife and surviving widow benefits on the man's retirement benefit. As a result, certain inconsistencies arise. For example, beginning in 1957, women were permitted to retire at age 62. Data are available for wives and widows in current payment status, but to avoid double-counting, Feldstein continues to base the number of wives and widows on the number of retired male workers. This procedure misses some women beneficiaries. For similar reasons, Feldstein calculates no wealth for current widows who are not yet beneficiaries. We explicitly base dependent wife and surviving widow benefits on the number of women eligible (or projected to be eligible) for such benefits.

(4) Feldstein implicitly assumes that only persons currently working in covered employment expect to pay future taxes, and that such workers expect to pay taxes continuously until retirement. Our algorithm bases the estimate of future tax liability on the probability of having taxable earnings at each future age. These projected probabilities are based on current cross-section coverage rates disaggregated by sex and age.

(5) Feldstein uses a single life-table for 1959-61. We use life tables for 1929-31, 1939-41, 1949-51, 1959-61, and 1969-71, interpolating for intermediate years.

(6) Feldstein relates benefit and tax perceptions to disposable income; we relate perceptions to average covered earnings per worker.

The latter assumption appears more realistic to us. 16/

To clarify the logic of the calculations using our algorithm, we again consider the computation of social security wealth for young workers. Gross social security wealth for workers aged 15-61 is calculated as

$$SSWG_{s,t} = \sum_{a=15}^{61} N_{s,a,t}\, i_{s,t+65-a,t} \sum_{j=65}^{100} (B_{s,a,j}\, S_{s,a,j})/(1+r)^{j-a} ,$$

where

$N_{s,a,t}$ = population of sex s and age a in year t,

$i_{s,t+65-a,t}$ = probability of persons of sex s and age a in year t being insured at age 65 (in year t+65-a),

$B_{s,a,j}$ = benefit anticipated at age j by a person of sex s and current age a,

$S_{s,a,j}$ = probability of a person of sex s and age a surviving to age j, and

r = annual real interest rate (assumed constant).

The benefit ratios underlying anticipated benefits are estimated using the same 10 perceptions discussed for the Feldstein replica algorithm, except that these perceptions are related to covered earnings per worker instead of disposable income per capita.

The tax liability for workers aged 15-64 is computed as

$$SSTX_{s,t} = \sum_{a=15}^{64} N_{s,a,t} \sum_{j=a}^{64} (c_{s,j,t}\, T_{s,a,j}\, S_{s,a,j})/(1+r)^{j-a},$$

where

$c_{s,j,t}$ = probability of a person of age j and sex s in year t being in covered employment,

$T_{s,a,j}$ = tax payment anticipated at age j by a person of sex s and current age a,

and the remaining variables are as defined above.

Again, the tax ratios underlying anticipated tax payments are estimated using the same 7 perceptions discussed for the Feldstein replica algorithm, except that they are related to covered earnings per worker rather than disposable income per capita.

A complete description of our algorithm is given in Appendix B; tables B.1-B.3 in Appendix B present the gross wealth, tax liability and net wealth series. Table 4 compares these series for perception 2 (current ratios) using the Feldstein (F) construction and the Leimer-Lesnoy (LL) construction.

For perception 2, gross wealth using the LL construction is about 75 percent of gross wealth using the F construction for the first decade, increases to about 95 percent by 1960, and then fluctuates about this level. Although it is difficult to disentangle all interactions, some contributing explanations may be noted. First, except for the early years, projected insured rates for the LL algorithm are greater than insured (coverage) rates for the F algorithm. Second, survival probabilities for the LL algorithm increase over time, while those for the F algorithm are constant. Other things equal, this results in an upward trend for the LL series relative to the F series. Third, for the F construction, dependent wife and surviving widow benefits are approximately a constant percentage of retired male worker benefits. For the LL construction, they decline relatively. This follows from the fact that, over time, an increasing proportion of women earn retirement benefits on their own account under the LL algorithm. Fourth, retirement benefits for active aged workers are much smaller for the LL construction than for the F construction. The LL algorithm uses insured workers not in current payment status; the F algorithm uses covered workers. The latter involves double-counting since many covered workers are receiving retired worker benefits.

The future tax liability in 1937 estimated using the LL algorithm is about 80 percent of the liability estimated using the F algorithm, increases to about 95 percent in the early 1960's and then declines to about 90 percent. Again, part of the explanation lies in the use of different survival probabilities. The remaining differences are undoubtedly explained by different assumptions concerning life-cycle coverage rates. As indicated above, the F algorithm implicitly assumes that the coverage rate for a future age is equal to the coverage rate for the current age. The LL algorithm assumes that the coverage rate for a future age is equal to the coverage rate for current workers of that future age. Much to our surprise, we found in cross-section that, for men, the coverage rate is generally at a maximum between ages 20-29 and then declines; for women, the maximum coverage rate occurs at ages 25-29.

As a result of these relationships between the F and LL gross wealth and future tax liability series for perception 2, the net social security wealth using the LL construction is about 70 percent of the F construction from 1937 to the mid-40's, rises to about 95 percent by 1960, and then approaches 100 percent for the remaining years. The patterns for other perceptions are similar. 17/

Consumer expenditure functions estimated using the LL social security wealth variables appear in Tables 5.1, 5.2, 5.3, and 5.4. Regressions using gross wealth estimated for the period 1930-74 are found in Table 5.1. For this period, the coefficients of gross social security wealth for all perceptions are approximately zero--and so are all t-ratios. The coefficient of household wealth is about .01 and t-ratios are typically about 1.6, not significant. The coefficient of retained earnings is about .09 to .10 and, with t-ratios of 1.1 to 1.2, is not significant. Coefficients of current and lagged disposable income are significant, with the reasonable sum of about .83. The coefficients of SSW imply essentially no effect on saving at all.

When we consider the post-war period (Table 5.2), the coefficient of gross social security wealth becomes negative, as it did for the F equations. For perceptions 2-5, 7, and 9-10, the results are the same as for the corresponding F equations. The coefficient of gross SSW is negative, small and insignificant. For perception 1 (average ratio), perception 6 (perfect foresight), and perception 8 (average ratio, decoupled), the estimated coefficients are again negative and significant. But now, using the LL algorithm, absolute coefficient values are considerably smaller than those estimated using the F algorithm. Considering all perceptions, the coefficients imply a reduction of consumption (increase of saving) of \$14.6 to \$39.8 billion in 1974. These values compare with actual real saving in 1974 of \$61.3 billion. While perhaps implausible, the increase in saving implied by the statistically significant coefficients of social security wealth can no longer be rejected as impossible.

Other coefficients in the 1947-74 gross wealth equations are reasonable. The coefficients for current and lagged disposable income are significant and sum to .83 to .84. The coefficient for household wealth ranges from .015 to .026 and is generally significant. Retained earnings has a small and insignificant coefficient. It is interesting to note that the constant term is not significantly different from zero, which is consistent with the preferred specification according to Barro.[18/]

Regressions using net social security wealth appear in Table 5.3 for the period 1930-74, and in Table 5.4 for the period 1947-74. Estimates are quite similar to those obtained using gross social security wealth. For the full period, the coefficient of net SSW is small, negative, and insignificant. Household wealth has a coefficient of about .01; t-ratios are generally slightly higher than in the gross wealth equations, so that HW is significant using a one-tailed test in half the regressions. Current and lagged disposable income are significant; retained earnings is again small and insignificant.

For the post-war period, the coefficient of net social security wealth ranges from -.005 to -.029. As for gross SSW, the smaller negative coefficients are insignificant; the larger coefficients are significant. These coefficients imply that social security increased real personal saving in 1974 by between $9.9 and $36.5 billion, slightly less than the increases implied by the gross wealth equations for the post-war period. The coefficients of the remaining explanatory variables are about the same in the net SSW equations as in the gross SSW equations.

To summarize: Using the LL construction, whether we use net SSW or gross SSW, whatever perception we adopt, whether we use as the period of estimation the full period, 1930-1974, or the post-war period, the coefficient of social security wealth is never positive and significant. Indeed, for the post-war period, it is negative and sometimes significant. We are skeptical that social security has increased saving; however, using the Feldstein specification and SSW series based on the Leimer-Lesnoy algorithm, we can find no statistically significant evidence to support the view that social security has reduced saving.

7. Conclusions

The time series evidence does not support the hypothesis that the introduction of social security has substantially reduced personal saving in the United States. Feldstein's original construction of social security wealth was flawed by a programming error. If we use a correct replica of his variable, we find that the coefficient of social security wealth is positive but insignificant for the full period, 1930-74, and negative and significant (but implausibly large) for the post-war period, 1947-74.

Our conclusions are unchanged if we modify the Feldstein algoritem to incorporate alternative benefit and tax perceptions. Whether we consider net or gross social security wealth, whether we use as the period of estimation 1930-74 or 1947-74, whatever perception we choose, the coefficient of social security wealth is generally insignificant, and for the post-war period, is negative. The only coefficients that are significant are negative, but of implausible magnitude.

When we use a set of alternative social security wealth variables based upon an improved algorithm of our own construction, the results are similar.[19/] For both net social security wealth and gross social security wealth, for both the full period, 1930-74, and the post-war period, 1947-74, for whatever benefit and tax perception we examine, the story is the same. The coefficient of social security wealth is generally insignificant, and in the post-war period, is negative. For certain perceptions, the coefficient of social security wealth estimated for the post-war period is significant, but negative.

Although the extended life cycle model does imply a negative coefficient for social security wealth if the retirement effect is larger than the asset substitution effect, we are personally skeptical that the introduction of social security increased saving. Most of our results provide no statistically significant support for the hypothesis that social security has had an effect on personal saving, either positive or negative. This interpretation is consistent with Feldstein's extended life cycle theory if the retirement effect is about equal to the asset substitution effect. It is also consistent with the Barro hypothesis that private, voluntary intergenerational transfers offset any potential effect of social security on saving. It is also consistent with the view that the life cycle model provides an inadequate explanation of individual saving behavior.

We again emphasize that our empirical investigation has been limited in this paper to the Feldstein specification of the consumer expenditure function. It is possible that with different specifications, different variable constructions, or different time periods, the results will differ. It is unlikely, however, that additional time series estimates will provide a definitive answer--in part because we simply do not know how individuals perceive their social security wealth and in part because of the inherent difficulties of using time series data.

Table 1

Comparison of Original and Replica
Feldstein Social Security Wealth Series
(Billions of 1972 Dollars)

	Gross Wealth			Tax Liability			Net Wealth		
	Original	Replica	Percent	Original	Replica	Percent	Original	Replica	Percent
1937	156.1	151.5	97.1	82.0	82.9	101.1	74.1	68.6	92.6
1938	139.6	135.8	97.3	74.0	74.8	101.1	65.6	61.0	93.0
1939	230.8	152.0	65.9	87.0	87.6	100.7	143.8	64.4	44.8
1940	256.9	255.8	99.6	99.0	99.8	100.8	157.9	156.0	98.8
1941	335.9	334.4	99.6	136.0	136.8	100.6	199.9	197.6	98.8
1942	427.1	426.1	99.8	173.0	175.1	101.2	254.1	251.0	98.8
1943	447.3	446.8	99.9	177.0	179.0	101.1	270.3	267.8	99.1
1944	444.2	444.1	100.0	174.0	174.8	100.5	270.2	269.3	99.7
1945	438.5	438.0	99.9	177.0	178.0	100.6	261.5	260.0	99.4
1946	453.6	452.5	99.8	201.0	201.1	100.1	252.6	251.4	99.5
1947	432.4	431.0	99.7	198.0	197.7	99.8	234.4	233.3	99.5
1948	452.5	450.7	99.6	213.0	211.7	99.4	239.5	239.0	99.8
1949	431.1	429.1	99.5	204.0	202.4	99.2	227.1	226.6	99.8
1950	477.4	474.6	99.4	231.0	229.2	99.2	246.4	245.4	99.6
1951	585.3	583.1	99.6	273.0	270.8	99.2	312.3	312.3	100.0
1952	612.9	608.2	99.2	288.0	284.1	98.7	324.9	324.1	99.8
1953	645.2	642.4	99.6	306.0	302.0	98.7	339.2	340.3	100.3
1954	639.1	635.5	99.4	302.0	297.6	98.5	337.1	338.0	100.3
1955	738.3	733.8	99.4	347.0	340.5	98.1	391.3	393.2	100.5
1956	793.5	788.8	99.4	374.0	366.2	97.9	419.5	422.6	100.7
1957	860.1	849.3	98.7	409.0	400.5	97.9	451.1	448.7	99.5
1958	876.7	847.0	96.6	409.0	398.4	97.4	467.7	448.5	95.9
1959	943.6	893.3	94.7	440.0	428.2	97.3	503.6	465.1	92.4
1960	979.0	908.0	92.7	452.0	438.9	97.1	527.0	469.1	89.0
1961	1,025.3	933.8	91.1	463.0	448.3	96.8	562.3	485.6	86.4
1962	1,134.9	1,004.0	88.5	491.0	474.1	96.6	643.9	529.8	82.3
1963	1,201.8	1,043.8	86.9	516.0	495.8	96.1	685.8	548.0	79.9
1964	1,334.2	1,129.6	84.7	563.0	539.0	95.7	771.2	590.6	76.6
1965	1,465.7	1,229.6	83.9	621.0	593.0	95.5	844.7	636.6	75.4
1966	1,611.5	1,331.3	82.6	684.0	650.4	95.1	927.5	680.9	73.4
1967	1,728.7	1,406.1	81.3	728.0	689.3	94.7	1,000.7	716.8	71.6
1968	1,847.4	1,479.5	80.1	774.0	729.7	94.3	1,073.4	749.8	69.9
1969	1,951.5	1,539.5	78.9	819.0	769.5	94.0	1,132.5	770.0	68.0
1970	2,065.8	1,606.4	77.8	860.0	799.2	92.9	1,205.8	807.1	66.9
1971	2,163.8	1,659.4	76.7	887.0	826.1	93.1	1,276.8	833.2	65.3
1972	2,331.3	1,762.3	75.6	954.0	883.5	92.6	1,377.3	878.8	63.8
1973	2,590.2	1,929.4	74.5	1,057.0	975.6	92.3	1,533.2	953.8	62.2
1974	2,615.6	1,912.5	73.1	1,059.0	966.6	91.3	1,556.6	945.9	60.8

Table 2.--Consumer Expenditure Functions Using Original and Replicated Feldstein Social Security Wealth Variables

Equation	Period of Estimation*	SSW Concept	Source	YD	YD_{-1}	RE	W	SSW	Constant	$\bar{R}^2$	Durbin-Watson Statistic	Sum of Squared Residuals
(2.1)	1930-1974	Gross	Feldstein	.600 (9.84)	.114 (2.83)	.184 (2.45)	.005 (.83)	.026 (2.82)	354 (4.29)	.999	1.56	14,290
(2.2)	1930-1974	Gross	Replication	.688 (12.17)	.098 (2.15)	.057 (.72)	.010 (1.77)	.011 (1.06)	186 (3.20)	.999	1.39	17,140
(2.3)	1930-1974	Net	Feldstein	.611 (10.37)	.126 (3.11)	.213 (2.64)	.003 (.51)	.037 (2.78)	337 (4.33)	.999	1.57	14,370
(2.4)	1930-1974	Net	Replication	.707 (13.08)	.104 (2.24)	.067 (.79)	.010 (1.72)	.009 (.50)	151 (3.13)	.999	1.38	17,590
(2.5)	1947-1974	Gross	Feldstein	.635 (4.31)	.163 (1.48)	.151 (.94)	.012 (1.01)	.004 (.10)	154 (.38)	.998	1.46	11,880
(2.6)	1947-1974	Gross	Replication	.765 (9.64)	.208 (2.92)	.118 (.88)	.025 (2.91)	-.060 (-2.96)	-166 (-1.68)	.998	1.94	8,495
(2.7)	1947-1974	Net	Feldstein	.551 (5.14)	.094 (.95)	.145 (.95)	.007 (.73)	.059 (1.32)	482 (1.72)	.998	1.71	11,010
(2.8)	1947-1974	Net	Replication	.729 (10.06)	.200 (2.87)	.151 (1.15)	.024 (2.86)	-.095 (-3.13)	-79 (-1.17)	.998	1.88	8,226

*1930-1974 regressions exclude the years 1941-1946. The Durbin-Watson statistic is adjusted for this gap.

Figures in parentheses are t-statistics.

Table 3.1.--Consumer Expenditure Functions Estimated Using SSW Variables With Alternative Perceptions: Feldstein Algorithm

Gross Social Security Wealth

1930-1974 excluding 1941-1946*

Equation	Perception	YD	YD_{-1}	RE	HW	SSWG	Constant	$\bar{R}^2$	Durbin-Watson Statistic	Sum of Squared Residuals
(3.1.1)	Feldstein replication	.688 (12.17)	.098 (2.15)	.057 (.72)	.010 (1.77)	.011 (1.06)	186 (3.20)	.999	1.39	17,140
(3.1.2)	Current benefit ratio	.717 (13.11)	.110 (2.46)	.090 (1.13)	.010 (1.63)	.0002 (.04)	132 (2.57)	.999	1.37	17,730
(3.1.3)	Adaptive expectations δ = .25	.716 (13.23)	.110 (2.46)	.090 (1,15)	.010 (1.61)	.0003 (.06)	133 (2.56)	.999	1.37	17,730
(3.1.4)	Adaptive expectations δ = .50	.715 (13.42)	.110 (2.46)	.091 (1.18)	.010 (1.54)	.0006 (.11)	136 (2.50)	.999	1.37	17,720
(3.1.5)	Adaptive expectations δ = .75	.707 (13.37)	.110 (2.46)	.095 (1.27)	.008 (1.18)	.003 (.55)	163 (2.52)	.999	1.37	17,570
(3.1.6)	Perfect foresight	.679 (11.85)	.096 (2.14)	.063 (.84)	.010 (1.75)	.011 (1.25)	203 (3.21)	.999	1.37	16,920
(3.1.7)	Actuarial projection	.714 (13.17)	.110 (2.46)	.092 (1.20)	.010 (1.65)	.0007 (.18)	137 (3.08)	.999	1.35	17,710
(3.1.8)	Feldstein replication, decoupled	.688 (12.16)	.098 (2.16)	.058 (.73)	.010 (1.77)	.013 (1.06)	186 (3.20)	.999	1.39	17,150
(3.1.9)	Current benefit ratio, decoupled	.717 (13.11)	.110 (2.46)	.090 (1.13)	.010 (1.63)	.0002 (.04)	132 (2.58)	.999	1.37	17,730
(3.1.10)	Adaptive expectations δ = .5, decoupled	.715 (13.42)	.110 (2.46)	.091 (1.18)	.010 (1.54)	.0007 (.12)	136 (2.50)	.999	1.37	17,720

*Excludes the years 1941-46. The Durbin-Watson statistic is adjusted for this gap.
Figures in parentheses are t-statistics.

Table 3.2 --Consumer Expenditure Functions Estimated Using SSW Variables with Alternative Perceptions: Feldstein Algorithm

Gross Social Security Wealth
1947-1974

Equation	Perception	YD	YD_{-1}	RE	HW	SSW	Constant	$\bar{R}^2$	Durbin-Watson Statistic	Sum of Squared Residuals
(3.2.1)	Feldstein replication	.765 (9.64)	.208 (2.92)	.118 (.88)	.025 (2.91)	-.060 (-2.96)	-166 (-1.68)	.998	1.94	8,495
(3.2.2)	Current benefit ratio	.672 (8.36)	.169 (2.12)	.068 (.41)	.017 (1.86)	-.007 (-1.32)	47 (.78)	.998	1.68	11,010
(3.2.3)	Adaptive expectations δ = .25	.669 (8.39)	.171 (2.15)	.075 (.47)	.018 (1.90)	-.007 (-1.35)	44 (.71)	.998	1.66	10,980
(3.2.4)	Adaptive expectations δ = .50	.664 (8.46)	.175 (2.22)	.085 (.54)	.019 (1.99)	-.008 (-1.44)	32 (.49)	.998	1.64	10,860
(3.2.5)	Adaptive expectations δ = .75	.654 (8.46)	.193 (2.41)	.113 (.75)	.023 (2.13)	-.012 (-1.54)	-14 (-.16)	.998	1.61	10,730
(3.2.6)	Perfect foresight	.747 (8.93)	.209 (2.76)	.104 (.73)	.023 (2.54)	-.038 (-2.38)	-141 (-1.27)	.998	1.92	9,452
(3.2.7)	Actuarial projection	.666 (8.15)	.172 (2.12)	.123 (.78)	.014 (1.60)	-.004 (-.99)	73 (1.40)	.998	1.69	11,380
(3.2.8)	Feldstein replication, decoupled	.765 (9.64)	.207 (2.91)	.117 (.87)	.025 (2.90)	-.070 (-2.96)	-164 (-1.67)	.998	1.94	8,502
(3.2.9)	Current benefit ratio, decoupled	.672 (8.35)	.169 (2.12)	.068 (.42)	.017 (1.86)	-.008 (-1.32)	47 (.78)	.998	1.67	11,010
(3.2.10)	Adaptive expectations δ = .5, decoupled	.664 (8.46)	.175 (2.21)	.085 (.54)	.019 (1.99)	-.009 (-1.44)	32 (.49)	.998	1.64	10,870

Figures in parentheses are t-statistics.

Table 3.3.--Consumer Expenditure Functions Estimated Using SSW Variables with Alternative Perceptions: Feldstein Algorithm

Net Social Security Wealth

1930-1974 excluding 1941-1946*

Equation	Perception	YD	YD_{-1}	RE	HW	SSW	Constant	$\bar{R}^2$	Durbin - Watson Statistic	Sum of Squared Residuals
(3.3.1)	Benefits: average ratio Taxes: average ratio	.710 (13.04)	.106 (2.33)	.079 (1.00)	.009 (1.56)	.005 (.34)	150 (2.34)	.999	1.37	17,670
(3.3.2)	Benefits: current ratio Taxes: current ratio	.725 (13.95)	.111 (2.49)	.084 (1.11)	.010 (1.62)	-.002 (-.45)	120 (3.51)	.999	1.40	17,620
(3.3.3)	Benefits: adaptive expectations δ = .25 Taxes: adaptive expectations δ = .25	.723 (14.03)	.111 (2.48)	.086 (1.15)	.010 (1.65)	-.002 (-.37)	122 (3.49)	.999	1.39	17,650
(3.3.4)	Benefits: adaptive expectations δ = .50 Taxes: adaptive expectations δ = .50	.721 (14.16)	.111 (2.48)	.089 (1.19)	.010 (1.68)	-.001 (-.28)	123 (3.39)	.999	1.38	17,680
(3.3.5)	Benefits: adaptive expectations δ = .75 Taxes: adaptive expectations δ = .75	.717 (14.22)	.110 (2.44)	.088 (1.16)	.010 (1.58)	.0002 (.034)	132 (3.06)	.999	1.37	17,730
(3.3.6)	Benefits: perfect foresight Taxes: perfect foresight	.692 (12.34)	.099 (2.17)	.065 (.84)	.010 (1.73)	.012 (.95)	181 (3.07)	.999	1.37	17,250
(3.3.7)	Benefits: actuarial projection Taxes: legislated	.722 (13.32)	.110 (2.45)	.084 (1.07)	.010 (1.62)	-.001 (-.23)	125 (3.52)	.999	1.40	17,700
(3.3.8)	Benefits: average ratio, decoupled Taxes: average ratio	.714 (13.29)	.108 (2.37)	.085 (1.08)	.010 (1.56)	.003 (.15)	139 (2.17)	.999	1.37	17,720
(3.3.9)	Benefits: current ratio, decoupled Taxes: current ratio	.725 (14.09)	.112 (2.50)	.084 (1.13)	.009 (1.58)	-.003 (-.54)	120 (3.83)	.999	1.41	17,570
(3.3.10)	Benefits: adaptive δ = .5, decoupled Taxes: adaptive expectations δ = .5	.721 (14.27)	.111 (2.49)	.090 (1.21)	.010 (1.68)	-.002 (-.35)	123 (3.70)	.999	1.39	17,660
(3.3.11)	Feldstein replication	.707 (13.08)	.104 (2.24)	.067 (.79)	.010 (1.72)	.009 (.50)	151 (3.13)	.999	1.38	17,590

*The Durbin-Watson statistic is adjusted for this gap.
Figures in parentheses are t-statistics.

Table 3.4.--Consumer Expenditure Functions Estimated Using SSW Variables with Alternative Perceptions: Feldstein Algorithm

Net Social Security Wealth

1947-1974

Equation	Perception	YD	YD_{-1}	RE	HW	SSW	Constant	$\bar{R}^2$	Durbin-Watson Statistic	Sum of Squared Residuals
(3.4.1)	Benefits: average ratio	.720	.195	.140	.027	-.062	-120	.998	1.87	8,417
	Taxes: average ratio	(9.93)	(2.78)	(1.05)	(3.04)	(-3.01)	(-1.45)			
(3.4.2)	Benefits: current ratio	.667	.164	.057	.016	-.008	80	.998	1.72	10,800
	Taxes: current ratio	(8.49)	(2.07)	(.35)	(1.83)	(-1.49)	(2.12)			
(3.4.3)	Benefits: adaptive expectations δ = .25	.663	.165	.065	.017	-.008	79	.998	1.69	10,840
	Taxes: adaptive expectations δ = .25	(8.46)	(2.09)	(.40)	(1.87)	(-1.46)	(2.04)			
(3.4.4)	Benefits: adaptive expectations δ = .50	.655	.169	.075	.019	-.009	73	.998	1.67	10,780
	Taxes: adaptive expectations δ = .50	(8.45)	(2.14)	(.47)	(1.98)	(-1.50)	(1.79)			
(3.4.5)	Benefits: adaptive expectations δ = .75	.641	.181	.102	.023	-.013	43	.998	1.64	10,490
	Taxes: adaptive expectations δ = .75	(8.38)	(2.32)	(.68)	(2.22)	(-1.71)	(.84)			
(3.4.6)	Benefits: perfect foresight	.720	.204	.118	.022	-.049	-83	.998	1.88	9,652
	Taxes: perfect foresight	(9.00)	(2.68)	(.82)	(2.40)	(-2.26)	(-.90)			
(3.4.7)	Benefits: actuarial projection	.670	.165	.112	.013	-.004	91	.998	1.67	11,430
	Taxes: legislated	(8.04)	(2.03)	(.70)	(1.45)	(-.93)	(2.27)			
(3.4.8)	Benefits: average ratio, decoupled	.711	.191	.143	.027	-.073	-107	.998	1.85	8,446
	Taxes: average ratio	(9.92)	(2.73)	(1.07)	(3.03)	(-2.99)	(-1.36)			
(3.4.9)	Benefits: current ratio	.666	.162	.056	.016	-.010	88	.998	1.73	10,770
	Taxes: current ratio	(8.50)	(2.06)	(.34)	(1.81)	(-1.51)	(2.52)			
(3.4.10)	Benefits: adaptive δ = .5, decoupled	.654	.167	.073	.018	-.010	82	.998	1.67	10,770
	Taxes: adaptive expectations δ = .5	(8.44)	(2.12)	(.46)	(1.97)	(-1.51)	(2.20)			
(3.4.11)	Feldstein replication	.729	.200	.151	.024	-.095	-79	.998	1.88	8,226
		(10.06)	(2.87)	(1.15)	(2.86)	(-3.13)	(-1.17)			

Figures in parentheses are t-statistics.

Table 4

Comparison of Social Security Wealth Series for Perception 2
Using Feldstein and Leimer-Lesnoy Algorithms

	Gross Wealth			Tax Liability			Net Wealth		
	Feldstein	Leimer -Lesnoy	Percent	Feldstein	Leimer -Lesnoy	Percent	Feldstein	Leimer -Lesnoy	Percent
1937	192.9	136.6	70.8	42.3	33.3	78.6	150.7	103.4	68.6
1938	173.2	132.6	76.6	35.5	29.2	82.2	137.6	103.4	75.1
1939	193.9	148.1	76.4	40.4	32.8	81.2	153.5	115.3	75.1
1940	319.6	245.6	76.8	43.7	35.9	82.1	275.8	212.2	76.9
1941	346.2	241.7	69.8	53.4	43.0	80.4	292.8	200.1	68.4
1942	369.3	240.5	65.1	60.0	49.8	83.0	309.4	192.0	62.0
1943	360.5	240.3	66.7	67.4	59.4	88.1	293.0	182.1	62.2
1944	334.1	239.2	71.6	68.1	63.5	93.3	266.0	176.9	66.5
1945	327.6	244.8	74.7	61.6	56.3	91.5	266.0	189.0	71.0
1946	322.4	238.4	74.0	63.8	54.5	85.3	258.6	184.3	71.3
1947	305.4	230.5	75.5	71.2	60.7	85.3	234.3	170.2	72.7
1948	302.2	231.5	76.6	75.4	64.4	85.4	226.7	167.4	73.8
1949	306.3	249.2	81.3	72.8	63.7	87.5	233.5	185.8	79.6
1950	367.0	293.7	80.0	118.0	102.2	86.6	249.0	191.9	77.1
1951	492.5	441.1	89.6	140.8	125.6	89.2	351.7	316.0	89.9
1952	674.7	607.1	90.0	149.5	134.5	89.9	525.2	473.4	90.1
1953	758.4	683.2	90.1	159.4	144.1	90.4	598.9	540.2	90.2
1954	806.7	759.6	94.2	204.1	188.7	92.5	602.6	572.3	95.0
1955	1,013.9	944.6	93.2	220.8	207.6	94.0	793.1	738.7	93.1
1956	1,043.4	965.7	92.5	238.6	225.8	94.6	804.8	741.4	92.1
1957	1,089.9	990.9	90.9	249.7	229.0	91.7	840.2	762.9	90.8
1958	1,167.1	1,096.0	93.9	240.1	225.6	94.0	927.0	871.8	94.0
1959	1,297.0	1,218.3	93.9	291.0	272.7	93.7	1,006.0	947.0	94.1
1960	1,303.4	1,246.3	95.6	361.2	341.7	94.6	942.2	906.7	96.2
1961	1,261.1	1,220.1	96.8	364.8	346.8	95.1	896.3	875.6	97.7
1962	1,349.8	1,304.7	96.7	401.9	385.9	96.0	947.9	921.0	97.2
1963	1,399.6	1,357.3	97.0	488.5	470.7	96.4	911.1	888.8	97.6
1964	1,445.3	1,399.1	96.8	520.3	500.6	96.2	925.0	900.7	97.4
1965	1,571.2	1,496.9	95.3	557.5	530.3	95.1	1,013.7	969.0	95.6
1966	1,701.3	1,592.3	93.6	630.3	591.8	93.9	1,071.0	1,003.0	93.6
1967	1,678.6	1,564.0	93.2	672.4	631.0	93.8	1,006.2	935.6	93.0
1968	1,917.6	1,784.9	93.1	665.2	619.3	93.1	1,252.4	1,168.6	93.3
1969	1,923.9	1,782.5	92.6	787.2	726.6	92.3	1,136.7	1,058.8	93.1
1970	2,177.2	2,037.4	93.6	779.3	725.3	93.1	1,397.9	1,315.3	94.1
1971	2,372.0	2,254.7	95.1	874.2	815.2	93.3	1,497.8	1,442.9	96.3
1972	2,553.1	2,406.7	94.3	930.4	855.7	92.0	1,622.8	1,554.5	95.8
1973	2,865.0	2,715.8	94.8	1,051.4	948.6	90.2	1,813.6	1,770.9	97.6
1974	3,026.9	2,887.3	95.4	1,051.8	946.2	90.0	1,975.1	1,945.0	98.5
1975	3,070.9	2,978.6	97.0	1,005.0	912.9	90.8	2,065.9	2,069.3	100.2
1976	3,215.3	3,090.7	96.1	1,065.6	960.0	90.1	2,149.7	2,134.5	99.3
1977	3,387.8	3,234.2	95.5	1,106.0	955.0	86.4	2,281.8	2,282.8	100.0

Note: Monetary aggregates are in billions of 1972 dollars.

Table 5.1.--Consumer Expenditure Functions Estimated Using SSW Variables with Alternative Perceptions: Leimer-Lesnoy Algorithm

Gross Social Security Wealth

1930-1974 excluding 1941-1946*

Equation	Perception	YD	YD_{-1}	RE	HW	SSW	Constant	$\bar{R}^2$	Durbin-Watson Statistic	Sum of Squared Residuals
(5.1.1)	Average benefit ratio	.720 (14.20)	.112 (2.47)	.098 (1.19)	.010 (1.68)	-.002 (-.26)	120 (2.65)	.999	1.38	17,690
(5.1.2)	Current benefit ratio	.720 (13.45)	.110 (2.46)	.085 (1.07)	.010 (1.64)	-.001 (-.13)	125 (2.40)	.999	1.38	17,720
(5.1.3)	Adaptive expectations δ = .25	.719 (13.59)	.110 (2.46)	.087 (1.11)	.010 (1.61)	-.0003 (-.08)	127 (2.44)	.999	1.38	17,720
(5.1.4)	Adaptive expectations δ = .50	.718 (13.79)	.110 (2.46)	.088 (1.16)	.010 (1.56)	-.0001 (-.02)	130 (2.44)	.999	1.37	17,730
(5.1.5)	Adaptive expectations δ = .75	.715 (13.92)	.109 (2.45)	.089 (1.20)	.009 (1.35)	.001 (.20)	141 (2.38)	.999	1.37	17,710
(5.1.6)	Perfect foresight	.718 (13.97)	.110 (2.44)	.090 (1.14)	.010 (1.60)	-.0004 (-.07)	127 (2.44)	.999	1.37	17,720
(5.1.7)	Actuarial projection	.718 (13.41)	.110 (2.46)	.089 (1.15)	.010 (1.64)	-.0000 (-.01)	130 (2.82)	.999	1.37	17,730
(5.1.8)	Average benefit ratio, decoupled	.720 (14.22)	.112 (2.47)	.099 (1.19)	.010 (1.68)	-.002 (-.27)	120 (2.68)	.999	1.38	17,690
(5.1.9)	Current benefit ratio, decoupled	.720 (13.48)	.110 (2.46)	.085 (1.08)	.010 (1.64)	-.001 (-.13)	124 (2.42)	.999	1.38	17,720
(5.1.10)	Adaptive expectations δ = .5, decoupled	.718 (13.81)	.110 (2.46)	.088 (1.16)	.010 (1.56)	-.0002 (-.03)	129 (2.46)	.999	1.37	17,730

*The Durbin-Watson statistic is adjusted for this gap.

Figures in parentheses are t-statistics.

Table 5.2.--Consumer Expenditure Functions Estimated Using SSW Variables with Alternative Perceptions: Leimer-Lesnoy Algorithm

Gross Social Security Wealth

1947-1974

Equation	Perception	YD	YD_{-1}	RE	HW	SSW	Constant	$\bar{R}^2$	Durbin-Watson Statistic	Sum of Squared Residuals
(5.2.1)	Average benefit ratio	.665 (9.41)	.170 (2.38)	.133 (.96)	.026 (2.84)	-.019 (-2.70)	8 (.17)	.998	1.82	8,924
(5.2.2)	Current benefit ratio	.669 (8.41)	.167 (2.11)	.067 (.41)	.018 (1.92)	-.007 (-1.37)	47 (.82)	.998	1.65	10,950
(5.2.3)	Adaptive expectations δ = .25	.664 (8.41)	.170 (2.14)	.076 (.47)	.019 (1.93)	-.007 (-1.37)	47 (.80)	.998	1.64	10,950
(5.2.4)	Adaptive expectations δ = .50	.657 (8.43)	.174 (2.20)	.085 (.54)	.020 (2.00)	-.007 (-1.43)	40 (.67)	.998	1.63	10,870
(5.2.5)	Adaptive expectations δ = .75	.647 (8.43)	.184 (2.34)	.103 (.67)	.023 (2.18)	-.010 (-1.62)	12 (.17)	.998	1.63	10,620
(5.2.6)	Perfect foresight	.668 (9.24)	.175 (2.38)	.126 (.90)	.026 (2.71)	-.016 (-2.47)	-9 (-.15)	.998	1.82	9,305
(5.2.7)	Actuarial projection	.666 (8.24)	.171 (2.12)	.115 (.73)	.015 (1.68)	-.005 (-1.12)	68 (1.31)	.998	1.69	11,240
(5.2.8)	Average benefit ratio, decoupled	.664 (9.40)	.170 (2.37)	.133 (.97)	.026 (2.84)	-.022 (-2.70)	11 (.22)	.998	1.82	8,920
(5.2.9)	Current benefit ratio, decoupled	.669 (8.42)	.167 (2.11)	.067 (.41)	.018 (1.92)	-.008 (-1.38)	48 (.84)	.998	1.65	10,930
(5.2.10)	Adaptive expecations δ = .5, decoupled	.657 (8.43)	.174 (2.20)	.086 (.54)	.020 (2.01)	-.009 (-1.44)	41 (.69)	.998	1.63	10,860

Figures in parentheses are t-statistics.

Table 5.3 .--Consumer Expenditure Functions Estimated Using SSW Variables with Alternative Perceptions: Leimer-Lesnoy Algorithm

Net Social Security Wealth

1930-1974 excluding 1941-1946*

Equation	Perception	YD	YD_{-1}	RE	HW	SSW	Constant	$\bar{R}^2$	Durbin-Watson Statistic	Sum of Squared Residuals
(5.3.1)	Benefits: average ratio Taxes: average ratio	.722 (14.39)	.113 (2.52)	.105 (1.31)	.011 (1.75)	-.004 (-.54)	109 (2.28)	.999	1.39	17,570
(5.3.2)	Benefits: current ratio Taxes: current ratio	.725 (14.09)	.111 (2.50)	.080 (1.06)	.010 (1.67)	-.003 (-.54)	117 (3.25)	.999	1.40	17,570
(5.3.3)	Benefits: adaptive expectations δ = .25 Taxes: adaptive expectations δ = .25	.723 (14.16)	.111 (2.49)	.084 (1.12)	.010 (1.69)	-.002 (-.44)	119 (3.29)	.999	1.40	17,620
(5.3.4)	Benefits: adaptive expectations δ = .50 Taxes: adaptive expectations δ = .50	.721 (14.28)	.111 (2.48)	.088 (1.18)	.010 (1.70)	-.002 (-.35)	121 (3.28)	.999	1.39	17,660
(5.3.5)	Benefits: adaptive expectations δ = .75 Taxes: adaptive expectations δ = .75	.719 (14.38)	.111 (2.47)	.091 (1.21)	.010 (1.65)	-.001 (-.20)	124 (3.04)	.999	1.38	17,710
(5.3.6)	Benefits: perfect foresight Taxes: perfect foresight	.720 (14.10)	.111 (2.46)	.095 (1.19)	.010 (1.67)	-.002 (-.22)	122 (2.57)	.999	1.38	17,700
(5.3.7)	Benefits: actuarial projection Taxes: legislated	.725 (13.47)	.109 (2.45)	.079 (1.00)	.010 (1.64)	-.002 (-.35)	121 (3.24)	.999	1.42	17,660
(5.3.8)	Benefits: average ratio, decoupled Taxes: average ratio	.722 (14.44)	.114 (2.53)	.106 (1.34)	.011 (1.78)	-.006 (-.61)	106 (2.24)	.999	1.39	17,530
(5.3.9)	Benefits: current ratio, decoupled Taxes: current ratio	.725 (14.22)	.112 (2.51)	.081 (1.08)	.010 (1.64)	-.004 (-.62)	117 (3.57)	.999	1.41	17,520
(5.3.10)	Benefits: adaptive δ = .5, decoupled Taxes: adaptive expectations δ = .5	.721 (14.37)	.112 (2.49)	.089 (1.20)	.010 (1.70)	-.002 (-.42)	121 (3.59)	.999	1.39	17,630
(5.3.11)	Benefits: average ratio Taxes: perfect foresight	.721 (14.42)	.114 (2.52)	.110 (1.30)	.010 (1.72)	-.005 (-.53)	116 (3.12)	.999	1.38	17,580

*The Durbin-Watson statistic is adjusted for this gap.
Figures in parentheses are t-statistics.

Table 5.4.--Consumer Expenditure Functions Estimated Using SSW Variables with Alternative Perceptions: Leimer-Lesnoy Algorithm

Net Social Security Wealth

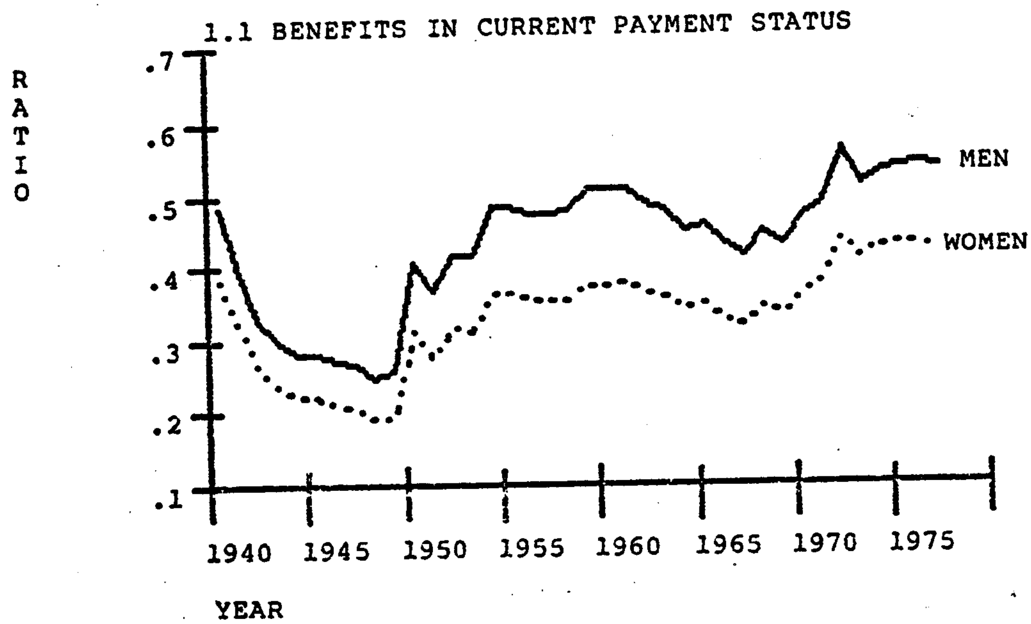
1947-1974

Equation	Perception	YD	YD_{-1}	RE	HW	SSW	Constant	$\bar{R}^2$	Durbin-Watson Statistic	Sum of Squared Residuals
(5.4.1)	Benefits: average ratio Taxes: average ratio	.660 (9.34)	.169 (2.35)	.127 (.92)	.027 (2.84)	-.022 (-2.68)	8 (.16)	.998	1.81	8,960
(5.4.2)	Benefits: current ratio Taxes: current ratio	.665 (8.49)	.163 (2.06)	.053 (.32)	.017 (1.88)	-.008 (-1.49)	78 (1.99)	.998	1.69	10,800
(5.4.3)	Benefits: adaptive expectations δ = .25 Taxes: adaptive expectations δ = .25	.660 (8.44)	.165 (2.09)	.062 (.38)	.018 (1.90)	-.008 (-1.44)	78 (1.97)	.998	1.66	10,860
(5.4.4)	Benefits: adaptive expectations δ = .50 Taxes: adaptive expectations δ = .50	.652 (8.40)	.168 (2.13)	.071 (.45)	.019 (1.98)	-.008 (-1.46)	75 (1.85)	.998	1.64	10,830
(5.4.5)	Benefits: adaptive expectations δ = .75 Taxes: adaptive expectations δ = .75	.639 (8.36)	.174 (2.24)	.087 (.57)	.023 (2.22)	-.011 (-1.71)	56 (1.23)	.998	1.64	10,500
(5.4.6)	Benefits: perfect foresight Taxes: perfect foresight	.666 (9.18)	.170 (2.32)	.106 (.75)	.025 (2.65)	-.023 (-2.42)	12 (.24)	.998	1.80	9,382
(5.4.7)	Benefits: actuarial projection Taxes: legislated	.671 (8.12)	.164 (2.02)	.102 (.63)	.013 (1.52)	-.005 (-1.03)	87 (2.11)	.998	1.68	11,340
(5.4.8)	Benefits: average ratio, decoupled Taxes: average ratio	.658 (9.32)	.168 (2.34)	.127 (.92)	.027 (2.84)	-.027 (-2.68)	10 (.22)	.998	1.80	8,964
(5.4.9)	Benefits: current ratio, decoupled Taxes: current ratio	.664 (8.51)	.161 (2.04)	.051 (.31)	.017 (1.87)	-.009 (-1.52)	85 (2.38)	.998	1.70	10,760
(5.4.10)	Benefits: adaptive δ = .5, decoupled Taxes: adaptive expectations δ = .5	.651 (8.40)	.167 (2.11)	.069 (.43)	.019 (1.98)	-.010 (-1.48)	83 (2.23)	.998	1.65	10,810
(5.4.11)	Benefits: average ratio Taxes: perfect foresight	.661 (9.44)	.163 (2.29)	.111 (.81)	.025 (2.82)	-.029 (-2.78)	43 (1.14)	.998	1.82	8,797

Figures in parentheses are t-statistics.

Figure 1

Ratio of Benefits per Beneficiary to Disposable Income per Capita



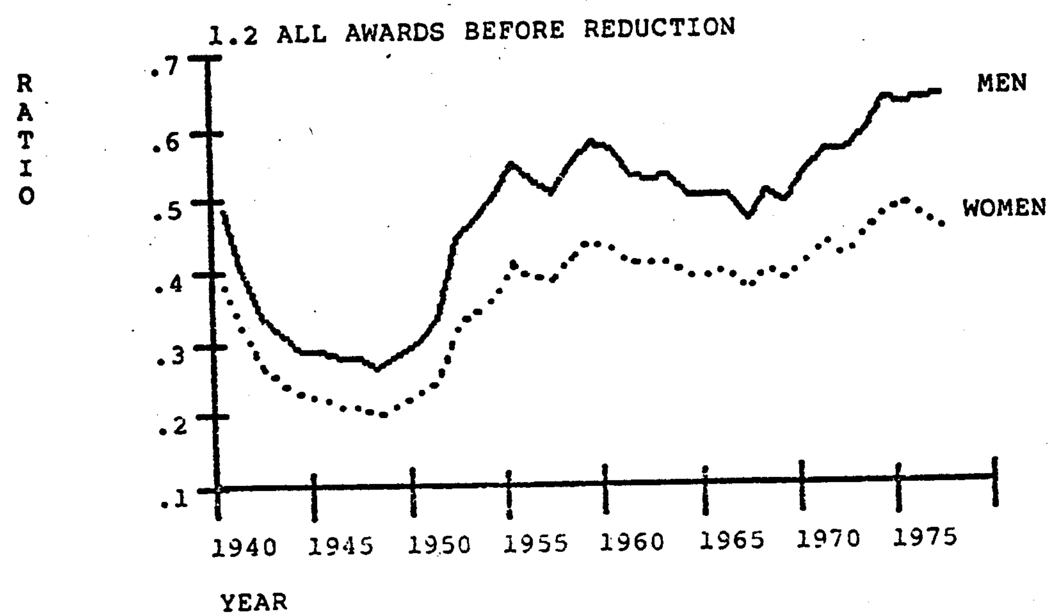
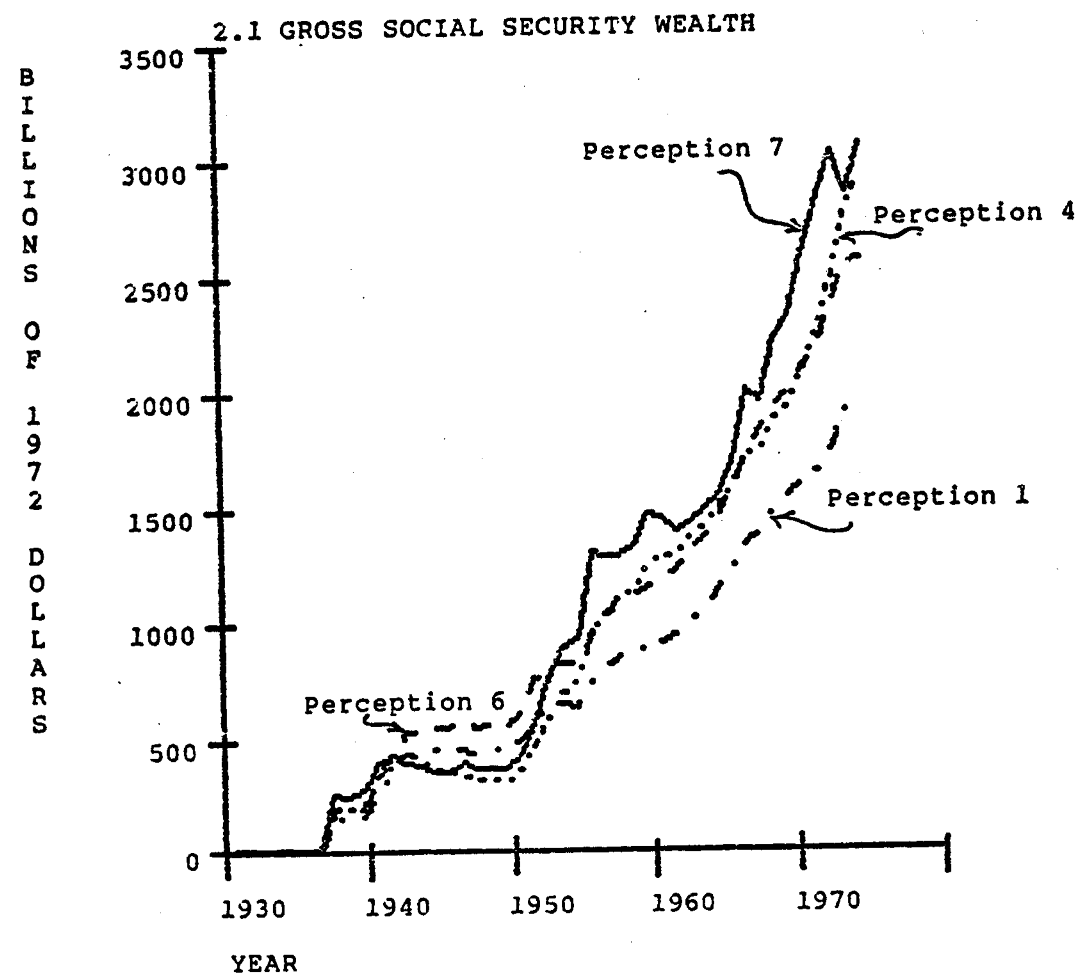


Figure 2

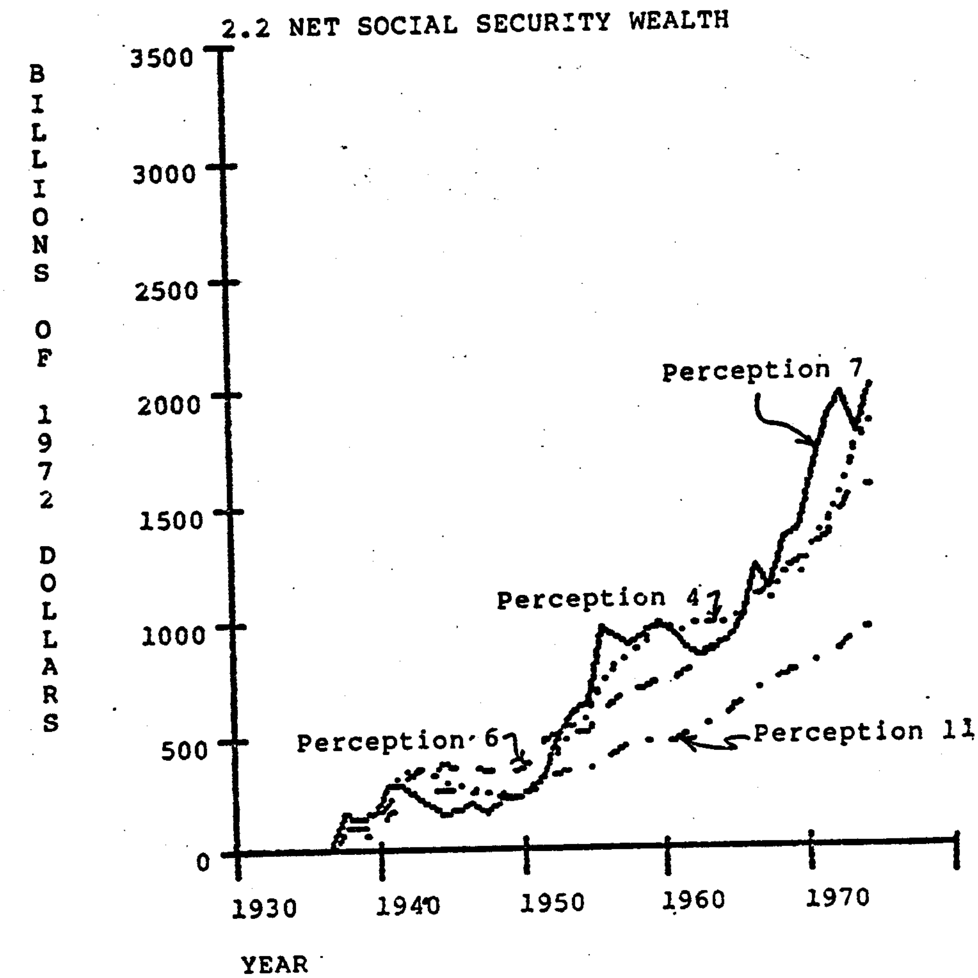
Social Security Wealth for Selected Alternative Perceptions: Feldstein Replica Algorithm



Source: Appendix A, Table A.1.

Figure 2

Social Security Wealth for Selected Alternative Perceptions: Feldstein Replica Algorithm



Source: Appendix A, Table A.2.

FOOTNOTES

* This paper was presented at the Ninety-third Annual Meeting of the American Economic Association held in Denver, Colorado, September 6, 1980. The authors thank Suzanne Worth and Anne Richard for their careful and able assistance. The Office of the Actuary was very helpful in providing unpublished data.

The views expressed are the authors' and do not necessarily reflect the position of the Office of Research and Statistics or the Social Security Administration.

1/ Ando-Modigliani used permanent labor income, which is the correct theoretical construct. Because of the difficulty of estimating disposable labor income (including the labor share of self-employment income), later studies have used disposable personal income.

2/ Munnell's study differs from the other studies noted in using as the dependent variable a saving variable based on SEC-Goldsmith data. All of the other studies cited use consumer expenditures as the dependent variable and are based on NIPA data.

3/ Our dicussion of Feldstein's construction of the social security wealth variable is based on M. Feldstein [1974], pp. 911-913 and A. Munnell [1974], pp. 122-125. Anthony Pellechio was helpful in providing information about several assumptions and about data sources. Certain aspects of the construction required educated guesses, since we did not have access to Feldstein's algorithm. Appendices A and D provide a more detailed description of the algorithm and the data sources we used to replicate Feldstein's SSW variable.

4/ For example, if 60 percent of the youngest male age group and 90 percent of prime age males are in the labor force, the $p_{s,a}$ adjustment factor for the youngest male age group would be set equal to two-thirds (.6/.9); the $p_{s,a}$ adjustment factor for the prime age group is set equal to one.

5/ Feldstein assumes that 60 percent of the men are married to women who will receive benefits as dependent wives and/or surviving widows. With approximately 10 percent of men unmarried, 30 percent of men are married to women who receive retirement benefits solely on own account.

6/ We suspect that the large difference in the 1939 values is due to an incorrect interpretation of the effective date (January 1940) of the 1939 Amendments to the Social Security Act.

7/ Feldstein's own corrected gross wealth series, as shown in Table E.2, uses somewhat different data than his previous series. In particular, different female labor force participation adjustment factors are used, and a female benefit ratio of (.32) is used in place of the previous value of (.256).

8/ If Feldstein's own corrected series are used, the results are essentially the same as using our replica series. Equation (2.1) differs slightly from the equation reported by Feldstein [1978]. We use more recent data.

9/ It may be noted that for the post-war period, the coefficient of gross SSW using Feldstein's own series is only .004 and insignificant. This contrasts with Feldstein's first published result [1974], where the coefficient of SSW, although insignificant, was only slightly smaller, .014, than the coefficient for the full period, .021. Retained earnings is also no longer significant for either period.

10/ Appendix C discusses the benefit and tax perceptions in greater detail. Except for benefit perception 1, expected benefit ratios were determined separately for young workers, aged workers, and current beneficiaries. To conform with Feldstein's approach, perception 1 uses the same benefit ratio (.41 or .256) for all three groups.

11/ Prior to the 1977 amendments, the brackets in the benefit formula defining the marginal benefit rates applied to average earnings were fixed. Because the rate structure is characterized by declining marginal rates, this implies that the average ratio of benefits to average earnings declines as wage levels rise over time. The Actuary recognized the likelihood that the Congress would amend the law in the future to prevent such a decline from continuing indefinitely. To avoid predicting such legislative changes, the Actuary adopted the procedure of assuming level wages for long-run cost estimates. With respect to the benefit ratio at entitlement, this procedure is essentially equivalent to assuming growing wages using a benefit structure with brackets that are adjusted by the percent change in average wages. The 1977 amendments legislated such bracket changes.

12/ Thus, net wealth perception series 1 to 7 are formed as the difference between the gross wealth perception series 1 to 7 and the future tax liability perception series 1 to 7, respectively. Similarly, net wealth perception series 8, 9, and 10 are formed as the gross wealth perception series 8, 9, and 10 less the corresponding future tax liability perception series 1, 2, and 4, respectively.

13/ For example, see Bayo and Ritchie [1974], page 21. These projections have their own potential shortcomings. First, we rely on the expert judgment of the Actuary staff concerning such matters as currently anticipated changes in future labor force participation patterns. Second, and most important, there is a paucity of detail available for the early years of the social security program. We have adopted an interpolation procedure which appears to yield consistent results.

14/ The amount which a wife receives is the maximum of her retired worker benefit or her dependent wife benefit. Technically, if eligible for both, she is a "dual beneficiary" and receives her retired worker benefit plus the difference between the larger wife benefit and the retirement benefit. The treatment of a woman eligibbe for both a retired worker benefit and surviving widow benefit is analogous.

15/ For example, we estimate that the probability of a married (or widowed) woman being insured for retirement benefits increased from .04 in 1950 to .55 in 1976. (Dual beneficiaries are counted as retired workers.)

16/ In addition, Feldstein assumes that wives are two years younger than their husbands; based on data from the March Current Population Survey, we assume instead that wives are three years younger on average.

17/ The exceptions are perceptions 1, 6, and 8. For perception 1 and 8 (the average ratio and decoupled average ratio series), the LL series are generally above the corresponding F series. This is because the actual average benefit ratios used for the LL construction are larger (relative to disposable income per capita) than the .41 and .256 figures used in the F construction. For perception 6, the LL series are also above the corresponding F series for about half of the years, although the series converge by 1977.

18/ See Barro [1978]. If underlying household utility functions are homothetic, a one percent change in all income and wealth variables should lead to a one percent change in consumption.

19/ A complete documentation of both the Feldstein and Leimer-Lesnoy algorithms is in preparation. This documentation includes assumptions, equations, data sources, input data and tables of output for each perception. We also hope to make available gross wealth and tax liability series disaggregated by sex and age group for selected perceptions.

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Appendix A. Feldstein replica algorithm

I. Introduction

This appendix presents the algorithm underlying our construction of the Feldstein replica gross social security wealth, future tax liability, and net social security wealth series. The formulas used in this construction are generalized to permit the incorporation of the alternative benefit and tax perception assumptions which are detailed in Appendix C. Variable definitions and data sources are given in Appendix D. Tables A.1 to A.3 at the end of this appendix display the resulting gross wealth, tax liability, and net wealth series.

Under benefit perception 1 and tax perception 6, the formulas presented below are consistent (to the extent we could determine) with the algorithm employed by Feldstein (1974).1/ Our gross wealth replica series tracks Feldstein's own series relatively well after the latter is corrected for a programming error affecting years after 1956. Our tax liability replica series grows less rapidly than Feldstein's own tax series because of our use of a more recent final year (1977).2/ Abstracting from that difference, however, our tax liability replica series appears to track Feldstein's own series relatively well. As indicated in the text, our replica series and Feldstein's own (corrected) series behave similarly in the consumption expenditure regression equations.

II. Some assumptions

1. Only wealth deriving from expected OASI benefits or future tax liability deriving from expected OASI taxes is estimated.

2. Wives are assumed to be two years younger than their husbands.

3. Couples do not expect divorce after the date that they are

identified by the algorithm as married.

4. Only persons currently paying OASI taxes expect to pay future taxes; such individuals expect to pay taxes continuously until they retire.

5. Individuals expect to remain entitled to social security benefits after first entitlement.

6. The number of persons expecting future retirement benefits is estimated by the number of current covered workers adjusted for sex- and age-specific labor force participation patterns; these patterns are assumed constant over time. No adjustment is made for workers who are also current beneficiaries.

7. Except for current widows, the number of women expecting auxiliary benefits is based on the number of current male covered workers and retirees. Sixty percent of insured males are assumed to have wives entitled to a dependent wife or widow benefit. No adjustment is made for future widow beneficiaries whose husbands have already died but achieved insured status prior to dying.

8. The number of current retirees and widow beneficiaries is based on program statistics. The number of current dependent wife (and potential future widow) beneficiaries is based on the number of retired males aged 67+. (This assumption ignores the existence of dependent wife beneficiaries aged less than 65.)

9. In general, current non-beneficiaries expect entitlement to social security benefits at the first subsequent age at which such benefits can be received without actuarial reduction. One exception is that over the entire period 1957-77, potential future widows of workers aged less than 65 expect entitlement (if eligible) to a widow benefit at own age 62. (After 1972, the age of eligibility for a full widow's benefit reverted to age 65. This change is not reflected in the Feldstein replica algorithm.)

III. Gross wealth formulas

Gross social security wealth is calculated annually for the 13 categories presented below.3/

1. young male workers (aged less than 65):

$$\sum_{a=14}^{64} (W_{1,a,t}/P_{1,a}) \sum_{j=65}^{100} (B^{y}_{1,a,65,j,t}\ S_{1,a,j})/(1+r)^{j-a}$$

2. young female workers (aged less than 65):

$$\sum_{a=14}^{64} (W_{2,a,t}/P_{2,a}) \sum_{j=65}^{100} (B^{y}_{2,a,65,j,t}\ S_{2,a,j})/(1+r)^{j-a}$$

3. aged male workers (aged 65+):

$$\sum_{a=65}^{99} (W_{1,a,t}/P_{1,a}) \sum_{j=a+1}^{100} (B^{o}_{1,a,a+1,j,t}\ S_{1,a,j})/(1+r)^{j-a}$$

4. aged female workers (aged 65+):

$$\sum_{a=65}^{99} (W_{2,a,t}/P_{2,a}) \sum_{j=a+1}^{100} (B^{o}_{2,a,a+1,j,t}\ S_{2,a,j})/(1+r)^{j-a}$$

5. future dependent wives of young male workers (aged less than 65):

$$\sum_{a=14}^{64} .6\ (W_{1,a,t}/P_{1,a}) \sum_{j=67}^{102} (d_t\ B^{y}_{1,a,65,j,t}\ S_{2,a-2,j-2}\ S_{1,a,j})/(1+r)^{j-a}$$

6. future dependent wives of aged male workers (aged 65+):

$$\sum_{a=65}^{99} .6\ (W_{1,a,t}/p_{1,a}) \sum_{j=e}^{102} (d_t\ B^{o}_{1,a,a+1,j,t}\ S_{2,a-2,j-2}\ S_{1,a,j})/(1+r)^{j-a}$$

where e = max(67,a+1) = later of husband's age at wife age 65 or next age

7. future widows of young male workers (aged less than 65):

a. years 1937-56:

$$\sum_{a=14}^{64} .6\ (W_{1,a,t}/p_{1,a})\ (S_{1,a,65}\ Q_1 + (1-S_{1,a,65})\ Q_2)$$

where $Q_1 = \sum_{j=67}^{102} (w_t\ B^{y}_{1,a,65,j,t}\ S_{2,a-2,j-2}\ (1-S_{1,65,j}))\ /\ (1+r)^{j-a}$

$$Q_2 = \sum_{j=67}^{102} (w_t\ B^{y}_{1,a,67,j,t}\ S_{2,a-2,j-2})/(1+r)^{j-a}$$

b. years 1957-77:

$$\sum_{a=14}^{64} .6\ (W_{1,a,t}/p_{1,a})\ (S_{1,a,64}\ Q_1 + (1-S_{1,a,64})\ Q_2)$$

where $Q_1 = \sum_{j=65}^{102} (w_t\ B^{y}_{1,a,65,j,t}\ S_{2,a-2,j-2}\ (1-S_{1,64,j}))\ /\ (1+r)^{j-a}$

$$Q_2 = \sum_{j=64}^{102} (w_t\ B^{y}_{1,a,64,j,t}\ S_{2,a-2,j-2})/(1+r)^{j-a}$$

8. future widows of aged male workers (aged 65+):

$$\sum_{a=65}^{99} .6\ (W_{1,a,t}/P_{1,a}) \sum_{j=e}^{102} (w_t\ B^{o}_{1,a,e,j,t}\ S_{2,a-2,j-2}\ (1-S_{1,a,j}))\ /\ (1+r)^{j-a}$$

where e = max(67,a+1) = later of husband's age at wife age 65 or next age

9. retired males:

$$\sum_{a=62}^{100} R_{1,a,t} \sum_{j=a}^{100} (B^{c}_{1,a,j,t}\ S_{1,a,j})/(1+r)^{j-a}$$

10. retired females:

$$\sum_{a=62}^{100} R_{2,a,t} \sum_{j=a}^{100} (B^{c}_{2,a,j,t}\ S_{2,a,j})/(1+r)^{j-a}$$

11. dependent wives of retired males:

$$\sum_{a=62}^{100} .6\ R_{1,a,t} \sum_{j=e}^{102} (d_t\ B^{c}_{1,a,j,t}\ S_{2,a-2,j-2}\ S_{1,a,j})/(1+r)^{j-a}$$

where e = max(67,a) = later of husband's age at wife age 65 or current age

12. future widows of retired males:

$$\sum_{a=62}^{99} .6\ R_{1,a,t} \sum_{j=e}^{102} (w_t\ B^{c}_{1,a,j,t}\ S_{2,a-2,j-2}\ (1-S_{1,a,j}))\ /\ (1+r)^{j-a}$$

where e = max(67,a+1) = later of husband's age at wife age 65 or next age

13. current widows:

$$\sum_{a=60}^{100} R_{4,a,t} \sum_{j=a}^{100} (w_t \; B^c_{1,a,j,t} \; S_{2,a,j})/(1+r)^{j-a}$$

IV. Future tax liability formulas:

The present value of future tax liabilities is calculated annually for the four categories shown below.

1. young male workers (aged less than 65):

$$\sum_{a=14}^{64} W_{1,a,t} \sum_{j=a}^{64} (T_{1,a,j,t} \; S_{1,a,j})/(1+r)^{j-a}$$

2. young female workers (aged less than 65):

$$\sum_{a=14}^{64} W_{2,a,t} \sum_{j=a}^{64} (T_{2,a,j,t} \; S_{2,a,j})/(1+r)^{j-a}$$

3. aged male workers (aged 65+):

$$\sum_{a=65}^{100} W_{1,a,t} \; T_{1,a,a,t}$$

4. aged female workers (aged 65+):

$$\sum_{a=65}^{100} W_{2,a,t} \; T_{2,a,a,t}$$

V. Net wealth construction

Net wealth under perceptions 1-7 is constructed as the difference between gross wealth under perceptions 1-7 and future tax liability under perceptions 1-7, respectively. Net wealth under perceptions 8, 9, and 10 is constructed as the difference between gross wealth under perceptions 8, 9, and 10 and future tax liability under perceptions 1, 2, and 4, respectively. The "decoupled" assumption applies only to the benefit structure and does not affect anticipated taxes.

For comparison with Feldstein's own net wealth computation, an additional net wealth series, referred to as perception 11, is constructed as the difference between gross wealth under perception 1 and future tax liability under perception 6. (The alternative benefit and tax perceptions are described in Appendix C.)

Table A.1

Gross Social Security Wealth for Alternative Perceptions:
Feldstein Algorithm

	Perception 1	Perception 2	Perception 3	Perception 4	Perception 5	Perception 6	Perception 7	Perception 8	Perception 9	Perception 10
1937	151.5	192.9	192.9	192.9	192.9	189.3	253.1	129.6	164.9	164.9
1938	135.8	173.2	173.2	173.2	173.2	166.8	228.1	116.1	148.0	148.0
1939	152.0	193.9	193.9	193.9	193.9	190.4	258.4	130.0	165.7	165.7
1940	255.8	319.6	319.6	319.6	319.6	308.3	386.9	216.0	269.8	269.8
1941	334.4	346.2	364.2	382.1	400.1	411.1	418.0	282.3	292.3	322.6
1942	426.1	369.3	393.6	429.4	476.6	518.3	393.1	359.9	311.9	362.6
1943	446.8	360.5	374.5	407.5	468.5	534.0	377.7	377.4	304.4	344.2
1944	444.1	334.1	344.1	370.5	434.3	539.6	346.7	375.2	282.3	312.9
1945	438.0	327.6	330.3	346.0	402.3	538.5	340.5	370.2	276.8	292.3
1946	452.5	322.4	326.6	338.8	390.3	570.5	381.1	382.4	272.4	286.3
1947	431.0	305.4	306.7	313.7	354.6	540.0	358.4	364.3	258.1	265.2
1948	450.7	302.2	306.8	315.0	353.5	559.3	351.8	381.1	255.4	266.3
1949	429.1	306.3	302.7	303.0	328.8	536.9	353.5	362.9	259.0	256.2
1950	474.6	367.0	358.9	350.9	364.4	604.8	419.5	401.5	310.6	296.9
1951	583.1	492.5	479.9	462.4	459.7	744.9	553.9	493.5	416.9	391.4
1952	608.2	674.7	631.4	578.9	528.8	777.8	752.0	515.0	571.2	490.1
1953	642.4	758.4	735.5	685.1	608.8	816.6	874.8	544.1	642.1	580.1
1954	635.5	806.7	786.8	742.0	653.3	811.0	913.4	538.5	683.4	628.6
1955	733.8	1,013.9	987.3	935.0	818.8	936.1	1,302.0	622.0	859.0	792.3
1956	788.8	1,043.4	1,047.8	1,024.2	921.1	1,015.7	1,283.6	668.8	884.3	868.1
1957	849.3	1,089.9	1,098.8	1,095.1	1,014.9	1,095.4	1,288.0	719.1	922.6	926.9
1958	847.0	1,167.1	1,149.0	1,129.1	1,050.4	1,093.0	1,328.6	717.4	988.1	956.0
1959	893.3	1,297.0	1,275.8	1,244.0	1,155.2	1,150.0	1,463.2	756.7	1,098.2	1,053.4
1960	908.0	1,303.4	1,301.7	1,283.9	1,206.6	1,173.2	1,457.6	769.3	1,103.9	1,087.3
1961	933.8	1,261.1	1,280.1	1,290.0	1,245.0	1,221.6	1,399.6	791.4	1,068.5	1,092.8
1962	1,004.0	1,349.8	1,356.1	1,367.5	1,340.2	1,305.8	1,417.9	849.9	1,142.4	1,157.4
1963	1,043.8	1,399.6	1,402.2	1,410.8	1,395.0	1,359.5	1,486.0	883.8	1,184.6	1,194.1
1964	1,129.6	1,445.3	1,463.5	1,486.4	1,494.1	1,456.3	1,550.9	956.5	1,223.4	1,258.2
1965	1,229.6	1,571.2	1,576.9	1,595.1	1,613.3	1,584.5	1,704.3	1,041.2	1,330.1	1,350.3
1966	1,331.3	1,701.3	1,703.4	1,715.4	1,737.1	1,731.8	2,004.1	1,127.4	1,439.9	1,452.0
1967	1,406.1	1,678.6	1,709.1	1,746.0	1,796.9	1,832.0	1,959.7	1,190.8	1,421.0	1,478.0
1968	1,479.5	1,917.6	1,888.2	1,878.1	1,898.5	1,933.0	2,219.3	1,253.1	1,623.4	1,590.0
1969	1,539.5	1,923.9	1,934.6	1,940.0	1,964.0	2,012.7	2,315.6	1,303.9	1,628.7	1,642.3
1970	1,606.4	2,177.2	2,137.6	2,100.9	2,081.5	2,106.2	2,607.9	1,360.6	1,843.3	1,778.7
1971	1,659.4	2,372.0	2,330.8	2,270.7	2,205.0	2,195.6	2,828.7	1,405.7	2,008.3	1,922.6
1972	1,762.3	2,553.1	2,534.0	2,482.8	2,395.4	2,367.8	3,027.2	1,492.8	2,163.1	2,102.9
1973	1,929.4	2,865.0	2,842.7	2,792.4	2,684.2	2,537.1	2,851.2	1,634.4	2,425.8	2,364.7
1974	1,912.5	3,026.9	2,975.1	2,898.3	2,753.5	2,546.7	3,054.2	1,620.2	2,562.7	2,454.1
1975	1,927.1	3,070.9	3,052.3	2,995.2	2,848.0	2,569.3	3,139.6	1,632.9	2,600.5	2,536.5
1976	2,031.5	3,215.3	3,216.5	3,187.6	3,057.3	2,711.5	3,334.6	1,721.5	2,723.0	2,699.6
1977	2,150.8	3,387.8	3,392.2	3,381.3	3,274.6	2,862.4	3,570.7	1,822.4	2,868.7	2,863.2

Note: Monetary aggregates are in billions of 1972 dollars.

Table A.2

Social Security Tax Liability for Alternative Perceptions:
Feldstein Algorithm

	Perception 1	Perception 2	Perception 3	Perception 4	Perception 5	Perception 6	Perception 7
1937	104.2	42.3	42.3	42.3	42.3	82.9	102.9
1938	91.6	35.5	35.9	36.4	36.8	74.8	88.8
1939	103.1	40.4	40.4	40.6	41.1	87.6	103.9
1940	113.4	43.7	43.9	44.2	44.8	99.8	113.0
1941	148.8	53.4	54.5	55.8	57.5	136.8	142.3
1942	183.8	60.0	61.8	64.5	68.5	175.1	164.2
1943	182.2	67.4	65.8	65.7	68.0	179.0	186.8
1944	173.0	68.1	66.7	65.2	65.5	174.8	191.1
1945	170.1	61.6	62.6	62.8	63.7	178.0	175.3
1946	183.8	63.8	64.7	65.9	67.5	201.1	183.2
1947	174.1	71.2	68.7	66.8	65.7	197.7	205.7
1948	180.3	75.4	74.4	72.3	69.9	211.7	141.3
1949	167.3	72.8	71.8	69.9	66.8	202.4	139.2
1950	183.1	118.0	108.2	97.3	84.4	229.2	153.9
1951	212.0	140.8	136.9	126.7	108.5	270.8	241.1
1952	216.9	149.5	147.2	139.6	120.6	284.1	261.7
1953	224.9	159.4	157.7	152.1	133.7	302.0	285.6
1954	216.4	204.1	191.0	175.2	147.5	297.6	280.5
1955	243.7	220.8	219.4	209.1	179.8	340.5	336.2
1956	257.3	238.6	236.9	229.7	202.0	366.2	370.8
1957	276.0	249.7	250.9	248.2	225.1	400.5	397.4
1958	269.5	240.1	241.3	241.2	224.9	398.4	390.1
1959	283.8	291.0	281.8	272.5	250.3	428.2	489.2
1960	286.3	361.2	342.0	318.1	279.7	438.9	507.5
1961	289.9	364.8	360.2	343.4	303.6	448.3	520.4
1962	303.7	401.9	395.8	380.8	339.0	474.1	577.5
1963	315.3	488.5	469.0	441.9	386.1	495.8	607.4
1964	342.5	520.3	517.6	500.2	444.6	539.0	653.6
1965	376.3	557.5	560.3	553.5	505.7	593.0	707.6
1966	411.6	630.3	625.9	617.8	572.4	650.4	774.2
1967	435.5	672.4	669.9	663.0	622.4	689.3	822.3
1968	460.7	665.2	676.0	683.3	660.0	729.7	874.0
1969	483.9	787.2	767.9	752.4	716.7	769.5	934.3
1970	503.3	779.3	784.2	781.0	753.9	799.2	935.0
1971	519.7	874.2	858.1	840.3	802.4	826.1	952.9
1972	557.4	930.4	927.9	915.8	878.0	883.5	1,046.8
1973	617.0	1,051.4	1,045.3	1,032.6	991.8	975.6	1,047.0
1974	613.5	1,051.8	1,048.6	1,039.2	1,002.5	966.6	1,043.2
1975	612.7	1,005.0	1,015.6	1,021.4	1,002.2	961.6	997.5
1976	650.7	1,065.6	1,068.8	1,075.1	1,064.5	1,019.2	1,058.8
1977	707.6	1,106.0	1,120.0	1,137.6	1,144.8	1,106.0	1,100.4

Note: Monetary aggregates are in billions of 1972 dollars.

Table A.3

Net Social Security Wealth for Alternative Perceptions:
Feldstein Algorithm

	Percept. 1	Percept. 2	Percept. 3	Percept. 4	Percept. 5	Percept. 6	Percept. 7	Percept. 8	Percept. 9	Percept. 10	Percept. 11
1937	47.3	150.7	150.7	150.7	150.7	106.4	150.2	25.4	122.6	122.6	68.6
1938	44.2	137.6	137.2	136.8	136.4	92.0	139.4	24.5	112.4	111.6	61.0
1939	49.0	153.5	153.5	153.2	152.7	102.8	154.5	27.0	125.3	125.0	64.4
1940	142.4	275.8	275.7	275.3	274.7	208.4	273.9	102.6	226.1	225.6	156.0
1941	185.6	292.8	309.7	326.4	342.5	274.3	275.7	133.5	238.9	266.9	197.6
1942	242.3	309.4	331.8	364.9	408.1	343.1	228.9	176.0	251.9	298.1	251.0
1943	264.5	293.0	308.7	341.8	400.6	355.1	190.9	195.2	237.0	278.5	267.8
1944	271.1	266.0	277.4	305.3	368.9	364.7	155.6	202.2	214.2	247.8	269.3
1945	267.9	266.0	267.7	283.1	338.7	360.4	165.3	200.0	215.3	229.5	260.0
1946	268.7	258.6	261.8	272.9	322.9	369.4	197.9	198.7	208.6	220.4	251.4
1947	256.8	234.3	238.0	247.0	288.9	342.3	152.7	190.1	187.0	198.4	233.3
1948	270.4	226.7	232.4	242.7	283.6	347.6	210.5	200.7	180.0	194.0	239.0
1949	261.8	233.5	230.8	233.0	261.9	334.5	214.3	195.6	186.2	186.3	226.6
1950	291.5	249.0	250.7	253.7	280.0	375.7	265.6	218.4	192.6	199.7	245.4
1951	371.1	351.7	343.0	335.7	351.2	474.1	312.8	281.5	276.1	264.7	312.3
1952	391.4	525.2	484.2	439.3	408.2	493.7	490.4	298.1	421.6	350.5	324.1
1953	417.4	598.9	577.8	533.0	475.1	514.5	589.2	319.1	482.7	428.0	340.3
1954	419.1	602.6	595.8	566.8	505.8	513.4	632.9	322.1	479.4	453.4	338.0
1955	490.0	793.1	768.0	725.9	639.0	595.6	965.7	378.3	638.2	583.2	393.2
1956	531.5	804.8	811.0	794.5	719.1	649.5	912.8	411.5	645.7	638.4	422.6
1957	573.2	840.2	847.9	847.0	789.8	694.8	890.6	443.0	672.8	678.8	448.7
1958	577.4	927.0	907.7	887.9	825.5	694.6	938.5	447.9	748.0	714.8	448.5
1959	609.4	1,006.0	993.9	971.5	904.9	721.9	974.1	472.9	807.2	780.8	465.1
1960	621.6	942.2	959.7	965.8	926.9	734.3	950.1	483.0	742.6	769.3	469.1
1961	643.9	896.3	919.9	946.6	941.4	773.3	879.2	501.5	703.7	749.4	485.6
1962	700.2	947.9	960.3	986.7	1,001.2	831.7	840.5	546.2	740.6	776.5	529.8
1963	728.5	911.1	933.2	968.9	1,009.0	863.7	878.6	568.5	696.2	752.2	548.0
1964	787.1	925.0	945.9	986.2	1,049.5	917.3	897.3	614.0	703.1	758.0	590.6
1965	853.3	1,013.7	1,016.7	1,041.6	1,107.6	991.5	996.7	664.9	772.6	796.8	636.6
1966	919.8	1,071.0	1,077.5	1,097.6	1,164.7	1,081.4	1,229.9	715.8	809.7	834.2	680.9
1967	970.5	1,006.2	1,039.3	1,082.9	1,174.5	1,142.7	1,137.4	755.2	748.6	815.0	716.8
1968	1,018.8	1,252.4	1,212.1	1,194.8	1,238.5	1,203.3	1,345.3	792.3	958.2	906.7	749.8
1969	1,055.7	1,136.7	1,166.7	1,187.6	1,247.3	1,243.2	1,381.3	820.0	841.5	890.0	770.0
1970	1,103.1	1,397.9	1,353.4	1,319.9	1,327.6	1,307.0	1,673.0	857.3	1,064.0	997.8	807.1
1971	1,139.6	1,497.8	1,472.8	1,430.3	1,402.6	1,369.5	1,875.8	885.9	1,134.2	1,082.2	833.2
1972	1,204.9	1,622.8	1,606.1	1,567.0	1,517.4	1,484.3	1,980.4	935.4	1,232.7	1,187.1	878.8
1973	1,312.3	1,813.6	1,797.4	1,759.8	1,692.4	1,561.5	1,804.3	1,017.4	1,374.4	1,332.1	953.8
1974	1,299.0	1,975.1	1,926.5	1,859.1	1,751.0	1,580.1	2,011.0	1,006.7	1,510.9	1,415.0	945.9
1975	1,314.4	2,065.9	2,036.7	1,973.8	1,845.9	1,607.7	2,142.1	1,020.2	1,595.5	1,515.1	965.5
1976	1,380.8	2,149.7	2,147.7	2,112.5	1,992.8	1,692.3	2,275.8	1,070.8	1,657.5	1,624.5	1,012.3
1977	1,443.2	2,281.8	2,272.1	2,243.7	2,129.8	1,756.4	2,470.3	1,114.8	1,762.7	1,725.7	1,044.9

Note: Monetary aggregates are in billions of 1972 dollars.

FOOTNOTES TO APPENDIX A

1/ Several differences appear to arise in implementation between our replica series and Feldstein's own (corrected) series. Most of these are differences in data sources which we were unable to resolve due to incomplete information. It also appears that Feldstein's own series errs in its interpretation of the provisions and timing of social security legislation in the early years of the program.

2/ See the explanation of tax perception 6 in Appendix C.

3/ Consistent with the provisions of then current social security legislation, we assumed that during the period 1937-39 no one expected to retire prior to 1942, no one aged 60+ expected any benefits at all, and no auxiliary benefits were expected. These constraints were implemented by only computing gross wealth for ages 15-59 under categories 1 and 2 during the years 1937-39.

Appendix B. Leimer-Lesnoy algorithm

I. Introduction

This appendix presents the algorithm underlying the construction of the Leimer-Lesnoy gross social security wealth, future tax liability, and net social security wealth series. The computation of anticipated benefits and taxes under the alternative perception assumptions is described in Appendix C. Variable definitions and data sources are given in Appendix D. Tables B.1 to B.3 at the end of this appendix display the resulting gross wealth, tax liability, and net wealth series.

II. Some assumptions

1. Only wealth deriving from expected OASI benefits or future tax liability deriving from expected OASI taxes is estimated.

2. Wives are assumed to be three years younger than their husbands. This assumption is based on data drawn from the 1976 Current Population Survey.

3. Couples do not expect divorce after the date that they are identified by the algorithm as married.

4. Individuals base their expected future OASI tax payments (until their projected retirement dates) on the probability of having taxable earnings at each future age. These projected probabilities are based on current cross-section coverage rates disaggregated by sex and age.

5. Individuals expect to remain entitled to social security benefits after first entitlement.

6. The number of current non-beneficiaries expecting future retirement benefits is estimated for a given sex and age group by applying insured rates projected for that group as of their expected date of entitlement.

These projected insured rates are based on estimates made by the SSA Actuary which take into account current and expected changes in labor force participation patterns. The highest (or "ultimate") insured rate for each sex and cohort group is assumed to be achieved by age 65 and to remain constant after that age.

7. The number of women expecting only auxiliary benefits is based on the projected probabilities that they fail to attain insured status on own account while their husbands attain insured status. Auxiliary benefits to dually-entitled women are subsumed under benefit payments to women entitled on own account. (This classification is consistent with the reporting of program statistics. Reported benefit payments to women on own account include auxiliary benefits to dually-entitled women whose benefit on own account is less than their auxiliary benefit. Similarly, reported auxiliary benefit payments to women consist entirely of payments to women receiving only auxiliary benefits.)

8. The number of current beneficiaries of all types is based on program statistics.

9. Without exception, current non-beneficiaries expect entitlement to social security benefits at the first subsequent age at which such benefits can be received without actuarial reduction (assuming they are eligible and survive).

10. Eligible wives (wives of insured males) not entitled on own account, not in current payment status, and whose husbands are currently alive are assumed to not be in current payment status because their insured husband has not yet retired. (This is consistent with the stronger but likely proposition that eligible wives not entitled on own account apply for a dependent wife benefit when their husbands retire.)

III. Gross wealth formulas

Gross social security wealth is calculated annually for the various categories described below.[1/]

1. young male workers

a. young workers aged 15-61:

$$\sum_{a=15}^{61} N_{1,a,t}\ i_{1,65,t+65-a,t} \sum_{j=65}^{100} (B^y_{1,a,65,j,t}\ S_{1,a,j,t}) \ / \ (1+r)^{j-a}$$

b. insured non-beneficiaries aged 62-64:

$$\sum_{a=62}^{64} (I_{1,a,t} - R_{1,a,t}) \sum_{j=65}^{100} (B^y_{1,a,65,j,t}\ S_{1,a,j,t}) \ / \ (1+r)^{j-a}$$

2. young female workers[2/]

a. young workers aged 15-61:

$$\sum_{a=15}^{61} N_{2,a,t}\ i_{2,65,t+65-a,t} \sum_{j=65}^{100} (B^y_{2,a,65,j,t}\ S_{2,a,j,t}) \ / \ (1+r)^{j-a}$$

b. insured non-beneficiaries aged 62-64:

$$\sum_{a=62}^{64} (I_{2,a,t} - R_{2,a,t}) \sum_{j=65}^{100} (B^y_{2,a,65,j,t}\ S_{2,a,j,t}) \ / \ (1+r)^{j-a}$$

3. aged male workers (insured non-beneficiaries aged 65+):

$$\sum_{a=65}^{99} (I_{1,a,t} - R_{1,a,t}) \sum_{j=a+1}^{100} (B^o_{1,a,a+1,j,t}\ S_{1,a,j,t}) \ / \ (1+r)^{j-a}$$

4. aged female workers (insured non-beneficiaries aged 65+):2/

$$\sum_{a=65}^{99} (I_{2,a,t} - R_{2,a,t}) \sum_{j=a+1}^{100} (B^{o}_{2,a,a+1,j,t}\ S_{2,a,j,t}) / (1+r)^{j-a}$$

5. young future dependent wives, not entitled on own account

a. women currently aged 15-61:

$$\sum_{a=15}^{61} N_{2,a,t}\ m_{1,62}\ (1-i_{3,65,t+65-a,t})\ i_{1,65,t+62-a,t}$$

$$\sum_{j=65}^{100} (d_t\ B^{y}_{1,a,62,j,t}\ S_{2,a,j,t}\ S_{1,65,j+3,t}) / (1+r)^{j-a}$$

b. eligible wives (wives of insured males), not in current payment status, aged 62-64:

$$\sum_{a=62}^{64} (N_{2,a,t}\ m_{1,a}\ (1-i_{3,65,t+65-a,t})\ i_{1,65,t+62-a,t} - R_{3,a,t})$$

$$\sum_{j=65}^{100} (d_t\ B^{o}_{1,a,a+1,j,t}\ S_{2,a,j,t}\ S_{1,a+3,j+3,t}) / (1+r)^{j-a}$$

6. aged future dependent (eligible) wives, not entitled on own account, not in current payment status, aged 65+:

$$\sum_{a=65}^{99} (N_{2,a,t}\ m_{1,a}\ (1-i_{3,65,t+65-a,t})\ i_{1,65,t+62-a,t} - R_{3,a,t})$$

$$\sum_{j=a+1}^{100} (d_t\ B^{o}_{1,a,a+1,j,t}\ S_{2,a,j,t}\ S_{1,a+3,j+3,t}) / (1+r)^{j-a}$$

7. young future widows, not entitled on own account

a. women currently aged 15-59

1. husband attains age 65:

$$\sum_{a=15}^{59} N_{2,a,t}\ m_{1,62}\ (1-i_{3,65,t+65-a,t})\ i_{1,65,t+62-a,t}$$

$$\sum_{j=e}^{100} (w_t\ B^{y}_{1,a,62,j,t}\ S_{2,a,j,t}\ (1-S_{1,65,j+3,t})) / (1+r)^{j-a}$$

where $e = R^{w}_{t}$ = first age of unreduced widow benefits

2. husband dies before age 65:3/

$$\sum_{a=15}^{59} N_{2,a,t}\ m_{2,62}\ (1-i_{3,65,t+65-a,t})\ i_{1,h,t+h-a-3,t}$$

$$\sum_{j=e}^{100} (w_t\ B^{y}_{1,a,e,j,t}\ S_{2,a,j,t}) / (1+r)^{j-a}$$

where $e = R^{w}_{t}$ = first age of unreduced widow benefits

b. women currently aged 60-64, eligible (husbands attained insured status), not in current payment status

1. husband currently alive:

$$\sum_{a=60}^{64} (N_{2,a,t}\ m_{1,a}\ (1-i_{3,65,t+65-a,t})\ i_{1,65,t+62-a,t} - R_{3,a,t})$$

$$(S_{1,a+3,e,t}\ Q_1 + (1-S_{1,a+3,e,t})\ Q_2)$$

$$\text{where } Q_1 = \sum_{j=f}^{100} (w_t\ B^{o}_{1,a,e-3,j,t}\ S_{2,a,j,t}\ (1-S_{1,e,j+3,t}))\ /\ (1+r)^{j-a}$$

$$Q_2 = \sum_{j=k}^{100} (w_t\ B^{o}_{1,a,k,j,t}\ S_{2,a,j,t})\ /\ (1+r)^{j-a}$$

$e = \max(65,a+4)$ = expected husband retirement age

$f = \max(R^{w}_{t},e-2)$ = later of first age of unreduced widow benefits or woman's age in first year after husband's retirement

$k = \max(R^{w}_{t},a+1)$ = later of first age of unreduced widow benefits or woman's age next year

2. husband no longer alive:3/

$$\sum_{a=60}^{64} (N_{2,a,t}\ m_{2,a}\ (1-i_{3,65,t+65-a,t})\ i_{1,h,t+h-a-3,t} - R_{4,a,t})$$

$$\sum_{j=e}^{100} (w_t\ B^{y}_{1,a,e,j,t}\ S_{2,a,j,t})\ /\ (1+r)^{j-a}$$

where $e = \max(R^{w}_{t},a+1)$ = later of first age of unreduced widow benefits or woman's age next year

8. aged future (eligible) widows, not entitled on own account, not in current payment status, aged 65+

a. husband currently alive:

$$\sum_{a=65}^{97} (N_{2,a,t}\; m_{1,a}\; (1-i_{3,65,t+65-a,t})\; i_{1,65,t+62-a,t} - R_{3,a,t})$$

$$\sum_{j=a+1}^{100} (w_t\; B^{o}_{1,a,a+1,j,t}\; S_{2,a,j,t}\; (1-S_{1,a+3,j+3,t}))\; /\; (1+r)^{j-a}$$

b. husband no longer alive:3/

$$\sum_{a=65}^{99} (N_{2,a,t}\; m_{2,a}\; (1-i_{3,65,t+65-a,t})\; i_{1,h,t+h-a-3,t} - R_{4,a,t})$$

$$\sum_{j=a+1}^{100} (w_t\; B^{y}_{1,a,a+1,j,t}\; S_{2,a,j,t})\; /\; (1+r)^{j-a}$$

9. retired males:

$$\sum_{a=62}^{100} R_{1,a,t} \sum_{j=a}^{100} (B^{c}_{1,a,j,t}\; S_{1,a,j,t})\; /\; (1+r)^{j-a}$$

10. retired females:2/

$$\sum_{a=62}^{100} R_{2,a,t} \sum_{j=a}^{100} (B^{c}_{2,a,j,t}\; S_{2,a,j,t})\; /\; (1+r)^{j-a}$$

11. dependent wives of retired males:

$$\sum_{a=62}^{100} R_{3,a,t} \sum_{j=a}^{100} (B^{c}_{3,a,j,t}\; S_{2,a,j,t}\; S_{1,a+3,j+3,t})\; /\; (1+r)^{j-a}$$

12. future widows (now dependent wives) of retired males:

$$\sum_{a=62}^{100} R_{3,a,t} \sum_{j=a+1}^{100} ((w_t/d_t)\ B^c_{3,a,j,t}\ S_{2,a,j,t}\ (1-S_{1,a+3,j+3,t}))\ /\ (1+r)^{j-a}$$

13. current widows:

$$\sum_{a=60}^{100} R_{4,a,t} \sum_{j=a}^{100} (B^c_{4,a,j,t}\ S_{2,a,j,t})\ /\ (1+r)^{j-a}$$

IV. Future tax liability formulas

The present value of future tax liabilities is calculated annually for the four categories shown below.

1. young males (aged 15-64):

$$\sum_{a=15}^{64} N_{1,a,t} \sum_{j=a}^{64} (c_{1,j,t}\ T_{1,a,j,t}\ S_{1,a,j,t})\ /\ (1+r)^{j-a}$$

2. young females (aged 15-64):

$$\sum_{a=15}^{64} N_{2,a,t} \sum_{j=a}^{64} (c_{2,j,t}\ T_{2,a,j,t}\ S_{2,a,j,t})\ /\ (1+r)^{j-a}$$

3. aged males (aged 65+):

$$\sum_{a=65}^{100} W_{1,a,t}\ T_{1,a,a,t}$$

4. aged females (aged 65+):

$$\sum_{a=65}^{100} W_{2,a,t}\ T_{2,a,a,t}$$

V. Net wealth construction

Net wealth under perceptions 1-7 is constructed as the difference between gross wealth under perceptions 1-7 and future tax liability under perceptions 1-7, respectively. Net wealth under perceptions 8, 9, and 10 is constructed as the difference between gross wealth under perceptions 8, 9, and 10 and future tax liability under perceptions 1, 2, and 4, respectively. The "decoupled" assumption applies only to the benefit structure and does not affect anticipated taxes.

For comparison with Feldstein's own net wealth computation, an additional net wealth series, referred to as perception 11, is constructed as the difference between gross wealth under perception 1 and future tax liability under perception 6. (The alternative benefit and tax perceptions are described in Appendix C.)

Table B.1

Gross Social Security Wealth for Alternative Perceptions:
Leimer-Lesnoy Algorithm

	Perception 1	Perception 2	Perception 3	Perception 4	Perception 5	Perception 6	Perception 7	Perception 8	Perception 9	Perception 10
1937	134.9	136.6	136.6	136.6	136.6	148.0	180.8	116.9	118.3	118.3
1938	130.9	132.6	132.6	132.6	132.6	141.5	176.9	113.3	114.8	114.8
1939	146.2	148.1	148.1	148.1	148.1	160.4	199.1	126.5	128.2	128.2
1940	245.5	248.1	248.1	248.1	248.1	263.8	301.2	208.9	211.0	211.0
1941	263.9	243.1	249.0	255.0	260.9	287.0	293.8	224.3	206.6	216.7
1942	284.6	241.7	248.5	258.4	271.5	309.1	262.2	241.7	205.3	219.4
1943	319.2	241.6	250.8	265.7	288.8	343.2	260.8	270.9	205.0	225.5
1944	343.3	240.5	247.8	263.1	293.1	372.8	258.2	291.1	203.9	223.1
1945	336.4	245.3	244.7	251.6	276.8	368.5	262.4	285.0	207.8	213.2
1946	340.8	238.8	241.1	246.9	270.2	377.3	284.0	288.5	202.2	209.1
1947	369.6	230.9	238.6	249.4	277.6	409.9	272.3	312.8	195.4	211.0
1948	395.3	231.8	237.7	249.3	280.7	439.7	271.2	334.3	196.1	210.8
1949	416.6	249.5	249.7	256.2	284.3	461.5	289.4	352.0	210.8	216.5
1950	445.3	294.0	287.3	284.0	301.7	505.8	337.5	376.1	248.6	240.0
1951	643.5	441.6	434.9	425.8	437.3	722.1	498.1	544.7	373.9	360.6
1952	684.1	607.9	571.6	530.5	500.8	768.5	679.4	579.1	514.6	449.2
1953	734.9	684.2	666.8	627.4	575.1	823.5	790.7	622.0	579.1	531.0
1954	769.3	760.9	745.1	708.7	641.9	866.8	861.9	651.4	644.3	600.1
1955	871.4	946.3	920.7	874.5	781.9	981.7	1,216.9	738.0	801.4	740.6
1956	948.2	967.2	975.7	959.2	880.0	1,078.5	1,190.5	803.2	819.2	812.5
1957	998.3	991.9	1,000.7	1,001.0	943.2	1,135.0	1,171.0	844.5	839.2	846.8
1958	1,035.1	1,097.4	1,082.4	1,067.5	1,007.8	1,183.0	1,244.3	875.8	928.3	903.2
1959	1,099.6	1,219.8	1,202.2	1,176.7	1,107.7	1,254.7	1,369.1	930.6	1,032.1	995.7
1960	1,149.6	1,248.4	1,250.4	1,239.1	1,180.4	1,316.3	1,388.1	973.1	1,056.6	1,048.7
1961	1,187.5	1,222.4	1,239.5	1,250.8	1,219.7	1,379.9	1,345.5	1,005.4	1,035.0	1,058.9
1962	1,280.0	1,306.9	1,314.2	1,327.5	1,312.5	1,488.7	1,366.9	1,082.8	1,105.5	1,123.0
1963	1,329.0	1,359.5	1,360.8	1,368.9	1,361.8	1,543.9	1,436.8	1,123.7	1,149.4	1,157.4
1964	1,405.0	1,401.4	1,410.7	1,424.3	1,430.1	1,633.6	1,496.0	1,187.5	1,184.2	1,203.6
1965	1,468.3	1,499.3	1,493.0	1,493.9	1,495.6	1,711.5	1,617.0	1,240.5	1,266.6	1,262.0
1966	1,547.7	1,594.8	1,589.5	1,584.6	1,580.9	1,819.7	1,868.5	1,306.9	1,346.3	1,337.9
1967	1,623.7	1,566.6	1,591.8	1,614.5	1,635.5	1,912.9	1,819.6	1,370.4	1,321.8	1,362.2
1968	1,693.7	1,787.9	1,756.0	1,736.0	1,726.4	1,998.3	2,059.2	1,428.5	1,507.6	1,463.8
1969	1,755.9	1,785.4	1,794.2	1,792.6	1,788.8	2,082.9	2,134.3	1,480.3	1,504.7	1,510.8
1970	1,799.4	2,040.5	1,990.2	1,939.0	1,885.2	2,153.8	2,424.9	1,517.0	1,719.9	1,634.3
1971	1,849.2	2,258.1	2,204.8	2,125.3	2,017.4	2,224.0	2,671.5	1,558.3	1,902.3	1,790.4
1972	1,957.8	2,410.2	2,391.1	2,330.0	2,204.3	2,394.2	2,835.0	1,649.0	2,031.2	1,962.8
1973	2,057.9	2,719.5	2,668.1	2,584.3	2,417.2	2,485.7	2,705.6	1,731.0	2,287.3	2,173.9
1974	2,030.1	2,891.2	2,826.5	2,720.4	2,511.3	2,485.8	2,916.7	1,706.4	2,429.5	2,286.3
1975	2,018.9	2,982.2	2,938.9	2,843.1	2,618.2	2,482.4	3,050.6	1,698.3	2,507.8	2,391.0
1976	2,126.0	3,094.5	3,094.5	3,044.1	2,841.3	2,606.8	3,210.0	1,787.6	2,601.5	2,559.1
1977	2,215.0	3,237.8	3,234.2	3,204.4	3,029.3	2,717.0	3,407.3	1,861.9	2,721.6	2,693.3

Note: Monetary aggregates are in billions of 1972 dollars.

Table B.2

Social Security Tax Liability for Alternative Perceptions:
Leimer-Lesnoy Algorithm

	Perception 1	Perception 2	Perception 3	Perception 4	Perception 5	Perception 6	Perception 7
1937	85.7	33.3	33.3	33.3	33.3	59.6	76.9
1938	79.0	29.2	29.6	29.9	30.3	57.5	70.2
1939	87.8	32.8	32.8	33.0	33.5	66.5	81.6
1940	96.5	35.9	35.9	36.1	36.5	76.2	90.0
1941	112.1	43.0	42.7	42.5	42.6	92.4	111.5
1942	128.1	49.8	49.5	49.2	49.0	111.8	134.2
1943	139.5	59.4	58.0	56.5	55.0	129.9	163.5
1944	140.4	63.5	62.2	60.2	57.4	137.5	177.8
1945	131.8	56.3	56.8	56.4	54.5	133.0	159.8
1946	132.3	54.5	55.1	55.5	54.6	135.4	155.4
1947	139.7	60.7	60.0	59.7	58.4	148.6	174.4
1948	146.2	64.4	64.0	63.4	62.0	161.6	119.6
1949	145.3	63.7	63.7	63.3	62.1	167.0	121.2
1950	154.9	102.2	93.6	84.8	75.2	184.7	132.9
1951	193.1	125.6	123.3	115.7	101.7	244.3	212.8
1952	201.9	134.5	133.1	127.7	113.4	263.4	233.5
1953	213.7	144.1	143.3	139.6	126.0	287.0	256.6
1954	213.1	188.7	177.2	163.9	141.4	295.0	258.7
1955	242.0	207.6	206.0	196.9	172.3	343.0	315.9
1956	262.1	225.8	225.1	219.5	196.4	380.4	351.2
1957	272.3	229.0	230.2	228.6	210.3	403.5	362.6
1958	274.5	225.6	227.2	228.0	215.4	417.1	366.1
1959	289.8	272.7	264.5	256.7	238.8	451.5	457.8
1960	297.8	341.7	324.2	302.7	269.4	474.1	479.8
1961	301.6	346.8	342.2	326.7	291.4	487.5	494.7
1962	320.8	385.9	380.4	366.7	328.9	526.9	554.8
1963	332.4	470.7	451.6	425.3	373.3	553.9	585.8
1964	352.7	500.6	495.2	476.0	422.2	592.7	629.3
1965	373.3	530.3	528.7	517.0	467.7	632.4	673.3
1966	399.6	591.8	585.3	572.6	523.4	682.8	726.7
1967	421.0	631.0	627.4	617.1	571.3	724.5	771.3
1968	438.4	619.3	627.8	630.9	601.0	759.3	813.3
1969	456.2	726.6	708.3	691.5	650.6	797.3	861.9
1970	464.9	725.3	724.4	715.0	678.6	816.0	870.1
1971	471.4	815.2	795.0	770.1	719.9	831.6	888.6
1972	498.9	855.7	852.1	835.4	785.3	880.9	962.5
1973	519.6	948.6	933.3	909.3	850.6	918.8	944.2
1974	509.1	946.2	938.2	918.5	861.6	899.0	938.1
1975	500.3	912.9	915.2	907.7	863.2	881.3	905.7
1976	528.4	960.0	961.7	959.4	923.8	929.5	953.0
1977	543.6	955.0	963.6	971.1	951.6	955.0	948.2

Note: Monetary aggregates are in billions of 1972 dollars.

Table B.3

Net Social Security Wealth for Alternative Perceptions:
Leimer-Lesnoy Algorithm

	Percept. 1	Percept. 2	Percept. 3	Percept. 4	Percept. 5	Percept. 6	Percept. 7	Percept. 8	Percept. 9	Percept. 10	Percept. 11
1937	49.3	103.4	103.4	103.4	103.4	88.5	103.9	31.2	85.1	85.1	75.4
1938	51.9	103.4	103.0	102.6	102.3	84.0	106.6	34.3	85.6	84.8	73.4
1939	58.4	115.3	115.3	115.1	114.7	93.9	117.5	38.7	95.4	95.1	79.7
1940	149.1	212.2	212.2	212.0	211.6	187.6	211.2	112.4	175.2	175.0	169.3
1941	151.8	200.1	206.3	212.5	218.3	194.7	182.3	112.1	163.6	174.2	171.5
1942	156.5	192.0	198.9	209.2	222.5	197.3	127.9	113.6	155.5	170.2	172.8
1943	179.7	182.1	192.8	209.2	233.8	213.4	97.3	131.3	145.6	169.0	189.3
1944	202.9	176.9	185.6	203.0	235.7	235.3	80.5	150.7	140.4	163.0	205.8
1945	204.5	189.0	187.8	195.2	222.3	235.5	102.6	153.2	151.5	156.8	203.4
1946	208.5	184.3	186.0	191.4	215.5	241.9	128.7	156.3	147.7	153.5	205.4
1947	229.9	170.2	178.5	189.7	219.2	261.4	97.9	173.0	134.7	151.4	221.0
1948	249.1	167.4	173.7	185.9	218.8	278.1	151.6	188.0	131.6	147.4	233.7
1949	271.2	185.8	186.1	192.8	222.3	294.4	168.2	206.7	147.1	153.1	249.5
1950	290.4	191.9	193.7	199.2	226.5	321.0	204.6	221.2	146.4	155.2	260.6
1951	450.4	316.0	311.5	310.2	335.6	477.9	285.3	351.6	248.3	244.9	399.3
1952	482.1	473.4	438.5	402.7	387.5	505.1	445.9	377.2	380.1	321.4	420.7
1953	521.2	540.2	523.5	487.8	449.1	536.4	534.1	408.3	435.0	391.4	447.9
1954	556.3	572.3	567.9	544.8	500.5	571.8	603.3	438.3	455.7	436.2	474.3
1955	629.4	738.7	714.6	677.6	609.6	638.7	901.0	496.0	593.8	543.7	528.4
1956	686.1	741.4	750.6	739.7	683.6	698.1	839.3	541.1	593.4	593.0	567.8
1957	726.0	762.9	770.5	772.4	732.9	731.6	808.4	572.2	610.2	618.2	594.9
1958	760.6	871.8	855.2	839.5	792.4	766.0	878.2	601.3	702.7	675.2	618.0
1959	809.7	947.0	937.6	920.0	868.9	803.2	911.3	640.7	759.3	738.9	648.0
1960	851.8	906.7	926.2	936.4	911.0	842.2	908.3	675.4	714.9	746.0	675.5
1961	885.9	875.6	897.3	924.1	928.3	892.4	850.8	703.8	688.2	732.2	700.0
1962	959.3	921.0	933.8	960.8	983.7	961.9	812.1	762.0	719.6	756.3	753.2
1963	996.5	888.8	909.2	943.5	988.6	990.0	851.0	791.3	678.7	732.0	775.1
1964	1,052.3	900.7	915.4	948.3	1,007.9	1,040.9	866.8	834.8	683.6	727.7	812.3
1965	1,095.0	969.0	964.3	976.8	1,027.9	1,079.1	943.6	867.2	736.3	745.0	835.9
1966	1,148.1	1,003.0	1,004.2	1,012.1	1,057.5	1,137.0	1,141.8	907.3	754.4	765.3	864.9
1967	1,202.7	935.6	964.4	997.4	1,064.2	1,188.5	1,048.4	949.4	690.8	745.1	899.3
1968	1,255.3	1,168.6	1,128.3	1,105.1	1,125.5	1,239.0	1,245.9	990.1	888.3	832.9	934.4
1969	1,299.8	1,058.8	1,086.0	1,101.1	1,138.1	1,285.7	1,272.4	1,024.1	778.1	819.2	958.7
1970	1,334.4	1,315.3	1,265.8	1,224.0	1,206.5	1,337.8	1,554.8	1,052.1	994.6	919.2	983.3
1971	1,377.8	1,442.9	1,409.8	1,355.2	1,297.5	1,392.3	1,783.0	1,086.9	1,087.1	1,020.3	1,017.5
1972	1,458.9	1,554.5	1,539.0	1,494.6	1,418.9	1,513.3	1,872.5	1,150.1	1,175.5	1,127.4	1,076.8
1973	1,538.3	1,770.9	1,734.8	1,675.0	1,566.7	1,566.9	1,761.4	1,211.5	1,338.7	1,264.5	1,139.0
1974	1,521.1	1,945.0	1,888.2	1,801.9	1,649.7	1,586.8	1,978.6	1,197.3	1,483.3	1,367.7	1,131.1
1975	1,518.7	2,069.3	2,023.8	1,935.4	1,755.0	1,601.1	2,144.9	1,198.0	1,594.8	1,483.3	1,137.7
1976	1,597.6	2,134.5	2,132.9	2,084.7	1,917.5	1,677.3	2,257.0	1,259.2	1,641.6	1,599.7	1,196.6
1977	1,671.3	2,282.8	2,270.5	2,233.3	2,077.7	1,762.0	2,459.1	1,318.3	1,766.6	1,722.2	1,260.0

Note: Monetary aggregates are in billions of 1972 dollars.

FOOTNOTES TO APPENDIX B

1/ Consistent with social security provisions in the early years of the program, gross wealth was calculated only for ages 15-59 in categories 1.a and 2.a over the period 1937-39. Also, wherever the number of wealth holders in categories 1 through 8 was computed net of current beneficiaries, the net result was set equal to zero if the computed result was negative. Finally, in wealth categories 5.b, 6, 7.b.1, and 8.a, the "ultimate" or age-65 insured rate for males attaining age 65 in 1940 was used to estimate the "ultimate" insured rate for husbands who attained age 65 prior to 1940.

2/ The benefits for female retirees are assumed to reflect the female worker's own retirement benefits plus any auxiliary benefits accruing by virtue of dual-entitlement. (The same is true for males, but is of little empirical significance.)

3/ In implementing those widow categories for which the husband is no longer alive or dies prior to attaining age 65, the husband is assumed to die between the ages of h=50 to 54; this is the expected age of death of a male (based on the U.S. decennial life tables spanning the period of analysis, 1937-77) given that he dies between the ages of 20 and 65. The term $i_{1,h,t+h-a-3,t}$ is then an approximation to the probability that the husband attained insured status prior to his death.

Appendix C. Alternative benefit and tax perceptions

I. Introduction

The formulas in Appendices A and B refer to three basic benefit types, denoted as $B^{c}_{...}$, $B^{y}_{...}$, and $B^{o}_{...}$. These types correspond respectively to benefit payments anticipated by persons in current payment status (in CPS), benefit awards anticipated by young workers (aged less than 65) not yet retired, and benefit awards anticipated by aged workers (aged 65+) not yet retired. This appendix describes the determination of these benefits as well as the determination of anticipated tax payments under the alternative perception assumptions considered.

II. Benefit determination

The formulas in Appendices A and B are designed to estimate "potential" social security wealth relative to a "benchmark" retirement age. This benchmark retirement age is defined as the first subsequent age at which an eligible individual can apply for social security benefits without actuarial reduction. This corresponds to age 65 for most individuals aged less than 65,[1/] and to current age + 1 for individuals aged 65+.

Under this benchmark concept, an estimate of the benefit award anticipated by young workers should reflect the average benefit award over all members of a given cohort if they were to retire at age 65; i.e., a benefit based only on age 14-64 earnings without actuarial reduction or increase. The best available program statistic to use as an estimate appears to be the average unreduced benefit award over all workers retiring in a given year. This program statistic is used as the numerator of the

$b^y_{...}$ ratios shown in table C.1 below. Similarly, the program statistic used to estimate the benchmark award anticipated by aged workers is the average unreduced benefit award over all workers aged 65+ retiring in a given year. This statistic is used as the numerator of the $b^o_{...}$ ratios shown in table C.1. Finally, the average benefit in current payment status for each beneficiary type (retired males, retired females, dependent wives, and surviving widows) is used as the numerator in the corresponding $b^c_{...}$ ratios represented in table C.1.

The formulas used to determine anticipated benefits under the ten alternative perception assumptions are given in table C.1. The table is divided into three parts; the first contains variable definitions; the second contains the formulas used to determine anticipated benefits for current beneficiaries; and the third contains the formulas used to determine anticipated benefits for persons not yet in current payment status (including both young ($B^y_{...}$) and aged ($B^o_{...}$) persons).

The first benefit perception assumes that individuals anticipate the benefit ratio b^x_k (ratio of the benefit in question to either covered earnings per worker under the Leimer-Lesnoy construction or disposable income per capita under the Feldstein replica construction) to be constant over time and based on some average over the period of analysis.2/ Under the assumption that current covered earnings per worker (or disposable income per capita), y_t, is expected to grow annually at rate g, the anticipated benefit at age j for an individual currently aged a in year t is given by $b^x_k \, y_t \, (1+g)^{j-a}$.

Under the second benefit perception, individuals assume that the relevant current benefit ratio will remain constant over future time.

Thus, the benefit at any future age j is the product of the current benefit ratio ($b^x_{k,t}$) and expected earnings per worker (or disposable income per capita) at that age.

Under perceptions 3-5, individuals' expectations about the future benefit ratio are formed adaptively, with varying weights given to the current benefit ratio and last period's expectation (which is, in turn, a weighted average of prior actual ratios and the initial expectation).[3] The initial expectation in 1936 is arbitrarily assumed equal to the actual benefit ratio for 1940; this assumption, coupled with the use of the 1940 ratio for the years 1937-39, implies that the initial expectation remains unaltered until 1941.[4]

Perception 6 assumes individuals have perfect foresight (up to the latest year for which published data is available) concerning future benefit ratios at entitlement and the path of benefit adjustments after entitlement. Individuals not yet in CPS, currently age a in year t, correctly perceive their benefit ratio at entitlement age e to be $b^x_{k,t+e-a}$; this ratio is multiplied by expected covered earnings per worker (or disposable income per capita), $y_t\ (1+g)^{e-a}$, to determine the anticipated benefit at that age. After entitlement, individuals correctly perceive real benefit adjustments to follow the path of the post-entitlement benefit index. For years in which actual data is not yet available (1978+ for the benefit ratios and 1981+ for the post-entitlement benefit index), this perception is roughly consistent with the intended operation of the presently legislated benefit structure; i.e., this perception assumes that benefit ratios (or replacement rates) will remain constant at 1977 values for workers retiring in the future, while benefits will stay constant in real terms after entitlement.

Under perception 7, individuals assume that the relevant current benefit ratios will change over time at the same rate that the benefit ratio projected by the SSA Actuary changes over the corresponding period, as of the last available projection. This anticipated benefit ratio is then multiplied by expected covered earnings per worker (or disposable income per capita) in the future period to compute the anticipated benefit. Because of the different nature of the projected benefit structure in the first years of the program, a separate procedure is used for the years 1937-39 under perception 7; i.e., the benefit ratio projected by the SSA Actuary is directly multiplied by expected earnings per worker (or disposable income per capita) to calculate the anticipated benefit.

Perceptions 8, 9, and 10 are exactly equivalent to perceptions 1, 2, and 4, respectively, except that workers and current beneficiaries are assumed to anticipate that post-entitlement benefits will be maintained in real terms and will not grow as productivity increases. In this aspect, these perceptions correspond to the presently legislated benefit structure and are referred to as "decoupled" perceptions.

III. Tax payment determination

The determination of anticipated tax payments under perceptions 1-7 is analogous to, but less complicated than, the determination of anticipated benefits. It is less complicated because there is only one type of tax payment differentiated by the sex of the worker. Since no program statistics are available on average tax payments by sex, the numerators of the tax ratios $\theta_{...}$ in table C.2 reflect the OASI tax payment (both the employer's and employee's share)5/ on median taxable earnings by sex.

Under each of the tax perceptions, the procedure for determining the anticipated tax payment consists of two steps. First, the tax ratio applicable to the projected year (at age j) is determined. Second, this tax ratio is multiplied by expected covered earnings per worker (or disposable income per capita) in the projected year, which is given by $y_t\ (1+g)^{j-a}$ under all of the tax perceptions.

Under perception 1, individuals perceive the tax ratio to be constant over time and equal to the average ratio over the period 1937-77. Under perception 2, the current tax ratio is assumed to apply to all future years. Perceptions 3-5 are adaptive, with the tax ratio anticipated for future years given by a weighted average of the current ratio and last period's expectation. Perception 6 assumes perfect knowledge of the actual tax ratios during the period 1937-77 and uses the 1977 value for later years.6/ Perception 7 assumes that the effective tax ratio $\theta_{s,t}$ will follow the same pattern over time as the current legislated schedule of OASI tax rate changes.

Table C.1. Anticipated benefit determination

I. Variable definitions

let x = type of individual anticipating future benefits:
- c = current beneficiary
- o = aged worker
- y = young worker

k = type of benefit or beneficiary:
- 1 = retired male
- 2 = retired female
- 3 = dependent wife
- 4 = surviving widow

$B^{c}_{k,a,j,v}$ or $B^{x}_{k,a,e,j,v}$ = benefit of type k anticipated at age j by individual of type c or x of age a in current year v, assuming entitlement at benchmark age e (the latter for individuals of type y or o only)

y_v = (LL) real covered earnings per worker in year v (under the Leimer-Lesnoy construction)
or (F) real disposable personal income per capita in year v (under the Feldstein replica construction)

$b^{x}_{k,v}$ = ratio of (actual average benefit of type k in year v associated with individuals of type x) to (y_v) (1940 value used for years $v < 1940$; 1977 value used for years $v > 1977$)

b^{x}_{k} = (LL) average benefit ratio over the period 1940-77 by benefit type k and individual type x (under the Leimer-Lesnoy construction)
or (F) .41 for male retirees and .256 for female retirees regardless of individual type (under the Feldstein replica construction)

b^{PE}_{v} = post-entitlement benefit index for year v; the ratio of this index between any two years reflects the change in real benefits between those years for any benefit which has been in current payment status during that period (1980 value used for years $v > 1980$)

$b^{AC}_{k,v,t}$ = sex-specific (k=1,2) benefit ratio (ratio of average retirement benefit to y_v) projected for year v by the SSA Actuary as of the most recent projection available in current year t

g = assumed (constant) annual rate of growth in y_v (.02)

Table C.1. (continued)

II. Anticipated benefits for persons in CPS (k=1 to 4) $(B^{c}_{k,a,j,t})$

Perception	Anticipated benefit	
1	$b^{c}_{k}\ y_t\ (1+g)^{j-a}$	
2	$b^{c}_{k,t}\ y_t\ (1+g)^{j-a}$	
3-5	$\hat{b}^{c}_{k,t}\ y_t\ (1+g)^{j-a}$ where $\hat{b}^{c}_{k,t} = \delta\ \hat{b}^{c}_{k,t-1} + (1-\delta)\ b^{c}_{k,t}$ and $\delta = .25, .50, .75$ respectively for perceptions 3-5	
6	$b^{c}_{k,t}\ y_t\ (b^{PE}_{t+j-a}/b^{PE}_{t})$	
7	$b^{AC}_{k,t+j-a,t}\ y_t\ (1+g)^{j-a}$	for $t < 1940$
	$b^{c}_{k,t}\ y_t\ (b^{AC}_{k,t+j-a,t}/b^{AC}_{k,t,t})\ (1+g)^{j-a}$	for $t \geq 1940$
8	$b^{c}_{k}\ y_t$	
9	$b^{c}_{k,t}\ y_t$	
10	$\hat{b}^{c}_{k,t}\ y_t$ where $\hat{b}^{c}_{k,t} = .5\ \hat{b}^{c}_{k,t-1} + .5\ b^{c}_{k,t}$	

III. Anticipated benefits for persons not in CPS (k=1 or 2) $(B^{x}_{k,a,e,j,t})$

Perception	Anticipated benefit	
1	$b^{x}_{k}\ y_t\ (1+g)^{j-a}$	
2	$b^{x}_{k,t}\ y_t\ (1+g)^{j-a}$	
3-5	$\hat{b}^{x}_{k,t}\ y_t\ (1+g)^{j-a}$ where $\hat{b}^{x}_{k,t} = \delta\ \hat{b}^{x}_{k,t-1} + (1-\delta)\ b^{x}_{k,t}$ and $\delta = .25, .50, .75$ respectively for perceptions 3-5	
6	$b^{x}_{k,t+e-a}\ y_t\ (1+g)^{e-a}\ (b^{PE}_{t+j-a}/b^{PE}_{t+e-a})$	
7	$b^{AC}_{k,t+j-a,t}\ y_t\ (1+g)^{j-a}$	for $t < 1940$
	$b^{x}_{k,t}\ y_t\ (b^{AC}_{k,t+j-a,t}/b^{AC}_{k,t,t})\ (1+g)^{j-a}$	for $t \geq 1940$
8	$b^{x}_{k}\ y_t\ (1+g)^{e-a}$	
9	$b^{x}_{k,t}\ y_t\ (1+g)^{e-a}$	
10	$\hat{b}^{x}_{k,t}\ y_t\ (1+g)^{e-a}$ where $\hat{b}^{x}_{k,t} = .5\ \hat{b}^{x}_{k,t-1} + .5\ b^{x}_{k,t}$	

Table C.2. Anticipated tax payment determination

I. Variable definitions

let s = sex of worker:
1 = male
2 = female

$T_{s,a,j,v}$ = tax payment anticipated at age j by an individual of sex s and age a in current year v

y_v = (LL) real covered earnings per worker in year v (under the Leimer-Lesnoy construction)
or (F) real disposable personal income per capita in year v (under the Feldstein replica construction)

$\theta_{s,v}$ = ratio of (actual OASI tax payment on median earnings for workers of sex s in year v) to (y_v)
(1977 value used for years v > 1977)

θ_s = average tax ratio over the period 1937-77 by sex

$\theta^L_{v,t}$ = legislated OASI tax rate scheduled for year v as of current year t

g = assumed (constant) annual growth rate in y_v (.02)

II. Anticipated tax payments ($T_{s,a,j,t}$)

Perception	Anticipated tax payment
1	$\theta_s \, y_t \, (1+g)^{j-a}$
2	$\theta_{s,t} \, y_t \, (1+g)^{j-a}$
3-5	$\hat{\theta}_{s,t} \, y_t \, (1+g)^{j-a}$ where $\hat{\theta}_{s,t} = \delta \, \hat{\theta}_{s,t-1} + (1-\delta) \, \theta_{s,t}$ and δ = .25,.50,.75 respectively for perceptions 3-5
6	$\theta_{s,t+j-a} \, y_t \, (1+g)^{j-a}$
7	$\theta_{s,t} \, (\theta^L_{t+j-a,t}/\theta^L_{t,t}) \, y_t \, (1+g)^{j-a}$

FOOTNOTES TO APPENDIX C

1/ The one exception is that widows could apply for actuarially unreduced benefits at age 62 during the period 1957-72.

2/ Under the Leimer-Lesnoy construction, a separate average benefit ratio is computed over the period 1940-77 for each of the four benefit types and three types of individuals anticipating benefits. The resulting averages are then used for the corresponding constant benefit ratios under perception 1. However, to preserve consistency with Feldstein's own series, the values used in the Feldstein replica construction for perception 1 are the same two values used in his series. The first, .41, is used as the constant benefit ratio for all male benefits; this value corresponds to the average benefit in current payment status for males over the period 1940-71. The second value, .256, is used as the benefit ratio for all female benefits; we were unable to determine the derivation of this value.

3/ Perceptions 1 and 2 can also be viewed as extreme forms of an adaptive expectations model. Perception 2 corresponds to the case $\delta=0$; i.e., no weight is given to prior values or expectations while total weight is given to the current value. Similarly, perception 1 corresponds to the case $\delta=1$ with an initial expectation equal to b_k^x; in this case, no weight is given to current values and total weight is given to the initial expectation.

4/ The current and adaptive expectations perceptions (2-5 and 9-10) share the problem that the appropriate benefit expectations prior to 1940 (before benefits were paid) are not clear. We have used the 1940 benefit ratio for those years.

5/ Under the Leimer-Lesnoy construction, an adjustment is made in years after 1950 to account for the lower tax rate on self-employment income. This adjustment is not made in the Feldstein replica construction.

6/ This corresponds to the tax perception employed in Feldstein's own tax series (except that subsequent data availability permits us to use a more recent final year).

Appendix D. Variable definitions and data sources

This appendix provides variable definitions and data sources for the variables introduced in Appendices A to C. Both the Leimer-Lesnoy (LL) and Feldstein replica (F) constructions are covered. Besides the LL and F construction designations, abbreviations used in the definitions below include ASS (for Annual Statistical Supplement to the Social Security Bulletin--1977 data preliminary), BLS (for BLS Handbook of Labor Statistics), CPR (for Current Population Reports, Series P-25), NIPA (for National Income and Product Accounts data), and SSYB (for Social Security Yearbook). The variables are listed in alphabetical order, beginning on the following page.

a = subscript denoting age group

b_s = constant benefit ratio by sex, used for F benefit perception 1 (.41 for males; .256 for females)

b_k^x = average benefit ratio over the period 1940-77 by benefit type k and individual type x, used for LL benefit perception 1 (calculated as the average of the corresponding $b_{k,t}^x$ values)

$b_{k,t}^x$ = $(B_{k,t}^x / y_t^c)$ = calculated benefit ratio for type k beneficiary in year t associated with individuals of type x (1940 value used for t < 1940; 1977 value used for t > 1977)

where y_t^c = covered earnings per worker in current dollars for LL (table 33, 1977 ASS)

= disposable personal income per capita in current dollars for F (NIPA data)

and $B_{k,t}^x$ = average benefit in current payment status at year end by beneficiary type k for x=c (tables 79 and 100, 1977 ASS)

= average benefit award during the year to age 65+ retirees by sex k for x=o (calculated from various tables in annual ASSs and SSYBs, 1940-77)

= average unreduced benefit award during the year over all workers retiring each year by sex k for x=y (calculated from various tables in annual ASSs and SSYBs, 1940-77)

$b_{s,v,t}^{AC}$ = ratio of average benefit by sex s to covered earnings per worker (for LL) or to disposable income per capita (for F) as projected for year v by the SSA Actuary as of the most recent projection available in current year t (calculated using data drawn from official cost-projection studies published by the SSA Actuary between 1937-78, interpolated between projected years)

b_t^{PE} = post-entitlement benefit index by year; the ratio of this index between any two years reflects the change in real benefits between those years for any benefit which has been in current payment status during that period (1980 value used for t > 1980) (calculated from information on statutory and automatic benefit increases; deflated to real terms using the CPI)

$B_{k,a,j,t}^c$ = type k benefit anticipated at age j by beneficiary of current age a in year t (computation described in Appendix C)

$B^{o}_{s,a,e,j,t}$ = sex-specific retirement benefit anticipated at age j by aged individual of current age a in year t assuming entitlement at age e (for auxiliary beneficiaries, the a, e, and j subscripts refer to the auxiliary rather than the primary beneficiary--computation described in Appendix C)

$B^{y}_{s,a,e,j,t}$ = sex-specific retirement benefit anticipated at age j by young individual of current age a in year t assuming entitlement at age e (for auxiliary beneficiaries, the a, e, and j subscripts refer to the auxiliary rather than the primary beneficiary--computation described in Appendix C)

$c_{s,a,t}$ = proportion of the population in covered employment by sex s and age a in year t (calculated as the ratio $W_{s,a,t}/N_{s,a,t}$, adjusting for differences between social security and NIPA populations)

d_t = dependent wife benefit factor as a proportion of husband's benefit in year t (based on program provisions: d_t=0 for 1937-39; d_t=.5 for 1940-77)

g = annual rate of growth in real covered earnings per worker (for LL) or in real disposable personal income per capita (for F), assumed constant over time (g=.02 used in all calculations, following Feldstein's own assumption)

$i_{s,e,v,t}$ = insured rate at age e in year v for person currently aged t+e-v in year t, by sex s (for v≤t: calculated as actual insured rates $I_{s,e,v}/N_{s,e,v}$, adjusting for differences between social security and NIPA populations; for v>t: constructed from published and unpublished insured rate projections made periodically by the SSA Actuary)

$i_{3,e,v,t}$ = insured rate at age e in year v for married or widowed woman currently aged t+e-v in year t (estimated from $i_{s,e,v,t}$ under the assumption that the insured rates for single women and males are identical and that 90 percent of women are married or widowed (see $m_{n,a}$ definition); i.e.,

$$i_{3,e,v,t} = (1/.9)\,(i_{2,e,v,t} - .1\, i_{1,e,v,t})\ )$$

$I_{s,a,t}$ = number of persons insured for social security benefits by sex s and age a in year t, for ages 62+ (for ages 65+: table 50, 1977 ASS and table 51, 1973 ASS, converted to end of year data with 1950 data adjusted to account for change in insured requirements; for ages 62-64: calculated as $N_{s,a,t}\ i_{s,65,t+65-a,t}$ due to lack of published insured data for this age group covering the entire period 1940-77)

k = subscript denoting benefit or beneficiary type:
1 = retired male
2 = retired female
3 = dependent wife
4 = surviving widow

$m_{n,a}$ = probability of a woman being married (n=1) or widowed (n=2) at age $a \geq 60$, if she survives (assumed constant over time) (calculations based on 1959-61 U.S. life table under the assumption that 90 percent of women aged 60+ are either married or widowed; the latter assumption is based on relatively stable averages across age groups and over time for the period 1952-78)

$N_{s,a,t}$ = population by sex and age in year t (based on CPR population estimates for July 1 of each year by single year of age, adjusted to NIPA population totals)

$p_{s,a}$ = labor force participation adjustment factor by sex s and age a used in F algorithm (for males: data reportedly used by Feldstein; for females: data used by Feldstein not available, so based on BLS female labor force participation rates by age group, averaged over the period 1947-71)

r = real discount rate, assumed constant over time (calculations made using r=.03, following Feldstein's own assumption)

$R_{k,a,t}$ = beneficiary population in current payment status by type of beneficiary k and age a in year t (based on end of year data drawn from various tables in annual ASSs and SSYBs, 1940-77)

R_t^w = earliest age at which a widow can apply for widow benefits without actuarial reduction (based on program provisions: R_t^w=65 for 1940-56 and 1973-77; R_t^w=62 for 1957-72)

s = subscript denoting sex: 1 = male
2 = female

$S_{s,a,j}$ = probability of person of sex s surviving from age a to age j, used in F construction (calculated from mortality rates in the 1959-61 U.S. decennial life tables)

$S_{s,a,j,t}$ = probability of person of sex s surviving from age a to age j based on mortality rates for year t, used in LL construction (calculated from mortality rates published in the U.S. decennial life tables from 1929-31 through 1969-71 and interpolated between decennial years; for $t > 1970$, extrapolated 1960-70 trend)

t = subscript denoting current year

$T_{s,a,j,t}$ = tax payment anticipated at age j by a person of sex s and age a in current year t (computation described in Appendix C)

θ_s = constant tax ratio by sex, used for tax perception 1 (calculated as average of corresponding $\theta_{s,v}$ values over the period 1937-77)

$\theta_{s,t}$ = $(\bar{T}_{s,t}/y_t^c)$ = calculated tax ratio in year t by sex s (1977 value used for t > 1977)

where y_t^c = covered earnings per worker in current dollars for LL (table 33, 1977 ASS)

= disposable personal income per capita in current dollars for F (NIPA data)

and $\bar{T}_{s,t}$ = OASI tax payment (employee + employer) in year t on median earnings for workers with taxable earnings, by sex (OASI tax rates: 1976 ASS, page 29; median earnings: table 36, 1977 ASS and table 38, 1967 ASS; adjusted in LL construction for lower tax rate on self-employment income in years after 1950 by applying a constant factor of .98)

$\theta_{v,t}^L$ = legislated OASI tax rate scheduled for year v as of current year t (1976 ASS, pages 27-28)

w_t = surviving widow benefit factor as a proportion of husband's benefit in year t (based on program provisions with exception under F construction for years 1973-77: w_t=0 for 1937-39; w_t=.75 for 1940-61; w_t=.825 for 1962-72; and for 1973-77, w_t=1.0 under the LL construction and w_t=.825 under the F construction)

$W_{s,a,t}$ = number of workers with taxable earnings of sex s and age a in year t (table 38, 1977 ASS; table 39, 1972 ASS; table 38, 1968 ASS; and table 37, 1967 ASS)

x = superscript denoting type of individual anticipating future benefits: c = current beneficiary
o = aged worker (≥65)
y = young worker (<65)

y_t = real covered earnings per worker in year t under LL construction (calculated as current values from table 33, 1977 ASS, deflated by NIPA personal consumption expenditures price deflator)

= real disposable personal income per capita in year t under F construction (NIPA data)

Appendix E

Table E.1

Variables Other Than SSW Used in Regressions

	C	YD	RE	HW	NNIA	PC
1929	1,770.2	1,885.2	46.4	10,696.6	121.9	35.8
1930	1,621.4	1,709.0	-8.5	10,303.8	123.2	35.0
1931	1,547.2	1,625.4	-82.7	9,815.4	124.1	31.5
1932	1,394.4	1,395.5	-133.7	9,165.8	124.9	27.9
1933	1,359.9	1,349.9	-125.9	9,053.8	125.7	26.8
1934	1,399.6	1,420.2	-63.4	8,840.1	126.5	29.0
1935	1,473.8	1,543.4	-31.1	8,903.8	127.4	29.7
1936	1,612.0	1,721.7	-27.8	9,435.8	128.2	30.0
1937	1,660.6	1,766.1	-14.1	9,394.6	129.0	31.1
1938	1,609.7	1,636.9	-10.1	8,979.4	130.0	30.6
1939	1,681.6	1,756.2	2.9	9,240.7	131.0	30.4
1940	1,744.5	1,849.2	46.3	9,757.5	132.1	30.8
1941	1,829.1	2,084.5	46.7	9,647.7	133.4	33.1
1942	1,789.4	2,352.1	73.1	NA	134.9	36.7
1943	1,818.0	2,430.1	91.3	NA	136.7	40.0
1944	1,847.4	2,484.5	103.5	NA	138.4	42.3
1945	1,941.2	2,420.4	60.9	NA	139.9	44.0
1946	2,132.3	2,352.3	29.1	10,325.8	141.4	47.7
1947	2,125.4	2,212.7	60.7	10,085.6	144.1	52.8
1948	2,132.0	2,286.8	117.9	10,309.1	146.6	55.9
1949	2,143.7	2,251.9	114.5	10,645.3	149.2	55.7
1950	2,228.1	2,385.3	80.5	10,831.5	151.7	56.8
1951	2,218.3	2,407.8	75.2	10,987.4	154.3	60.5
1952	2,234.5	2,433.0	77.1	11,211.0	157.0	61.9
1953	2,281.0	2,489.7	63.5	10,530.8	159.6	63.1
1954	2,283.5	2,475.5	76.0	10,653.5	162.4	63.6
1955	2,390.7	2,576.8	115.4	11,274.5	165.3	64.2
1956	2,414.2	2,643.3	89.4	11,799.3	168.2	65.5
1957	2,421.9	2,650.8	78.8	11,849.9	171.3	67.6
1958	2,405.5	2,635.5	60.0	11,820.7	174.1	69.1
1959	2,492.9	2,696.3	99.7	12,715.4	177.1	70.4
1960	2,508.1	2,697.0	84.9	13,099.3	180.7	71.7
1961	2,515.4	2,725.0	80.9	13,152.5	183.7	72.5
1962	2,587.3	2,796.1	120.0	13,794.0	186.5	73.6
1963	2,649.7	2,849.1	126.4	13,517.6	189.2	74.7
1964	2,756.3	3,008.6	149.2	14,298.5	191.9	75.7
1965	2,871.4	3,151.8	180.9	14,918.5	194.3	77.1
1966	2,981.9	3,274.5	188.9	15,284.3	196.6	79.3
1967	3,035.3	3,370.7	165.1	14,594.0	198.7	81.3
1968	3,156.3	3,463.8	143.9	15,336.5	200.7	84.6
1969	3,231.9	3,514.7	107.1	16,182.3	202.7	88.5
1970	3,265.2	3,619.5	55.6	15,698.7	204.9	92.5
1971	3,340.6	3,713.8	82.5	15,688.5	207.1	96.6
1972	3,509.9	3,836.8	124.2	16,209.6	208.8	100.0
1973	3,648.6	4,062.1	101.7	17,344.1	210.4	105.5
1974	3,591.3	3,974.9	0.9	16,654.9	211.9	116.9
1975	3,626.3	4,024.8	52.6	15,867.6	213.6	126.4
1976	3,813.6	4,144.8	89.3	17,253.1	215.2	132.8
1977	3,973.0	4,286.0	116.0	18,061.1	216.9	140.4
1978	4,119.0	4,448.0	110.0	17,774.0	218.6	150.0
1979	4,193.0	4,511.0	91.0	18,265.8	220.5	163.3

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Notes

National income and product accounts (NIPA) data are from the Data Resources, Inc. (DRI) data bank. Data may be found in The National Income and Product Accounts of the United States, 1929-74. Revised estimates of the national income and product accounts are found in the July issues of the Survey of Current Business. A description of the revised accounts is found in "The National Income and Product Accounts of the United States, Revised Estimates, 1929-74," Survey of Current Business, January 1976, 56:1, Part I.

Monetary values are 1972 dollars per capita. Aggregate values in 1972 dollars may be obtained by multiplying per capita values by population, NNIA. Aggregate values in current dollars may be obtained by multiplying aggregate values in 1972 dollars by PC, the implicit deflator for consumer expenditures.

C is per capita consumer expenditures in 1972 dollars.

YD is per capita disposable income in 1972 dollars.

RE is per capita net retained earnings in 1972 dollars. Data on nominal retained earnings are the revised estimates that include both the capital consumption adjustment and inventory valuation adjustment. The capital consumption adjustment is an adjustment to tax depreciation, which corrects for changes in the prices of capital goods, and is based on more realistic estimates of service lives of assets. The adjusted measure of capital consumption allowances conforms more closely to the economic definition of depreciation.

HW is ordinary household wealth (real plus financial assets less liabilities) at beginning of year. For 1929-1952, data are the Ando-

Modigliani series published in M. K. Evans, Macroeconomic Activity, Harper & Row, 1969, page 37. For 1953 ff., data are from the data bank for the Federal Reserve Quarterly Econometric Model, as of January 1980. We thank Jared Enzler for making these data available.

NNIA is the U.S. population including Armed Forces abroad, in millions of persons. NNIA is the population used in the NIPA to obtain per capita series. The NNIA series differs from that published by the Bureau of the Census. (See U.S. Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1970, Washington, D.C.: Government Printing Office, 1975.) The Cenaus series excludes Armed Forces overseas before 1940 and includes Alaska and Hawaii from 1950-1959.

PC is the NIPA implicit price deflator for personal consumption expenditures, expressed as a percent.

Table E.2

Comparison of Corrected and Replica Feldstein Social Security Wealth Series

	Gross Wealth			Net Wealth		
	Feldstein Corrected	Feldstein Replica	Percent	Feldstein Corrected	Feldstein Replica	Percent
1937	170.1	151.5	89.1	88.1	68.6	77.9
1938	152.3	135.8	89.2	78.3	61.0	77.9
1939	246.3	152.0	61.7	159.3	64.4	40.4
1940	274.0	255.8	93.4	175.0	156.0	89.1
1941	358.5	334.4	93.3	222.5	197.6	88.8
1942	452.2	426.1	94.2	279.2	251.0	89.9
1943	485.4	446.8	92.0	308.4	267.8	86.8
1944	484.4	444.1	91.7	310.4	269.3	86.7
1945	476.7	438.0	91.9	299.7	260.0	86.8
1946	489.8	452.5	92.4	288.8	251.4	87.0
1947	465.9	431.0	92.5	267.9	233.3	87.1
1948	487.2	450.7	92.5	274.2	239.0	87.2
1949	464.0	429.1	92.5	260.0	226.6	87.2
1950	513.8	474.6	92.4	282.8	245.4	86.8
1951	632.2	583.1	92.2	359.2	312.3	86.9
1952	662.5	608.2	91.8	374.5	324.1	86.5
1953	698.0	642.4	92.0	392.0	340.3	86.8
1954	691.1	635.5	92.0	389.1	338.0	86.9
1955	797.6	733.8	92.0	450.6	393.2	87.3
1956	857.7	788.8	92.0	483.7	422.6	87.4
1957	927.1	849.3	91.6	518.1	448.7	86.6
1958	925.7	847.0	91.5	516.7	448.5	86.8
1959	977.8	893.3	91.4	537.8	465.1	86.5
1960	996.1	908.0	91.2	544.1	469.1	86.2
1961	1,024.9	933.8	91.1	561.9	485.6	86.4
1962	1,106.7	1,004.0	90.7	615.7	529.8	86.1
1963	1,151.3	1,043.8	90.7	635.3	548.0	86.3
1964	1,252.5	1,129.6	90.2	689.5	590.6	85.7
1965	1,357.3	1,229.6	90.6	736.3	636.6	86.5
1966	1,470.6	1,331.3	90.5	786.6	680.9	86.6
1967	1,553.7	1,406.1	90.5	825.7	716.8	86.8
1968	1,634.8	1,479.5	90.5	860.8	749.8	87.1
1969	1,703.6	1,539.5	90.4	884.6	770.0	87.1
1970	1,778.5	1,606.4	90.3	918.5	807.1	87.9
1971	1,837.5	1,659.4	90.3	950.5	833.2	87.7
1972	1,953.8	1,762.3	90.2	999.8	878.8	87.9
1973	2,145.9	1,929.4	89.9	1,088.9	953.8	87.6
1974	2,140.6	1,912.5	89.3	1,081.6	945.9	87.5

Note: Monetary aggregates are in billions of 1972 dollars.