The Effects of Investing the Social Security Trust Funds in GNMA Mortgage-Backed Securities

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Introduction

Social Security is one of the most popular and successful government programs in the United States. The program is credited with dramatically reducing old-age dependency and poverty among the elderly. The Social Security program, however, faces a long-term financing problem, and the Social Security Trustees project that the trust funds will be depleted in 2041. The 1994–96 Advisory Council on Social Security recommended that trust fund investment income be increased as part of the solution to the long-term financing problem. This increase would be accomplished by either investing part of the trust funds in the stock market or establishing private Social Security accounts and having workers invest in the market. As market returns have been, on average, higher than returns on U.S. government Treasury bonds (the current investment vehicle for the trust funds), income to the trust funds could be increased. However, these investments are not a legal option for trust fund assets, and congressional action would be required to allow market investments.

Purpose

Mortgage-backed securities (MBSs) issued by the Government National Mortgage Association (GNMA, or Ginnie Mae) are one alternative legal investment option for trust fund assets. Mortgage-backed securities are debt obligations that represent an ownership claim on cash flows (principal and interest) from a pool of mortgage loans. Ginnie Mae MBSs have typically provided a higher rate of return than Treasury bonds and are guaranteed in principal and interest by the United States government. In the 1960s and 1970s, trust fund investments included securities issued by GNMA and the Federal National Mortgage Association (FNMA, or Fannie Mae). A change in the investments of the trust fund could benefit Social Security in two ways. First, investing the trust fund in alternative investments could strengthen the political viability of Social Security. Second, investing a portion of the trust funds in GNMA MBSs could postpone the insolvency date.

Methodology

There are two major components to the analysis. The first component addresses the effect of Ginnie Mae MBS investments on the trust funds, using a model based on Social Security Administration information and projections. The model assumes that each year, beginning in 2006, excess tax revenues and trust funds monies due to be rolled over are invested in GNMA MBSs. The buying of GNMA MBSs continues until a certain percentage (either 30% or 50%) of the trust funds is invested in MBSs. Mortgage-backed securities are bought or sold to keep the investment percentage constant. Investments in GNMA MBSs continue until (1) the trust fund exhaustion date is reached or (2) the trust fund ratio drops below 200.[1] Three interest rate scenarios are modeled: The return on GNMA MBSs is either 100, 50, or 10 basis points higher than the interest rate of special issues assumed by the Social Security Trustees.

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[1] The trust fund ratio is the ratio of end of year trust fund assets to the projected costs in the coming year, expressed as a percentage.

The second component of the analysis estimates the effect of Social Security surpluses on the budget of the rest of the federal government. This analysis is a replication of the work by Nataraj and Shoven (2004) and Smetters (2003). The empirical strategy is to regress the federal funds surplus on the trust funds surplus and other control variables.

Principal Findings

If 50 percent of the Social Security Trust Funds is invested in GNMA MBSs and a return that is 100 basis points higher than special issues is earned, the insolvency date could be postponed by two years to 2043. If the returns were only 50 basis points higher, the insolvency date is postponed by one year. The insolvency date is unchanged if the return is only 10 basis points higher. The results are broadly similar if 30 percent of the trust funds are invested in MBSs. The increase in trust fund investment income varies from $28.2 billion (in present value terms) for the 30 percent trust fund investment and the lowest rate of return to $523.8 billion for the 50 percent investment and highest rate of return.[2] These numbers represent 0.01 percent to 0.23 percent of taxable payroll (that is, the present value of 75-year taxable payroll).[3]

If some of the trust fund surplus were diverted to GNMA MBS investments, the federal government would be forced to borrow from the public by selling U.S. Treasury securities. The question is, how much will the yield on Treasuries need to increase in order to induce the public to purchase these Treasury securities? With 30 percent of trust fund investments in MBSs, the investments could eventually amount to slightly less than 7 percent of gross domestic product (GDP). If there are no changes in the non-Social Security government budget surplus and if the non-Social Security government budget continues to run deficits, federal debt held by the public could eventually rise by 7 percent of GDP and interest rates could rise by 21 basis points. However, the rise in interest rates will be gradual, because it takes 13 years for the trust fund's investments in MBSs to reach their peak. Furthermore, both the strength of the economy and the Federal Reserve have a greater impact on interest rates.

Conclusions

Clearly, this investment policy will not solve the long-term financing problem of Social Security, but the change could certainly help close the long-term financing gap. Investing in GNMA MBSs does entail some risk compared with investing in special issues. With special issues, the maturity dates are set for the benefit of the trust funds, and special issues can always be redeemed at par. GNMA MBSs carry prepayment risk and the possibility of incurring capital losses. The trust funds have had the experience of selling marketable securities before maturity at a loss. However, with prudent management, the benefits of investing in GNMA MBSs could outweigh the costs.

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[2] The present discounted value shows the amount of money that would have to be invested today in U.S. Treasury securities to yield the nominal dollar amounts.

[3] These numbers should be compared to the 75-year actuarial deficit of Social Security, which amounts to 1.9 percent of taxable payroll (present value).

I. Introduction

The Social Security program is one of the most popular and successful government programs in the United States. The Old-Age, Survivors and Disability Insurance (OASDI) program, the formal name for Social Security, has paid monthly benefits to retirees and their family members since 1940,[4] and to disabled workers and their family members since 1957.[5] The program is credited with dramatically reducing old-age dependency and poverty among the elderly.

To say the least, Social Security is a large federal government program. In 2004, Social Security paid $493.3 billion in benefits to recipients and collected $553.0 billion in contributions from workers, their employers, and the self-employed. Since the beginning of the program in 1937, the program has accounted for a growing share of federal budget receipts and outlays. By 2004, Social Security income amounted to 34 percent of federal government receipts, and total outgo accounted for 22 percent of federal government outlays. At the end of 2004, the OASDI Trust Funds held almost $1.7 trillion in federal government bonds and notes.

The Social Security program, however, faces a long-term financing problem. Currently, the program takes in more than it pays out, with the excess revenues credited to the OASDI Trust Funds. However, the Social Security Trustees project that the trust funds will be depleted in 2041. After that, tax revenue will cover only about 72 percent of promised benefits and the percentage will slowly decline.

This is not the first time Social Security has faced problems, nor are these the worst problems it has ever experienced. In the early 1980s, the trust funds were nearly depleted, and Social Security faced an immediate fiscal crisis. This short-term crisis was fixed through a combination of revenue enhancements (such as raising the payroll tax rate) and cost reductions (such as raising the normal retirement age). Most of the specific actions were recommended by the National Commission on Social Security Reform (the Greenspan Commission).

The revenues for Social Security don't come solely from payroll taxes. Of the $657.7 billion in total OASDI 2004 income, 84.1 percent came from payroll taxes, 13.5 percent from interest paid on trust fund assets, and 2.4 percent from taxes on current benefits. The 1994–96 Advisory Council on Social Security recommended that trust fund investment income be increased. This increase would be accomplished by either investing part of the trust funds in the stock market or establishing private Social Security accounts and having workers invest in the market. As market returns have been, on average, higher than U.S. government Treasury bond returns, income to the trust funds could be increased. However, these investments are not a legal option for trust fund assets, and congressional action would be required to permit them.

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[4] The first monthly old-age benefit check was issued on January 31, 1940, to Ida May Fuller of Ludlow, Vermont. The amount of the check was $22.54. Before 1940, only lump-sum payments were made, which provided some payback for past contributions. The first recipient of a lump sum was Ernest Ackerman of Cleveland, Ohio, who received 17 cents.
[5] The amendments to the Social Security Act creating the Disability Insurance (DI) program were passed in 1956, but the first DI benefit payments were not made until January 1957.

This paper examines one alternative legal investment option for trust fund assets: mortgage-backed securities (MBSs) issued by the Government National Mortgage Association (GNMA, or Ginnie Mae). MBSs are debt obligations that represent an ownership claim on cash flows (principal and interest) from a pool of mortgage loans. Typically, with Ginnie Mae MBSs, the mortgages in the pool have similar maturities and the same interest rate. The mortgages in GNMA MBS pools are Federal Housing Administration (FHA) and Veterans Administration (VA) insured or guaranteed loans. Ginnie Mae MBSs have typically provided a higher rate of return than Treasury bonds and are guaranteed in principal and interest by the United States government. Investing Social Security trust funds in alternative investments is nothing new. In the 1960s and 1970s, trust fund investments included securities issued by GNMA and the Federal National Mortgage Association (FNMA, or Fannie Mae). The results of the analysis show that investing part of the Social Security Trust Funds in GNMA MBSs could increase investment income to the trust funds and postpone the insolvency date by a year or two.

II. Background and Literature Review

a. Origin of the Trust Fund

Whether or not to accumulate a significant trust fund was vigorously debated in the early years of the Social Security program. Under the provisions of the 1935 Social Security Act, a large reserve account[6] (the Old-Age Reserve Account) would accumulate and would be invested in "interest-bearing obligations of the United States or in obligations guaranteed as to both principal and interest by the United States."[7] Robert Myers of the Committee on Economic Security projected that the Social Security reserve balance would reach $47 billion by 1980.[8] This projected reserve was approximately equal to 1,300 percent of projected 1980 benefit payments. This widely cited reserve balance alarmed both conservatives and liberals. Conservatives argued that a large reserve would provide an excuse to increase government expenditures to pay for New Deal programs not otherwise funded, or increase federal debt (Derthick 1979; Kollmann and Solomon-Fears 2001; Schieber and Shoven 1999). Liberals were worried about the contractionary economic effect of the "excess savings" of building up such a surplus (Schieber and Shoven 1999).

The projected $47 billion reserve balance was being considered at a time when the federal debt was around $30 billion. Republican Senator Arthur Vandenberg was afraid that the accumulation of such a large sum would basically eliminate public access to Treasury bonds and that such a sum would be larger than the government debt. In fact, the Social Security Board under Arthur Altmeyer had drawn contingency plans for investing the funds in other securities that would give preference to those obligations that "are issued to finance social undertakings, such as housing . . ." (Schieber and Shoven 1999, p. 70). Furthermore, the possibility of the reserve account buying up all the available government bonds could seriously hamper the Federal Reserve's operation of monetary policy.

The 1939 amendments to the Social Security Act essentially put Social Security on a pay-as-you-go basis by increasing benefits. In addition, the 1939 amendments created the Old-Age and Survivors Insurance Trust Fund (formerly the reserve account). The requirement to invest surplus monies in U.S. Treasury securities or obligations with both principal and interest guaranteed by the United States remained.

In the first 15 years of the Social Security program, the trust fund grew to about 5 percent of gross domestic product (GDP; see figure 1). After 1955, however, the trust fund gradually fell relative to GDP and, by the time of the early 1980s funding crisis, trust fund assets were less than 1 percent of GDP and only about 15 percent of annual benefits. After the 1983 amendments, Social Security started running large surpluses; by the end of 2004, the trust funds held $1.7 trillion in assets (about 14% of GDP). The Trustees currently project that the trust fund assets

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[6] In the 1935 Act, the taxation and benefits features of the program were legally separated for constitutional reasons. Consequently, tax receipts were not automatically credited to the Social Security program but went to the general fund for later appropriation to the reserve account. By 1939, the constitutional issues were resolved and the program was amended to credit payroll tax revenues directly to the Trust Fund.

[7] Title II of the Social Security Act of 1935, section 201(b).

[8] The table that Myers prepared is reproduced in SSA history research note #20 available at www.ssa.gov.

will peak at about $6.0 trillion in the mid-2020s. Relative to GDP, however, the trust funds are projected to peak at 22 percent of GDP in 2019. After the mid-2020s, trust funds are projected to rapidly decline until the exhaustion date in 2041.

b. The Trust Fund, the Federal Budget, and the Economy

Many observers today argue that the real Social Security financing problem will begin in 2017, when annual benefit payments exceed annual payroll tax revenue. At that time, the Social Security Trust Fund will begin to redeem the Treasury bonds held in the trust fund. As the President's Commission to Strengthen Social Security (2001, p. 18) stated, the Treasury bonds are claims on real resources and "the Treasury will have to find those real resources." This statement is true, but it ignores the possible economic effects of the build-up of the trust fund before 2017.

The first academic article dealing with the build-up of Social Security assets appeared in 1937 in the *Quarterly Journal of Economics*.[9] In this article, the author offered a defense of the Old-Age Reserve Account. He argued that the reserve account is not fictitious and stated that "[t]he real value of the reserve will consist, not in the fact that the Government will hold its own bonds, but in the fact that other people will not hold them" (p. 463). The government will not have to pay the interest charges on the bonds in the reserve account to the public, which thus benefits the taxpayer. The issue of trust fund investments and interest charges was further addressed in the reports of the 1948 Advisory Council on Social Security and the 1957–59 Advisory Council on Social Security Financing.

Though it is true that the U.S. Treasury will have to find the funds for the redemption of the trust funds' special issues, this is not the real issue. The issue is whether or not national income will be greater in 2017 because of the large build-up in the trust funds. Several researchers have pointed out that increased saving can finance capital accumulation and faster capital formation can boost future income (see, for example, Bosworth 1996; Bosworth and Burtless 2004; and Feldstein 1976). For example, Munnell (1988, p. 1) argued that the accumulating assets in the trust funds have "created the situation where the United States has the unique opportunity to augment national saving."[10] So the question of how Social Security affects the economy depends on how Social Security affects national saving.

National saving is the sum of private saving and public saving (i.e., the government budget surpluses or deficits). This relationship can be written as follows:[11]

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[9] Unsigned (1937). The editors note that "The writer of this article has asked that his name be not signed to it. We believe it to deserve careful attention."

[10] Most proponents of advanced funding of the public retirement system argue that increased retirement saving increases national saving and capital accumulation. The increased capital stock boosts economic growth and national income. However, the chain of events could also (and probably does) work in the opposite direction, with economic growth increasing national saving.

[11] The state and local government budget surpluses are ignored for ease of exposition. Net saving by state and local governments is very small compared with federal government net saving.

$$\text{National Saving} = \text{Private Saving} + \underbrace{\text{Non-OASDI Budget Surplus} + \text{OASDI Budget Surplus}}_{\text{Public Saving}}$$

Public saving is simply the sum of the non-OASDI budget surplus (currently in deficit) and the OASDI budget surplus (currently in surplus).

Two strands of the academic literature have argued that Social Security can adversely affect national saving. First, in a widely cited and influential article, Feldstein (1974) estimated that Social Security has had the effect of lowering personal saving (a component of private saving) by 20–50 percent through an asset-substitution effect and the inducement-to-retire effect. However, Feldstein's results have been questioned. Leimer and Lesnoy (1982) found that Feldstein's work was flawed because of a computer programming error. After correcting the error, they concluded that the data show that Social Security has had very little effect on personal saving. In a subsequent paper, Feldstein (1996) reestimated his model with updated data and obtained essentially the same results as in his earlier paper. However, Coates and Humphreys (1999) and Meguire (1998) showed that Feldstein's results are not robust to alternative specifications. In a review of the literature, the Congressional Budget Office (CBO 1998) concluded that for each dollar of Social Security wealth, private wealth is reduced by between zero and 50 cents; however, CBO could not rule out higher or lower effects.

Second, over the past few years, several papers have examined the impact of the Social Security surplus (OASDI surplus in the equation) on the budget surpluses for the rest of the federal government (non-OASDI surplus). Diamond (2005) and Munnell (2005) concluded that the Social Security surplus has had no effect on the non-OASDI surplus and, thus, increased public saving and probably increased national saving in the 1980s and 1990s.

However, other researchers reach different conclusions. Three recent studies used time-series data to examine this issue. Nataraj and Shoven (2004) and Smetters (2003) found evidence that Social Security surpluses have induced larger deficits in the budget for the rest of government. Consequently, public saving and, hence, national saving are lower as a result of Social Security surpluses. These researchers blame the shift to a unified budget in 1970. Bosworth and Burtless (2004), also using time-series data, found that 60–100 percent of the OASDI surplus is offset by larger non-OASDI deficits. It appears, though, that these researchers may not have paid enough attention to the time-series properties of the variables in their regression equations (more on this later). Furthermore, Orszag (2004) argued that the results are sensitive to the variables used and time periods examined.

The evidence on how Social Security affects national saving is, at best, mixed. Some find a decidedly negative impact on national saving, while others find no effect or a positive effect. More research is needed and, undoubtedly, will be done on this important issue.

c. Current and Historical Investment Practices

Since the beginning of the Social Security program in 1935, the Secretary of the Treasury has been required to invest receipts in excess of those required "to meet current withdrawals"

only in "interest-bearing obligations of the United States or in obligations guaranteed as to both principal and interest by the United States."[12] There has been some confusion over the legal investment vehicles open to the trust fund. For example, in a 1994 report, CBO (1994, p.1) stated that "by law, reserves in the Social Security trust fund must be invested in special U.S. Treasury securities ('special issues')." However, the language of the Act makes clear that in addition to special issues, marketable Treasury securities and other obligations are also lawful investment vehicles, but only "where he [the Secretary of the Treasury as the managing Trustee] determines that the purchase of such other obligations is in the public interest."

Over the years, the main investments of the trust funds have been marketable U.S. Treasury securities and special-issue U.S. Treasuries. Since 1960, the law has required that special issues be purchased unless alternative investments are determined to be in the public interest. With regard to the maturity and interest rate of these special issues, the Act states:

> Such obligations issued for purchase by the Trust Funds shall have maturities fixed with due regard for the needs of the Trust Funds and shall bear interest at a rate equal to the average market yield . . . on all marketable interest bearing obligations of the United States then forming a part of the public debt which are not due or callable until after the expiration of four years from the end of such calendar month. [42 USC 401(d)]

Kunkel (1999) reviewed the investment policies and practices for the trust funds and said that the legal and administrative policies appear to be based on four principles:
- Nonintervention in the private economy or in the open market operations of the Federal Reserve;
- Security or protection against risk of loss of principal and interest;
- Neutrality with respect to other federal accounts; and
- Minimal management of the investments.

The current practice for trust fund investment is to spread the maturity dates of the obligations as evenly as possible over the following 1–15 years (with a maturity date of June 30). As the trust funds accumulate surplus monies over the course of a year, they are invested in short-term certificates of indebtedness that mature on the next June 30. As obligations reach maturity and are not needed to pay current benefits, they are rolled over into special issues with maturities chosen to maintain the even 1–15-year spread. Table 1 shows the maturity years for the assets in the OASDI Trust Funds at the end of 2004.

Though the current investment practice is to purchase special issues, the trust funds do hold and have held other securities.[13] At the end of 2004, the Disability Insurance Trust Fund held $30.2 million in marketable Treasury bonds, which is a very small fraction of the total OASDI Trust Funds.[14] In comparison, about 20 percent of the assets in the OASI Trust Fund in 1945 were marketable Treasury securities.

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[12] This language has been unchanged since 1935. See 42 USC 401(d).

[13] Before 1960, the preference for Trust Fund investments was marketable U.S. Treasury obligations.

[14] See table VI.A6, p. 135 of the 2005 Trustees' Report.

In the late 1960s and 1970s, other securities were added to the portfolio, such as federally sponsored agency obligations issued by FNMA, the Federal Intermediate Credit Bank, the Federal Home Loan Bank, the Federal Land Bank, and GNMA. Acquisitions of federally sponsored agency obligations by the OASDI Trust Funds amounted to $697.5 million in fiscal year 1967.[15] The 1968 Trustees' report also noted that "$34 million of federally-sponsored agency securities were sold, providing additional income to the fund in the form of a profit amounting to about $100,000" (p. 19). A similar sale of federally sponsored agency securities is reported for the Disability Insurance Trust Fund. As trust fund assets were liquidated in the early 1980s to make benefit payments, the remaining federally sponsored agency securities were sold in 1982 prior to maturity and incurred a capital loss of $319.2 million.[16]

d. Alternative Investments for the Social Security Trust Funds

Since the beginning of the Social Security program in 1935, what constitutes legal investments for the trust funds has remained unchanged in Title II of the Social Security Act (see above). The Treasury Department (1958) noted, however, that the 1954 law regarding the obligations of FNMA, which are not guaranteed by the United States, made all FNMA obligations legal investment options for the trust funds. The 1956 Social Security amendment again limited legal trust fund investments to Treasury obligations and other obligations guaranteed by the United States.[17]

Income to the trust funds from interest on the special issues has been a fairly minor revenue source throughout much of the history of the Social Security program (see figure 2). The primary reason to consider other investment options for the trust funds is to increase income, and some have argued that trust fund assets should be invested in corporate stocks. It is well known that other investment vehicles, such as stocks and corporate bonds, have higher rates of return than U.S. Treasury securities, but they also are riskier (see, for example, CBO 1994). In addition, federally sponsored agency securities typically have higher returns than U.S. Treasury securities.[18] For example, the returns of GNMA MBSs have averaged about 100 basis points (one percentage point) higher than rates on newly issued special issues. Over the past seven years, this difference between rates of return has fluctuated between 45 basis points and 180 basis points (see table 2). Of course, along with the higher returns of these alternative securities comes higher risk.

To be sure, other reasons have been offered for purchasing other securities for the trust funds. Many have worried that the build-up of the trust fund may leave no Treasury securities

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[15] See tables 8 and 12 in the 1968 Trustees' report.

[16] See table 2, p. 13 of the 1984 Trustees' report.

[17] It is interesting to note that the Treasury Department (1958) stated that it "would have no objection to amendments to the Social Security Act that would make non-guaranteed obligations of Federal agencies eligible as investments for the Funds." The 1957–59 Advisory Council on Social Security Financing, however, stated that U.S. government obligations are the proper investments for the Trust Funds. The 1971 Advisory Council on Social Security recommended that the Trust Funds purchase new obligations of various government-sponsored enterprises, such as FNMA.

[18] Investopedia.com states that mortgage-backed securities are quite liquid and generally offer a 1–2 percentage points higher return than U.S. Treasuries (see www.investopedia.com/university/20_investments/11.asp).

available for the public and could hamper the operation of monetary policy (see, for example, Aaron, Bosworth, and Burtless 1989). This was a real fear in the mid- to late-1990s, as the non-Social Security budget was moving toward surplus. As a matter of fact, the Federal Reserve Board decided to study the feasibility of outright purchases of GNMA MBSs for the System Open Market Account (Board of Governors 2002, p. 60).

In an analysis of the investment policies of Social Security, Aaron, Bosworth and Burtless (1989) considered the possible effects of investing the trust funds in alternative investment vehicles (e.g., stocks and federally sponsored agency obligations). They concluded that

> investing part of the social security reserves in assets of government-sponsored enterprises will help insulate the reserves from being used to pay for current government activities. It will certainly increase the yield that can be reasonably anticipated on the social security portfolio. (p. 114)

The CBO papers (1994, 2003) focused primarily on the effects of investing the trust funds in private securities such as stocks and corporate bonds. CBO (2003, p. 2) noted that investing Social Security surpluses in the private sector is "not a reliable way for the nation to increase its future resources." Both papers emphasized the riskiness of private securities. CBO (2003) also pointed out that risky trust fund investments could weaken budgeting control of federal financial resources.

In a theoretical analysis of investing Social Security funds in stocks, Diamond and Geanakoplos (2003) suggested that the portfolio choice for the trust funds has real effects on the economy. In addition, they concluded that workers are unlikely to be so risk averse that a 100 percent Treasury bond portfolio for the trust funds is optimal. They noted that the government has the ability to spread risk over successive cohorts, which argues for a broader trust fund portfolio.

Investing the trust fund in alternative investments could strengthen the political viability of Social Security. First, it could help counter the misguided notion that the trust funds are not real. Second, these alternative investments could help insulate the Social Security program against political risks by making benefit reductions harder to justify to the public, because part of the trust fund will be truly separate from the rest of the federal budget.

Though the literature is not definitive, it is almost certain that investing the Social Security Trust Funds in alternative securities will have effects that go beyond Social Security. The federal budget, as well as the economy as a whole, could very well be impacted. Any study of alternative investments for Social Security must consider all of these effects.

III. Methods and Data Sources

There are two major components to the analysis. The first component addresses the effect of Ginnie Mae MBS investments on the trust funds. A model, based on Social Security Administration information and projections,[19] was created. The 2005 intermediate cost assumptions were used in the model. Each year beginning in 2006, excess tax revenues and trust funds monies due to be rolled over are invested in GNMA MBSs. The buying of GNMA MBSs continues until a certain percentage (either 30% or 50%) of the trust funds is invested in MBSs. Mortgage-backed securities are bought or sold to keep the investment percentage constant. Investments in GNMA MBSs continue until (1) the trust fund exhaustion date is reached or (2) the trust fund ratio drops below 200.[20] Three interest rate scenarios are modeled: The return on GNMA MBSs is either 100, 50, or 10 basis points higher than the interest rate of special issues assumed by the Social Security Trustees.

The second component of the analysis estimates the effect of Social Security surpluses on the budget of the rest of the federal government. This analysis is a replication of the work by Nataraj and Shoven (2004) and Smetters (2003). However, particular attention is paid to the time-series properties of the variables used in the analysis. The empirical strategy is to regress the federal funds surplus on the trust funds surplus and other control variables. See the technical appendix for details of the estimation procedure, results of various hypothesis tests, and the regression results.

Time-series data from 1949 to 2004 are used for the analysis. The federal budget data on surpluses for the unified budget, the federal funds budget (which excludes information on the trust funds), and the trust funds budget come from table 1.4 in the historical tables of the *Budget of the United States Government, Fiscal Year 2006*. The data for the OASDI surplus and interest income come from table 13.1 of the historical tables. Interest income for all trust funds was obtained directly from the Office of Management and Budget.[21] The potential GDP data come from the Congressional Budget Office (available at www.cbo.gov), and actual GDP data come from the National Income and Product Account (NIPA) tables (available at www.bea.gov). Data on wage and salary disbursements also come from the NIPA tables. Total earnings subject to the Social Security payroll tax comes from various issues of the Annual Statistical Supplement to the *Social Security Bulletin*.

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[19] The year-by-year information under the intermediate cost assumptions was obtained from www.ssa.gov/OACT/TR/TR05/lrIndex.html.

[20] The trust fund ratio is the ratio of end of year trust fund assets to the projected costs in the coming year, expressed as a percentage.

[21] The author is grateful to Robert Kilpatrick of OMB for providing these data. They are the same data provided to Nataraj and Shoven.

IV. Results

Investing part of the Social Security Trust Funds in mortgage-backed securities can have effects on the federal budget in addition to effects on the trust funds and the market for MBSs. First, the effect on the trust funds is explored. Next, the possible effects on the federal budget are discussed. Last, the potential effects on the market for mortgage-backed securities are discussed.

a. Effect on the Social Security Trust Funds

The reason to change the investment policies of the Social Security Trust Funds is to increase investment income. GNMA MBSs typically have a higher return than U.S. Treasury securities (see section II). On average, the difference has been about 100 basis points (one percentage point). For the projections, three alternative return scenarios are used: The return on MBSs is either 100 basis points, 50 basis points, or 10 basis points above the yield on special issues. Furthermore, two investment scenarios are considered: 50 percent of the trust funds is invested in MBSs or 30 percent is invested in MBSs. Last, the projections are calculated under the assumption that the MBSs investments as a proportion of the trust fund build-up until 2020 and then are a constant fraction of the trust funds assets until (a) the insolvency date is reached or (2) the trust fund ratio falls below 200.[22]

The results are presented in table 3. The first two columns of the table show the proportion of the trust funds invested in MBSs and the increase in the return over U.S. Treasuries. The third column shows the year the Social Security Trust Funds are exhausted. The next three columns show the increase in trust fund investment income as a result of the MBS investments. Panel A shows the results when MBS investments continue until the insolvency date, and panel B shows the results when the investments continue until the trust fund ratio falls below 200.

The results in the two panels of table 3 show some differences, but none are particularly large. Consequently, the focus will be on panel B, because it probably represents a more reasonable scenario. If 50 percent of the Social Security Trust Funds is invested in GNMA MBSs and a return that is 100 basis points higher than special issues is earned, the insolvency date could be postponed by two years to 2043. If the returns were only 50 basis points higher, the insolvency date is postponed by one year. The insolvency date is unchanged if the return is only 10 basis points higher. The results are broadly similar if 30 percent of the trust funds are invested in MBSs. The increase in trust fund investment income varies from $28.2 billion (in present value terms) to $523.8 billion.[23] These numbers represent 0.01 percent to 0.23 percent of taxable payroll (that is, the present value of 75-year taxable payroll).[24]

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[22] The assumption of building-up MBSs investments so they reach 30 percent or 50 percent of the trust fund is made to prevent the trust fund from purchasing more MBSs than the administration projects will be issued.

[23] The present discounted value shows the amount of money that would have to be invested today in U.S. Treasury securities to yield the nominal dollar amounts.

[24] These numbers should be compared to the 75-year actuarial deficit of Social Security, which amounts to 1.9 percent of taxable payroll (present value).

If we consider investing 30 percent of the trust funds in GNMA MBSs as the more reasonable alternative, the results suggest that the insolvency date can be put off for a year, and trust fund investment income can be increased by $300 billion in present discounted value terms, or 0.13 percent of taxable payroll. Clearly, this investment policy will not solve the long-term financing problem of Social Security, but this change could certainly help to close the long-term financial gap.

GNMA mortgage-backed securities are fairly safe investments, because they are guaranteed in both principal and interest by the government. However, they are not completely without risk. As borrowers do not face penalties for prepaying their mortgages, holders of MBSs cannot be certain when they will receive the principal.[25] If interest rates fall, many homeowners will refinance their mortgages. In this case, a holder of MBSs will receive the principal sooner than expected and be forced to reinvest in a lower yielding security (either another GNMA MBS or special issues).[26]

It is important to keep in mind that prepayment risk is a risk of receiving lower trust fund investment income and not a risk of loss of principal. Furthermore, how much income is lost (with respect to special issue investments) depends on how much interest rates change. For small changes in interest rates, GNMA MBSs, with their prepayment risk, will still yield a higher return than special issues.

b. Effect on the Federal Budget

Changing the Social Security Trust Fund investment policy could affect the rest of the federal budget through two interrelated mechanisms. First, interest rates could be affected, which would affect government interest payments. Second, a change in the trust fund could induce a change in the federal budget surplus.

Currently, the Social Security Trust Fund surplus is invested in special issues. The money that the U.S. Treasury receives goes into the general fund, to be spent on various government operations. If some of the trust fund surplus were diverted to GNMA MBS investments, the federal government would be forced to borrow from the public by selling U.S. Treasury securities. The question is, how much will the yield on Treasuries need to increase in order to induce the public to purchase these Treasury securities?

Over the years, several researchers have examined whether or not federal deficits and debt affect interest rates. For the most part, the evidence is mixed, with some finding no effect and others finding large effects; however, recent papers appear to have reached a consensus. Laubach (2003) estimated that an increase in debt of 1 percent of GDP will raise interest rates by four basis points; Gale and Orszag (2004) put the effect at three to six basis points. Engen and Hubbard (2004) estimated that an increase in federal debt equal to 1 percent of GDP will raise

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[25] See Green and Shoven (1986) for examples of mortgage cash flows by age of the mortgage under various interest rates.

[26] Prepayment risk cannot be modeled here because the Social Security Trustees assume that interest rates are constant.

long-term real interest rates by about three basis points. The following calculations will use this estimate.

If 50 percent of the Social Security Trust Funds were invested in GNMA MBSs, these investments could amount to about 10 percent of GDP by 2020. Under the 30 percent trust fund investment in MBSs, the investments could eventually amount to slightly less than 7 percent of GDP by 2020. If there are no changes in the non-Social Security government budget surplus and if the non-Social Security government budget continues to run deficits, federal debt held by the public could eventually rise by 7–10 percent of GDP. On the basis of Engen and Hubbard's estimate, this increase in publicly held debt could raise interest rates by 21–30 basis points (0.21–0.30 percentage points). The rise in interest rates will eventually increase interest payments from the federal government to the public and to the trust funds. Of course, interest rates are affected to a much greater extent by the actions of the Federal Reserve and the strength of the economy.

The fiscal year 2005 federal budget numbers can be used to put this effect into perspective. If interest rates on all U.S. Treasury securities were higher by 30 basis points, interest payments (gross) would increase from $349.9 billion (14.2 percent of federal outlays) to $373.7 billion (15.1 percent of federal outlays). However, some of the $23.8 billion increase in interest payments (about $5.2 billion) would go to the Social Security Trust Funds. Consequently, net interest payments (interest payments to the public) would be less, at about $13.8 billion. It should be kept in mind that an increase in interest rates will not affect outstanding Treasury securities, just newly issued ones. Consequently, the budgetary effects could be considerably less. Furthermore, the rise in interest rates will be gradual, because it takes 14 years for the trust fund investments in MBSs to reach their peak as a percent of GDP, with the assumption that there will be no other changes in government policy.

Diverting part of the Social Security payroll tax receipts to GNMA MBS investments is comparable to decreasing the trust fund surplus (which is available to the rest of the government for spending), with the assumption that the funds used to purchase the MBSs are considered outlays in the budget. The estimation results presented in the technical appendix suggest that this diversion will have no direct effect on the rest of the federal budget, because changes in the trust fund surplus do not affect the surplus in the rest of the budget. The diversion of trust funds to GNMA MBSs could lead to a dollar-for-dollar increase in the unified budget deficit.

c. Effect on GNMA Mortgage-Backed Securities Market

How the market for Ginnie Mae MBSs would be affected by trust fund investments depends on the relation of the size of the investments to the MBSs issued and outstanding, and on the availability of close substitutes. Table 4 shows the annual amount of GNMA MBSs issued and outstanding since 2000. Over this five-year period, newly issued GNMA MBSs have varied from about $100 billion to over $200 billion. Outstanding issues, however, fell over this period from about $600 billion to less than $500 billion, primarily because repayments exceeded new

issuances. GNMA estimates that there will be $571.8 billion in outstanding securities by 2006 and $160 billion in new issuances.[27]

GNMA is not the only participant in the MBS market. For example, FNMA and the Federal Home Loan Mortgage Corporation, both government-sponsored enterprises (GSEs), also issue mortgage-backed securities. In 2000, GNMA and these two GSEs accounted for about 88 percent of outstanding MBSs (Estrella 2002). Mortgages in outstanding agency and GSE-backed mortgage pools stood at $3.5 trillion in 2004.[28]

Between 2006 and 2025, the trust funds would need to buy about $100 billion in MBSs per year to achieve and maintain 30 percent of the trust funds in MBS investments. For 2006, this amount represents 63 percent of anticipated new issues of GNMA MBSs. It is unknown what new issues of GNMA MBSs will amount to in future years.[29] It is quite possible that the trust funds could become the largest single buyer and holder of GNMA MBSs. There is, of course, another option for others who want to hold MBSs: the GSE mortgage-backed securities. Though the Social Security Trust Funds could come to dominate the GNMA MBS market, the availability of fairly close substitutes will probably minimize the impact the trust fund would have on the MBS market.

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[27] *Budget of the United States for Fiscal Year 2006.*
[28] Federal Reserve Board (2005), *Flow of Funds Accounts of the United States, Annual Flows and Outstandings, 1995-2004* (Washington, DC: Federal Reserve Board) available at www.federalreserve.gov.
[29] It is possible that there may not be enough GNMA mortgage-backed securities for the Trust Fund to buy. However, the amount of GNMA MBSs is, to some extent, affected by Congress. Each year, Congress determines the maximum number of loans to be insured by FHA and VA, and the amount of new commitments to guarantee MBSs by GNMA.

V. Summary and Concluding Remarks

The main findings of this study are as follows:
- The Social Security Trust Funds have, in the past, been invested in securities other than special U.S. Treasury securities.
- Investing a portion of the Social Security Trust Funds in GNMA mortgage-backed securities could postpone the trust funds' exhaustion date by a year or two and increase trust fund investment income by 0.01 percent to 0.24 percent of taxable payroll.
- Diverting a portion of the trust funds to MBSs could eventually increase the government's borrowing costs by up to 30 basis points; this would happen over a 13-year period and would increase the unified budget deficit.
- The Social Security Trust Fund surplus has increased public saving and probably national saving.
- The trust funds could become the largest single investor in GNMA MBSs, but because of the availability of close substitutes, the overall impact of trust fund investments on the GNMA MBS market is likely to be limited.

Investing in GNMA MBSs does entail some risk compared with investing in special issues. With special issues, the maturity dates are set for the benefit of the trust funds, and special issues can always be redeemed at par. GNMA MBSs carry prepayment risk and the possibility of incurring capital losses. The trust funds have had the experience of selling marketable securities before maturity at a loss. However, with prudent management, the benefits of investing in GNMA MBSs appear to outweigh the costs.

Many argue that the long-term financing problem will begin in 2017, when annual Social Security costs become larger than annual payroll tax revenue. They claim that the government will have to find real resources to make up the difference. However, the results indicate that the Social Security Trust Fund surpluses may have increased national saving, capital accumulation, and national income. Thus, the pool of real resources that the government can draw on to close the gap may be larger than it otherwise would have been. If so, it would appear that the Congress that adopted the Greenspan Commission's recommendation to build up the trust fund to finance the retirement of the baby boomers made the correct decision. Now, with $1.7 trillion in trust fund assets, investing the trust funds in GNMA mortgage-backed securities, combined with prudent management, could extend the life of the trust funds.

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Table 1: Maturity Dates for Assets in OASDI Trust Funds at the End of Calendar Year 2004

Year	Assets (billions)
2005	$170.72*
2006	108.30
2007	108.30
2008	108.30
2009	108.30
2010	108.30
2011	108.30
2012	108.30
2013	108.30
2014	108.30
2015	108.30
2016	108.30
2017	108.30
2018	108.30
2019	108.30
Total	$1,686.95

*Includes $81.25 billion in special issues and $89.47 billion in certificates of indebtedness.

Table 2: Nominal Annual Returns of GNMA Mortgage-Backed Securities and U.S. Treasury Special Issues

Year	GNMA MBSs	Special Issues	Spread
2003	5.90	4.10	1.80
2002	6.09	4.90	1.19
2001	6.72	5.20	1.52
2000	7.77	6.20	1.57
1999	6.99	5.90	1.09
1998	6.68	5.60	1.08
1997	7.05	6.60	0.45

Table 3: Effects of Investing Social Security Trust Fund Assets in GNMA Mortgage-Backed Securities

Proportion of Trust Funds Invested in GNMA MBSs	Difference in Return on MBSs over U.S. Treasury Securities	Revised Insolvency Date	Increase in Trust Fund Investment Income		
			Nominal Dollars	Present Discounted Value	Percentage of Taxable Payroll
A. GNMA MBS Investments Until Insolvency Date					
50 percent	100 basis points	2043	$2,153.5	$549.1	0.24%
50 percent	50 basis points	2042	$993.0	$260.6	0.11%
50 percent	10 basis points	2041	$184.7	$49.8	0.02%
30 percent	100 basis points	2042	$1,207.7	$315.6	0.14%
30 percent	50 basis points	2042	$575.6	$153.0	0.07%
30 percent	10 basis points	2041	$110.4	$29.8	0.01%
B. GNMA MBS Investments Until Trust Fund Ratio Less Than 200					
50 percent	100 basis points	2043	$1,982.8	$523.8	0.23%
50 percent	50 basis points	2042	$913.1	$248.1	0.11%
50 percent	10 basis points	2041	$168.7	$47.2	0.02%
30 percent	100 basis points	2042	$1,107.1	$299.9	0.13%
30 percent	50 basis points	2042	$520.0	$144.0	0.06%
30 percent	10 basis points	2041	$101.0	$28.2	0.01%

Note: Dollar amounts in billions of dollars.

Table 4: New Issuances and Outstanding GNMA Mortgage-Backed Securities (in billions of current dollars)

Year	MBSs Issued	Outstanding MBSs
2000	$105.5	$603.5
2001	$153.8	$604.3
2002	$174.9	$568.4
2003	$215.8	$473.9
2004	$149.1	$453.5

Source: GNMA Annual Reports, various years.

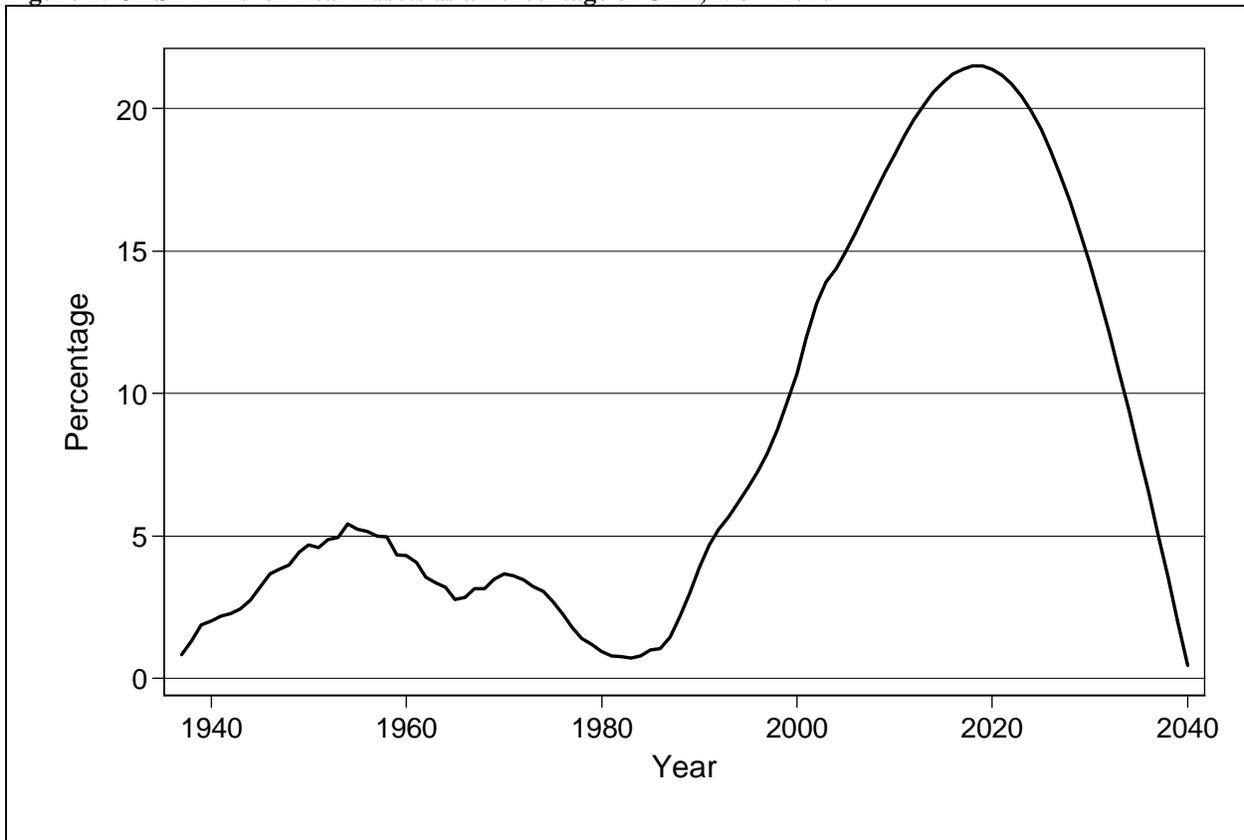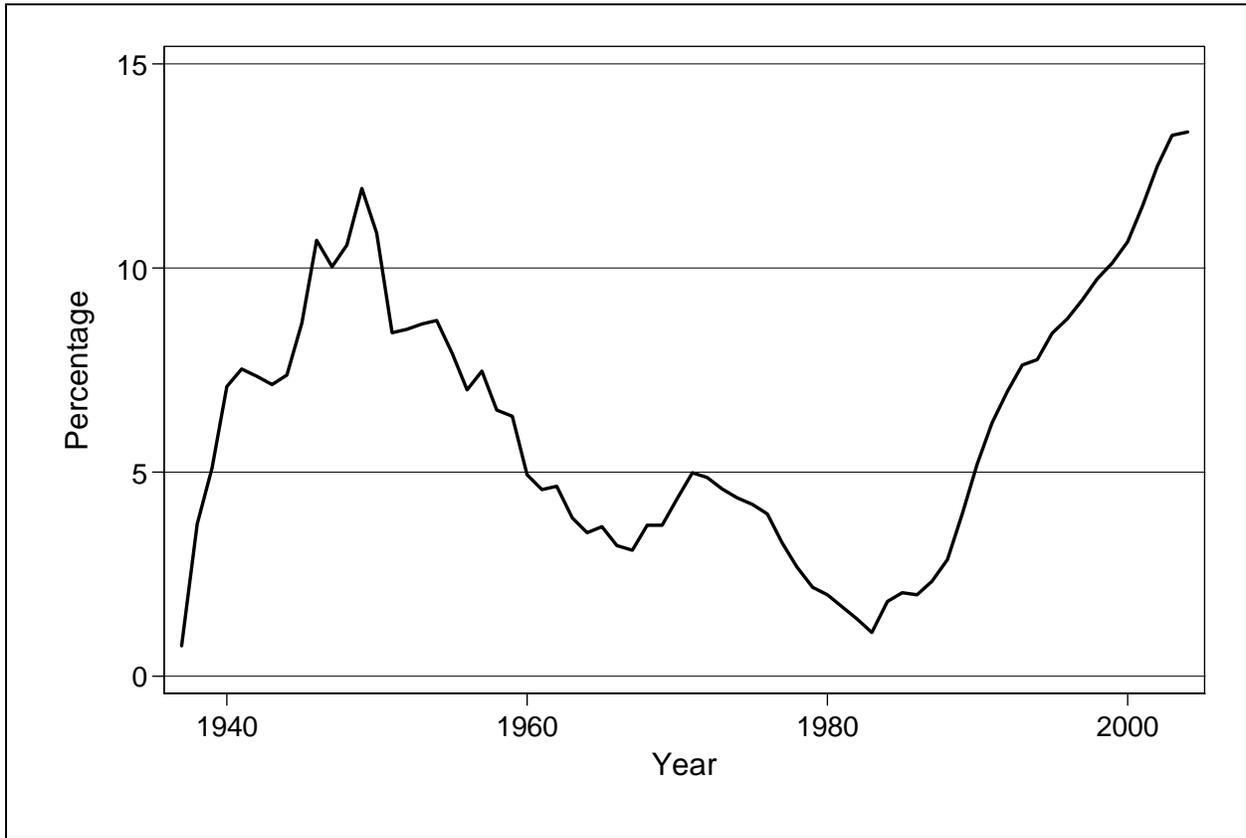**Figure 1: OASDI End-of-Year Assets as a Percentage of GDP, 1937–2040**

Figure 2: OASDI Income from Investments in U.S. Treasury Securities as a Percentage of Total Receipts, 1937–2004

Technical Appendix

One of the ways in which the Social Security surpluses can affect national saving is through public saving. Public saving is the difference between tax revenues and government expenditures; in other words, it is the government budget surplus. Following Smetters (2003), this general relationship can be written as

(A1) $$S_t = \underbrace{T_t^F - G_t^F - r_t TF_t}_{\text{Federal Funds Surplus}} + \underbrace{T_t^T - G_t^T + r_t TF_t}_{\text{Trust Funds Surplus}}$$

where S_t = government unified budget surplus

   T_t^F = federal funds tax revenue

   G_t^F = federal funds expenditures

   T_t^T = trust funds tax revenue

   G_t^T = trust funds expenditures

   $r_t TF_t$ = interest payments to the trust funds.

Because of the unified budget, the focus tends to be on the total government budget surplus. If the unified budget surplus remains constant, an increase in the trust fund surplus will be exactly offset by a decrease in the federal funds surplus with no change in public saving. If an increase in the trust fund surplus leads to no changes in the federal funds surplus, public saving will increase. And if trust fund surpluses lead to more than a dollar-for-dollar offset in the federal funds surplus, public saving will fall. Both Nataraj and Shoven (2004) and Smetters (2003) estimated that after the move to a unified budget in 1970, increases in the trust fund surpluses were more than offset by decreases in the federal funds surplus. Appendix figure 1 shows trends in the OASDI Trust Fund surplus and the non-OASDI budget surplus since 1949.

a. Methods

The recent papers by Bosworth and Burtless (2004), Nataraj and Shoven (2004), and Smetters (2003) examined whether or not surpluses in the trust funds increase public saving. All three sets of authors estimate the following equation:

(A2) $$S_t^F = \alpha + \beta S_t^T + X_t \theta + \varepsilon_t$$

using time-series data where X_t is a vector of control variables, ε_t is a random error term, and (α, β, θ) is the vector of parameters to be estimated. The authors use various definitions of S_t^F and S_t^T. Smetters (2003) defines $S_t^F = T_t^F - G_t^F$ and calls this the modified non-OASDI budget surplus. Likewise, he defines $S_t^T = T_t^T - G_t^T$ as the modified OASDI budget surplus. These two measures do not count the interest payments made on the special issues held in the OASDI Trust Fund as revenues to the OASDI Trust Funds. Smetters argues that excess tax revenues to the

trust fund are real resources available for spending by the rest of government. However, the interest income on the special issues does not represent real resources available for spending. That is, the interest income to the OASDI Trust Funds is just a bookkeeping entry transferring funds from one government account to another.

Nataraj and Shoven (2004) extended Smetters' analysis by looking at all government trust funds rather than just the OASDI Trust Funds. There are more than 150 government trust funds, most of which are considered on-budget. The two Social Security Trust Funds and the Postal Service Trust Fund are off-budget. Nataraj and Shoven use as their key variable the federal funds surplus (that is, the non-trust fund surplus) and the trust fund surplus. In addition, they use the modified trust fund surplus and the modified federal funds surplus. These two variables exclude interest income to the trust funds as trust fund income.

Bosworth and Burtless (2004) considered the non-OASDI budget surplus and the OASDI Trust Fund surpluses in their study. These measures include interest income as income to the OASDI Trust Funds. In this study, all four sets of variables are used.

Because of economic growth, the values of monetary variables (converted to 2000 dollars) in the early years are much smaller than those in the later years. To help control for heteroskedasticity, the monetary variables are normalized by dividing by potential GDP. Smetters (2003) noted that potential GDP is a more exogenous normalization than actual GDP.

The control variables have been used by the other researchers. These variables include the ratio of actual GDP to potential GDP, which will control for the business cycle. Both OASDI taxable earnings[30] and total wages and salaries are included as explanatory variables. Changes in the earnings distribution will have different effects on the trust fund surplus and the federal funds surplus. Suppose there is a mean preserving spread in earnings. On the one hand, because the payroll tax is a regressive tax, tax revenues to the trust funds will likely fall and, hence, so will the trust fund surplus. On the other hand, tax revenues to the federal funds will rise because the income tax is progressive (Nataraj and Shoven 2004).

Last, the nominal interest rate paid on special issues is included in some of the regressions. Changes in the interest rate will affect the magnitude of interest payments on the trust fund assets. As the interest rate increases, with all else held constant, the trust fund surplus will increase and the federal funds surplus will fall. Because the interest income is excluded from the modified surplus measures, this variable is not included as an explanatory variable in these specifications. The variables used in the analysis are listed and defined in appendix table 1.

b. Time-Series Properties of the Variables

A problem frequently encountered in time-series analysis of macroeconomic data is that the data are not stationary. If the data are integrated (for example, the series is characterized by a unit root), regressions of the data in levels will yield misleading t and F tests, and a researcher

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[30] Earnings are subject to the OASDI payroll tax only up to the taxable maximum earnings levels ($90,000 in 2005). Earnings above this amount are not subject to the payroll tax.

may estimate a significant relationship when, in fact, none exists. The first step of this analysis is to test the data for the existence of a unit root. The first 10 autocorrelations for each variable are shown in appendix figure 2. In each case, there is strong evidence that the time-series are nonstationary and may be characterized by a unit root, as the autocorrelations in most instances are still large after a lag of 10 years.

A modified Dickey-Fuller test (known as the DF-GLS test) is performed on all variables. Several studies have shown that this test has higher power than does the traditional augmented Dickey-Fuller (D-F) test. A problem with the augmented D-F test is that the test statistic can change depending on how many lags of the first difference terms are included and whether or not a trend term is included.[31] The DF-GLS test includes a trend term and 10 lags of the first difference term; the results are reported in appendix table 2. The null hypothesis of the presence of a unit root can be rejected at conventional significance levels for two variables.[32] In the case of the modified trust fund surplus, for 2 of the 10 lags, the null hypothesis can be rejected at the 5 percent level (and for another three lags at the 10 percent level). For the ratio of actual to potential GDP, the null hypothesis of a unit root can be rejected at the 5 percent level for one lag (and for another two lags at the 10 percent level).

The evidence for the presence of a unit root for all but two variables is quite convincing. The results for the other two variables, though not definitive, suggest the presence of a unit root. First differencing the variables (that is, $\Delta y_t = y_t - y_{t-1}$) yields a stationary series for all variables. Visual inspection of the autocorrelations and the results of the DF-GLS test show that the first differenced data do not have a unit root.

The next question is whether the variables are cointegrated. If two or more variables have a unit root and are cointegrated, there may be a long-run relationship between the variable, and they should not first be differenced. The variables were tested for cointegration with the Engle-Granger cointegration test.[33] The test statistics and related p-values are reported in appendix table 3. In each case, the null hypothesis that the variables are not cointegrated cannot be rejected at conventional confidence levels.

c. Estimation Results

The regression analyses of the four specifications in levels are shown in appendix table 4. In each case, the coefficient estimate for the trust fund surplus variable is negative and statistically significant at conventional confidence levels. This finding is in accord with the findings of Nataraj and Shoven (2004) and Smetters (2003). Furthermore, the hypothesis that the coefficient estimates are equal to -1.0 cannot be rejected. This finding strongly suggests that each

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[31] Smetters (2003) stated that he tested his dependent variable (the modified non-OASDI budget surplus) for a unit root by the augmented D-F test and could reject the null hypothesis of a unit root at the 5 percent level. However, he did not state the number of lag terms included or whether a trend term was included. Nataraj and Shoven (2004) did not mention whether they tested for the presence of a unit root.

[32] Furthermore, in almost every case, the null hypothesis cannot be rejected at the 10 percent level.

[33] The variables were also tested for cointegration using the Johansen test for cointegration. The results confirm the results of the Engle-Granger cointegration tests and are not reported.

dollar increase in the trust fund surplus is offset by a dollar decrease in the federal funds surplus. Therefore, the net effect on public saving is zero.

For the most part, the coefficient estimates for the other explanatory variables are similar to those estimated by others. The lone exception is the GDP ratio (the ratio of actual to potential GDP), which has a negative coefficient estimate. However, this variable is highly correlated with wages and salaries, and when it is excluded, the estimate for the GDP ratio is positive.

In each case, the Durbin-Watson statistic indicates a problem with serial correlation.[34] The low Durbin-Watson statistic and relatively high R^2 may indicate a problem of spurious regression—the independent variables may have no explanatory power whatsoever (Granger and Newbold 1986). This finding tends to support the analysis results reported above.

The data series are first differenced to obtain stationary series. The four specifications are reestimated and the results are reported in appendix table 5. The Durbin-Watson statistic indicates the absence of a serially correlated error terms, and the R^2s are much lower than in appendix table 4. The important difference is that the coefficient estimates for the trust fund surplus variables are now positive and none are statistically significant. Trust fund surpluses appear to not affect the rest of the federal budget.

The specifications were reestimated allowing for (1) the error term to follow a moving average process and (2) heteroskedasticity and serial correlation (that is, Newey-West standard errors are estimated). The estimated coefficients and standard errors are virtually identical to those reported in appendix table 5.

Both Smetters (2003) and Nataraj and Shoven (2004) argued that the unified budget is the root cause of profligate government spending. They reestimated their models for the period before 1970 and after 1970 separately. The United States moved to a unified budget in 1970. The results for the first differenced variables are reported in appendix table 6. There is some evidence for the Smetters/Nataraj and Shoven argument, but none of the relevant coefficient estimates are statistically significant and they are much smaller than those estimated by the others.

d. Conclusions

The results presented here differ dramatically from the findings of other researchers. No evidence is found to support the argument that trust fund surpluses have decreased the surplus in the rest of the federal budget. The same conclusion holds for before and after the move to a unified budget in 1970. The main reason for the dramatically different results in this paper is that previous researchers did not pay enough attention to the time-series properties of their variables. Consequently, their regression results appear to be spurious.

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[34] Durbin's alternative test also indicates a problem with serial correlation. This test does not require that all regressors be strictly exogenous.

Appendix Table 1: Variable Definitions and Means (std. dev. in parentheses)

Variable	Definition	Mean (Std. Dev.)
Federal Funds Surplus	Non-trust-fund federal budget surplus (2000 dollars) divided by potential GDP (2000 dollars)	-0.026 (0.020)
Trust Fund Surplus	Trust fund budget surplus (2000 dollars) divided by potential GDP (2000 dollars)	0.009 (0.007)
Modified Federal Funds Surplus	Non-trust-fund federal budget surplus plus trust fund interest income (2000 dollars) divided by potential GDP (2000 dollars)	-0.020 (0.019)
Modified Trust Fund Surplus	Trust fund budget surplus minus trust fund interest income (2000 dollars) divided by potential GDP (2000 dollars)	0.003 (0.004)
Non-OASDI Surplus	Non-OASDI Trust Fund federal budget surplus (2000 dollars) divided by potential GDP (2000 dollars)	-0.021 (0.018)
OASDI Surplus	OASDI Trust Fund budget surplus (2000 dollars) divided by potential GDP (2000 dollars)	0.004 (0.005)
Modified Non-OASDI Surplus	Non-OASDI Trust Fund federal budget surplus plus OASDI Trust Fund interest income (2000 dollars) divided by potential GDP (2000 dollars)	-0.019 (0.018)
Modified OASDI Surplus	OASDI Trust Fund budget surplus minus OASDI Trust Fund interest income (2000 dollars) divided by potential GDP (2000 dollars)	0.002 (0.004)
GDP Ratio	Actual GDP (2000 dollars) divided by potential GDP (2000 dollars)	0.9986 (0.0254)
OASDI Earnings	OASDI taxable earnings (2000 dollars) divided by potential GDP (2000 dollars)	0.4736 (0.0317)
Wages and Salaries	Total wage and salary disbursements (2000 dollars) divided by potential GDP (2000 dollars)	0.4942 (0.0285)
Interest Rate	Nominal interest rate	6.090 (2.907)

Appendix Table 2: Test Statistics for DF-GLS test (null hypothesis is presence of a unit root)

	Lags									
	1	2	3	4	5	6	7	8	9	10
Federal Funds Surplus	-2.279	-1.970	-2.213	-2.303	-2.640	-2.280	-2.089	-1.936	-2.548	-2.365
Trust Fund Surplus	-2.476	-2.361	-2.234	-2.397	-2.046	-2.028	-1.728	-1.254	-1.132	-1.267
Modified Federal Funds Surplus	-2.172	-1.891	-2.137	-2.222	-2.562	-2.202	-2.016	-1.885	-2.503	-2.335
Modified Trust Fund Surplus	-3.261**	-3.090	-2.886*	-3.121**	-2.825*	-2.923*	-2.511	-1.785	-1.538	-1.584
Non-OASDI Surplus	-2.660	-2.251	-2.390	-2.545	-2.840*	-2.296	-2.023	-1.796	-2.435	-2.271
OASDI Surplus	-1.326	-1.287	-1.992	-1.653	-1.632	-1.361	-1.261	-0.926	-0.992	-1.078
Modified Non-OASDI Surplus	-2.508	-2.120	-2.259	-2.419	-2.712*	-2.193	-1.948	-1.754	-2.379	-2.226
Modified OASDI Surplus	-1.817	-1.728	-2.453	-2.055	-1.990	-1.662	-1.514	-1.104	-1.125	-1.140
GDP Ratio	-3.598**	-3.072*	-2.963*	-2.549	-2.557	-2.388	-2.465	-2.214	-1.970	-1.673
OASDI Earnings	-1.946	-1.830	-1.761	-1.678	-1.578	-1.546	-1.528	-1.409	-1.305	-1.451
Wages and Salaries	-2.614	-2.230	-2.192	-2.012	-1.836	-1.736	-1.710	-1.504	-1.348	-1.272
Interest Rate	-1.149	-0.836	-1.333	-1.066	-1.135	-1.180	-1.269	-1.306	-1.226	-1.521

* Null hypothesis can be rejected at 10 percent level. ** Null hypothesis can be rejected at 5 percent level.

Appendix Table 3: Results from Engle-Granger Cointegration Tests, Test Statistic (P-value in parentheses)

Variables	No Trend	With Trend
Federal Funds Surplus	-2.76 (p = 0.179)	-2.62 (p = 0.456)
Trust Fund Surplus		
Non-OASDI Surplus	-2.70 (p = 0.200)	-3.43 (p = 0.1160)
OASDI Surplus		
Modified Federal Funds Surplus	-2.51 (p = 0.275)	-2.52 (p = 0.510)
Modified Trust Fund Surplus		
Modified Non-OASDI Surplus	-2.69 (p = 0.203)	-3.19 (p = 0.189)
Modified OASDI Surplus		

Appendix Table 4: Coefficient Estimates from Regression of Variables in Levels (standard errors in parentheses)

Dependent Variable:	Federal Funds Surplus	Non-OASDI Surplus	Modified Federal Funds Surplus	Modified Non-OASDI Surplus
Trust Fund Surplus Variable:	Trust Fund Surplus	OASDI Surplus	Modified Trust Fund Surplus	Modified OASDI Surplus
Constant	-0.1772	-0.2031	-0.1716	-0.2018
Trust Fund Surplus	-0.9043** (0.4463)	-1.5259** (0.7109)	-0.9308* (0.4805)	-1.6454** (0.6642)
GDP Ratio	-0.2004** (0.0990)	-0.2044* (0.1023)	-0.2030** (0.0973)	-0.1991** (0.0988)
OASDI Earnings	0.1295 (0.1048)	0.0978 (0.1176)	0.0754 (0.0940)	0.0399 (0.1061)
Wages and Salaries	0.6361*** (0.2182)	0.7268*** (0.2557)	0.6751*** (0.2219)	0.7607*** (0.2386)
Interest Rate	0.0010 (0.0011)	0.0009 (0.0011)		
Time	-0.0028*** (0.0009)	-0.0029*** (0.0010)	-0.0021*** (0.0006)	-0.0022*** (0.0007)
Time Squared ($\times 10^3$)	0.0539*** (0.0152)	0.0599*** (0.0179)	0.0439*** (0.0093)	0.0485*** (0.0126)
R^2	0.692	0.639	0.642	0.631
DW	1.037	1.130	1.078	1.182
N	56	56	56	56

*** significant at 1 percent level; ** significant at 5 percent level; * significant at 10 percent level.

Appendix Table 5: Coefficient Estimates from Regression of Variables First Differenced (standard errors in parentheses)

| Dependent Variable:	Federal Funds Surplus	Non-OASDI Surplus	Modified Federal Funds Surplus	Modified Non-OASDI Surplus
Trust Fund Surplus Variable:	Trust Fund Surplus	OASDI Surplus	Modified Trust Fund Surplus	Modified OASDI Surplus
Constant	-0.0011	-0.0014	-0.0005	-0.0010
Trust Fund Surplus	0.7822 (0.5273)	0.3584 (1.0161)	0.7835 (0.5681)	0.3142 (1.0919)
GDP Ratio	-0.1394 (0.1539)	-0.2204 (0.1770)	-0.1826 (0.1686)	-0.2546 (0.1893)
OASDI Earnings	0.1676 (0.1259)	0.4028[***] (0.1191)	0.1324 (0.1306)	0.3774[***] (0.1210)
Wages and Salaries	0.2073 (0.3435)	0.1950 (0.4212)	0.3269 (0.3600)	0.2956 (0.4328)
Interest Rate	0.0034[**] (0.0014)	0.0034[**] (0.0014)		
R^2	0.278	0.287	0.219	0.239
DW	2.075	2.274	2.116	2.294
N	55	55	55	55

[***] significant at 1 percent level; [**] significant at 5 percent level; [*] significant at 10 percent level.

Appendix Table 6: Coefficient Estimates from Regression of Variables First Differenced (Newey-West standard errors in parentheses)

Dependent Variable:	Federal Funds Surplus		Non-OASDI Surplus		Modified Federal Funds Surplus		Modified Non-OASDI Surplus	
Trust Fund Surplus Variable:	Trust Fund Surplus		OASDI Surplus		Modified Trust Fund Surplus		Modified OASDI Surplus	
	Before 1970	1970 & After	Before 1970	1970 & After	Before 1970	1970 & After	Before 1970	1970 & After
Constant	-0.0030	0.0009	-0.0067	0.0014	0.0001	0.0012	-0.0025	0.0015
Trust Fund Surplus	0.8435 (0.6158)	-0.0518 (0.6877)	0.7608 (1.3846)	-0.9207 (0.8578)	1.1804 (0.8143)	-0.0833 (0.8181)	0.8389 (1.9127)	-0.7568 (1.0650)
GDP Ratio	0.1014 (0.3327)	-0.2248[*] (0.1127)	-0.1082 (0.3340)	-0.2422[*] (0.1441)	0.1008 (0.3358)	-0.2379 (0.1149)	-0.1958 (0.3538)	-0.2310 (0.1489)
OASDI Earnings	0.2548 (0.1574)	0.0791 (0.5931)	0.6119[***] (0.1600)	0.0837 (0.7778)	0.1239 (0.1863)	-0.2312 (0.5831)	0.5125[***] (0.1538)	-0.2472 (0.7163)
Wages and Salaries	-0.6571 (0.8013)	0.7994 (0.6055)	-0.6486 (0.8807)	0.9494 (0.7427)	-0.5060 (0.7461)	1.1795[*] (0.6558)	-0.3652 (0.9014)	1.3081[*] (0.7080)
Interest Rate	0.0108 (0.0127)	0.0028[**] (0.0011)	0.0174 (0.0137)	0.0026[**] (0.0011)				
F (prob>χ^2)	5.99 (0.0036)	13.68 (0.0000)	7.29 (0.0015)	14.75 (0.0000)	6.30 (0.0035)	12.04 (0.0000)	6.98 (0.0022)	13.53 (0.0000)
N	20	35	20	35	20	35	20	35

[***] significant at 1 percent level; [**] significant at 5 percent level; [*] significant at 10 percent level.

Appendix Figure 1: U.S. Budget Surpluses
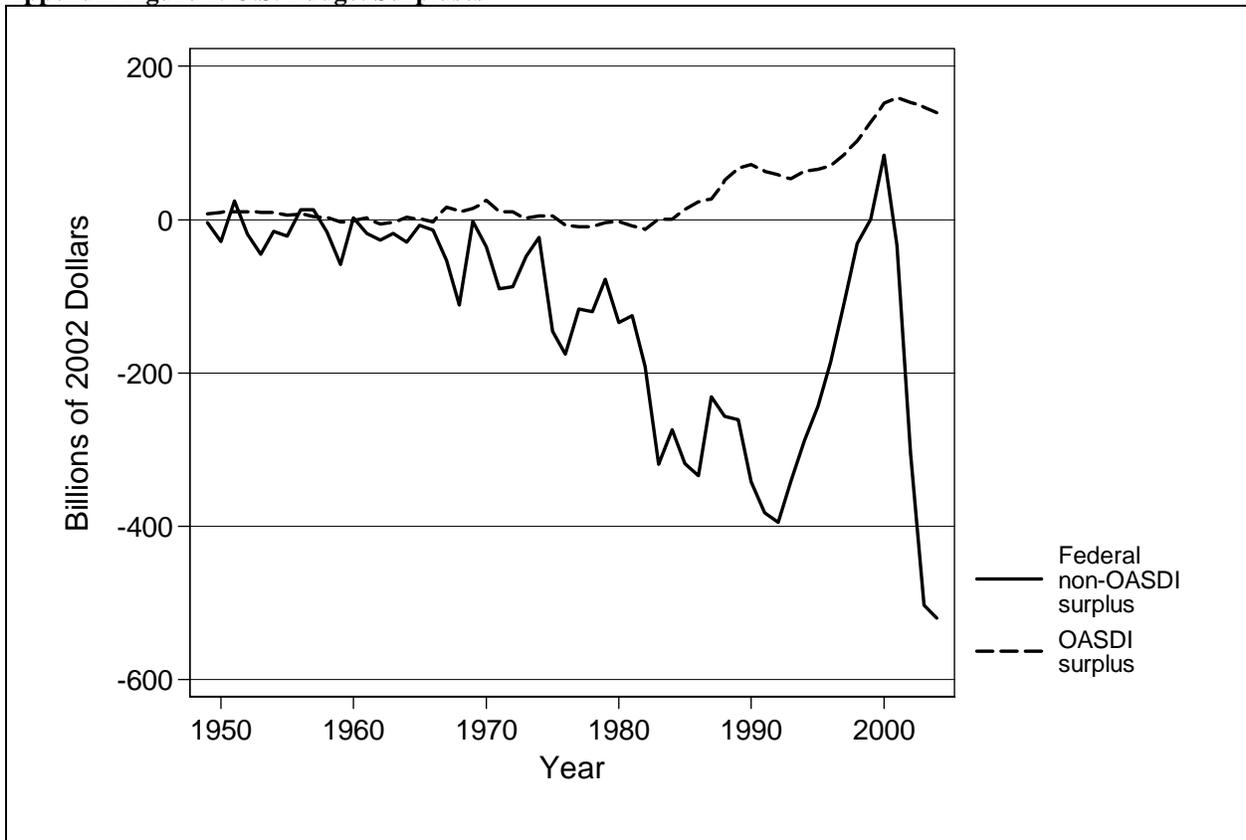
Appendix Figure 2: Autocorrelation Functions