Social Security and the Public Debt
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by

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Abstract

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The short- and long-term financial status of the U. S. social security program has been the topic of much attention in recent years. The motivation is compelling: beginning in the mid-1980s, the combined Old-Age, Survivors, and Disability Insurance (OASDI) program has been generating increasing surpluses, amounting to $62 billion in 1990, and is projected to have operating surpluses for the next twenty-five years, averaging .6% of GNP. Beyond that period, deficits begin to accumulate, eventually reaching 1.7% of GNP. When the health care portion of the program (Hospital Insurance) is taken into account, social security surpluses average .5% of GNP for the next eighteen years, followed by annual deficits that rise to over 4% of GNP. The manner in which these balances are financed in the Federal budget could have serious implications for future U. S. debt policy. This paper examines the behavior of long-run debt/income ratios that could evolve under alternative Federal budget scenarios and recent official social security projections. Under scenarios that reflect exceptional fiscal restraint, the economy will head toward a sizable net asset position during social security surplus years. After the program begins to accumulate deficits, however, debt ratios rise rapidly, moving the economy toward extraordinarily large and possibly unstable debt ratios.

I. Introduction

The short- and long-term financial status of the U. S. Social Security program has been the topic of much attention in recent years. The motivation is compelling: beginning in the mid-1980s, the combined Old-Age, Survivors, and Disability Insurance (OASDI) program has been generating increasing surpluses, amounting to $62 billion in 1990. The OASDI trust fund held $225 billion in assets at the end of 1990 and is projected to proceed on an unprecedented path of accumulation for the next 27 years, rising from 4.1% of GNP in 1990 to almost 24% of GNP in 2018 (see Figure 1). During that period, the trust fund will hold a growing proportion of gross Federal debt and could become the major determinant of marketable public debt. Beginning around 2017, however, the fund is expected to begin accumulating deficits, and to be depleted just after 2040 (U. S. Congress, 1991a).

The prospect of vast swings in the OASDI trust fund balances has motivated analyses of the implications for, *inter alia*, saving and economic growth (Aaron, *et al*, 1989), the nature of social security funding (Weaver, 1989), trust fund investment (Eisner, 1988), and intergenerational equity (Hambor, 1987). However, the long-run public debt implications have not been explored. Most empirical evaluations of debt policy in general are based on short-run models, usually extending over a five year horizon. In contrast, this paper focusses on the very long-run, and stresses the role of social security in future U. S. debt policy.

The financial status of social security is crucial to an analysis of future debt policy. Social security income (primarily payroll and benefit taxes) and outgo (benefit payments) flow through separate trust fund accounts that are part of overall Federal revenues and outlays. Thus, social security surpluses improve the Federal budget balance and deficits invoke the usual methods of government finance. According to the official projections cited above, deficits in the OASDI program will begin around 2017, rise rapidly for about fifteen years, level off at 1.4% of GNP for another fifteen years, and then rise gradually to about 1.7% of GNP (see Figure 3).[1] In addition, the conditions that bring about the OASDI deficits are expected to cause deficits in other social insurance programs, notably Medicare. If the Hospital Insurance (HI) part of Medicare is also considered (U. S. Congress, 1991b), then combined OASDHI deficits will rise to over 4%

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[1]The projected pattern of social security balances results from anticipated demographic changes combined with current social security law that calls for constant benefit replacement rates and payroll tax rates. The post-war baby boom and recent growth in the female labor force will have a positive effect on the financial status of social security for the next three decades. Subsequently, the decline in the fertility rate that started in the late 1970s, combined with an inevitable slowdown in the growth of the female labor force, will dampen the growth in the taxable payroll base. In addition, increased life expectancies and earlier retirements have resulted in larger outlays, trends that are likely to continue.

of GNP (Figure 3). Persistent deficits of that magnitude, ignoring any nonsocial security deficits, would be unique to U. S. budget experience and it seems unlikely that Congress would allow that situation to materialize. Yet, the alternatives are unappealing. A policy of continuous deficit financing, even if initially stable in relation to economy-wide growth, could create sufficient uncertainty over the form of future government financing to bring about an unstable (even explosive) debt/GNP path (Masson, 1985). Modifying the social security law to reduce benefits or raise payroll taxes is exceedingly unpopular and adjusting nonsocial security spending and revenues to accommodate social insurance deficits that are 4% of GNP may be infeasible. Moreover, as suggested by Figure 3, adjustments would have to be imposed in a precipitous, potentially disruptive, fashion if delayed until social security deficits commence.

The conditions under which persistent government borrowing leads to growing and possibly unstable debt/income ratios were examined over forty years ago by Evsey Domar (1944). Domar was concerned that continuous debt financing during war time could lead to an ever-increasing tax burden for future generations. Prompted by chronic deficits and growing debt in the U. S. and other countries in recent years, economists have reopened the debt burden debate. The standard neoclassical growth model predicts an intergenerational public debt burden in the form of a depressed future capital stock (Diamond, 1965). On the other hand, if Ricardian equivalence holds, no such burden arises (Barro, 1974). In the Barro model, government debt does not represent net wealth and has no affect on national saving and future capital formation. The literature remains divided on this issue (Barro, 1989; Bernheim, 1989) and both models typically abstract from situations in which debt rises continuously as a percent of GNP. Yet, the rising debt ratios apparent in recent years signal fiscal policies that are essentially unsustainable and portend undesirable long-run consequences for output and consumption (Tobin, 1986) and could ultimately lead to an acceleration of inflation (Bispham, 1987).

It is therefore of some interest to investigate the public debt consequences of anticipated social insurance deficits. This paper provides such an analysis. Debt/GNP paths that could evolve in the long-run under current social security law, a basic set of economic assumptions, and alternative Federal budget scenarios are derived. The approach is to partition the Federal budget into social security and nonsocial security components and fix the analysis on constant social security law. The budget targets posed, or alternative targets, could be achieved by modifications in either component, however. The results illuminate the potential consequences of forgoing early changes and provide an indication of the dimension such changes would entail.

The next section of the paper outlines the framework used here for analyzing the dynamics of

Federal debt. The third section describes the relationship between social security and the Federal budget and the fourth section analyzes the debt ratio paths for six possible Federal budget scenarios. The fifth section illustrates the possible effects on the debt/GNP ratio when social security imbalances affect economic assumptions. The final section presents conclusions.

II. The Federal Debt and Economic Growth

In order to highlight the long-run dynamics of Federal debt, budget deficits, and social security we utilize the following simple and well-known framework. Let D_t be the total outstanding marketable public debt in period t; let Y_t be nominal GNP in year t and have an annual growth rate of n; let d_t equal the ratio D_t/Y_t; and let i be the after-tax nominal interest rate on the public debt. The total deficit in year t is the sum of the primary (net of interest paid or received) deficit and the debt service:

(1)
$$D_t - D_{t-1} = pY_t + iD_{t-1},$$

where p is the ratio of the primary deficit to GNP. If p, i and n remain constant and $i < n$ then the debt ratio will evolve according to equation (2) $(d_t / D_t - n)$:

(2)d
$$_t = p(1+n)/d_{t-1} + (i-n),$$

and the limiting value of d, d^*, occurs when$_t = 0$:

(3)
$$d^* = p(1+n)/(n-i).$$

If i \$ n, then (3) does not hold and a limit for d does not exist; in that case, a primary deficit will lead to an explosive rise in the debt/GNP ratio.[2] Equation (3) could be expressed equivalently in real terms by

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[2]Lagging equation (1) and making successive substitutions leads to the following equation:

substituting $r = i-\pi$ for i and $g = n-\pi$ for n where π is the rate of inflation. Distinctions made throughout this paper between nominal interest and growth rates are valid for real rates if, as assumed, the same deflator applies to interest and GNP.

Several important aspects of debt behavior are subsumed in equation (3). First, the relationship between the interest rate and growth rate is crucial, though theoretically indeterminate. If i < n, a stable debt ratio path results and deficits can be rolled over indefinitely. On the other hand, if i $ n and p > 0, the debt ratio is on an unstable path in which interest payments will grow faster than GNP and will eventually absorb all of the budget and ultimately all of GNP. Financing a continuously growing debt requires either that the private and/or foreign sectors hold an increasing amount of Treasury bills, for which a limit exists, or the Federal Reserve to serve as the lender of last resort, thereby leading to hyperinflation. Clearly, contractionary fiscal policy would be required in this case.

$$d_t = p3_k z^k + d_0 z^t,$$

where $d_0 = D_0/Y_0$ and $z = (1+i)/(1+n)$. If $z = 1$, then $d\,6\,4$ as $t\,6\,4$. If $z \neq 1$, then the formula $3 z^k = (z^t-1)/(z-1)$ applies and the equation above becomes:

$$d_t = \{p/(z-1)\}z^t - p/(z-1) + d_0 z^t.$$

Therefore, if $z < 1$ (i < n) then as $t\,6\,4$, $d\,6\,-p/(z-1) = p(1+n)/(n-i)$ as in the text; however, if $z > 1$ (i > n) then as $t\,6\,4$, $d\,6\,4$ (see Bishpam, 1987 for further details).

The dynamic efficiency of an economy is often judged on the basis of the interest rate - growth rate relationship. In a long-run steady state economy, dynamic efficiency requires i $ n; i < n suggests that the economy is overaccumulating capital and is thereby dynamically inefficient (i = n corresponds to the Golden Rule). Thus, in an economy in which government debt affects capital intensity, the optimal level of debt (for efficiency) may be incompatible with debt stability (Zee, 1988). Historically, the interest rate has been well below the GNP growth rate in the United States, implying a stable but possibly inefficient growth path. However, Abel *et al* (1989) caution that the interest rate - growth rate relationship may be an inappropriate criterion for assessing dynamic efficiency. Based on a comparison of capital income and investment, they conclude that, at least since 1929, the U. S. economy has been dynamically efficient, despite relatively low interest rates.[3]

Second, even a stable debt ratio may have severe implications for public expenditure policy if the initial debt/GNP ratio (and implicitly the tax ratio) and/or the speed at which the limit is approached are relatively high. A small increase in d_t could be extremely burdensome for a country already faced with a very large debt/GNP ratio. And there may be little practical distinction between a stable and unstable debt ratio when d_t is rising rapidly and the stable limit is quite high. Indeed, a rapidly rising debt ratio could create sufficient uncertainty about future budget policy (e. g., through the threat of monetization) to convert a stable (i < n) to an unstable path (i > n) (Masson, 1985). Finally, the behavior of the primary deficit, which may not be constant and may be zero or negative (an implosive debt/GNP ratio), is also important. A rising p and a positive real interest rate may lead to a limitless rise in the debt/GNP ratio. These aspects of debt behavior will be of particular concern for the U. S. economy when the social security program begins to accumulate large deficits.

Table 1 displays values of d* for seven countries for the recent period and for the U. S. economy over the next five years. If the fiscal stance of the 1980-1990 period were to continue, the U. S. would be headed for a very large debt/GNP ratio. This path is expected to change direction under the policies and economic conditions assumed in the official projections. The main concern of this paper, however, is the potential U. S. fiscal experience for many years ahead, a focus that is generally outside the purview of official budget exercises.

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[3]Abel *et al* cite evidence which shows that the mean real return on Treasury bills was .3% over the period 1926 to 1986.

III. Social Security, the Federal Budget, and Federal Debt

The primary deficit (or surplus) in the U. S. Federal budget has two principal components: the balance in the general fund (gf) and the (cash) balance in the social security (ss) account. Thus, p can be expressed as:

$$(4) \qquad\qquad\qquad p = p_{gf} + p_{ss},$$

where p_{gf} is the gf/GNP ratio and p_{ss} is the ss/GNP ratio. Historically, p_{ss} has been a very small component of p. Figure 2 depicts actual values of p_{gf} and p_{ss} over the period 1950 to 1990. Clearly, past balances in the social security account have been too small to have had any significant effect on the overall budget balance and therefore on the behavior of Federal debt. Between 1950 and 1990 the average annual value of p was .29 while the average for the primary deficit that excludes social security (OASDI), p_{gf}, was .34.[4] Since 1985, however, p_{ss} has been a growing component of the Federal budget balance and, in the future, social security will be a consequential element in U. S. debt policy.

Figure 3 shows projected values of p_{ss} over the period 1991 to 2065. The lower line depicts the annual surpluses/deficits (tax income less outgo) expected to occur in the OASDI program. Surpluses averaging .6 percent of GNP are predicted until the year 2016 followed by rising deficits until 2030, after which the deficits level off at 1.4% of GNP and then rise gradually to about 1.7% of GNP.

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[4]Computed as the average of annual balances on a National Income and Product Basis. All historical budget data used data used in this paper are from U. S. Government (1991).

Table 1
The United States Fiscal Position, 1980 - 1995

Variable	Definition	1980-1989 Average (percent)	1990-1995 Average (percent)
d_0	initial debt/GNP ratio	26.1	42.8
p	primary deficit/GNP ratio	1.9	0.1
n	nominal GNP growth rate	7.7	6.8
i	before-tax nominal interest rate (3 month Treasury bill rate)	8.8	5.2
i^1	after-tax nominal interest rate	6.2	3.9
π	inflation rate (GNP deflator)	4.9	3.7
r	real after-tax interest rate ($i-\pi$)	1.3	0.2
g	real GNP growth rate ($n-\pi$)	2.9	3.1
d*	long-run debt ratio	133.1	1.5

[1]i is net of monetization, computed as .75i times the increment in monetized debt for the period (6% for 1980-1989 and 0% assumed for 1990-1995). Sources: U. S. Government, 1990 and *Economic Report of the President, 1990*.

The social security deficit outlook changes dramatically when the Hospital Insurance program is taken into account.[5] The HI program is projected to begin incurring annual cash deficits in the mid-1990s and the HI trust fund will be exhausted just after the turn of the century (U. S. Congress, 1991b). When the HI and OASDI balances are combined we get the OASDHI values for p_{ss} displayed in the top line of Figure

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[5]OASDI and HI together comprise what is commonly referred to as the U. S. social security prgram (U. S. Government, 1990), though they are conceptually distinct programs. They share the same financing basis, a payroll tax, and, in the past, intrafund borrowing has occurred when one of the funds faced a financial shortfall. In the event of financial difficulty in the future, Congressional action may again be based on the financial feasibility of the combined OASDHI program. The appendix contains additional information on the financing and benefit provisions of OASDI and HI.

3. The results are smaller surpluses (the average annual surplus is less than .5% of GNP) and earlier deficits (starting in 2009) which rise rapidly to 4% of GNP by the middle of the next century.

The pattern of social security surpluses and deficits shown in Figure 3 reflects the pattern of balances, opposite in sign, needed for the nonsocial security accounts, including interest for debt service, in order to achieve total budget balance, the goal of the Gramm-Rudman-Hollings Act of 1985 and as amended in 1987. Between 1991 and 2008, overall budget balance would require an average deficit in the nonsocial security accounts of no more than .5 percent of GNP. For the longer run, overall Federal budget balance would require an average annual nonsocial security account *surplus* of over 4% of GNP. Viewed from an historical perspective, this is a very severe requirement. Between 1950 and 1988 the nonOASDHI budget (including interest) experienced an average annual *deficit* of 1.44 percent of GNP, which is exceeded by the magnitude of the projected long run deficits in the OASDI program alone.

Under the projected pattern of p_{ss}, the behavior of the total Federal debt will hinge upon the behavior of p_{gf} which will be determined by future Federal budget policy. This can be seen more clearly by rewriting equation (1) in the following form:

$$(5) \qquad\qquad D_t - D_{t-1} = (p_{gf} + p_{ss})Y_t + iD_{t-1}.$$

For example, a balanced total budget policy requires that $D_t - D_{t-1} = 0$ (i. e., $p_{gf}Y_t + iD_{t-1} = -p_{ss}Y_t$), resulting in no new debt creation and a continually falling d_t (according to $d_0/(1+n)^t$). A balanced primary budget policy ($p = 0$) requires $p_{gf} = -p_{ss}$. In this case, new debt arises only from interest obligations on the extant debt. If interest obligations increase faster than GNP ($i > n$) then d_t will rise indefinitely. If $i < n$, then d_t will approach zero ($d^* = 0$) according to $d_0((1+i)/(1+n))^t$. A balanced primary budget is somewhat easier to achieve (debt service goes unpaid), though either scenario would likely provide an acceptable debt ratio path from the perspective of Federal debt policy. Both budget policies will become severely strained, however, fifteen years hence when p_{ss} begins to rise rapidly (Figure 3).

Other budget scenarios are possible, of course, and below we explore the Federal debt implications of four feasible alternatives, *given the projected path for* p_{ss}: two general fund (including interest) scenarios and two primary (net of interest) scenarios. All six (inclusive of the two described in the preceding paragraph) are summarized in Table 2. Under a balanced general fund budget ($p_{gf}Y_t + iD_{t-1} = 0$), the third scenario shown in the table, the debt will be determined by p_{ss}; interest obligations are paid each year (or

interest earnings are spent). During surplus years, the initial debt will decline each year by $p_{ss}Y_t$ and during deficit years the debt will rise by $p_{ss}Y_t$. The fourth scenario sets the general fund budget balance equal to the interest paid to the OASDI trust fund from the general fund ($p_{gf}Y_t + iD_{t-1} = I_{ss}Y_t$, where I_{ss} is the OASDI trust fund interest/GNP ratio).[6] In this case, the total budget balance equals the cash balance plus interest in the OASDI account. This scenario is consistent with the budget policy adopted recently by Congress in the Omnibus Budget Reconciliation Act of 1990 (OBRA90) which gives explicit recognition to the view that OASDI surpluses (cash plus interest) are intended to pay for benefit obligations of future retirees. We discuss this policy further below.

The fifth scenario in Table 2 is a balanced primary (net of interest) general fund budget ($p_{gf} = 0$) which differs from scenario three in allowing interest on accumulating debt. The last scenario in Table 2 combines the projected social security balances with the historical (1950-1990) average in the nonsocial security primary general fund (i. e., $p_{gf} = p_{gf}$). This scenario represents the situation that would occur if nonsocial security Federal spending decisions in the future were to mimic the past. The second column of Table 2 shows the total Federal budget balance that results from the budget policy represented in the first column. The third column displays the corresponding long-run debt ratio and the last column provides the interest rate-growth rate stability condition. The scenarios have different implications for the path and ultimate value of the debt/GNP ratio. For scenarios 2, 5, and 6 the relationship between the growth in GNP and the interest rate is important. Even with i and n constant, however, d_t and d^* will change throughout the projection period under the last four budget scenarios. That is because the projected values for p_{ss} will cause the primary deficit/GNP ratio to change dramatically, particularly during 2006-2030 (Figure 3). Indeed, during that period the last two budget scenarios could result in an unstable debt/GNP ratio due to a rapidly rising value of p.

IV. Social Security and Long-Run Debt Ratios

Determination of the debt/GNP path requires information about interest rates and GNP growth rates. The long-run behavior of these rates is highly uncertain and assumptions about that behavior must be

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[6]Any operating surpluses in the OASDI or HI Trust Funds are invested in special issue government bonds, allowing the funds to accumulate interest during surplus years. The interest amount is an intragovernmental transfer (an outlay from the general fund, income to the trust funds) and ordinarily would not appear when computing the total budget balance. See the appendix for further details.

judged accordingly. This paper utilizes the economic assumptions contained in the 1991 Federal OASDI Trustees Report (U. S. Congress, 1991a). The basic economic assumptions are displayed in Table 3 for subperiods selected to correspond to the projected pattern for p_{ss} described in the preceding section. The first subperiod roughly spans the period of surpluses in which p_{ss} does not change dramatically from year to year. Similarly, the last subperiod coincides with steady (large) deficits in the social security accounts.[7]

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[7]The nominal interest rate of 6.30% in Table 3 is assumed to be the ultimate new issue rate for government bonds. For marketable public debt, however, the after-tax rate is appropriate. A 25% tax on interest income, which is consistent with historical experience, is assumed for this paper, resulting in a nominal after-tax interest rate of 4.73% for most years. The after-tax rate is below the nominal GNP growth rate so that the stability condition, $i < n$, is always satisfied. As pointed out earlier in the text, the stability condition can be based on nominal rates rather than the usual real rates if, as assumed, the same deflator applies to interest and growth rates.

Table 2
Federal Budget Scenarios and Debt/GNP Ratios

Budget Scenario	Total Budget Balance	d*	Stability Condition
Total Fund Balance = 0	0	0	$i >=< n$
Primary Fund Balance = 0	iD_{t-1}	d_0	$i = n$
		0	$i < n$
		4	$i > n$
General Fund Balance = 0	$p_{ss}Y_t$	$p_{ss}(1+n)/n$	$i >=< n$
General Fund Balance = $I_{ss}Y_t$	$p_{ss}Y_t + I_{ss}Y_t$	$(p_{ss}+I_{ss})(1+n)/n$	$i >=< n$

| Primary General
Fund Balance = 0 | $p_{ss}Y_t + iD_{t-1}$ | $p_{ss}(1+n)/(n-i)$ | $i < n$ |
| | | 4 | $i \$ n$ |

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| Primary General
Fund Balance $=p_{gf}Y_t$ | $(p_{gf}+p_{ss})Y_t + iD_{t-1}$ | $(p_{gf}+p_{ss})(1+n)/(n-i)$ | $i < n$ |
| | | 4 | $i \$ n$ |

[1]Budget scenario definitions:

    Total Fund: the total Federal budget (including the "off-budget" OASDI account and net interest paid).

    Primary Fund: the total Federal budget net of interest paid or interest received.

    General Fund: the total Federal budget excluding the OASDI account.

    Primary General Fund: the General Fund net of interest.

Table 3
Economic Assumptions and Social Security Balances
Based on 1991 Social Security Trustees Report

Variable[1]	1991 to 2005	2006 to 2010	2011 to 2015	2016 to 2020	2021 to 2025	2026 to 2030	2031 to 2065
n	6.04	5.91	5.63	5.42	5.35	5.41	5.40
i	6.71	6.30	6.30	6.30	6.30	6.30	6.30
i	5.03	4.73	4.73	4.73	4.73	4.73	4.73
π	4.06	4.00	4.00	4.00	4.00	4.00	4.00
g	1.98	1.91	1.63	1.42	1.35	1.41	1.40
r	.97	.73	.73	.73	.73	.73	.73
p_{ss}(OASDI)	-.72	-.70	-.37	.19	.77	1.21	1.54

The five-year intervals covering 2006 to 2030 divide a period of rapid change in p_{ss} and are used below to emphasize changes in the long-run debt/GNP ratio (d*). The predicted OASDI and OASDHI cash (p_{ss}) and interest (I_{ss}) surpluses and deficits are also shown in the table.[8] OASDI interest rises rapidly, reaches a peak

p_{ss}(OASDHI)	-.49	-.07	.59	1.50	2.43	3.20	3.97
I_{ss}(OASDI)	-.73	-1.12	-1.33	-1.43	-1.33	-1.07	1.17
I_{ss}(OASDHI)	-.85	-1.01	-.96	-.68	-.11	.76	7.41

[1]Variable definitions (see also Table 1): p_{ss} is the predicted operating surplus (-) or deficit (+) in either the OASDI or OASDHI program, expressed as a percent of GNP; I_{ss} is predicted interest surplus (-) or deficit (+) also expressed as a percent of GNP. Sources: U. S. Congress, 1991a, 1991b and unpublished data provided by the Social Security Administration.

[8]Budget scenarios under OASDI balances implicitly assume either that HI blaances do not change as a proportion of GNP or that the deficits are financed through increased taxes. The analysis in this paper makes the projected HI balances explicit.

Table 2
Federal Budget Scenarios and Debt/GNP Ratios

Budget Scenario	Total Budget Balance	d*	Stability Condition
Total Fund Balance = 0	0	0	$i >=< n$
Primary Fund Balance = 0	iD_{t-1}	d_0	$i = n$
		0	$i < n$
		4	$i > n$
General Fund Balance = 0	$p_{ss}Y_t$	$p_{ss}(1+n)/n$	$i >=< n$

General Fund Balance $= I_{ss}Y_t$	$p_{ss}Y_t + I_{ss}Y_t$	$(p_{ss}+I_{ss})(1+n)/n$	$i >=< n$
Primary General Fund Balance $= 0$	$p_{ss}Y_t + iD_{t-1}$	$p_{ss}(1+n)/(n-i)$ 4	$i < n$ $i \$ n$
Primary General Fund Balance $= p_{gf}Y_t$	$(p_{gf}+p_{ss})Y_t + iD_{t-1}$	$(p_{gf}+p_{ss})(1+n)/(n-i)$ 4	$i < n$ $i \$ n$

[1]Budget scenario definitions:

Total Fund: the total Federal budget (including the "off-budget" OASDI account and net interest paid).

Primary Fund: the total Federal budget net of interest paid or interest received.

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i	6.71	6.30	6.30	6.30	6.30	6.30	6.30
i	5.03	4.73	4.73	4.73	4.73	4.73	4.73
π	4.06	4.00	4.00	4.00	4.00	4.00	4.00
g	1.98	1.91	1.63	1.42	1.35	1.41	1.40
r	.97	.73	.73	.73	.73	.73	.73

of 1.45% of GNP in the year 2016 and turns to deficit in the final subperiod after the OASDI trust fund is exhausted.[9] Clearly, the decision by Congress (in OBRA90) to include OASDI interest in setting an overall

p_{ss}(OASDI)	-.72	-.70	-.37	.19	.77	1.21	1.54
p_{ss}(OASDHI)	-.49	-.07	.59	1.50	2.43	3.20	3.97
I_{ss}(OASDI)	-.73	-1.12	-1.33	-1.43	-1.33	-1.07	1.17
I_{ss}(OASDHI)	-.85	-1.01	-.96	-.68	-.11	.76	7.41

[1]Variable definitions (see also Table 1): p_{ss} is the predicted operating surplus (-) or deficit (+) in either the OASDI or OASDHI program, expressed as a percent of GNP; I_{ss} is predicted interest surplus (-) or deficit (+) also expressed as a percent of GNP. Sources: U. S. Congress, 1991a, 1991b and unpublished data provided by the Social Security Administration.

[9]For the period 1950-1990, OASDI interest averaged .12% of GNP.

Table 2
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Budget Scenario	Total Budget Balance	d*	Stability Condition
Total Fund Balance = 0	0	0	$i >=< n$
Primary Fund Balance = 0	iD_{t-1}	d_0	$i = n$
		0	$i < n$
		4	$i > n$
General Fund Balance = 0	$p_{ss}Y_t$	$p_{ss}(1+n)/n$	$i >=< n$

General Fund Balance $= I_{ss}Y_t$	$p_{ss}Y_t + I_{ss}Y_t$	$(p_{ss}+I_{ss})(1+n)/n$	$i \geqslant\leqslant n$
Primary General Fund Balance $= 0$	$p_{ss}Y_t + iD_{t-1}$	$p_{ss}(1+n)/(n-i)$	$i < n$
		4	$i \$ n$
Primary General Fund Balance $= p_{gf}Y_t$	$(p_{gf}+p_{ss})Y_t + iD_{t-1}$	$(p_{gf}+p_{ss})(1+n)/(n-i)$	$i < n$
		4	$i \$ n$

[1]Budget scenario definitions:

Total Fund: the total Federal budget (including the "off-budget" OASDI account and net interest paid).

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n	6.04	5.91	5.63	5.42	5.35	5.41	5.40
i	6.71	6.30	6.30	6.30	6.30	6.30	6.30
i	5.03	4.73	4.73	4.73	4.73	4.73	4.73
π	4.06	4.00	4.00	4.00	4.00	4.00	4.00
g	1.98	1.91	1.63	1.42	1.35	1.41	1.40
r	.97	.73	.73	.73	.73	.73	.73

budget target could alter the long-run U. S. debt situation dramatically, as we will see below. The OASDHI interest balances reflect the fact that the HI fund is expected to be exhausted by 2005 and a seventy-five year projection of the fund is characterized mainly by large negative interest.[10]

p_{ss}(OASDI)	-.72	-.70	-.37	.19	.77	1.21	1.54
p_{ss}(OASDHI)	-.49	-.07	.59	1.50	2.43	3.20	3.97
I_{ss}(OASDI)	-.73	-1.12	-1.33	-1.43	-1.33	-1.07	1.17
I_{ss}(OASDHI)	-.85	-1.01	-.96	-.68	-.11	.76	7.41

[1]Variable definitions (see also Table 1): p_{ss} is the predicted operating surplus (-) or deficit (+) in either the OASDI or OASDHI program, expressed as a percent of GNP; I_{ss} is predicted interest surplus (-) or deficit (+) also expressed as a percent of GNP. Sources: U. S. Congress, 1991a, 1991b and unpublished data provided by the Social Security Administration.

[10]Negative interest has the implicit interpretation as the payment to the general fund for monies borrowed by the OASDI or HI funds during cash deficit years. There is no provision under current law for such payments to be made, however.

Table 2
Federal Budget Scenarios and Debt/GNP Ratios

Budget Scenario	Total Budget Balance	d*	Stability Condition
Total Fund Balance = 0	0	0	$i >=< n$
Primary Fund Balance = 0	iD_{t-1}	d_0	$i = n$
		0	$i < n$
		4	$i > n$

General Fund Balance = 0	$p_{ss}Y_t$	$p_{ss}(1+n)/n$	$i \gtreqless n$
General Fund Balance = $I_{ss}Y_t$	$p_{ss}Y_t + I_{ss}Y_t$	$(p_{ss}+I_{ss})(1+n)/n$	$i \gtreqless n$
Primary General Fund Balance = 0	$p_{ss}Y_t + iD_{t-1}$	$p_{ss}(1+n)/(n-i)$ 4	$i < n$ $i \$ n$
Primary General Fund Balance = $p_{gf}Y_t$	$(p_{gf}+p_{ss})Y_t + iD_{t-1}$	$(p_{gf}+p_{ss})(1+n)/(n-i)$ 4	$i < n$ $i \$ n$

[1]Budget scenario definitions:

    Total Fund: the total Federal budget (including the "off-budget" OASDI account and net interest paid).

    Primary Fund: the total Federal budget net of interest paid or interest received.

    General Fund: the total Federal budget excluding the OASDI account.

    Primary General Fund: the General Fund net of interest.

Table 3
Economic Assumptions and Social Security Balances
Based on 1991 Social Security Trustees Report

Variable[1]	1991 to 2005	2006 to 2010	2011 to 2015	2016 to 2020	2021 to 2025	2026 to 2030	2031 to 2065
n	6.04	5.91	5.63	5.42	5.35	5.41	5.40
i	6.71	6.30	6.30	6.30	6.30	6.30	6.30
i	5.03	4.73	4.73	4.73	4.73	4.73	4.73
π	4.06	4.00	4.00	4.00	4.00	4.00	4.00

Table 3

Federal Budget Scenarios and Social Debt/GNP Balances

Based on 1991 Social Security Trustees Report

Budget Scenario / Variable[1]	1991 to 2005	2006 to 2010	2011 to 2015	2016 to 2020	d*	2021 to 2025	2026 to 2030	2031 to 2065 Stability Condition
Total Fund Balance = 0 r	6.04	5.91	5.63	5.42	0	5.35	5.41	5.40 $i > n$
i	6.71	6.30	6.30	6.30	d_0	6.30	6.30	6.30 $i = n$
Primary Fund Balance = 0 i	5.03	4.73	4.73	4.73	0	4.73	4.73	4.73 $i < n$
π	4.06	4.00	4.00	4.00	4	4.00	4.00	4.00 $i > n$
General Fund Balance = 0 g	1.98	1.91	1.63	1.42		1.35	1.41	1.40 $i \geq < n$
r	.97	.73	.73	.73		.73	.73	.73
General Fund Balance = $I_{ss}Y_t$ p_{ss}(OASDI)	1.98 / -.72	1.91 / -.70	1.63 / -.37	1.42 / .19		1.35 / .77	1.41 / 1.21	1.40 / 1.54 $i \geq < n$
p_{ss}(OASDHI)	.97 / -.49	.73 / -.07	.73 / .59	.73 / 1.50		.73 / 2.43	.73 / 3.20	.73 / 3.97
Primary General Fund Balance = 0 p_{ss}(OASDI)	-.72 / -.73	-.70 / -1.12	-.37 / -1.33	.19 / -1.43	4	.77 / -1.33	1.21 / -1.07	1.54 / 1.17 $i < n$
p_{ss}(OASDHI)	-.49 / -.85	-.07 / -1.01	.59 / -.96	1.50 / -.68		2.43 / -.11	3.20 / .76	3.97 / 7.41
Primary General Fund Balance = $p_{gf}Y_t$ I_{ss}(OASDI)	-.73	-1.12	-1.33	-1.43		-1.33	-1.07	1.17 $i < n$

Total Budget Balance: iD_{t-1} $p_{ss}Y_t$ $p_{ss}(1+n)/n$ $p_{ss}Y_t + I_{ss}Y_t$ $(p_{ss}+I_{ss})(1+n)/n$ $p_{ss}Y_t + iD_{t-1}$ $p_{ss}(1+n)/(n-i)$ $(p_{gf}+p_{ss})Y_t + iD_{t-1}$ $(p_{gf}+p_{ss})(1+n)/(n-i)$

[1]Variable definitions (see also Table 1): p_{ss} is the predicted operating surplus (-) or deficit (+) in either the OASDI or OASDHI program, expressed as a percent of GNP; I_{ss} is predicted interest surplus (-) or deficit (+) also expressed as a percent of GNP. Sources: U. S. Congress, 1991a, 1991b and unpublished data provided by the Social Security Administration.

Total Fund: the total Federal budget (including the "off-budget" OASDI account and net interest paid).

Primary Fund: the total Federal budget net of interest paid.

General Fund: the total Federal budget excluding the OASDI account.

Primary General Fund: the General Fund net of interest.

Because $i < n$, d^* approaches zero under the first two budget scenarios in Table 2, though at considerably different speeds. For example, with $d_{1990} = 44.6$, the debt ratio falls to .5 by the end of the projection period under the first scenario ($d_{2065} = .5$ and $d_{2010} = 13.8$).[11] For the second scenario, however, the ratio falls slowly as the interest and growth rates are not far apart: $d_{2010} = 36.9$ and $d_{2065} = 21.8$. The first scenario, the one intended under the original and amended Gramm-Rudman-Hollings Act, would clearly set the economy on a desirable debt ratio path, though achieving a balanced total budget will, in the long-run, require a surplus in the nonOASDI account of 1.7% of GNP or a surplus in the nonOASDHI account of 4% of GNP.

Table 4 shows hypothetical debt/GNP ratios for the third and fourth budget scenarios represented in Table 2, using either OASDI or OASDHI values for p_{ss} (and I_{ss}) and the economic assumptions in Table 3. For each time period, long-run debt ratios ,d^*, debt ratios for the beginning of the period, d_0, and ten years hence, d_{10}, are shown. The ratios are based on the assumption that the parameters for each subperiod remain constant indefinitely and should be viewed as a series of debt ratio paths that change primarily as a consequence of the predicted changes in the social security balances. Table 5 shows the same information for the last two budget scenarios in Table 2.

The results differ dramatically across the four budget scenarios and whether OASDI or OASDHI balances are considered. Under the general fund scenarios in Table 4, the Federal budget is initially headed toward a net asset position, which persists for at least the first two subperiods. This arises, under the first budget scenario, from the operating (cash) balances in the OASDI (or OASDHI) account and, under the second scenario, from the cash plus interest balances in that account. Under the second scenario and considering OASDI balances, the total budget will be in continuous surplus into the fourth subperiod (2021 to 2025), with a peak surplus exceeding 1.8% of GNP during 2006 to 2010 (see Table 3). Under OASDHI balances, total budget surpluses continue into the third subperiod before deficits begin to rise very rapidly, exceeding 11% of GNP in the final period. The consequences are rapidly rising debt/GNP ratios in the last subperiod and an ultimate debt ratio that is very high by historical standards.

The primary fund budget scenarios in Table 5 are more general in allowing interest accumulations. Over the period 1950 to 1990, the average total budget deficit was 2.63 percent of GNP, and 1.12 percent when interest is excluded. The effect of interest can be seen by comparing the first two budget scenarios in

[11]The 1990 end-of-year debt/GNP percent was 44.6 (U. S. Government, 1991).

Tables 4 and 5. The debt ratios in Table are significantly larger and the differences between OASDI and OASDHI are also much greater. With a continuous zero primary fund balance, the long-run debt ratios rise to extraordinarily high levels. Yet, historically the primary fund general fund has not exhibited a zero balance. The 1950 to 1990 average primary fund balance was 1.18 percent of GNP, excluding OASDI, and 1.20 percent, excluding OASDHI. The last scenario in Table 5 depicts the potential debt ratios that could emerge if the historical average primary general fund balances were to prevail throughout the projection period. In that case, high long-run debt ratios arise very early and, under OASDHI balances, the economy is on a debt/GNP path that will not stop rising until d_t reaches 804.[12]

With the exception of the last scenario shown in Table 5, the initial debt ratios for each subperiod are not alarmingly high. Indeed, in each case changes in d_t will be slow at first, allowing ample time to make needed adjustments to the budget. Of more concern, is the rate of increase in the debt ratio following the inception of annual social security deficits. The debt ratio rises faster over subsequent time periods, between OASDI and OASDHI, and down the three budget scenarios shown in the table. The average annual rate of increase over the first ten years ranges from .1 percentage points for the 2021-2025 subperiod under OASDI and the first general fund balance scenario to 3.4 percentage points under the last scenario shown in the table.

Consider further the results for the primary general fund balance. Under this scenario, the nonsocial security Federal accounts are in continuous zero balance, implying a Federal budget policy devised to allow social security balances to show up fully and explicitly as changes to government saving. Such a policy provides for the maximum amount of "advance funding" in social security and has implications for the burden of debt. Because the OASDI program alone is projected to be in actuarial balance until 2048 (U.S. Congress, 1988a), the real debt at that time, based only on OASDI balances, will be essentially the same as at the beginning of the period. (Calculations consistent with those in Table 4 give a debt/GNP ratio of 37.5 in 2048, close to the figure for 1990 of 41.7.) In this scenario, social security surpluses are used initially to retire the existing Federal debt; during the deficit period, the debt is "reissued" and by 2048 the burden of debt is unchanged from 1990. Current workers, by paying higher than pay-as-you-go payroll taxes during the next twenty-five years, will absorb, at least partially, the burden of their own

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[12]Between 1950 and 1988 the debt/GNP ratio averaged 40, ranging from 82 in 1950 to 24 in 1974. During the periods of a rapidly rising p_{ss}, d^* would be unstable for the second two budget scenarios in Table 4. Because p_{ss} is roughly constant in the last subperiod, d^* would represent a stable though exceptionally high limit.

retirement benefits.[13] This scenario is unrealistic, however. The long-run deficits will not end in 2048; rather, under current law, they will go on indefinitely as they arise primarily from a permanent increase in the ratio of beneficiaries to workers which, in turn, is due to an expected permanent reduction in the fertility rate. Thus, under current social security law, long-run benefit obligations represent a lasting increase in Federal expenditures and if financed through continuous government borrowing will result in a very large debt/GNP ratio (136 under the assumptions in Table 4). Further, this scenario represents the unlikely outcome in which the nonOASDI Federal accounts, including HI, will be in continuous balance for the next sixty years. A continuously balanced nonOASDHI budget would be easier to achieve but then the scheme described above for OASDI would change. The combined OASDHI program is in actuarial balance only until 2030 (see Figure 1), implying that "advance funding" in social security, broadly defined, ends much sooner than under OASDI alone. Under this scenario, paying for OASDHI benefits through the continuous issuance of government debt will cause the debt ratio to reach 114 by the end of the projection period (2065) and ultimately to grow to an extraordinarily large debt ratio (300), as seen in Table 4.

Clearly, the situation just described worsens if future nonOASDHI expenditure decisions imitate the past. Moreover, the abrupt and permanent nature of the projected OASDHI deficits raises additional concerns (the OASDHI deficits rise from .22 percent of GNP in 2015 to 2.55 percent of GNP in 2030, over a ten-fold increase in just fifteen years). In the absence of early offsetting budget changes, a stable debt target would require precipitous changes in Federal budget policy that could cause serious distortions in economic behavior. Further, a policy of continuous deficit-financing could lead to higher interest rates through uncertainty premia attendant both to potential economic effects and the sustainability of fiscal policy. Private market participants may begin to question a government policy unresponsive to the prospect of continuing large deficits. In that case, uncertainty arises over the form of future government financing, taxation or monetization (Masson, 1985); the longer the deficits persist, the greater the need for one or the other and as the debt accumulates the probability of monetization rises. If private investors anticipate monetization then interest rates on government bonds will increase. Rising interest rates would worsen the deficit problem and could convert the stable debt ratio paths in Table 4 to unstable paths in which the interest rate exceeds the economy's growth rate.

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[13]In principle, any economic effects such as induced capital formation arising from social security surpluses would also be symmetrical between 1990 and 2048 so the only net result is that current workers contribute toward their own retirement benefits.

V. Social Security and the Economy

The results in Table 4 depend critically on the economic assumptions in Table 3. This raises two general issues. First, the nature of the assumptions may be questionable. Real GNP growth is quite low by historical U. S. standards and is possibly too low for a reasonable long-run growth path. Further, the real interest rate is high by historical standards. A higher growth rate (or lower interest rate), ceteris paribus, would tend to improve the debt outlook as compared to the results in Table 4. For example, if GNP growth and interest rates were to maintain their historic averages throughout the projection period, the ultimate debt/GNP ratios would be substantially smaller than those shown in the table. For this reason, the results in Table 4 may be somewhat pessimistic. Second, the assumptions change very little after the first subperiod and, in fact, change very little after the year 2000. Thus, the economy is projected to move along a steady growth path unperturbed by the rapidly changing financial status of social security. This is more explicit in Table 4 where the same economic assumptions are used for all three budget scenarios. If changes in government saving have no effect on national saving because, for example, they are offset by changes in private saving (Barro, 1974) then social security imbalances will not affect the economy. On the other hand, if social security surpluses and deficits do affect national saving which in turn affects capital accumulation and economic growth, then the public debt outcomes in Table 4 would be altered. During surplus years economic growth would be higher than otherwise and the real interest rate would be lower, thereby reducing growth in the debt/GNP ratio; the opposite would occur during deficit years. The effects on economic growth would depend upon the investment response to changes in saving and the amount of new saving engendered by the swings in the social security balances; the latter will vary inversely with deficits in the nonsocial security Federal budget.

The implications of these issues for the debt/GNP ratio are illustrated in Table 5 for the second two budget scenarios represented in Table 4. The economic assumptions corresponding to each budget scenario are based on results reported in a recent study on the economic effects on the

Table 5
Debt-GNP Ratios When the Economic Assumptions
Vary With the Federal Budget Scenarios, 1990-2065
(percent of GNP)

Assumptions, Ratios[1]	1990 to 2009	2010 to 2014	2015 to 2019	2020 to 2024	2025 to 2029	2030 to 2065
Primary General Fund						
Economic Assumptions						
n	6.5	5.8	5.6	5.5	5.5	5.4
i	5.3	4.3	4.2	4.2	4.2	4.5
OASDI						
d^*	-83.5	-48.1	-11.1	39.7	79.6	164.4
d_0	41.7	16.6	12.9	11.7	13.0	16.2
d_{10}	27.8	7.7	10.0	14.9	20.7	28.0
OASDHI						
d^*	-61.8	-11.6	46.0	121.5	182.2	363.3
d_0	41.7	21.0	19.1	20.4	25.2	32.8
d_{10}	30.2	16.9	22.3	32.0	43.4	59.0
Average Primary General Fund						
Economic Assumptions						
n	6.2	5.8	5.6	5.4	5.4	5.3
i	5.5	4.7	4.7	4.7	4.8	5.2
OASDI						
d^*	39.5	52.4	133.3	286.3	401.7	3,756.5
d_0	41.7	41.4	41.9	44.9	50.6	58.4
d_{10}	41.5	42.5	49.2	59.1	69.6	83.9
OASDHI						
d^*	76.0	104.3	221.4	449.8	628.4	6,109.5
d_0	41.7	45.9	48.3	54.0	69.5	75.9
d_{10}	44.0	51.7	62.2	77.3	94.0	117.7

[1]Variable definitions: see Tables 3 and 4. The inflation rate and p_{ss}, not shown, are the same as in Table 3.

OASDI trust fund buildup (Aaron, et. al., 1987).[14] Because a balanced primary general fund allows national saving to rise and fall by the full amount of the trust fund (unaffected by a change in private saving), this scenario has a more favorable effect on real growth and interest rates during the surplus period. The average primary general fund balance adds a constant deficit, thereby reducing the amount of new saving attributable to the trust fund balances, and has a relatively more unfavorable effect on growth and interest rates during the deficit period. In each case, the assumptions are based on deviations from the alternative II-B assumptions, displayed in Table 3. Consequently, the assumptions in may also be pessimistic for the reasons discussed in section III.[15]

The debt/GNP ratios in Table 5 indicate that a faster growing economy with a lower interest rate reduces the net asset positions which the economy is headed toward during surplus years and increases the ultimate debt positions during deficit years; a slower growing economy has the opposite effects. Compared to those in Table 4, the equilibrium debt ratios under the average primary general fund scenario are dramatically larger in the outyears, illustrating the obvious sensitivity to growth and interest rate assumptions. In all cases, the debt ratios at the beginning of each period (d_0) are not substantially different from those in Table 4, though the rate of increase in the debt ratio is much higher, reaching 4.2 percentage points per year in the last scenario shown in Table 5.

The upshot is that if growth rates and interest rates are substantially different from those assumed in the official social security projections, the debt/GNP path will also be different and, in light of the large projected social security deficits, the path will likely get much more burdensome.

VI. Conclusions

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[14]The base case in the Brookings' study is one in which the total Federal budget maintains a deficit of 1.5% of GNP and the economic-demographic assumptions are those in the 1986 OASDI trustees' report (alternative II-B). Two alternative simulations have a general fund deficit of either 1.5% or 4% of GNP. The GNP growth rate assumptions in Table 5 are based on new GNP series derived from the GNP data underlying Table 3 and the differential between the base case and the two alternatives in the Brookings' study; the interest rates are based on those reported in the study (the inflation rate did not change across budget scenarios). Because a simulation based on the OASDHI trust fund was not reported in the Brookings' study, the economic assumptions in Table 5 do not vary between the OASDI and OASDHI scenarios; otherwise, differences in the debt ratios between OASDI and OASDHI would be sharper.

Though the Brookings' scenarios do not correspond exactly to the scenarios studied in this paper, particularly the larger deficit scenario, the direction of change in the economic assumptions should be the same. It should also be noted that the two Brookings' scenarios selected here assume that all new saving is invested domestically and private saving is unaffected.

[15]The annual interest rates underlying the primary general fund balance scenario actually rise above the constant rate of 6.08 before the end of the projection period, though the average for the period 2030-2065 is lower.

This paper has stressed the public debt implications of the long-run financial status of the social security program, defined as either OASDI or the combined OASDHI programs. The central conclusion is that, under current social security law, projected social security deficits could result in a very high and unstable debt/GNP ratio in the next century unless extraordinary fiscal restraint is exercised.

The conclusion is based on official social security projections, a set of stylized Federal budget scenarios, and assumptions about the behavior of key economic variables long into the future. Naturally, the actual course of events will differ. Nevertheless, the key factor underlying the projections is demographic change, much of which has already been set in place (see footnote 1). As the population ages, policymakers will face three unenviable alternatives for financing social security obligations. Deficit financing is one possibility. The analysis in this paper warns that the longer such a policy is continued, the greater the uncertainty that will be engendered over likely economic effects and the sustainability of fiscal policy. The consequence could be even larger deficits and a concomitant higher probability of an explosive debt. Modifying social security law to lower benefits or raise payroll taxes is another possibility, one that has been used periodically in the past. This possibility is exceedingly unpopular and lowering benefits will become more so as the average voting age rises. Finally, general (nonsocial security) government revenues (taxes) could be raised or expenditures reduced. This is also politically difficult and future workers may refuse to support social insurance benefits of the magnitude predicted under current law. The three alternatives are not mutually exclusive, of course, and some combination may be feasible. Yet, any adjustments could be disruptive if implementation is deferred until social security deficits begin.

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