Consistency and Feedback in the Economic Assumptions Behind Federal Social Insurance Fund Solvency Projections

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Abstract:

Economic assumptions are an important input into the projections of the solvency of all of the major social insurance funds in the U.S. Policy analysts have been concerned with evaluating the assumptions, mostly as they investigate the sensitivity of the trust fund projections to economic assumptions. Typically, these analyses have addressed the effects on trust fund solvency of including a stochastic component to the economic projections. However, both the trust fund assumptions and the recent evaluations ignore a crucial aspect of the economic assumptions: they are developed without allowing the projected trust-fund outcomes to influence the assumptions in the first place. This approach is proper in settings where the trust fund revenues and outlays do not appreciably affect the underlying economic framework. However, given the size of the federal trust funds, and the possible tax and/or spending changes being discussed to prevent their insolvency, it is clear that the programs can have an enormous influence on economic outcomes like GDP growth and interest rates. In this paper, we evaluate the assumptions using a simple, but consistent economic model that allows the trust fund outcomes to influence the economy. Using this model, we show that the current economic assumptions imply paths for some variables that are well outside the range of historical experience. We conclude that using the assumptions as a basis for long-term policy discussion is questionable.

Consistency and Feedback in the Economic Assumptions Behind Federal Social Insurance Fund Solvency Projections[1]

Introduction

The future solvency of the system of federal social insurance funds, especially the Social Security and Medicare funds, has risen again as a serious public policy issue. Proposals to reform Medicare in an attempt to extend the solvency of the system for a few more years were a central issue of the recent presidential elections. The recent Social Security Advisory panel has described three main alternatives for reforming the Social Security system, all attempting to extend the solvency of the system well beyond the current expected insolvency date. From the point of view of the funds themselves the recent reports have been alarming. The 1996 Trustees' Reports for these funds were pessimistic. The Old-Age and Survivor's Insurance Fund combined with the Disability Insurance fund (OASDI) is expected to become insolvent around 2030. The insolvency date for the Hospital Insurance (HI, or Medicare, Part A) trust fund is much closer; the fund is expected to become insolvent in 2001.

Assumptions about macroeconomic variables play a primary role in the calculation of future solvency. The macroeconomic assumptions are developed in the Office of Actuary at the Social Security Administration and are published in the Report of the Board of Trustee's of the Old Age, Survivor's , and Disability Insurance Trust Funds (hereafter the OASDI Report). Along with other assumptions made by the Office of the Actuary at the Health Care Financing Administration (HCFA) the macroeconomic assumptions in the OASDI report are typically used to calculate the solvency of the HI trust fund and the Supplementary Medical Insurance (SMI) trust fund.

The OASDI report provides projections for a small number of macroeconomic variables for a 75-year horizon. Projected values are either assumed, or calculated from assumed values through the use of simple identities or linking equations. Macroeconomic assumptions are made about basic variables: labor productivity growth, inflation, real interest rates, labor force participation growth, *etc*. The long-run projected paths for basic variables are usually found by looking at the long historical record, and assuming that the average values after some specified time in the future will be equal to the long historical average over some specified time in the past. Judgement is also used to assign "ultimate" values. Projections are typically held constant at ultimate values after about 10 years into the projection period. Table 1 shows the assumed ultimate values for various variables from the 1996 OASDI Report, along with the historical figures cited in the report. Paths by which the variables move to their ultimate values are also assumed. To cover a wide range of possible outcomes, values are chosen consistent with Low, Intermediate, and High cost scenarios.[2]

Identities and simple analytic equations are used to try to maintain a rough economic consistency among the economic variables. For example, projections of real GDP growth are derived by adding labor force growth to labor productivity growth (after the unemployment rate hits it ultimate, and constant value for a scenario). Nominal interest rate projections are derived by adding projections of the real interest rate to projected inflation. Projections for wage growth -- particularly important because the tax base for social insurance taxes is wages, salaries, and proprietor income -- are derived by adding labor productivity growth to inflation, plus a real wage "linkages." The linkages capture the historical difference between labor productivity growth and real wage growth, and also forms a basic variable in

the assumptions.

This utility of this approach to making macroeconomic (and demographic) projections depends largely on how independent the macro and demographic projections are from the trust fund outcomes. It is clear that it would be difficult for a small, private insurance fund to affect interest rates, real GDP growth, inflation, or the unemployment rate. Thus, using exogenous macro and demographic projections to assess actuarial soundness is fine. However, each of the four main funds (OASI, DI, HI, and SMI) is large relative to the economy, and huge compared to any other private fund of a similar nature. When the funds' incomes or costs (from the public's point of view, tax receipts or beneficiary payments) are all added together, they account for a significant portion of GDP. This alone raises the likelihood that changes in the funds' costs and income (social insurance outlays or taxes) will affect other parts of the economy. A key public policy question is whether expected insolvencies in social insurance funds (either individually or in the aggregate) can seriously affect variables like real interest rates and labor productivity. To the extent that they do, this raises two questions (1) Should the current approach alone be used to assess the solvency of the federal social insurance funds, and (2) Do the assumptions provide a sound basis for public policy changes to the tax and spending programs?

In this paper we investigate what happens when we allow the projected cost and income positions of the social insurance trust funds together to feed back into the economic assumptions. We ask: Are economic "assumptions" incorporating feedback substantially different from the no-feedback case? Do the differences substantially change the solvency picture of the funds? To answer these questions, we divide the current paper into several parts. First, we briefly review the recent literature on evaluating the economic assumptions used in calculating trust fund solvency. We note that both the recent literature and the assumptions themselves ignore the feedback issue. Next we outline a simple neoclassical growth model that we use to evaluate the consistency of the trust fund outcomes with the general economic environment portrayed in the economic assumptions.

Our conclusion is that there are substantial differences between the assumptions that incorporate feedback and those that do not. We conclude that feedback, or allowing economic consistency between outcomes and assumptions, is important but neglected in public policy discussions. Incorporating feedback would significantly worsen the outlook for the funds and the economy, and lend greater urgency to proposals to improve the financial health of Social Security and Medicare.

Recent Evaluation Work on Economic Assumptions

Like the methods for generating the assumptions themselves, recent evaluation work has been done from an actuarial viewpoint. Two key issues have been examined. First, are the intermediate assumptions reasonable, evaluating the assumptions using methods beyond simple long-term averages? Second, how does the introduction of uncertainty into the assumptions alter both the view of the probability of the intermediate assumptions and the "probability" band encompassed by the low-cost and high-cost cases? This second line of work -- introducing the statistical uncertainty of the assumptions into the trust fund outcomes -- follows a recommendation of the 1991 Social Security Advisory panel on technical and demographic assumptions.

Foster (1994) looks at probability distributions around short-term trust fund economic assumptions (20 quarters). He uses univariate time-series forecasting models for each variable, allowing for levels shifts and outliers. He then compares the range of high-intermediate-low assumptions with the model-generated probability distributions. He concludes that:

- Intermediate assumptions for inflation and the real interest rate are very close to the median forecast from a statistical model.

- For real wage growth and the unemployment rate, intermediate assumptions have a higher probability of falling on the high-cost than the low-cost side using the probability distribution generated from a statistical model.

- There is roughly a 50-percent probability that the average future values of the inflation rate, unemployment rate, and increases in the real wage fall within the high-low range.

- There is a much smaller probability -- 26 percent-- that the average future value of the real interest rate falls within high-low range.

Foster recommends trying multivariate time series approaches to find more "appropriate" probability distributions for economic variable outcomes.

Following Foster, Sze (1996) allows for contemporaneous correlation among seven “input” variables used to determine trust fund solvency. He begins with the 1995 intermediate assumptions paths, and then varies "economic climate" variables to see impacts on OASDI income and costs. The distribution of possible macro outcomes is characterized by a mean, standard deviation and simple correlation (contemporaneous only) for five macroeconomic variables and two demographic variables. He then repeatedly samples from distributions (allowing interaction) and computes a variety of trust fund indicators from samples of macro-demographic variables. The result is a “probability band” for trust fund solvency, based on the assumed distributions of the “input” variables.

Frees *et. al.* (1996) extend Foster’s work in a different direction. Although they only evaluate the short-term (10-year) assumptions, they use both univariate and multivariate time series approaches. Among their findings are:

- Allowing for sophisticated lead-lag relationships among macro variables widens the range of possible economic results, relative to univariate models. For example, this means that the 95 percent probability band for the real interest rate associated with univariate models is narrower than the 95 percent probability band associated with multivariate models.

- For 10-year predictions, at least, OASDI projections are probably pessimistic (fund accumulates too little) and low-intermediate-high range of trust fund results is very narrow.

Extending the Evaluations

Recent evaluations have been exceptionally helpful in showing the importance of looking at probability distributions of economic assumptions to assess distribution of trust fund outcomes. Information of this sort is crucial to policy makers who might want to design a social insurance system that remained solvent across a wide variety of “bad draws” from the future economic environment. The literature has also shown that it is important to allow for feedback among macroeconomic variables. That is, it is useful to recognize that a high-inflation “draw” from the economic future is likely to be correlated with a high-interest rate “draw” and a low real GDP growth “draw”, when evaluating the possible trust fund outcomes. Incorporating relationships among variables changes the view of the likelihood of certain economic outcomes, and gives a more realistic view of the probability bands around the trust fund solvency outcomes. A hallmark of recent evaluations is their emphasis on statistical time-series approaches, rather than causal models.

While the literature has shown how important it can be to assess the joint probability of any set of macroeconomic assumptions, *it has not addressed the sensitivity of macroeconomic assumptions to trust fund outcomes themselves*. In other words, it has not addressed the feedback of the trust fund outcomes to the economic environment. For example, in the 1996 Intermediate assumptions, the real interest rate is unchanged after 2006. This occurs despite a tremendous implied rise in the federal deficit emanating from social insurance spending on Medicare and OASDI.[3] Recent evaluations of the SSA economic assumptions have focused on the sensitivity of the trust fund outcomes to *changes* in the assumptions. What has been missing is an evaluation of the internal consistency of the intermediate assumptions themselves. Economic theory suggests that the income and cost imbalances predicted in the social insurance trust fund reports would increase the probability of "bad draws" from the future economic environment.

Figure 1 gives a schematic of the current approach along with a "feedback" loop that we propose to use. The current approach is essentially limited to a unidirectional flow of information, that begins with macroeconomic and demographic assumptions, flows into trust fund calculations, which in turn produces trust fund outcomes. We argue that it is important to evaluate the trust fund outcomes in a system that allows the outcomes to feed back through some sort of economic model, to affect the economic "assumptions." Without some feedback, we argue that the current process is inconsistent. That is, knowing what the social insurance outcomes look like, it becomes hard to believe the economic assumptions.[4]

The 1994-95 Advisory Panel on Technical Assumptions has also noted this lack, and has made a recommendation that:

> "The SSA actuaries should work with outside economists to develop a model of national savings that can be integrated with their model. *Such a model would incorporate a feedback between national savings, real wage growth, and the status of the trust funds.* (emphasis added) The model would necessarily be preliminary at first, but might be used in the future to prepare conditional forecasts and to analyze the effects of various policy reforms on the trust funds." (p. 46)

Evaluating Economic Consistency

It is easy to demonstrate a strong prima-facie case that accounting for economic feedback can be very important. Consider only Medicare, for example. Medicare outlays have to be financed by the federal government, through some combination of borrowing money (increasing the deficit), increasing taxes, or cutting other spending. From 1996 through 2050, Medicare spending relative to GDP is projected to rise 4.1 percentage points. The rise in the Medicare-GDP share matters because the implied increases in the deficit, or taxes, or spending reductions are large. If all other federal spending components are held constant at their 1996 GDP shares, an increase in the Medicare-GDP share implies some combination of: (1) an equal increase in the deficit share of GDP or (2) an equal increase in the federal revenue share of GDP. Suppose we decided to keep the increases in Medicare spending deficit-neutral, that is, we raised the payroll tax just enough to cover any increases in Medicare outlays. Because the Medicare-GDP share increases by 4.1 percentage points, the revenue-GDP share would have to rise by the same amount. The wage share of GDP is about 50 percent, an important consideration because wages are the base for the Medicare tax. Together, these figures suggest that the payroll tax rate increase necessary to offset the increase in Medicare spending is about 8.2 percentage points by 2050. In effect, the current 2.9 percent tax rate would have to gradually rise to 11.1 percent by 2050.

The essential feedback question is, then, whether increases on the order of 4-percentage-points in the primary deficit share of GDP or a 8-percentage points in the payroll tax would have a noticeable

effect on the overall economy. Simple macroeconomic analysis suggests that either of those possibilities would tend to reduce real economic activity. For example, the rising deficit share suggests that real interest rates will rise. The rise in real interest rates hurts general economic activity through at least two channels. First, higher real interest rates inhibit capital formation directly. With less productive capital per worker, the long-run potential of the economy to produce goods and services is reduced. The second channel of effect works primarily through international markets. A higher real interest rate increases the real value of the dollar, reducing foreign demand for U.S. goods and increasing U.S. demand for foreign goods. This too, leads to a lower level of real U.S. activity.[5]

The effects described are apparently not included in the current set of economic assumptions, which we call the static-assumptions case. In the next section, we try to give an indication of how different the economic assumptions would be when we allow for feedback, or, how reasonable are the implied values for other variables seriously the intermediate assumptions are compromised by not allowing for feedback. In particular, we focus on one essential feature that appears to be missing from the intermediate assumptions path: the effect of lower levels of federal saving (higher deficits) on the economy.

A Method for Evaluating Feedback

To evaluate the size of the feedback effects, it is necessary to specify some sort of model that allows the outcome variables (trust fund cost and income), to influence the macroeconomic variables shown in Table 1. Traditionally, two kinds of models have been used to study macroeconomic relationships: (1) multivariate time series models such as VAR, VARIMA, etc., and (2) structural economic models. In this paper, we use a structural macroeconomic model approach, based on the simplest long-term neoclassical growth model we can specify to capture the necessary linkages. The neoclassical growth model is an extremely simple tool that can be used to describe how an economy will evolve in the long term. This particular model is closely related to a series of other growth models specified for related purposes.[6] Most of the parameters for the model are taken from other studies. Remaining parameters are derived by calibrating the model to 1995, that is, solving for the remaining parameters so that the model replicates 1995 observed outcomes. The model is fully described in Appendix A.

Here is how we used the growth model to evaluate the social insurance (SI) macroeconomic assumptions.

(1) Exogenize the variables for which we had SI macroeconomic assumptions. These are inflation, the nominal interest rate, labor force growth, real GDP growth, the unemployment rate, and the GDP shares of outlays for OASDI, HI, and SMI.

(2) Use the model's equations to solve for remaining variables in terms of the exogenous SI assumptions.

(3) Run the model and examine the path of the variables solved for in step 2. If the results for these variables are far outside historical experience, this indicates that feedback matters.

We used this approach for total factor productivity. We rewrote equation (4) (Appendix A) to solve for the total factor productivity growth in each year that would be consistent with the fixed real GDP growth rate, the fixed employment growth rate, and the model-generated capital stock. Movements in the total factor productivity growth rate then become an index of the relationship of model-generated results and the social insurance assumptions in the context of the model. If the total factor productivity growth rate that results from the combination of social insurance assumptions and the growth model equations

lies well outside the range of historical values, we conclude that accounting for feedback is important when thinking about the combined social insurance trust funds.

We used a similar idea for interest rates. In the growth model, interest rates are a function of the return to capital, which depends on the size of the capital stock relative to output (equation 8). Output is given by the SI assumptions, and the model determines the capital stock endogenously. At the same time, interest rates are also given by the SI assumptions. This gives us two views of the interest rate, one that is determined endogenously by the interplay the endogenous capital stock and the fixed output, and one that is taken directly from the SI assumptions. In the model, we simply calculated the endogenous interest rate, stored it in a variable, and then substituted the SI assumption in place of the calculated one, and let the model solve for all the other variables. There is a significant effect on the model's predictions when this procedure is used. As federal savings declines and the capital stock falls, the return to capital and interest rates should rise. That rise, in turn, should tend to increase private savings (and raise federal debt service). However, when we substitute the SI assumptions for the calculated interest rate, we cut off the second round effect. We call this "limited" feedback.

Having set up the model in this way, we substituted the assumed SI macroeconomic values into the proper equations and used the projected OASDI-to-GDP, HI-to-GDP, and SMI-to-GDP ratios from the trust fund reports for the exogenous shares used in equations 22, 29, and 36 respectively. We had to make several other assumptions about government spending and taxes. Here is what we assumed:

- Federal Medicaid outlays grow 0.5 percentage points more slowly than HI and SMI outlays. This assumption probably understates how fast Medicaid will actually grow, since most analysts believe that Medicaid will grow faster than Medicare, at least over the next several years.

- Federal outlays not explicitly accounted for in the model (note these are everything other than OASDI, HI, SMI, Medicaid, and interest payments) are assumed to maintain a constant share of nominal GDP.

- Federal receipts from taxes other than social insurance, capital income, and miscellaneous receipts associated with the trust fund operations are assumed to be a constant share of nominal GDP.

Evaluations of the Assumptions

Using the model described in Appendix A, and the method described above, we first asked a simple question. What happens when we allow feedback -- limited feedback -- and change nothing else? Figures 2 and 3 show the results for our two measures. In figure 2, we show the rate of total factor productivity that is needed to satisfy the SI assumptions and feedback simultaneously. The capital stock shrinks with the reduction in savings, but, by construction, total factor productivity growth rises to offset the capital stock effect. Through about 2020, total factor productivity must grow slightly less than 1 percent on average to satisfy the SI assumptions. After that, as the OASDI trust fund is depleted and the federal deficit begins to rise, so too must the implied total factor productivity growth. By 2050, total factor productivity must grow faster than 2.5 percent a year. For comparison purposes, the Bureau of Labor Statistics (BLS) estimates that total factor productivity in private business grew 1.9 percent annually from 1948 through 1975, but only 0.4 percent from 1975 through 1994.[7] Thus, the implication of the limited-feedback case is that the SI assumptions must embody total factor productivity growth that is ranges from 2-to-6 times higher than the recent historical experience.

Figure 3 shows that the model-generated interest rate and the assumed SI interest rate. The gap slowly increases at first, but then progressively widens after about 2020. By 2050, the model-generated interest rate is about 3 times the size of the SI projected value (it reaches more than 17 percent in 2050). Again, the culprit is the drop in savings in the economy (rise in the federal deficit), which reduces investment, lowers the capital stock, and raises the return to capital and the interest rate. Figure 4 shows that the federal deficit reaches about 27 percent of GDP in 2050 when limited feedback is allowed.

Both of our measures point to the same conclusion: the SI macroeconomic assumptions would be wildly different if they accounted for the feedback of the projected trust fund outcomes on the economy. These results -- as striking as they are -- are actually biased away from what the model would suggest if interest rates were fully endogenous. When running the model with limited feedback, the model "sees" only the OASDI interest rate projection when it needs to use an interest rate, say, in the federal interest payments equation. Had we allowed the interest rate rise predicted by the model to influence interest payments -- the full-feedback case -- the model gives arithmetically correct, but completely insensible results after 2030. This occurs because federal debt service payments explode, leading to enormous increases in the federal deficit and eventually, no investment. Similar results have been noted in CBO (1996).

In a separate experiment, we asked: What values for the federal deficit keep interest rates and total factor productivity growth in "reasonable" ranges when full feedback is allowed? This translates into cutting non-social insurance fund spending or raising taxes to keep the federal deficit in reasonable ranges. To make matters simple, we solved for the implied tax rate on wage income (the base of the current social insurance taxes) that was consistent with one popular proposal for the path of the federal deficit. That path is to balance the budget by 2002 and then to keep it balanced thereafter, which has recently been the basis for much negotiation between the White House and Congress.

When we imposed this federal deficit path on the model, we obtained results for total factor productivity growth and interest rates that look much more consistent with historical data. Total factor productivity growth bounces in a narrow range between 0.5 percent and 0.7 percent throughout the projection period (Figure 5). The difference between the model-generated interest rates and the SI assumptions is reasonably small and actually narrows as the simulation horizon lengthens (Figure 6).

The startling result is the increase in the SI tax rate necessary to have the model generate these more reasonable results (Figure 7). The tax rate must rise about 4.5 percentage point through 2002, then must ultimately rise by about 17 percentage points by 2033, after which it can remain relatively flat. Given that the current SI tax rate is 15.3 percent, allowing full feedback requires raising the SI tax rate to more than 32 percent.[8]

There are at least two more interesting points about this experiment. First, although the model-generated interest rate path is much more reasonable with the skyrocketing tax rate, it still shows a persistent tendency to be at least one percentage point above the SI assumption. This suggests that, at a minimum, the SI interest rate assumptions might be raised slightly.

Secondly, it is useful to view the results of experiment 2 as indicating what view of federal savings is implicitly contained in the SI assumptions. Experiment 2 shows that the 1996 SI assumptions apparently are fairly consistent with a continuously roughly-balanced federal budget throughout the forecast horizon. Balancing the federal budget while the aggregate SI position is seriously in deficit implies either (1) sharp increases in non-SI federal receipts relative to GDP or (2) sharp reductions in other federal spending relative to GDP. In both cases, by 2050, the implied change is about 80-to-90 percent of its 1995 value. For example, it is necessary to reduce federal outlays for programs other than

SI, Medicaid, or interest payments by 80-to-90 percent of their 1995 shares of GDP!

General Discussion of Feedback and Consistency Issues

A consistent economic model, like that suggested by Advisory Panel, creates a different picture of the economy and the trust funds than is shown in the Trustees' Reports. Without offsetting federal tax or spending changes, the picture of the future of the economy is almost immeasurably worse. The mechanism by which this occurs is simple and noncontroversial. The continuing reduction in federal savings leads to lower levels of investment than would otherwise be the case. In the long run, the reduction in the capital stock lowers labor productivity and raises the return to capital and the interest rate. The rising interest rates make it even more difficult to finance the federal debt, and, eventually, without a tax increase or a change in one or more of the parameters that govern saving, the economy goes wildly out of kilter. At the same time, the exercise shows how severe federal tax increases or spending reductions must be to achieve reasonable economic performance when feedback between the SI outcomes and the SI assumption variables is allowed via the economic model.[9]

Recent reports from the board of trustees of the four main SI funds (OASI, DI, HI, and SMI) are quite explicit about showing how far out of balance these trust funds are over a 75 year period. For example, in the case of the HI fund, the report declares that tax rates must immediately rise from 2.90 percent 7.42 percent immediately achieve actuarial balance over the 75 year projection period (HI Report, p. 14). However, these reports do not make the link between the projected imbalances in the funds and their effect on the economy. This tends to leave the public and policymakers with the idea that there is a serious trust fund problem, but not an economic performance problem. A related aspect of this problem is the fact that the trust fund problems are seldom aggregated together to form a coherent picture of the overall federal spending projection.[10]

The purpose of the current set of trust fund reports is to provide a long-run evaluation of the financial status of the individual funds. Financial status can be indicated in a rough way, even without feedback, especially by using a range of assumptions. But policy proposals need to consider all likely interactions, which may include examining implicit assumptions. In the case of the SI trust fund reports, it appears that an important implicit assumption is that the federal budget is roughly in balance over the evaluation period. Policymakers need to be aware that the interactions may lead to overall results that are different than those predicted when the system-wide impacts are not taken into account. This point is similar to the issue raised by advocates of "dynamic scoring" for federal tax and spending programs.

In this paper, we have used a simple model, incorporating a minimum amount of feedback, to show that there is a conceptual gap between assumptions currently used to generate SI trust-fund projections and the forseeable impacts of those trust funds projections. We have shown that the current intermediate assumptions do not hold up when feedback is allowed. Alternatively, we have shown that the additional assumptions needed to make the trust fund outcomes consistent with the intermediate macroeconomic assumptions are unreasonable. Our work suggests that there should be greater urgency in dealing with the trust fund imbalances, because more is at stake than the solvency of the particular funds themselves.

Tables and Figures

Table 1: 1996 Ultimate Projection Values and Selected Historical Data, percent

Annual Growth in	1955-64	1965-74	1975-84	1985-94	1955-94	Ultimate
Labor productivity	2.8	2.1	1.4	1.0	1.8	1.4
Real earnings	2.3	1.2	-0.6	0.7	0.9	1.0
Wage linkages	-0.5	-0.9	-1.9	-0.2	-0.9	-0.4
Real interest rate, average pct.	1.5	1.9	0.9	5.2	2.4	2.3
		1965-94	1975-94	1985-94	1955-94	Ultimate
CPI , annual growth		5.3	5.5	3.5	4.3	4.0
Source: 1996 Report of the Board of Trustees of Old-Age Insurance, Survivor's Insurance, and Disability Insurance Trust Funds, pages 148-151.						

Figure 1: Schematic of Approaches to Trust Fund Projections

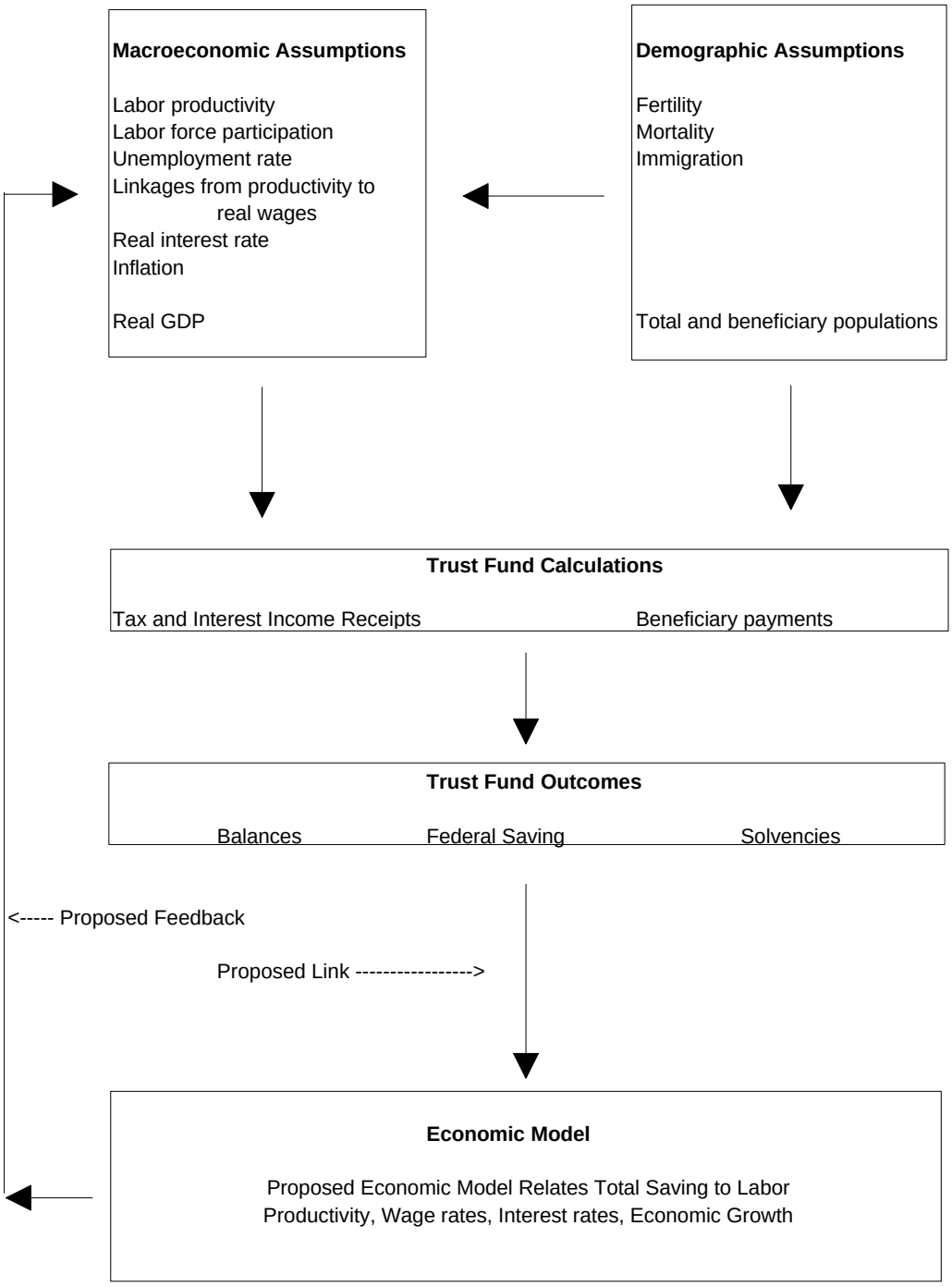


Figure 2
Experiment 1: Growth in Total Factor Productivity Needed to Achieve OASDI Assumptions, percent

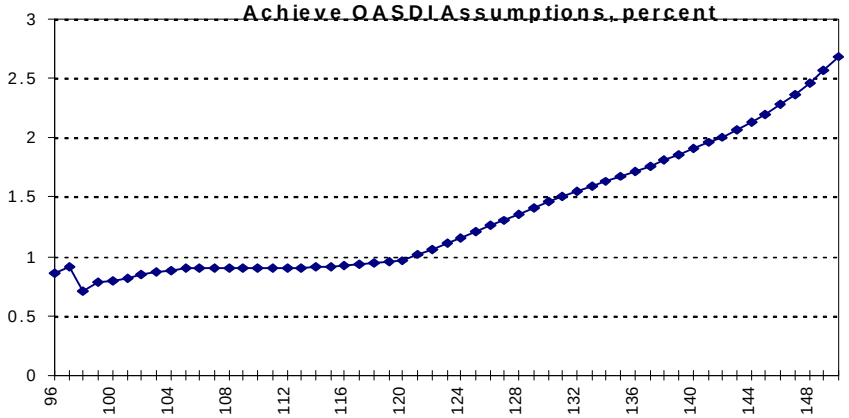


Figure 3
Experiment 1: Comparing Model-Generated Interest Rates to OASDI Assumptions

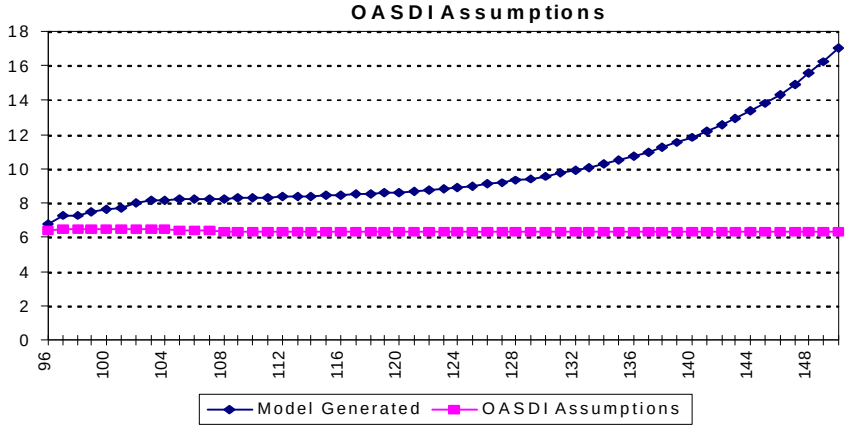


Figure 4
Experiment 1: Federal Deficit as a Percent of GDP

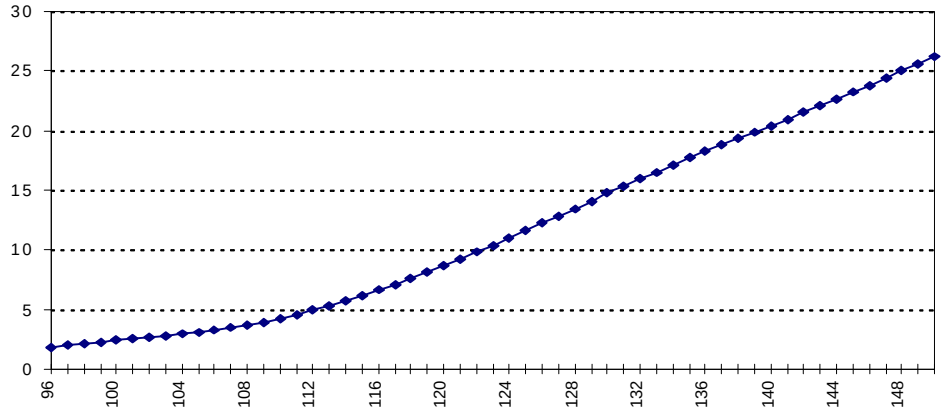


Figure 5
Experiment 2: Growth in Total Factor Productivity, percent

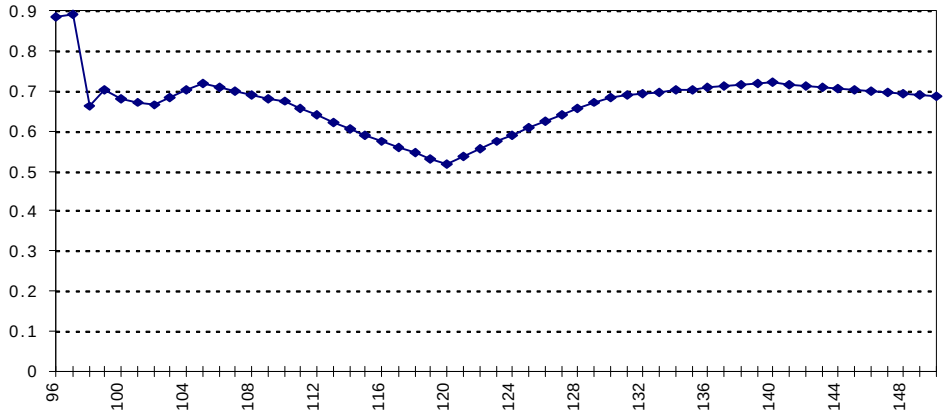


Figure 6
Experiment 2: Model Generated Interest Rates Compared to OASDI Assumptions, percent

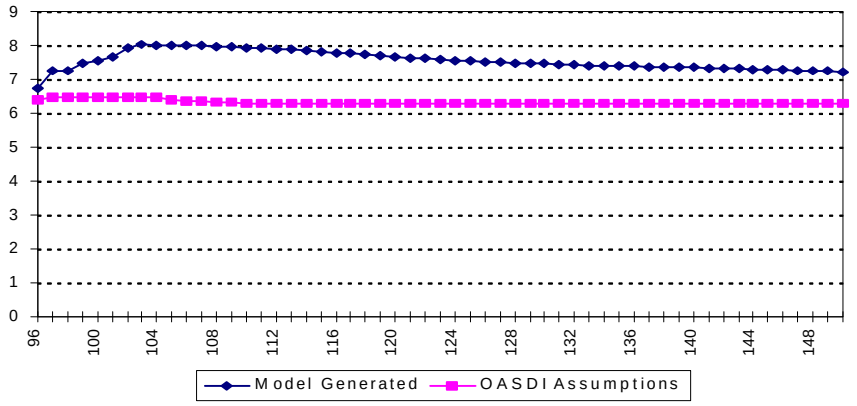
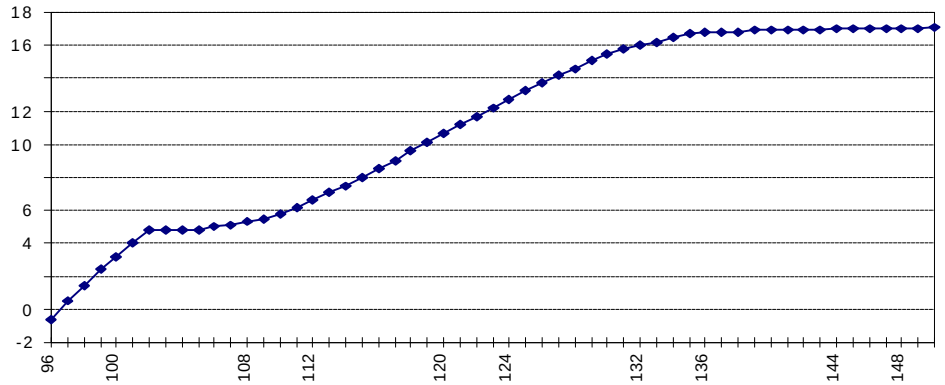


Figure 7
Experiment 2: Additional Wage Tax Necessary to Balance



APPENDIX A: Growth Models

The Simplest Growth Model

The first model presented is the crudest, long-term growth model. Because it is intended for illustrative long-term simulations, it begins from the assumption that the economy is always at full employment. Thus, in the long run, output is determined solely by the supply of productive factors; labor and capital. The model begins with a production function, that transforms quantities of inputs -- labor effort and available equipment and structures (the capital stock) -- into output. We assume that there is only one good in this economy. We chose a particularly convenient form for the production function, a Cobb-Douglas form.

$$Q_t = A_t K_t^{"} L_t^{(1-")}$$

The labor force depends on the working age population, (defined here as the number of people aged 20 through 64). Population, therefore labor force growth, is exogenous to the model.

$$L_t = \mathrm{N}POP_t$$

The capital stock at any time t is the stock in the previous period, less the amount that is used up (depreciation), plus new investment.

$$K_t = (1-\mathrm{H})K_{t-1} + I_t$$

New investment is defined by savings -- the excess of incomes over spending on current consumption. In this simple economy, savings can come from domestic non-federal sources (individuals, corporations, and state and local governments), from the federal government, and from foreigners.

$$I_t = SAVPR_t + SAVGOV_t + SAVFOR_t$$

For simplicity, assume that private saving (SAVPR) and foreign savings (SAVFOR) are exogenous. We assume that all income is taxed at the same rate, txr, and that primary government spending (SPENDGOV) is exogenous. Another part of government spending is interest payments at rate I on outstanding debt (DEBT). Thus government savings can be written as:

$$SAVGOV_t = txrQ_t - (SPENDGOV_t + i_t DEBT_t)$$

Current period DEBT is generated as:

$$DEBT_t = DEBT_{t-1} - SAVGOV_t$$

To complete the crude model, we need an equation for the interest rate. In the crudest model, we

assume that the interest rate is a proportional function of the equilibrium return to capital. The Cobb-Douglas form provides us with a straightforward relationship for the return to capital:

$$r_t = \alpha_t Q_t / K_t$$

from which we can write a simple interest rate equation:

$$i_t = \phi_t r_t$$

Together, these equations show how an increase in government spending, say, on Medicare, could lead to lower real GDP per worker. We can trace through the effects by working backwards through the equations just described. An increase in government spending leads to a reduction in SAVGOV. This, in turn, reduces investment and leads to a reduction in the capital stock (K). The reduction in K leads to lower output. At the same time, the reduction in K raises r, leading to higher I, which in turn raises the interest payments on the federal debt. Overall, the effects of a higher deficit (lower government saving) is a reduction in the capital stock, a reduction in real output, a higher interest rate, and lower real wages. Note that this sequence occurs with any increase in SPENDGOV, not only Medicare.

This model is exceptionally crude, but does provide a basis for expecting that the kinds of spending increases envisioned for the Medicare program could considerably change the underlying performance of the economy, depending on values for key elasticities.

An Expanded Growth Model

The simplest growth model illustrated the mechanism by which reductions in overall saving (a higher federal deficit) would reduce real GDP, the capital stock, and real wages, while raising interest rates and federal debt-service. In a slightly richer version of the model, we divide federal spending into several spending on OASDI, Medicare (parts A and B), Medicaid, and other, categories, introduce inflation, an unemployment rate, and several other refinements. The model is written so that it can be typed into almost any software that can evaluate equations. Values for key parameters are either shown in the equations themselves or are listed at the end. Starting values are also listed at the end.

Equations of the expanded neoclassical growth model.

Some notation:

pc	--	a percentage change variable	d	--	a first difference variable
nom	--	a nominal variable	[x]	--	a lag of length x years

Labor and population block

1.	lf	=	(1+pclf/100)*lf[1]	Derive labor force level from exogenous growth rate
2.	employ	=	(1-unrate/100)*lf	Derive employment
3.	pcemploy	=	(employ/employ[1]-1)*100	Employment growth

Production function block

4.	pcq	=	(techch + 0.65*pcemploy + 0.35*pckap)	Production function in growth rates, using $\alpha = 0.35$
5.	q	=	q[1]*(1+pcq/100)	Derive output level

Price level and nominal output

6.	plevel	=	(1+infl/100)*plevel[1]	Derive price level from exogenous inflation
7.	nomq	=	q*plevel	Derive nominal output

Factor returns and the nominal interest rate

8.	caprtn	=	0.35*q/kap	First derivative of production function, w.r.t. kap
9.	capinc	=	0.35*nomq	Capital income share
10.	nomirat	=	0.64*(caprtn/(1+captxr)-deprat)*100 + infl	Interest rate (0.64 makes equation hold in 1995)
11.	labrtn	=	0.65*q/employ	First derivative of production function, w.r.t. employ
12.	nomwag	=	labrtn*plevel	Nominal wages
13.	nomwaginc	=	nomwag*employ	Labor income share

Savings, Investment, and the Capital stock

14.	prisavsh	=	0.146 + 0.2*((nomirat-infl)/100 - 0.0550175)	Private savings rate with 0.2 elasticity w.r.t. real interest rate
15.	prisav	=	prisavsh*nomq	Derive private savings
16.	slsav	=	slsavsh*nomq	State and local government savings
17.	forsavsh	=	0.0195 - 0.25*((prisavsh-0.146)+(fedsavsh+0.021))	Foreign savings offsets 1/4 of movement in economywide savings
18.	forsav	=	forsavsh*nomq	Derive foreign savings
19.	invest	=	(prisav + forsav + slsav + fedsav)/plevel	Derive real investment from savings
20.	kap	=	(1-deprat)*kap[1] + invest	Update capital stock
21.	pckap	=	(kap/kap[1]-1)*100	Derive growth in capital stock (enters eq. 4)

OASDI Part of federal government

22.	ssoutly	=	ssgdpsh*nomq	Derive OASDI outlays from exogenous share of GDP
23.	sstxshr	=	sstxshr[1] - 0.001	Reduce taxable income share of labor comp. by 0.1 percent
24.	sstax	=	sstxrat*sstxshr*nomwaginc	Derive OASDI tax receipts
25.	ssoth	=	0.016*ssoutly	Derive other OASDI receipts
26.	ssint	=	nomirat/100*ssfund[1]	Derive interest on trust fund
27.	ssrec	=	sstax + ssoth + ssint	Derive total receipts
28.	ssfund	=	ssrec - ssoutly + ssfund[1]	Derive fund position

Medicare part of federal government
Hospital Insurance part

29.	hioutly	=	higdpsh*nomq	Derive HI outlays from exogenous share of GDP
30.	hitxshr	=	hitxshr[1] - 0.001	Reduce taxable income share of labor comp. by 0.1 percent
31.	hitax	=	hitxrat*hitxshr*nomwaginc	Derive HI tax receipts
32.	hioth	=	0.0008*nomq	Derive HI other receipts
33.	hiint	=	nomirat/100 * hifund[1]	Derive HI interest receipts
34.	hirec	=	hitax + hioth + hiint	Derive total HI receipts
35.	hifund	=	hirec - hioutly + hifund[1]	Derive fund position

Supplementary Medical Insurance part

36.	smioutly	=	smigdpsh*nomq	Derive SMI outlays from exogenous share of GDP
37.	smirec	=	smiprmrat*smioutly	Derive SMI receipts from SMI premium rate and outlays

Other federal government

38.	fedmdcd	=	fedmdcd[1]*((hioutly+smioutly)/(hioutly[1]+smioutly[1])-0.005)	Medicaid spending grows 0.5 percentage points more slowly than other federal medical outlays.
39.	othoutly	=	0.111*nomq	Other federal outlays a constant share of GDP
40.	capincrec	=	captxr*capinc	Capital income taxes
41.	othrec	=	0.115*nomq	Other federal receipts

Total federal components

42.	fedint	=	nomirat/100*feddebt[1]	Derive federal interest payments
43.	fedrec	=	othrec + smirec + hitax + hioth + sstax + ssoth + capincrec	
44.	fedoutly	=	ssoutly + hioutly + smioutly + othoutly + fedmdcd + fedint	
45.	fedsav	=	fedrec - fedoutly	
				Identities for total receipts, outlays, and saving (deficit)
46.	feddebt	=	feddebt[1]-fedsav	Derive federal debt
47.	fedsavsh	=	fedsav/nomq	Federal saving as a share of GDP

Values for exogenous variables set here. These values can be used for the entire simulation.

techch	=	1.0	percent
slsavsh	=	0.0232	ratio
unrate	=	5.6	percent
deprat	=	0.03	ratio
captxr	=	0.075	ratio
smiprmrat	=	0.294	ratio
sstxshr	=	0.618	ratio
sstxrat	=	0.124	ratio
hitxshr	=	0.724	ratio
hitxrat	=	0.029	ratio

Needed starting values of endogenous variables for 1995.

nomq	=	7245.8	billions $
q	=	7245.8	billions $
lf	=	132.3	million people
kap	=	25360.3	billions $
plevel	=	1.0	Identity
feddebt	=	3603.3	billions $
ssfund	=	496.1	billions $
hifund	=	130.3	billions $
employ	=	124.9	millions people
caprtn	=	0.085	ratio
fedmdcd	=	83.2	billions $
hioutly	=	117.6	billions $
smioutly	=	66.6	billions $

Data for Labor force growth (OASDI Trust Fund Report, p. 54)

data	pclf
95	0.9
96	0.9
97	1.0
98	1.0
99	0.9
100	0.9
105	0.8
110	0.6
120	0.2
130	0.2
140	0.2
150	0.0
160	0.1
170	0.1

Data for OASDI outlays as share of GDP (taken from OASDI, HI, and SMI Trust Fund Reports, 1996)

data	ssgdpsh	higdpsh	smigdpsh
95	0.0470	0.0160	0.0092
96	0.0470	0.0170	0.0098
100	0.0470	0.0197	0.0117
105	0.0473	0.0220	0.0149
110	0.0485	0.0241	0.0197
115	0.0522	0.0273	0.0247
120	0.0573	0.0313	0.0282
125	0.0615	0.0352	0.0317
130	0.0642	0.0392	0.0347
135	0.0647	0.0422	0.0361
140	0.0637	0.0440	0.0361
145	0.0632	0.0452	0.0355
150	0.0633	0.0459	0.0351
160	0.0650	0.0475	0.0364
170	0.0656	0.0504	0.0379

Experiment 1: What Does Feedback from Trust Fund Outcomes to Economic Assumptions Imply?

	1996	1997	1998	2000	2005	2010	2015	2020	2030	2040	2050	96-00	00-15	15-30	30-50
Nominal and Real Production															
Nominal GDP, billions	7597.7	8013.3	8435.2	9391.9	12555.4	16766.5	22138.3	28873.5	48897.3	83176.0	139957.5	5.3	5.7	5.3	5.3
Real GDP, billions 1995 $	7398.0	7560.7	7711.9	8023.5	8858.6	9723.2	10552.2	11311.9	12941.5	14871.9	16905.6	2.0	1.8	1.4	1.3
Price level, 100 = 1995	102.7	106.0	109.4	117.1	141.7	172.4	209.8	255.3	377.8	559.3	827.9	3.3	3.9	3.9	3.9
Labor and population															
Labor force, millions	133.5	134.8	136.2	138.6	144.6	149.5	153.2	155.3	158.5	161.7	163.1	0.9	0.7	0.2	0.1
Employment, millions	126.0	127.3	128.5	130.9	136.5	141.2	144.6	146.6	149.6	152.6	154.0	0.9	0.7	0.2	0.1
Unemployment rate, %	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	0.0	0.0	0.0	0.0
Factor returns															
Return to capital, real, %	10.0	10.1	10.1	10.1	10.3	10.4	10.7	11.0	12.6	16.4	25.2	0.2	0.3	1.1	3.5
Nominal interest rate	6.4	6.5	6.5	6.5	6.4	6.3	6.3	6.3	6.3	6.3	6.3	0.4	-0.2	0.0	0.0
Per worker income, 1995 $	38159	38613	38995	39850	42195	44771	47439	50148	56237	63347	71365	1.1	1.2	1.1	1.2
Per worker income, $	39190	40924	42652	46647	59804	77202	99525	128002	212483	354291	590816	4.4	5.1	5.1	5.1
Total labor income, bil $	4939	5209	5483	6105	8161	10898	14390	18768	31783	54064	90972	5.3	5.7	5.3	5.3
Savings and Investment, $ billion															
Private saving	1082	1135	1194	1324	1755	2341	3090	4031	6826	11611	19538	5.1	5.6	5.3	5.3
Foreign saving	150	163	174	201	294	441	692	1085	2578	5564	11396	7.4	8.2	8.8	7.4
State and local gov't	176	186	196	218	291	389	514	670	1134	1930	3247	5.3	5.7	5.3	5.3
Investment, bill. 1995 $	1236	1250	1267	1299	1382	1432	1398	1283	881	380	-306	1.2	0.5	-3.1	0.0
Capital stock, bill. 1995 $	25836	26311	26789	27749	30176	32577	34643	36031	35929	31747	23489	1.8	1.5	0.2	-2.1
Other indicators															
Capital-output ratio	3.5	3.5	3.5	3.5	3.4	3.4	3.3	3.2	2.8	2.1	1.4	-0.2	-0.3	-1.1	-3.5
Capital-labor ratio	205.0	206.7	208.4	212.0	221.1	230.8	239.6	245.7	240.2	208.0	152.5	0.8	0.8	0.0	-2.3
Technical change	0.9	0.9	0.7	0.8	0.9	0.9	0.9	1.0	1.5	1.9	2.7	-2.0	0.9	3.2	3.0
Labor productivity, 95$	58.7	59.4	60.0	61.3	64.9	68.9	73.0	77.2	86.5	97.5	109.8	1.1	1.2	1.1	1.2
Tests of model															
Nominal interest rate, %	6.4	6.5	6.5	6.5	6.4	6.3	6.3	6.3	6.3	6.3	6.3	0.4	-0.2	0.0	0.0
Calculated nominal rate, %	6.7	7.3	7.3	7.6	8.2	8.3	8.4	8.6	9.6	11.8	17.1	3.0	0.7	0.9	2.9
Assumed to calculated	0.9	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.5	0.4	-2.6	-0.9	-0.9	-2.9

Experiment 1: What Does Feedback from Trust Fund Outcomes to Economic Assumptions Imply?

	1996	1997	1998	2000	2005	2010	2015	2020	2030	2040	2050	96-00	00-15	15-30	30-50
Federal Government Accounts, $ billion															
Receipts															
Total	1588	1675	1764	1965	2632	3531	4685	6128	10428	17689	29583	5.3	5.8	5.3	5.2
Income, ind. bus. taxes, etc.	874	922	970	1080	1444	1928	2546	3320	5623	9565	16095	5.3	5.7	5.3	5.3
Profits taxes	199	210	221	247	330	440	581	758	1284	2183	3674	5.3	5.7	5.3	5.3
Social Security	384	404	424	471	625	828	1086	1407	2348	3926	6493	5.1	5.6	5.1	5.1
Hospital insurance	110	115	121	135	179	237	311	404	674	1131	1877	5.2	5.6	5.1	5.1
Supplementary Medical Insurance	22	24	27	32	55	97	161	239	499	883	1444	9.7	10.7	7.5	5.3
Outlays															
Total	1726	1834	1942	2188	3015	4233	6048	8639	17639	34670	66294	5.9	6.8	7.1	6.6
Discretionary, etc.	843	889	936	1043	1394	1861	2457	3205	5428	9233	15535	5.3	5.7	5.3	5.3
Social Security	357	377	397	443	594	813	1156	1654	3139	5298	8859	5.4	6.4	6.7	5.2
Hospital insurance	129	142	155	185	276	404	604	904	1917	3660	6424	9.0	7.9	7.7	6.0
Supplementary Medical insurance	74	82	91	110	187	330	547	814	1697	3003	4913	9.7	10.7	7.5	5.3
Medicaid	92	100	109	130	200	310	475	692	1389	2444	3965	8.8	8.6	7.2	5.2
Interest payments	231	243	253	278	364	514	810	1369	4069	11033	26598	4.7	7.1	10.8	9.4
Federal saving	-138	-158	-178	-223	-382	-702	-1364	-2511	-7211	-16981	-36711	12.0	12.1	11.1	8.1
Federal debt outstanding, public	3741	3900	4077	4500	6068	8868	14217	24244	71804	192106	458893	4.6	7.7	10.8	9.3
OASDI Detail, $ billions															
Outlays	357	377	397	443	594	813	1156	1654	3139	5298	8859	5.4	6.4	6.7	5.2
Receipts	415	440	465	520	702	940	1233	1561	2258	2901	3159	5.6	5.8	4.0	1.7
Tax receipts	378	398	418	464	615	815	1067	1380	2298	3841	6351	5.1	5.6	5.1	5.1
Other receipts	6	6	6	7	10	13	18	26	50	85	142	5.4	6.4	6.7	5.2
Interest receipts	32	36	40	49	77	113	148	154	-90	-1026	-3334	11.0	7.3	0.0	18.1
OASDI fund	554	617	685	835	1313	1913	2425	2351	-2310	-18677	-58613	10.2	7.1	0.0	16.2
Medicare Detail, $ billions															
Outlays	204	224	245	295	463	734	1151	1718	3614	6662	11337	9.3	9.1	7.6	5.7
Hospital insurance, Pt. A	129	142	155	185	276	404	604	904	1917	3660	6424	9.0	7.9	7.7	6.0
Supplm. Medical Ins., Pt. B	74	82	91	110	187	330	547	814	1697	3003	4913	9.7	10.7	7.5	5.3
Receipts	140	147	155	170	213	263	301	280	-130	-1825	-6498	4.8	3.8	0.0	19.6
Medicare tax	104	109	115	127	169	224	294	380	635	1065	1765	5.2	5.6	5.1	5.1
Other Pt. A	6	6	7	8	10	13	18	23	39	67	112	5.3	5.7	5.3	5.3
Interest income, Pt. A	8	8	7	2	-21	-71	-172	-363	-1303	-3839	-9819	-30.9	0.0	13.5	10.1
Pt. B premiums	22	24	27	32	55	97	161	239	499	883	1444	9.7	10.7	7.5	5.3
HI balance	-11	-18	-27	-48	-118	-238	-465	-864	-2545	-6367	-14366	36.3	15.2	11.3	8.7
HI fund	119	101	74	-11	-443	-1368	-3190	-6631	-23226	-67298	-170219	0.0	38.1	13.2	10.0
Extra taxes section															
New federal receipts	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0
Federal savings target, % of GDP	-2.1	-1.8	-1.4	-0.8	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-25.2	-13.6	0.0	0.0
Tax rate on nominal wage income	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Results for Experiment 2: What Does Reducing Federal Deficit to 0 and Holding it There Do?

	1996	1997	1998	2000	2005	2010	2015	2020	2030	2040	2050	96-00	00-15	15-30	30-50
Nominal and Real Production															
Nominal GDP, billions	7597.7	8013.3	8435.2	9391.9	12555.4	16766.5	22138.3	28873.5	48897.3	83176.0	139957.5	5.3	5.7	5.3	5.3
Real GDP, billions 1995 $	7398.0	7560.7	7711.9	8023.5	8858.6	9723.2	10552.2	11311.9	12941.5	14871.9	16905.6	2.0	1.8	1.4	1.3
Price level, 100 = 1995	102.7	106.0	109.4	117.1	141.7	172.4	209.8	255.3	377.8	559.3	827.9	3.3	3.9	3.9	3.9
Labor and population															
Labor force, millions	133.5	134.8	136.2	138.6	144.6	149.5	153.2	155.3	158.5	161.7	163.1	0.9	0.7	0.2	0.1
Employment, millions	126.0	127.3	128.5	130.9	136.5	141.2	144.6	146.6	149.6	152.6	154.0	0.9	0.7	0.2	0.1
Unemployment rate, %	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	0.0	0.0	0.0	0.0
Factor returns															
Return to capital, real, %	10.0	10.1	10.1	10.0	10.0	9.8	9.6	9.4	9.0	8.9	8.7	0.1	-0.3	-0.4	-0.2
Nominal interest rate	6.4	6.5	6.5	6.5	6.4	6.3	6.3	6.3	6.3	6.3	6.3	0.4	-0.2	0.0	0.0
Per worker income, 1995 $	38159	38613	38995	39850	42195	44771	47439	50148	56237	63347	71365	1.1	1.2	1.1	1.2
Per worker income, $	39190	40924	42652	46647	59804	77202	99525	128002	212483	354291	590816	4.4	5.1	5.1	5.1
Total labor income, bil $	4939	5209	5483	6105	8161	10898	14390	18768	31783	54064	90972	5.3	5.7	5.3	5.3
Savings and Investment, $ billion															
Private saving	1082	1135	1194	1324	1755	2341	3090	4031	6826	11611	19538	5.1	5.6	5.3	5.3
Foreign saving	155	158	160	164	202	270	356	465	787	1339	2253	1.3	5.2	5.3	5.3
State and local gov't	176	186	196	218	291	389	514	670	1134	1930	3247	5.3	5.7	5.3	5.3
Investment, bill. 1995 $	1221	1262	1306	1396	1577	1730	1877	2012	2302	2646	3007	3.3	2.0	1.4	1.3
Capital stock, bill. 1995 $	25820	26307	26825	27944	31139	34607	38292	42118	50088	58781	68331	2.0	2.1	1.8	1.6
Other indicators															
Capital-output ratio	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.7	3.9	4.0	4.0	-0.1	0.3	0.4	0.2
Capital-labor ratio	204.9	206.7	208.7	213.5	228.2	245.2	264.8	287.3	334.9	385.2	443.8	1.0	1.4	1.6	1.4
Technical change	0.9	0.9	0.7	0.7	0.7	0.7	0.6	0.5	0.7	0.7	0.7	-6.6	-1.0	1.0	0.0
Labor productivity, 95$	58.7	59.4	60.0	61.3	64.9	68.9	73.0	77.2	86.5	97.5	109.8	1.1	1.2	1.1	1.2
Tests of model															
Nominal interest rate, %	6.4	6.5	6.5	6.5	6.4	6.3	6.3	6.3	6.3	6.3	6.3	0.4	-0.2	0.0	0.0
Calculated nominal rate, %	6.8	7.3	7.3	7.6	8.0	7.9	7.8	7.7	7.5	7.4	7.2	2.8	0.2	-0.3	-0.2
Assumed to calculated	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.9	-2.5	-0.4	0.3	0.2

Model Results for Experiment 2: What Does Reducing Federal Deficit to 0 and Holding it There Do?

	1996	1997	1998	2000	2005	2010	2015	2020	2030	2040	2050	96-00	00-15	15-30	30-50
Federal Government Accounts, $ billion															
Receipts															
Total	1567	1694	1821	2106	2912	3975	5496	7528	13831	23904	39973	7.4	6.4	6.2	5.3
Income, ind. bus. taxes, etc.	874	922	970	1080	1444	1928	2546	3320	5623	9565	16095	5.3	5.7	5.3	5.3
Profits taxes	199	210	221	247	330	440	581	758	1284	2183	3674	5.3	5.7	5.3	5.3
Social Security	384	404	424	471	625	828	1086	1407	2348	3926	6493	5.1	5.6	5.1	5.1
Hospital insurance	110	115	121	135	179	237	311	404	674	1131	1877	5.2	5.6	5.1	5.1
Supplementary Medical Insurance	22	24	27	32	55	97	161	239	499	883	1444	9.7	10.7	7.5	5.3
Outlays															
Total	1726	1835	1942	2178	2924	3992	5518	7557	13880	23987	40113	5.8	6.2	6.1	5.3
Discretionary, etc.	843	889	936	1043	1394	1861	2457	3205	5428	9233	15535	5.3	5.7	5.3	5.3
Social Security	357	377	397	443	594	813	1156	1654	3139	5298	8859	5.4	6.4	6.7	5.2
Hospital insurance	129	142	155	185	276	404	604	904	1917	3660	6424	9.0	7.9	7.7	6.0
Supplementary Medical insurance	74	82	91	110	187	330	547	814	1697	3003	4913	9.7	10.7	7.5	5.3
Medicaid	92	100	109	130	200	310	475	692	1389	2444	3965	8.8	8.6	7.2	5.2
Interest payments	231	245	254	268	273	274	280	287	311	350	417	3.8	0.3	0.7	1.5
Federal saving	-160	-142	-121	-72	-13	-17	-22	-29	-49	-83	-140	-19.9	-7.9	5.3	5.3
Federal debt outstanding, public	3763	3904	4025	4195	4284	4359	4459	4589	4979	5641	6763	2.7	0.4	0.7	1.5
OASDI Detail, $ billions															
Outlays	357	377	397	443	594	813	1156	1654	3139	5298	8859	5.4	6.4	6.7	5.2
Receipts	415	440	465	520	702	940	1233	1561	2258	2901	3159	5.6	5.8	4.0	1.7
Tax receipts	378	398	418	464	615	815	1067	1380	2298	3841	6351	5.1	5.6	5.1	5.1
Other receipts	6	6	6	7	10	13	18	26	50	85	142	5.4	6.4	6.7	5.2
Interest receipts	32	36	40	49	77	113	148	154	-90	-1026	-3334	11.0	7.3	0.0	18.1
OASDI fund	554	617	685	835	1313	1913	2425	2351	-2310	-18677	-58613	10.2	7.1	0.0	16.2
Medicare Detail, $ billions															
Outlays	204	224	245	295	463	734	1151	1718	3614	6662	11337	9.3	9.1	7.6	5.7
Hospital insurance, Pt. A	129	142	155	185	276	404	604	904	1917	3660	6424	9.0	7.9	7.7	6.0
Supplm. Medical Ins., Pt. B	74	82	91	110	187	330	547	814	1697	3003	4913	9.7	10.7	7.5	5.3
Receipts	140	147	155	170	213	263	301	280	-130	-1825	-6498	4.8	3.8	0.0	19.6
Medicare tax	104	109	115	127	169	224	294	380	635	1065	1765	5.2	5.6	5.1	5.1
Other Pt. A	6	6	7	8	10	13	18	23	39	67	112	5.3	5.7	5.3	5.3
Interest income, Pt. A	8	8	7	2	-21	-71	-172	-363	-1303	-3839	-9819	-30.9	0.0	13.5	10.1
Pt. B premiums	22	24	27	32	55	97	161	239	499	883	1444	9.7	10.7	7.5	5.3
HI balance	-11	-18	-27	-48	-118	-238	-465	-864	-2545	-6367	-14366	36.3	15.2	11.3	8.7
HI fund	119	101	74	-11	-443	-1368	-3190	-6631	-23226	-67298	-170219	0.0	38.1	13.2	10.0
Extra taxes section															
New federal receipts	-22	18	57	141	279	444	811	1400	3404	6215	10390	0.0	11.6	9.6	5.6
Federal savings target, % of GDP	-2.1	-1.8	-1.4	-0.8	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-25.2	-13.6	0.0	0.0
Tax rate on nominal wage income	-0.6	0.5	1.4	3.2	4.8	5.8	8.0	10.7	15.5	16.9	17.1	0.0	6.1	4.4	0.5

ENDNOTES

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2. The OASDI Report provides alternative assumptions by which to judge the solvency of the system. For example, it provides "low cost" and "high cost" assumption paths. In these cases, deviations in the projections from the "intermediate" values are all chosen to move the fund either toward solvency (low cost) or away from solvency (high cost). The low cost case links variables like higher fertility rates (leading to faster labor force growth) with faster labor productivity growth (raising the taxable wage base), and higher mortality rates (reducing the length of time people receive benefits). On the other hand, the high cost case links lower fertility rates with lower productivity growth and lower mortality rates.

3. In the jargon of the reports, the "cost" rates are well in excess of the "income" rates for Medicare (starting almost immediately) and OASDI (after about 2015). Because the OASDI fund has built up a large surplus, however, it takes another 15 years to exhaust the fund and cause the whole fund to be insolvent.

4. To be complete, we note that it is possible that feedback is allowed, but that other parts of the economy are adjusting in such a way as to avoid an effect on the key macroeconomic projections variables. We examine this possibility below.

5. It should be noted that some analysts have implicitly incorporated these thoughts into the trust fund reports. In both the HI and the SMI fund reports, it was admitted that spending projections for SMI as a percentage of GDP were held down in the Trustees report because "...assuming a continuation of the historical trend would result in an SMI program so large as a percentage of GDP that it would be implausible given other demands on those resources." (p. 71 HI Report).

6. See Harris and Steindel (1991), Aaron (1989), and Gravelle (1997). Elasticities for private savings as a function of the real interest rate were taken from Gravelle, along with the 1995 initial capital to output ratio. The relationship of foreign saving and domestic saving was lifted from Harris and Steindel, although the offset was reduced from 1/3 to 1/4 in response to an analysis of more recent data.

7. Data from Jacobs (1997), pp 183-184. Other recent estimates suggest that total factor productivity growth between 1960 and 1973 was 1.6 percent per year. Between 1973 and 1990, it was 0. See Shigehara, p. 17. Gordon (1996) estimates that nonfarm business multifactor productivity grew 1.42 percent between the second quarter of 1950 and the third quarter of 1963, 1.09 percent annually between the third quarter of 1963 and the second quarter of 1972, 0.32 percent annually from the second quarter of 1972 through the third quarter of 1987, and 0.9 percent from the third quarter of 1987 through the end of 1994 (p. 142). Differences in the estimates of multifactor productivity -- which is always measured as a residual -- are mostly attributable to differences in the measurement of capital and the extent to which other factors of production (human capital, energy, etc., are accounted for in the underlying production function.

8. We should note that we are not using "full" feedback in the broadest sense of the term. For example, we do not have an equation that makes labor force growth a function of the after-tax real wage. If we had incorporated such a feedback, the tax rate would have had to have risen even more, since the tax rate increase itself would have reduced labor force growth below what is contained in the SI assumptions.

9. These federal tax increases are large enough to make any elasticity of labor supply with respect to tax rate changes lead to a slowing labor force. This raises the importance of the labor supply response in the policy debate.

10. This may be partially explained by the fact that two separate agencies are involved with the projections. Although HCFA uses OASDI macroeconomic assumptions, the OASDI report gives no indication that they are influenced by the HCFA HI or SMI trust fund projections.

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