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Fiscal and Generational Imbalances: New Budget Measures For New Budget Priorities

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Introduction

Traditional budget measures are becoming obsolete as federal budget priorities shift from providing "brick and mortar" public goods toward delivering social insurance services. As the share of retirees in the nation's population balloons and human lifespans continue to lengthen, Social Security and Medicare transfers will increasingly dominate total federal outlays. Traditional annual cash-flow budget measures may have been sufficient when Congress could directly allocate almost all budgetary resources via the annual appropriations process. During this century, however, federal spending will be determined mostly by factors outside of short-term legislative control. Because the current structure of Social Security and Medicare involves long-term payment obligations, backward looking or short-term measures such as debt and deficits need to be complemented by long-term forward looking ones that explicitly measure future payment obligations relative to the resources available to meet them under current laws. Such measures are needed to assess how far the federal budget is from fiscal sustainability and the size of policy changes needed to achieve sustainability.

Some budget analysts acknowledge that short-term measures such as national debt and deficits are inadequate.[1] But there is no consensus on the appropriate long-term measures that should be adopted. Indeed, many, if not most, analysts and policymakers continue to evaluate the nature and direction of current fiscal policy by observing the sizes of traditional fiscal measures such as debt held by the public, deficit projections over a limited—usually 5 or 10

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[1] "Beyond Borrowing: Meeting the Government's Financial Challenges in the 21st Century," Remarks of Under Secretary of the Treasury Peter R. Fisher to the Columbus Council on World Affairs Columbus, Ohio, November 14, 2002, available at http://www.ustreas.gov/press/releases/po3622.htm. See also the related subsequent article by Steven Cecchetti, "A Forward Looking Fiscal Policy Strategy," The Financial Times, December 23, 2002, available at http://economics.sbs.ohio-state.edu/cecchetti/pdf/cpi23.pdf. Also see Howell Jackson (2002). For an even more recent discussion, see the Federal Reserve Board's Semiannual Monetary Policy Report to the Congress Before the United States Senate Committee on Banking, Housing, and Urban Affairs, February 11, 2003, available at http://www.federalreserve.gov/boarddocs/hh/2003/february/testimony.htm.

year—horizon, or 75-year estimates of Social Security and Medicare financial shortfalls.[2] For example, the recently published Budget of the United States Government for fiscal year 2004 reports 75-year "actuarial deficiency" measures for Social Security and Medicare.

This *Pamphlet* shows that that adopting short-term measures or arbitrarily truncating the projection horizon understates significantly the prospective financial shortfall that the federal government faces under today's fiscal policies. As a consequence, the degree to which current policy is unsustainable remains hidden from policymakers and introduces a bias in favor of current debt minimization at the expense of policies that would be fiscally sounder from a long-term perspective.

This *Pamphlet* proposes a pair of new measures called Fiscal Imbalance (FI) and its decomposition into the imbalance arising from past and living generations—Generational Imbalance (GI). The FI measure for the federal government equals current federal debt held by the public plus the present value of all future federal non-interest spending minus the present value of all future federal receipts. The FI measure indicates how much fiscal policy must be changed in order to be sustainable; a sustainable fiscal policy requires FI to be zero. The GI measure indicates how much of this imbalance is caused, in particular, by past and current generations. Together, these measures possess several desirable properties the most important being that they render policy decisions free of the aforementioned bias and allow comparisons of alternative policies on a neutral footing.

As described below in greater detail, the Fiscal Imbalance associated with today's U.S. federal fiscal policy is very large. Taking present values as of fiscal-year-end 2002 and interpreting the policies in the federal budget for fiscal year 2004 as "current policies," the

[2] See Budget of the United States Government, Fiscal Year 2004, Analytical Perspectives, Chapter 3 "Stewardship."

federal government's total Fiscal Imbalance is equal to $44.2 trillion. By "present value," we mean that all future spending and revenue are not only reduced for inflation but are additionally discounted by the government's (inflation-adjusted) long-term borrowing rate. This calculation allows us to determine how much money the government must come up with *immediately* to put fiscal policy on a sustainable course. Since, of course, the government does not have an extra $44.2 trillion today it must make cuts or increase revenue in *future* years so that, when discounted to today, the present value total of those cuts and extra revenue equals $44.2 trillion. Of course, for their discounted value to equal $44.2 trillion, the cumulative dollar value of future spending cuts and revenue increases must be *more* than $44.2 trillion.

Of the total federal FI of $44.2 trillion, Social Security's FI is about $7.0 trillion in present value. Medicare's FI is $36.6 trillion (for both Parts A and B). Medicare Part A (Hospital Insurance) contributes $20.5 trillion and Part B (Supplementary Medical Insurance) contributes $16.1 trillion.[3] By contrast, the rest of federal government's FI amounts to only $0.5 trillion, which is comprised of a surplus of prospective revenues over outlays of $4.6 trillion as well as liabilities to Social Security, Medicare, and the debt held by the public of $5.1 trillion.

Our estimate of federal Fiscal Imbalance is more than 10 times as large as today's debt held by the public. Hence, implementing policy changes that only eliminate debt held by the public would still leave the federal government far from being financially solvent. Moreover, the FI grows by about $1.6 trillion per year to about $54.0 trillion by just 2008 unless

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[3] As we explain later, consistent with the Social Security and Medicare Trustees, we assume that health care per capita grows a rate of one percentage point faster than GDP per capita until 2080 -- a very conservative assumption relative to the past two decades. Between 2080 and 2100, the one percentage point differential is gradually reduced to zero, thereby assuming that health care spending grows no faster than GDP. Even with these very cautious assumptions, very large Medicare Fiscal Imbalances exist.

corrective policies are implemented before then. This rapid annual increment is also around 10 times as large as the official annual deficit reported for 2002.

How large must spending cuts or revenue increases be to eliminate the current $44.2 trillion FI? We estimate that to achieve fiscal sustainability, an additional 16.6 percent of annual payrolls would have to be taxed away *forever* beginning *today*. Alternatively, income tax revenues would have to be hiked *permanently* by another two-thirds beginning immediately. Yet another alternative would be to *permanently* eliminate *all* future federal discretionary outlays. Moreover, the size of corrective policies will grow larger the longer their adoption is postponed. For example, waiting until just 2008 before initiating corrective policies would require a permanent increase in wage taxes by 18.2 percentage points rather than 16.6 percentage points beginning today.

Finally, this *Pamphlet* shows that the estimated Fiscal Imbalance remains large under reasonable variations in underlying economic assumptions. Calculations under alternative growth and discount rate assumptions suggest a low-side estimate of federal FI of about $29 trillion and, under very conservative assumptions, a high-side estimate of about $65 trillion. Although FI is fairly sensitive to these economic assumptions, we argue below that this sensitivity only strengthens the need to focus on FI rather than on traditional shorter-term fiscal measures. Furthermore, the ratios of FI to the present value of GDP and future payrolls—and, hence, estimates of tax hikes or spending cuts required to restore fiscal sustainability—are not as sensitive to alternative economic assumptions because GDP and the payroll base are similarly sensitive to the underlying assumptions. For example, under our low productivity growth rate assumption, eliminating the current Fiscal Imbalance would require an immediate 18.0 percentage point wage tax increase, compared with 15.9 percentage points under our baseline. Under our high growth rate assumption, a 14.8 percentage point payroll tax increase would be needed.

The Fiscal Imbalance Measure

The federal government provides a myriad public goods and services. Programs such as Social Security and Medicare provide retirement and health security to American citizens and residents. Other programs include national defense, homeland security, judicial and legislative operations, international diplomacy, transportation, energy, and infrastructure development, education and income support for the needy.

The continued operation of these programs through the indefinite future at current levels of service or benefit provision per capita will depend upon the availability of resources for financing them. All federal purchases and debt service payments must ultimately be financed out of future federal revenues. Sources of federal revenue include tax receipts, net income of public enterprises, fees, and other levies imposed on US citizens and residents. Although the government can borrow for temporary periods of time, the additional debt must also be serviced out of future tax receipts. Hence, current (net) debt held by the public plus the government's future non-interest spending must be balanced over time by its future receipts.

The government's overall fiscal policy may be called *balanced* if today's outstanding debt held by the public plus the *present value* of projected future non-interest spending equals the present value of projected future government receipts, where projections are made under today's fiscal policies. By present value, we mean that dollars paid or received throughout the future are discounted by the government's long-term interest rate in order to reflect their value today. A fiscal policy that is balanced can be sustained without future policy changes in either federal outlays or in the various sources of federal revenues. Hence, the Fiscal Imbalance measure as of the end of year t is defined as

(1) $$FI_t = PVE_t - PVR_t - A_t .$$

This definition is simply understood as the excess of total expenditures over available resources in present value. Here, PVE_t stands for the present value of projected expenditures under current policies at the end of period t, PVR_t stands for the present value of projected receipts under current policies, and A_t represents assets in hand at the end of period t. Note that if the program for which FI is being calculated has debt outstanding, A_t would be negative and would increase FI. The FI measure can be calculated for the entire federal government and for federal programs that are financed with dedicated revenues—such as Social Security and Medicare.

The Generational Imbalance Measure

To be a useful as a guide to policymakers, any proposed measure must correctly and fully reflect the impact of all policy changes. The FI measure *alone*, however, is not capable of doing so for all types of policy changes. As is obvious from equation (1), any new policy that changes projected expenditures and revenues so that their increments are exactly equal in every future year will produce offsetting increases PVE_t and PVR_t, and will leave FI unchanged.

As an example, suppose Congress introduces a new Medicare benefit financing it by hiking future payroll taxes such that each future year's additional outlay is exactly matched by additional revenue in that year. By construction, this policy would not have any impact on Medicare's FI since the new benefit paid in each year is financed by taxes paid in that year.

Nevertheless, it will affect the resources available to different generations: Current retirees and some workers close to retirement at the time of the policy change would gain from the new benefit for which they would pay little or nothing when working. Younger workers and future generations, however, would be worse off because they must pay extra taxes when working and will not fully recover these payments through benefits received after they retire: the investment income that they would lose on the resources now devoted to paying additional payroll taxes would not be fully made up by their future benefits.

To identify such fiscally induced redistributions we need to augment the FI measure for Medicare with its generational decomposition. It suffices to show separately the contribution to Medicare's FI by *past and living generations* which we call Generational Imbalance (GI). Here, we adopt the following definition of the GI measure:

(2) $$GI_t = PVE_t^L - PVR_t^L - A_t,$$

where PVE_t^L represents the present value of projected outlays paid to generations currently alive, PVR_t^L represents that present value of projected tax revenues from the same generations and *A,* again, represents the program's current assets. Note that if the program has positive current assets, it implies that past tax payments of deceased generations and of those currently alive exceed the programs outlays to date that benefited those generations. Therefore, GI captures the part of FI arising from all transactions with past and living generations throughout their lifetimes. The projected contribution to FI by *future* generations simply equals the difference, FI minus GI. [4]

[4] As shown in Appendix A, the measure for future generations, FI-GI, can be further decomposed into projected net transfers to each future birth cohort under current policy. These estimates are not reported in this Policy Discussion Paper, but they are available from the authors upon request.

Returning to our previous example, a new pay-as-you-go Medicare benefit would *increase* Medicare's imbalance on account of past and living generations (GI) and *reduce* that on account of future generations (FI–GI) by the same amount, leaving overall Fiscal Imbalance (FI) unchanged. In other words, past and living generations would receive a windfall that is directly offset by a reduction in the resources available to future generations. Medicare's FI does not capture this redistribution because it adds together the net Medicare transfers received by all generations—past, living, and future—under current policies. This redistribution is, however, indicated by the change in GI.

Notice that the traditional focus on the debt held by the public would also not capture the redistributive impact of the Medicare policy described earlier: Outstanding debt would remain unchanged for any new outlay that is financed on a strictly pay-as-you-go basis. So, while the Fiscal Imbalance measure properly captures many large unfunded payment obligations that are not included in the debt held by the public, both of these measures fail to reveal the resource transfers across generations that some policies can cause. The GI measure does, however, capture the redistributive effect of policies. Under the pay-as-you-go financed Medicare policy described above, the GI measure would increase even though FI does not change. Of course, this implies that the imbalance on account of future generations would decrease. Therefore, the FI and GI measures taken together comprise a powerful analytical tool for policymakers, enabling them to make more informed decisions.

Note that going forward policymakers must achieve two objectives simultaneously: First, they must reduce the Fiscal Imbalance to zero by a combination of increased taxes or reduced spending. This task can be accomplished in a myriad different ways, each of which will typically yield a very different impact on the resources of different generations. For example, lowering the growth of entitlement benefits will be more beneficial to future generations than increasing future taxes. Hence, the second objective for policy makers is to choose a policy from among many alternatives that they believe delivers the best tradeoff between losses and gains to living and future generations. The GI measure would prove useful in doing so.

Identifying the GI component of FI is feasible for programs such as Social Security and Medicare where outlays can be easily attributed to different individuals. It cannot be easily identified, however, for the rest of federal government because the benefits of outlays, such as national defense and public infrastructure, cannot easily be allocated to different individuals or generations. For example, a large element of the benefit from current outlays on education, the justice system, and on national defense accrues to society in general and to unborn generations. Only the revenue side of the rest-of-government's budget can be so attributed.[5] Hence, for the rest of federal government, only the decomposition of revenues into those on account of past and living generations can be reported. Although it does not fully correspond to the GI measure, it is nevertheless useful to know the generational distribution of the burden of paying for rest-of-government's outlays under current policies.

The Desirable Properties of a Fiscal Measure

As we outline in Table 1, the FI and GI fiscal measures satisfy several properties that other fiscal measures do not. We discuss these different measures in this section.

[5] Note that we can only estimate the direct and immediate incidence of taxes on different generations but not the ultimate incidence that includes the distorting effects that taxes have on work-effort and consumption-saving decisions. Bohn (1992) discusses this type of difficulty in more detail.

Under current budget accounting, many budget analysts and policymakers as well as the general public tend focus on annual deficits and the level of debt held the public.[6] For years, policymakers and public-interest groups have debated on how to control deficits and debt. These measures, however, substantially understate the true magnitude of the fiscal shortfall that the federal government faces. The large future obligations associated with Social Security and Medicare, in particular, are not reported in standard budget documents because these documents focus primarily on the impact of current policies on current fiscal flows. However, current budget policies provide *the* major impulse for the evolution of future budgets, and not just over the next 5 or 10 years. Because of the growing importance of social insurance services provision, current and proposed policies will influence our fiscal affairs for several decades, if not centuries. Under this environment, adopting new forward-looking budget measures is especially important because they reveal a very different and truer picture of the federal government's financial status as well as the size and nature of needed future policy adjustments. Indeed, as the results below suggest, even if we could immediately pay off the entire $3.5 trillion of outstanding debt held by the public, federal spending would nevertheless have to be reduced and/or revenues increased by about $41 trillion in present value. Hence, the first desirable property of a proper fiscal measure is that it should be *forward-looking*.

Several agencies have been regularly reporting other forward-looking measures. For example, the Social Security and Medicare Trustees' measure of "actuarial balance" incorporates those programs' assets and 75-year ahead projections of revenues and outlays.

[6] To be sure, alternative concepts of debt do exist in budget reports—gross debt, debt subject to ceiling, debt held in trust funds, and debt held by the public. But these measures suffer from the same problems as the debt held by the public that we identify herein. In the text, we focus our attention on debt held by the public because it is the most meaningful concept for measuring overall federal indebtedness.

Normal cash flow budget reporting covers a span of only 5 or 10 future years. However, the recently released Budget of the United States Government for fiscal year 2004 also reports 75-year present-value "actuarial deficiencies" for Social Security and Medicare based on the information included in the Trustees Reports and prepared by the same actuaries. As is well known, however, such measures do not completely account for those programs' fiscal imbalances because of the arbitrary truncation of the projection horizon at 75 years. As the 75-year projection window moves forward over time, the cumulative inclusion of an additional year's deficit or surplus will impart instability to such measures even if the underlying revenue and outlay projections remain unchanged. If deficits/surpluses beyond the 75th year are especially large and growing, measures based on only 75-year-ahead projections will severely understate the true magnitude of the program's Fiscal Imbalance by two-thirds or more, as we show later. Hence, the second desirable feature of a proper fiscal measure is that it should include all future years. That is, it should be *calculated in perpetuity*.[7]

A third desirable feature of a fiscal measure is that it is *complete*—that is, it encompass the entire government's operations. Fiscal measures that do not encompass the government's entire operation would be subject to manipulation – or "budget arbitrage" -- by reshuffling revenues and outlays among programs. This issue has been particularly important in recent Social Security reform discussions where some plans recommend using general-revenue to

[7] Before 1965, Social Security's trustees calculated that program's financial imbalance in perpetuity. However, because Social Security benefits were not indexed to prices, the perpetuity estimates incorporated "level-cost" benefits over time. Imbalance estimates based on level costs were not heavily influenced by the truncation of the projection horizon to 75 years. Indeed, the 1965 Advisory Council noted that truncation reduced the projected shortfall by less than 3 percent. Not surprisingly, the 1965 Advisory Council on Social Security notes: "It serves no useful purpose to present estimates as if they had validity in perpetuity." However, Social Security's Chief Actuary at the time agreed that including all future years was the appropriate choice in theory. See the Oral History Interview by Robert Myres available at http://www.ssa.gov/history/myersorl.html. Today, however, retirement benefits are indexed for price inflation. Moreover, Social Security benefit formulae take into account real wage growth over beneficiaries' working lifetimes. Therefore, the practical motivation for truncating the projection horizon to 75 years no longer exists. Indeed, such truncation severely underestimates Social Security's long-term imbalance by two-thirds.

shoulder some of the future shortfalls. These transfers are not indicated by the traditional 75-year measures that focus on Social Security and Medicare, giving the illusion of free money.

A fourth desirable property is that the measure should be *based on current fiscal policy*. If a proposed measure is to be useful for policymaking, it must first characterize today's fiscal policy. That is, it should incorporate projected revenues and outlays based on the continuation of current policy and should exclude potential future policy changes.[8] This would reveal how far current policy is from being sustainable. For example, a Social Security "shutdown" liability measure based on the accrual accounting concept would overestimate Social Security's imbalance relative to the continuation of current law (see Smetters and Walliser, forthcoming), and so accrual accounting is not consistent with current law.[9] A corollary of this requirement is that the measure should not incorporate hypothetical policies that cannot be implemented.[10]

A fifth desirable feature is that the measure should *correctly reflect the impact* of all policy changes. This condition has two complementary components: First, the measure should not change when policy changes are actuarially neutral for all generations. That is, if a policy alters future taxes, benefits, or outlays in a way that leaves all generations' resources unaffected in present value, the measure should remain unchanged. Second, it must

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[8] In some cases—such as discretionary outlays that are subject to annual appropriations—it is sometimes uncertain what "current policy" entails for the long-term. For example, under the Budget Enforcement Act of 1990 (renewed through September of 2002), discretionary appropriations were temporarily subject to statutory limits with no clear principle guiding their evolution after the limits expired. In such circumstances, our proposed measure would adopt a convention consistent with longer-term historical experience: Namely, that long-term outlay/revenue growth will occur in tandem with overall economic growth after such temporary rules expire.

[9] Accrual accounting for Social Security has been analyzed by Jackson (2002). See also the Federal Reserve Board's Semiannual Monetary Policy Report to the Congress Before the United States Senate Committee on Banking, Housing, and Urban Affairs, February 11, 2003, *op cited*. Another problem with accrual accounting is that it is unclear how to implement it for non-Social Security programs.

[10] An example of a measure based on such a hypothetical policy is the concept of generational balance developed in Auerbach, Gokhale, and Kotlikoff (1991). This measure distributes a component of the overall fiscal burden equally across all future-born cohorts. See the critique by Diamond (1996).

accurately reflect all actuarially *non-neutral* policies. As noted in the previous section, the measure should correctly reflect the size and direction of intergenerational redistributions engineered via pay-as-you-go policies.[11]

Finally, the sixth desirable feature is that the measure should be conceptually straightforward and possess properties that are *easy to communicate*. The proposed FI measure has the appealing property that under given budget projections it grows over time at the rate of interest—just like a corpus of debt. Hence, the change in the measure from one year to the next can be decomposed into the amounts due to accumulated interest, policy changes, differences in economic outcomes relative to projections, and updates to economic assumptions used in making budget projections.

The Bias in Policymaking Arising from Current Budget Accounting

The previous section emphasized that focusing exclusively on backward-looking or short-term fiscal measures—such as debt held by the public—substantially understates the true magnitude of the fiscal shortfall that the federal government faces. This section discusses the biases that such an understatement can introduce into policymaking, in particular with regard to our choices among alternative ways of financing programs such as Social Security and Medicare. Currently, these programs are financed mostly on a *pay-as-you-go* basis, whereby worker's payroll taxes are immediately used up to pay retiree benefits. In particular, worker taxes are not saved to pay the contributors' own future benefits. To be sure, Social

[11] The desirable features mentioned here imply that the measure will be *invariant to accounting conventions* adopted in describing different transactions between the government and private entities (Kotlikoff, 2001). The FI and GI measures proposed here for assessing the financial position of the entire federal government are both invariant to the choice of accounting labels. For example, if Social Security taxes and benefits were re-labeled as "borrowing" and "repayment," the size of FI for the entire federal government would remain unchanged. However, this labeling change would result in Social Security's FI being reclassified as a part of debt held by the public.

Security and Medicare both have "trust funds" reflecting past payroll tax revenue and other receipts in excess of past benefit payments. But their size is very small in comparison to the programs' future liabilities. Moreover, the trust funds represent a liability on the rest-of-federal-government account.[12]

An alternative system would be one where individuals are given the option to invest some of their payroll taxes into personal accounts, which they would own and control. Suppose, in exchange for this option, a person's Social Security benefit is reduced one dollar in present value for each payroll tax dollar that the person is allowed to invest into a personal account. The retirement benefits of those who choose to participate in such a personal accounts system would be composed of reduced Social Security benefits plus income derived from personal account assets.

Because those who remain under the current Social Security system must be paid benefits when they are due, lower payroll tax revenues would imply a need for greater borrowing by the federal government. In fact, government borrowing would have to increase by one dollar for each dollar that is invested in a personal account rather than paid to the government as payroll taxes. As a result, annual deficits and debt held by the public would increase. Under the traditional focus on deficits and the debt, therefore, this reform does not look favorable. In other words, current discussions about reform start from a *biased* position since even a neutral reform looks bad under current budgeting.

However, the level of the debt held by the public is just one component of the government's true fiscal imbalance. The government's fiscal imbalance also includes future Social Security obligations. Under this reform, future Social Security obligations would

[12] Whether previous trust fund surpluses have reduced the debt held by the public or produced higher levels of spending, however, is an area of active research.

decrease by the same amount as the increase in the debt held by the public. The government's true fiscal imbalance, therefore, would remain unchanged.

Suppose, for example, future Social Security benefits were now reduced by a little more than one dollar for each dollar of payroll that a person invests into a personal account. This example is very similar to Plan 1 of the President's Commission to Strengthen Social Security where future benefits were discounted by 50 basis points above the government's borrowing rate. Many people might choose this plan in order to have more control over their retirement resources. But this reform also increases debt held by the public over the short-term because the government needs to borrow additional resources to meet current benefit obligations. Still, the government's true long-term fiscal imbalance actually *declines* because the increase in debt is less than the reduction in the present value of future Social Security benefits. Nonetheless, policymakers would not favor such a plan if debt were the only measure used for judging the government's fiscal position.

The traditional focus on the debt held by the public, therefore, creates a bias in decision-making against potential reforms that could reduce the government's fiscal imbalance. This bias is especially problematic given the large existing imbalances. A more complete accounting, which explicitly recognizes the future net obligations of Social Security and Medicare as well as the rest of government, would help remove this bias. As argued earlier, calculations of the government's long-term obligations should be done in perpetuity rather than over just 75-years. Doing the latter would understate the true magnitude of future unfunded obligations and so some of current policy-bias in favor of short-term fixes would remain in place. That would be true, for example, if the costs of the reform fell within the 75-year window while some of the benefits fell outside it. Indeed, this bias was the key reason why the maximum size of the personal accounts was limited to a $1,000 annual contribution (indexed over time with wages) in Model 2 of the President's Social Security Commission.

Estimates of Federal Fiscal and Generational Imbalances in the United States

This section reports estimates of total Fiscal Imbalance (FI) and, where appropriate, the Generational Imbalance (GI) for the U.S. federal government under the assumption that the FY2004 Budget's policies represent "current policies." The calculations are based on projections provided by the Office and Management and Budget and, naturally, incorporate the FY2004 Budget's economic assumptions. All budget aggregates are extended beyond OMB's projection horizon using the terminal baseline productivity growth rate--1.7 percent per year. [13]

As demonstrated later, the most important assumption is the future growth rate in real health-care (Medicare and Medicaid) outlays per capita. Consistent with the Medicare's Trustees, in our baseline case, we assume real health-care outlays per capita grow at an annual rate that is 1 percentage point faster than the growth rate in GDP per capita until 2080.[14] Between 2080 and 2100, the 1 percentage point differential is gradually reduced to zero so that health care outlays per capita grow at the same rate at GDP per capita. These assumptions are very conservative relative to historical experience. Indeed, between 1980 and

[13] This rate of real GDP growth per capita is obtained by deflating projected nominal GDP per capita by the projected CPI rather than by the GDP deflator. This procedure implies that all constant dollars values reflect the opportunity cost in consumption units. In addition, because the CPI is known to contain an upward bias, the FI and GI estimates reported here are likely to err on the low side.

[14] See the Medicare trustees assumptions on health care outlay growth available at http://www.cms.gov/publications/trusteesreport/2003/tabid1.asp.

2001, health care expenditures have grown by 2.3 percentage points faster per year than GDP.[15]

FI calculations are reported beginning with fiscal-year-end 2002—the fiscal year that just ended as of the writing of this *Pamphlet*. However, to show the evolution of FI and GI under current policies and projections, they are recalculated each year through 2008. Present values are calculated using projected interest rates on long-term treasury securities—also provided by OMB. Appendices A through F contain a detailed description of the method used in extending OMB's budget projections.

A. Total Federal Fiscal Imbalance

Table 2 comprehensively documents total federal FI, its sources by program, and its decomposition into the GI attributable to past and living generations. The first three panels show FI and GI measures for Social Security, Medicare Part A, and Medicare Part B. In each of these three panels, the GI measure is subdivided into the present value of prospective payments and receipts by living generations and the trust fund that includes the net contributions from past transactions. The last row in each panel shows the residual—FI minus GI—that indicates the contribution to FI on account of future generations. Panel 4 of Table 2 shows the FI measure for the rest of the federal government—that is for non-Social Security and non-Medicare transactions. As mentioned earlier, the GI measure is not calculated for the rest of federal government because outlays cannot be distributed across

[15] This calculation is based on the Centers for Medicare and Medicaid Services' estimates of national health care expenditures (see http://www.cms.hhs.gov/statistics/nhe/historical/t1.asp). Heffler et al. (2003) provide a more detailed breakdown by period. They show that during 1966-88, real NHE (national health expenditures) grew at an annual average rate of 6.3 percent whereas chain-weighted GDP index grew at 5.4 percent—a difference of 0.9 percent. During 1989-93, the numbers were 6.3 percent and 3.2 percent respectively; and during 1994-2000 they were 3.8 percent and 1.8 percent respectively.

generations. Instead, only prospective revenues are subdivided into those that living and future generations are projected to pay under current fiscal policy.

Total FI for the federal government in 2002 equals $44.2 trillion. The Social Security program contributes $7.0 trillion. Medicare contributes $36.6 trillion—the largest share by far. The rest-of-federal-government's contribution is relatively small—only $0.5 trillion. Appendix A shows that the total fiscal imbalance grows at the rate of interest. This implies that if future projected revenues and outlays remain unchanged, the imbalance will quickly grow larger over time. By 2008, for example, it will have grown to $54.0 trillion.

B. Social Security

Social Security's FI of $7.0 trillion as of the end of 2002 equals the present value of projected Social Security benefits plus administrative costs minus the present value of projected payroll taxes, federal employer payments, income taxes on Social Security benefits, and minus the initial balances in the Social Security trust fund. It is decomposed into the GI of $8.7 trillion and the residual, FI minus GI, of –1.7 trillion.

Social Security's imbalance is caused by past and living generations. In particular, as of 2002, past and living generations are projected to receive over $8.7 trillion more in present value of benefits than the present value of their past and projected payroll taxes. In contrast, future generations are projected to pay $1.7 trillion more in taxes than they will receive in benefits in present value. Hence, under current tax and benefit rules, future generations are projected to reduce Social Security's imbalance by $1.7 trillion but not by enough to restore the Social Security program to a sustainable system in the presence of the $8.7 trillion liability "overhang" left over from current and past participants.

For Social Security to fully return to balance, living and future generations must collectively receive fewer benefits and/or pay more taxes by $7.0 trillion in present value. For example, if only future generations were required to carry the full burden of eliminating Social Security's FI, they would need to pay an *additional* $7.0 trillion in taxes or receive lower benefits by this amount. As another example, suppose, instead, that living generations were required to cover half of Social Security's imbalance in the form of lower benefits or higher taxes while future generations were required to cover the remainder. In this case, the imbalance on account of past and living generations would decline to approximately $5.2 trillion in 2002 while the imbalance on account of future generations would be -$5.2 trillion. Thus, some generations must receive less or pay more in order to return Social Security to sustainability. Regardless of which policy is chosen, creating balance in Social Security (i.e., a zero Social Security FI) requires that the Generational Imbalance (GI) caused by past and current generations is equal in magnitude but of opposite sign as the imbalance caused by future generations (FI – GI).

C. Medicare

Medicare's total FI equals $36.6 trillion—more than 5 times as large as Social Security's imbalance. This reflects the projected faster growth of Medicare outlays per capita in addition to the projected aging of the U.S. population during this century. The Medicare Program has two parts—Part A (Hospital Insurance) and Part B (Supplementary Medical Insurance). Unlike Medicare Part A, which is financed out of dedicated payroll taxes, Medicare Part B is partially financed out of premiums paid by those who choose to participate. Premiums cover roughly 25 percent of Medicare Part B's annual outlay. The remaining 75 percent is financed through transfers from the general fund (rest-of-government account) to Medicare Part B's trust fund. The transfers are made several times each year based on estimated outlays through the following year. Because these transfers cannot be counted as a dedicated resource for Medicare Part B, this program's FI is calculated as the difference between the present-value of projected outlays minus the present-value of projected premium receipts.[16] Table 2 shows the decomposition of Medicare's FI arising from Parts A and B. It shows that Part A contributes $20.5 trillion, or about 56 percent of Medicare's overall FI. At $16.1 trillion, Medicare Part B's FI is about 80 percent as large as that of Medicare Part A.

In sharp contrast to Social Security, a majority of Medicare's FI is caused by the imbalance contributed by future generations (FI – GI) rather than by past and current generations (GI). For example, the GI for Medicare Part A is only $8.6 trillion whereas the residual, FI minus GI, contributes $11.9 trillion to Medicare Part A's total imbalance of $20.5 trillion. The reason for future generations' significantly larger contribution is the rapid projected growth in Medicare outlays per capita during the next several decades. As with Social Security, some current or future generations must receive less or pay more for Medicare to become fiscally sustainable.

D. Rest of Federal Government

Table 2 shows that the rest of federal government's FI is small relative those of Social Security and Medicare. Under current projections, the present value of the rest-of-federal-government's projected receipts exceeds its non-Social Security and non-Medicare outlays by

[16] If, alternatively, general revenue transfers were treated as dedicated revenue to Part B, they would appear as an outlay in the rest of the budget and, therefore, have no effect on the federal government's total FI.

$4.6 trillion. However, the treasury securities held by the Social Security and Medicare trust funds, and counted among those programs' dedicated resources, must be entered as a liability on the rest-of-government's account. This liability plus debt held by the public exceeds the prospective surplus of rest-of-government receipts over outlays by $0.5 trillion.

Out of the present value of all prospective receipts of $85.0 trillion, past and living generations are projected to contribute only $32.6 trillion—or about 37 percent. Future generations contribute the remainder—$52.7 trillion.

Evaluating the Size of Federal Fiscal Imbalance

A. Comparison with Official Estimates

The FI estimate shown in Table 2 dwarfs the traditional measure of fiscal indebtedness—debt held by the public—by more than a factor of 10. The Budget of the United States prepared by the Office of Management and Budget (OMB) for fiscal year 2004 acknowledges the inadequacy of debt held by the public as an indicator of the government's long-term financial solvency. Nevertheless, the summary budget tables do not include complementary indicators of the federal government's fiscal position. Rather, the fiscal year 2004 Budget devotes a separate chapter to report on prospective shortfalls in Social Security and Medicare only.[17] An analysis of these estimates is presented in the Analytical Perspectives volume of the Budget. These estimates, however, are based on the economic assumptions of the Social Security and Medicare Trustees, which differ from OMB's own economic assumptions that they use in preparing their budget forecasts that appear elsewhere in the Budget. Moreover, the Social Security and Medicare calculations reported in the

[17] These comments also apply equally to other budget reporting agencies such as the Congressional Budget Office, Joint Tax Committee, and others who employ short-term reporting horizons.

Budget are limited to a projection horizon of 75 years and do not include the Administration's own new policy recommendations, in contrast to the "policy inclusive" nature of the rest of the Budget. Social Security's "long-term deficiency" is reported as $3.4 trillion and Medicare's is $13.0 trillion (counting the respective trust fund balances as resources dedicated to the two programs). Because of the limited projection horizon, these estimates understate considerably the true magnitude of overall fiscal imbalance embedded in baseline federal fiscal policy. In addition, as just noted, they even understate the true 75-year fiscal imbalance because they do not include the policies proposed in the budget.

More recently, the 2004 Trustees' report on Social Security's financial status reports 75-year and infinite-horizon estimates for that program. The Trustees' 75-year number closely approximates that reported in the Budget. Their infinite horizon estimate is $10.5 trillion—larger than that reported in this *Pamphlet*. We conjecture that this is primarily because of the higher discount rate we use—a rate consistent with OMB's projection of interest rates on long-term Treasury debt. The Trustees do not provide an infinite horizon estimate of Medicare's fiscal imbalance. The estimate of Medicare's FI that we report is almost 3 times as large as the 75-year number reported in the Budget. Our estimate, however, also includes the policy proposals contained in the FY2004 Budget.

This paper does not endorse the use of an FI measure calculated over just 75 years. However, for comparison with the estimates in the Budget and in the Social Security Trustees' report (both of which are based on the Trustees' economic assumptions and exclude the Budget's newest policy proposals), Table 3 shows 75-year estimates of FI based on policy-inclusive OMB projections and OMB's own economic assumptions that it uses in the rest of the Budget.[18] Our estimate of the 75-year FI for Social Security is only $1.6 trillion, compared to $3.4 trillion that was reported in the Budget. The difference primarily stems from the higher assumed rate of productivity growth under the OMB assumptions that we use. Higher productivity growth increases payroll tax receipts over the short- and medium-term and increases Social Security benefit outlays over the long-term. Also OMB's long-term real discount rate—3.6 percent per year—is about 60 basis points higher than that used by the Social Security Trustees. The cumulative effect over a 75-year projection window is to make Social Security's FI estimates smaller than those reported in the Budget.

By contrast, Table 3 shows that our 75-year $15.1 trillion estimate of Medicare's FI using OMB assumptions, is larger than the $13 trillion value reported in the Budget. Our estimate would have been much lower than that reported in the Budget because of the higher assumed discount rate under OMB assumptions if, like them, we also excluded the President's newest policy proposals. However, the impact of new Medicare proposals contained in the Budget more than offset the effect of using a higher rate of discount. In general, we conclude that the estimate for Social Security's FI reported here is more conservative than official estimates. That for Medicare would also be smaller but for the impact of new Medicare policies proposed in the Budget.

B. Comparison of FI with Present Values of Payroll, GDP, and Other Aggregates

Another way to assess the magnitude of total federal FI is to compare it with the present value of future payrolls or future GDP. Table 4 shows this comparison by reporting total FI as a share of the present value of future payrolls, where the latter is also calculated in perpetuity. As of end-year 2002, total FI is equal to about 16.6 percent of the present value of

[18] OMB did not provide baseline budget projections.

future payrolls. This implies that restoring a balanced fiscal policy would require an immediate and permanent wage tax hike of 16.6 percentage points beginning today. If we choose to eliminate FI by increasing income taxes, this revenue would have to be increased by another two-thirds. Alternatively, Table 4 shows that future non-Social Security and non-Medicare outlays would have to be cut by 54.8 percent immediately and forever. Alternatively, the entire federal discretionary budget would have to be eliminated permanently. Such tax hikes or outlay cuts will obviously be devastating to the economy. However, the alternative of waiting to make the adjustment is worse. Waiting until just 2008 to make the adjustment would require an immediate and permanent wage tax hike of 18.2 percentage points rather than 16.6 percentage points, or a 73.7 percent increase in income tax revenues instead of 68.5 percent. If the entire adjustment were made by cutting non-Social Security and non-Medicare outlays, they would have to be reduced by 59.8 percent in 2008 instead of 54.8 percent today.

Sensitivity to Alternative Assumptions

This section reports the sensitivity of the FI estimates to variations in three key underlying assumptions: the government's long-term annual discount rate, r; the annual growth rate of GDP per capita, g;[19] and, the differential, h, between the annual growth rate of outlays on Medicare and Medicaid per capita and g. This differential, however, only exists until 2080. Between 2080 and 2100, the annual growth rate of outlays on Medicare and Medicaid per capita is gradually reduced to g so that the differential, h, becomes zero where it

[19] Hence, the effective discount rate equals $r - g$. However, an increase in g does not necessarily have the same impact as an equal decline in r, because higher growth does not necessarily imply higher outlays in every category. For example, higher growth is likely to result in lower social welfare outlays. Hence, we show below the sensitivity of FI estimates to variations in r and g separately.

remains after 2100. Under the baseline set of assumptions corresponding to results presented earlier, *r* = 3.6, *g* = 1.7, *h* = 1.0 percent. We now consider two alternative values – a "low" value and a "high" value -- for each parameter. The low and high values for *r* are 3.3 and 3.9 percent, respectively; those for *g* are 1.2 and 2.2 percent, respectively; and those for *h* are 0.5 and 1.5 percent, respectively.[20]

Table 5 shows the variation in end-year 2002 FI estimates for the alternative values of *r*, *g*, and *h*. The FI estimate is quite sensitive to the discount rate assumption: FI is estimated to be $34.6 trillion under the high discount rate assumption (*r* = 3.9 percent) whereas it is $58.6 trillion when the assumed discount rate is low (*r* = 3.3 percent). The high sensitivity of the estimates to the different values of *r* is not surprising. Notice, for example, that the baseline total FI estimate is almost 3 times larger than the truncated 75-year estimate (see Tables 2 and 3), suggesting that annual imbalances are projected to grow considerably beyond the 75th year. This high projected growth in the distant future means that FI estimate is quite sensitive to the discount rate.

Consider, for example, two different time series of annual imbalances. Assume that both time series are initially equal in present value at a given discount rate. By the process of compound interest, a change in the discount rate alters the discount factor applicable to values further in time by more than those nearer in time. Hence, between these two time series, the one that exhibits growing annual imbalances over time will be more sensitive to discount rate changes than one that is stable over time. Therefore, the high sensitivity of FI to changes in the discount rate indicates that projected annual financial shortfalls continue to grow over time. Hence, the sensitivity of FI only *confirms* the inappropriateness of using short-term

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[20] We consider the sensitivity of each parameter relative to the baseline set of parameters. Future work could extend this analysis by considering different parameter combinations along combined with the probability of each combination in order to create a distribution of possible outcomes.

fiscal measures or measures based on an arbitrarily truncated projection to measure the extent of policy unsustainability.

Turning now to the productivity growth rate assumption, g, the total FI is estimated to be $55.9 trillion under the high growth rate assumption (*g*=2.2 percent). Social Security's FI increases from $7.0 trillion under baseline assumptions to $12.0 trillion.[21] Medicare's FI increases from $36.6 trillion to $66.1 trillion since greater productivity growth also occurs in the Medicare sector (i.e., the differential, *h*, is unchanged). But faster productivity growth also brings in more general revenue and reduces the outlays on some programs such as Medicaid, Unemployment Compensation, Women-Infants and Children, Child Care, and Food Stamps. As a result, the rest-of-federal-government's FI shifts from $0.5 trillion under the baseline to –$22.2 trillion. Nevertheless, across all government programs, the net effect of higher productivity is to increase total FI relative to its value under baseline assumptions.

Similarly, lower assumed productivity growth (*g*=1.2 percent) reduces Social Security and Medicare's imbalances, but increases the imbalance on account of the rest of federal government. The resulting total FI is $36.9 trillion, which is smaller than the $44.2 trillion baseline estimate.

The impact of alternatively assuming higher- and lower-than-baseline growth rates in federal health-care spending on FI is more substantial. Under the high-*h* assumption (*h*=1.5 percent), FI is estimated to be $65.4 trillion, whereas it comes in at just $28.7 trillion under

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[21] The increase in Social Security's FI seems counter-intuitive at first glance because faster future productivity growth does not affect the real value of existing retirees' benefits. Rather, payroll tax revenues increase immediately but benefits rise only gradually as faster wage growth (stemming from the assumed faster productivity growth) is incorporated in calculating future retirees' benefits. Suppose that in response to faster productivity growth, the payroll tax base, payroll tax revenues, and outlays double. Then, the present value gap between outlays and revenues would also double. However, if the dollar increases in outlays are delayed by a few years, the present value gap would increase to less than twice its original size. Note that because the payroll tax base also doubles, the present value gap becomes *smaller* relative to that base. We discuss below how the total FI changes relative to payroll tax base and other measures as we change the underlying economic assumptions.

the low-*h* assumption (*h*=0.5 percent).[22] Under the high-*h* assumption, annual health care costs per capital are assumed to grow at 1.5 percentage points above the annual GDP per capita growth rate until 2080 – an assumption that is actually quite plausible when compared with experience during the previous two decades that, as noted earlier, have witness an annual differential of 2.3 percentage points. Under the low-*h* assumption, however, health care costs are assumed to grow at just 0.5 percentage points above GDP, an assumption that strikes us as fairly unlikely. In both cases, between 2080 and 2100, the differential is reduced to zero where it stays forever.

The *ratio* of FI to the present values of payroll and GDP, however, exhibits greater stability than the present value constant 2002 *dollar* amounts in response to changes in *r* because the denominator—the present value of future payrolls or GDP—changes in the same direction as total FI. In other words, while the dollar-value of the Fiscal Imbalance is sensitive to the underlying assumptions, the size of the tax rate increase or percent decrease in spending required to achieve sustainability is much less sensitive. Table 6 shows that under baseline assumptions, this ratio is estimated at 16.6 percent as of fiscal year-end 2002. Under high and low productivity growth assumptions respectively, it is estimated to be 14.8 and 18.0 percent respectively. Although total FI is larger in present-value dollar terms under the high productivity growth assumption, it is actually *smaller* as a share of the present value of future payrolls relative to the baseline. The reason is that FI grows less than proportion to the payroll base because of larger rest-of-government receipts and smaller outlay growth for some expenditure categories. Under the high and low health-care growth assumptions, the variation in the ratio of FI to the present value of payrolls is wider—between 24.6 and 10.8 percent

[22] Notice that Medicare's FI is actually larger under the high-*g* assumption relative to the high-*h* assumption even though the assumed growth rate of future health, $g + h$, is identical under both assumptions. The reason is that we follow OMB rules and begin the high-*g* assumption in 2003 while starting the high-*h* assumption in 2014.

respectively. This variation is not so surprising given that there is a 100 basis point difference *per year* between our high- and low-cost health growth rate assumptions, producing a large compounded difference over time. Still, these numbers show that an immediate and permanent 10.8 percent tax on all wages is still needed to create a sustainable fiscal policy system in the United States even if we assume that health costs per capita grow at only 50 basis points above GDP until 2080 (declining to 0 basis points thereafter), in sharp contrast to experience during the past two decades.

Conclusion

The federal government's spending priorities are set to change over the coming decades as the baby boom generation retires and federal outlays are predominantly composed of social insurance payments. In such a budget environment, traditional measures such as debt, 5- or 10-year cash-flow projections, and longer-term but truncated summary measures have limited usefulness in policymaking. Indeed, continuing to focus on such measures is likely to sustain a policy-bias that favors short-term debt reduction above policies that are more beneficial in addressing the nation's true longer-term Fiscal Imbalance. In order to evaluate and compare all available policy alternatives on a neutral footing, we need introduce new measures as part of our fiscal vocabulary.

The Fiscal and Generational Imbalance measures proposed in this *Pamphlet* have several desirable properties. The main desirable property is that using these measures would place the debate on entitlement reform on a *neutral* basis. These two measures comprise a powerful tool-set for policymakers. The FI measure fully reflects the impact of policy changes on the federal government's long-term solvency while the GI measure gives policymakers the additional information that they need to choose among alternative sustainable policy paths.

Based on OMB's policy-inclusive budget projections, we estimate that the federal government's long-term Fiscal Imbalance is $44.2 trillion. This Fiscal Imbalance is 10 times the size of the debt currently held by the public and is also several times larger than similar estimates published elsewhere under a 75-year projection horizon. To fully eliminate the existing FI, wage taxes, for example, will have to be increased by 16.6 percentage points. Alternatively, future non-Social Security and non-Medicare outlays will have to be reduced by almost 55 percent. To be sure, the dollar value of the FI is sensitive to underlying growth and discount rate assumptions. But this occurs because of the rapid growth in projected financial shortfalls, thereby only reinforcing the case for reporting the perpetuity FI measure rather than a truncated 75-year measure. The ratio of the FI to the tax base or GDP -- and, hence, the sizes of alternative fiscal reforms to achieve solvency – are much less sensitive to changes in these economic assumptions since the tax base and GDP tend to respond in the same direction as FI.

In closing, we remain optimistic about the potential for further reform in federal budget accounting. Positive changes have already occurred in the official reporting of the long-term financial status of Social Security and Medicare: The Social Security Trustees have adopted the FI and GI measures for that program along with other changes including stochastic analysis. We hope that these measures will soon be officially reported for Medicare and the rest of the federal government as well.

Table 1: Properties of Alternative Fiscal Measures

	Various Budget Measures					
Properties of Budget Measures	Annual Deficit	Debt Held by the Public	75-year actuarial deficit	Generational Accounting	Accrued Obligation Measures	FI and GI Composite Measure
Forward Looking	✘	✘	✓	✓	✓	✓
Comprehensive	✘	✘	✘	✓	✘	✓
Calculated in Perpetuity	✘	✘	✘	✓	✘	✓
Based on Current Law	✓	✓	✓	✘	✘	✓
Correctly Indicates Impact of All Policies	✘	✘	✘	✓	✘	✓
Easy to Communicate	✓	✓	✘	✘	✓	✓

Source: Constructed by the authors.

Table 2: Fiscal and Generational Imbalances in Social Security, Medicare, and the Rest of Federal Government (Present Values in Billions of Constant 2002 Dollars; Fiscal Years)

	2002	2003	2004	2005	2006	2007	2008
1. Fiscal Imbalance (FI) in Social Security	**7,022**	**7,204**	**7,436**	**7,692**	**7,967**	**8,258**	**8,569**
Imbalance on Account of Past and Living Generations (GI)	**8,701**	**8,871**	**9,097**	**9,347**	**9,617**	**9,904**	**10,212**
Future Net Benefits of Living Generations†	10,030	10,327	10,688	11,089	11,516	11,966	12,442
Trust Fund	-1,329	-1,455	-1,591	-1,742	-1,899	-2,062	-2,230
Imbalance on Account of Future Generations††,♣	**-1,680**	**-1,668**	**-1,661**	**-1,655**	**-1,650**	**-1,646**	**-1,644**
2. Fiscal Imbalance (FI) in Medicare--Part A	**20,497**	**21,071**	**21,764**	**22,513**	**23,285**	**24,091**	**24,939**
Imbalance on Account of Past and Living Generations (GI)	**8,623**	**8,970**	**9,374**	**9,812**	**10,258**	**10,725**	**11,217**
Future Net Benefits of Living Generations†	8,852	9,220	9,646	10,107	10,580	11,074	11,593
Trust Fund	-229	-250	-271	-295	-323	-350	-377
Imbalance on Account of Future Generations††,♣	**11,874**	**12,101**	**12,390**	**12,701**	**13,027**	**13,366**	**13,723**
3. Fiscal Imbalance (FI) in Medicare--Part B	**16,145**	**16,519**	**16,978**	**17,479**	**18,009**	**18,562**	**19,144**
Imbalance on Account of Past and Living Generations (GI)	**6,780**	**6,994**	**7,259**	**7,548**	**7,856**	**8,177**	**8,513**
Future Net Benefits of Living Generations†	6,819	7,022	7,291	7,579	7,890	8,213	8,551
Trust Fund	-39	-28	-32	-32	-35	-36	-38
Imbalance on Account of Future Generations††,♣	**9,365**	**9,525**	**9,719**	**9,931**	**10,153**	**10,386**	**10,631**
Fiscal Imbalance (FI) in Medicare (Parts A and B)	**36,643**	**37,590**	**38,742**	**39,992**	**41,293**	**42,653**	**44,084**
4. Fiscal Imbalance (FI) in the Rest-of-Federal-Government	**550**	**676**	**753**	**864**	**1,005**	**1,153**	**1,310**
Future Outlays	80,676	81,701	83,161	84,780	86,503	88,307	90,202
Future Revenues	-85,263	-86,552	-88,295	-90,103	-91,985	-93,917	-95,938
Living Generations†	-32,596	-33,273	-34,141	-34,997	-35,885	-36,781	-37,698
Future Generations††	-52,667	-53,278	-54,154	-55,106	-56,100	-57,136	-58,240
Excess Future Outlays Over Revenues	**-4,587**	**-4,851**	**-5,134**	**-5,323**	**-5,482**	**-5,609**	**-5,736**
Liabilities to Social Security and Medicare Trust Funds	**1,597**	**1,734**	**1,894**	**2,069**	**2,256**	**2,448**	**2,644**
Debt Held by the Public	**3,540**	**3,793**	**3,993**	**4,119**	**4,231**	**4,314**	**4,402**
Total Federal Fiscal Imbalance (FI)	**44,214**	**45,470**	**46,930**	**48,548**	**50,265**	**52,064**	**53,962**

Note: Positive items increase the Fiscal Imbalance.

† Those born 15 years ago and earlier. In the year 2002, for example, this category includes people born before 1988.

†† Those born 14 years ago and later. In the year 2002, for example, this category includes people born during 1988 and later.

♣Calculated as FI minus GI.

Source: Authors' calculations.

Table 3: 75-Year Fiscal Imbalances
(Present Values in Billions of Constant 2002 Dollars; Fiscal Years)

Fiscal Years	2002	2003	2004	2005	2006	2007	2008
75-Year Fiscal Imbalance--U.S. Federal Government	**16,315**	**17,101**	**17,943**	**18,889**	**19,900**	**20,966**	**22,097**
Social Security	1,596	1,689	1,804	1,932	2,072	2,224	2,389
Medicare	15,080	15,676	16,361	17,102	17,868	18,672	19,518
Rest of Federal Government	-360	-264	-222	-145	-41	70	190

Source: Authors' calculations.

Table 4: Total Fiscal Imbalance As a Share of Present Values of Payroll and GDP

	2002	2003	2004	2005	2006	2007	2008
Total Fiscal Imbalance (FI)	**44,214**	**45,470**	**46,930**	**48,548**	**50,265**	**52,064**	**53,962**
PV of Payroll Base	265,646	272,027	275,398	280,161	285,399	290,918	296,641
Total FI as a Percent of PV of Payroll	**16.6**	**16.7**	**17.0**	**17.3**	**17.6**	**17.9**	**18.2**
PV of Income Taxes	64,564	65,593	66,995	68,474	70,005	71,561	73,181
Total FI as a Percent of PV of Income Taxes	**68.5**	**69.3**	**70.1**	**70.9**	**71.8**	**72.8**	**73.7**
PV of Payroll Taxes	47,038	47,655	48,517	49,456	50,451	51,482	52,565
PV of FI as Percent of Payroll Taxes	**94.0**	**95.4**	**96.7**	**98.2**	**99.6**	**101.1**	**102.7**
PV of Discretionary Outlays	42,458	42,884	43,533	44,260	45,045	45,875	46,752
PV of FI as a Percent of PV of Discretionary Outlays	*	*	*	*	*	*	*
PV of Non-Social Security and Non-Medicare Outlays	80,676	81,701	83,161	84,780	86,503	88,307	90,202
PV of FI as a Percent of Non-Social Security and Non-Medicare Outlays	**54.8**	**55.7**	**56.4**	**57.3**	**58.1**	**59.0**	**59.8**
PV of GDP	682,156	699,070	708,187	720,896	734,861	749,573	764,811
Total FI as a Percent of PV of GDP	**6.5**	**6.5**	**6.6**	**6.7**	**6.8**	**6.9**	**7.1**

Note: Positive items increase the imbalance.
* Greater than 100 percent.
Source: Authors' calculations.

Table 5: Sensitivity of Fiscal Imbalance (2002) To Discount Rate and Growth Assumptions (Present Values in Billions of Constant 2002 Dollars; Fiscal Years)

	Baseline Assumptions	Discount Rate		GDP Growth Per Capita		Health-Care Outlay Growth Per Capita	
		High	Low	High	Low	High	Low
Total Fiscal Imbalance--U.S. Federal Government	**44,214**	**34,564**	**58,608**	**55,892**	**36,908**	**65,403**	**28,722**
Social Security	**7,022**	**5,025**	**9,978**	**11,975**	**4,933**	**7,022**	**7,022**
Medicare	**36,643**	**28,910**	**47,962**	**66,071**	**23,194**	**51,508**	**25,915**
Rest of Federal Government	**550**	**629**	**668**	**-22,153**	**8,781**	**6,874**	**-4,215**
Present Value of Excess of Outlays Over Receipts	-4,587	-4,508	-4,470	-27,290	3,644	1,737	-9,352
Liability to SS and Medicare	1,597	1,597	1,597	1,597	1,597	1,597	1,597
Debt Held by the Public	3,540	3,540	3,540	3,540	3,540	3,540	3,540

Source: Authors' calculations.

Table 6: Sensitivity of Total Fiscal Imbalance As A Share of the Present Value of Payroll

	Policy Baseline	High	Low
Discount Rate	16.6	15.0	18.8
Productivity Growth Per Capita	16.6	14.8	18.0
Health Care Outlay Growth Per Capita	16.6	24.6	10.8

Source: Authors' calculations.

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Appendix A
The Fiscal Imbalance Measure

Derivation of the Infinite Horizon Fiscal Imbalance Measure

The derivations refer to any program with dedicated resources such as Social Security and Medicare. Subtract the actuarial present value of the program's projected revenues and the inherited value of the program's assets from the actuarial present value of projected outlays (see equation 1 in the text). If present values are calculated in perpetuity, the residual represents the Fiscal Imbalance (FI) measure:

$$\text{(A1)}\quad FI_0 = \sum_{b=-\Delta}^{\infty} \sum_{t=\max(0,b)}^{b+\Delta} R^t [\sum_{x=m,f} (\beta^x_{b,t} - \tau^x_{b,t}) p^x_{b,t}] - \Gamma_{-1} R^{-1},$$

where $\beta^x_{b,t}$ represents period-*t* outlays per capita and $\tau^x_{b,t}$ represents period-*t* taxes per capita on persons of sex *x* (=*m* or *f*) born in period *b*, both in inflation adjusted terms, and $p^x_{b,t}$ represents the population in period t of such individuals. The discount factor *R* equals *1/(1+r)*, where *r* is the per-period real interest rate and Γ_{-1} denotes the trust fund inherited in period 0 (its value at the end of period t=–1). The necessary condition for the program to be actuarially solvent in perpetuity (but not necessarily solvent in each period if trust fund borrowing is prohibited) is $FI_0 \leq 0$.

How this measure changes over time under given projections of benefits, outlays, and demographics can be seen by decomposing the first term into two parts—the current surplus/deficit and the present value of future surpluses/deficits. Doing so yields

$$\text{(A2)}\quad FI_0 = \sum_{b=-\Delta}^{0} \sum_{x=m,f} (\beta^x_{b,0} - \tau^x_{b,0}) p^x_{b,0} + R \sum_{b=-\Delta+1}^{\infty} \sum_{t=\max(1,b)}^{b+\Delta} R^{t-1} [\sum_{x=m,f} (\beta^x_{b,t} - \tau^x_{b,t}) p^x_{b,t}] - \Gamma_{-1} R^{-1}.$$

Manipulate equation (A2)—add and subtract Γ_0 and use the relation

$$\text{(A3)}\quad \Gamma_0 = \Gamma_{-1} R^{-1} - \sum_{b=-\Delta}^{0} \sum_{x=m,f} (\beta^x_{b,0} - \tau^x_{b,0}) p^x_{b,0}$$

—to get

$$\text{(A4)}\quad FI_0 = R \bullet \{ \sum_{b=-\Delta+1}^{\infty} \sum_{t=\max(1,b)}^{b+\Delta} R^{t-1} [\sum_{x=m,f} (\beta^x_{b,t} - \tau^x_{b,t}) p^x_{b,t}] - \Gamma_0 R^{-1} \} = R \bullet FI_1,$$

Thus, under given tax and benefit projections, the time series of FI grows at the rate of interest. If FI_0=0, equation (A4) implies that all terms in the FI_t time series equal 0. Hence, this measure exhibits a knife-edge characteristic: Absent changes in projections and policy, if Social Security is just actuarially solvent initially, it stays so through time. However, if it is in deficit (surplus) initially, the deficit (surplus) grows larger over time at a rate equal to the rate of interest.

Fiscal Imbalance On Account of Past and Living Generations (FIG)

The right-hand-side of equation (A1) can be decomposed in another way—according to cohort-specific present values of benefits net of payroll taxes. Simplest is to distinguish between the cohort of those alive today (which includes those born Δ periods ago through period-0 newborns) and the cohort of past generations (those no longer alive). The inherited assets of the program encompass the excess of past payments by both groups. This measure is calculated as the present value of benefits received by those currently alive minus the present value of their taxes and minus the inherited trust fund:

(A5) $$FI_0 = \{\sum_{b=-\Delta}^{0}\sum_{t=0}^{b+\Delta} R^t[\sum_{x=m,f}(\beta^x_{b,t} - \tau^x_{b,t})p^x_{b,t}] - \Gamma_{-1}R^{-1}\} + \sum_{b=1}^{\infty}\sum_{t=b}^{b+\Delta} R^t[\sum_{x=m,f}(\beta^x_{b,t} - \tau^x_{b,t})p^x_{b,t}],$$

where the term in curly brackets is FIG_0. Expanding this term into current flows and the present value of future flows, and expanding the second term into the present values of benefits minus taxes of those born in period 1 and those born in periods 2 and later, we get.

(A6) $$FIG_0 = \sum_{b=-\Delta}^{0}\sum_{x=m,f}(\beta^x_{b,0} - \tau^x_{b,0})p^x_{b,0} + R\sum_{b=-\Delta+1}^{0}\sum_{t=1}^{b+\Delta} R^{t-1}[\sum_{x=m,f}(\beta^x_{b,t} - \tau^x_{b,t})p^x_{b,t}] - \Gamma_{-1}R^{-1}.$$

$$+R\sum_{t=1}^{1+\Delta} R^{t-1}[\sum_{x=m,f}(\beta^x_{1,t} - \tau^x_{1,t})p^x_{1,t}] + \sum_{b=2}^{\infty}\sum_{t=b}^{b+\Delta} R^t[\sum_{x=m,f}(\beta^x_{b,t} - \tau^x_{b,t})p^x_{b,t}]$$

Manipulate equation (A6) as earlier [add and subtract Γ_0 and use equation (A3)] to get

(A7)

$$FI_0 = R\bullet\{\sum_{b=-\Delta+1}^{1}\sum_{t=1}^{b+\Delta} R^{t-1}[\sum_{x=m,f}(\beta^x_{b,t} - \tau^x_{b,t})p^x_{b,t}] - \Gamma_0 R^{-1}\} + R\sum_{b=2}^{\infty}\sum_{t=b}^{b+\Delta} R^{t-1}[\sum_{x=m,f}(\beta^x_{b,t} - \tau^x_{b,t})p^x_{b,t}]$$

Hence, the relationship between the FIG terms [the terms in curly brackets in equations (5) and (7)] can be expressed as

(A8) $$FIG_0 = R\bullet FIG_1 - R\sum_{t=1}^{1+\Delta} R^{t-1}[\sum_{x=m,f}(\beta^x_{1,t} - \tau^x_{1,t})p^x_{1,t}]$$

Rearranging,

(A9) $$R\bullet FIG_1 - FIG_0 = R\bullet NT_1$$

or

(A9a) $$NT_1 = FIG_1 - (FIG_0 / R)$$

Where NT_b stands for $\sum_{t=b}^{b+\Delta} R^{t-b}[\sum_{x=m,f}(\beta_{b,t}^{x} - \tau_{b,t}^{x})p_{b,t}^{x}]$—the net transfer to the cohort born in period b. Equation (A9) says that the difference between FIG_0 and the discounted value of FIG_1 equals the discounted net transfer to the generation born in period 1. Rewriting equation (A9) after shifting the time index ahead by 1 period yields

(A10) $R \bullet FIG_2 - FIG_1 = R \bullet NT_2$.

Hence, it is easy to deduce that,

(A11) $R^n \bullet FIG_n - FIG_0 = \sum_{s=1}^{n} R^s \bullet NT_s$

In general, the difference between appropriately discounted FIG measures equals the total net transfer to cohorts born in the intervening time periods.

Appendix B
Assumptions and Methods for Estimating Fiscal Imbalances for Social Security, Medicare and the Rest of the Federal Budget

The assumptions and methods used to estimate the measures of fiscal imbalance presented in this chapter were first developed in connection with generational accounting. They have been updated and integrated with OMB's budget projections to compute the fiscal imbalance measures reported here. The techniques described below are used to estimate how Federal program benefits are distributed and, for the period beyond OMB's projection horizon, to project the growth of total federal outlays and receipts.

Method of Extending the Social Security Administration's Population Projections

Population projections are extended beyond the last year for which the Social Security Administration (SSA) provides projections (the year 2080). SSA's terminal-year fertility, immigration, and mortality assumptions are used. The following method is employed in extending the projections:

First, the population of newborns for 2081 is obtained by applying the terminal-year female fertility rates by age to the population of females in 2080. The resulting births are split into male and female newborns applying the historical norm of male births to total births. This ratio equals 0.5122. Next, the 2080 population of individuals aged 0 year through 99 years is aged by 1 year to obtain the 2081 population aged 1 through 99 and the addition to the 100-and-older population. This process involves applying age-sex mortality rates and immigration counts to the 2080 population. The SSA procedure assumes that immigration remains constant in absolute terms after about 2 decades.

The survival probabilities, mortality rates and immigration counts through 2080 are those under SSA's intermediate assumptions. Mortality rates for years after 2080 are estimated using SSA's projection methodology. This methodology adjusts each future year's mortality rates by age and sex according to a cause-of-death-specific rate of decline in the death rate weighted by the number of deaths by cause of death. The annual decline in mortality rates by cause of death is assumed to be constant.

Finally, the evolution of the age100-plus population is estimated. The survival rate for "100-year-olds" is computed as follows: The "100-year-old" population is the sum of those aged 100 and more. As a first approximation, it is assumed their population is divided between ages 100 through 119, in the same proportion as their cumulative survival probabilities to particular ages within that interval conditional on having survived to age 100. The fraction of 100-year-olds that survive equals 1 minus the product of their population proportions between age 101 and 119 and mortality rates applicable at these ages. The procedure detailed here is applied repeatedly to derive each successive year's population projection beyond 2080--for as long as needed. A more precise description of this procedure is given in Appendix C.

Method for Projecting Social Security Revenues and Benefits

Social Security's payroll tax revenues are distributed by age and sex using age-sex relative profiles of payroll tax payments obtained from the CPS (March 2001). The profile is constructed after imposing a taxable earnings limit on survey respondent's wages, salaries, and self-employment earnings. These age sex profiles are used to distribute OMB's projected payroll tax revenues plus revenue from taxation of benefits as separate age-sex profiles are not available to distribute these two categories of revenue separately. For years beyond OMB's terminal projection year, per-capita payroll tax payments are incremented at the rate of GDP growth per capita—1.7 percent per year.

Social Security benefit rules in effect today are not static. Current rules schedule a gradual increase in the normal or full retirement age (FRA) beginning in 2003 that has already begun to affect the benefits of some individuals who have decided to retire and collect benefits early. The already scheduled increases in FRA will not be completed until the third decade of this century. Because of the scheduled increase in FRA, the latest available age-sex Social Security benefit profile cannot be applied to distribute projected Social Security benefits during the next few decades. The profile applicable to the year 2000 must be adjusted to take into account the projected reduction in benefits of those who begin to collect benefits prior to attaining their applicable FRA. A detailed adjustment procedure is developed to estimate changes in age-sex profile for future years. The adjustment procedure uses data published by the Social Security Administration in its Annual Statistical Supplement to the Social Security Bulletin. That publication reports the number or retirees by age and sex and the average benefits received by age and sex for several different types of Social Security benefits.

Data from years 2000 and 2001 is used to estimate the fraction of new retiree, widow(er), and dependent beneficiaries at each age and by sex--the types of benefits that are subject to reduction for collection at ages earlier than the applicable FRA. New beneficiaries at each age and sex are calculated as the number of beneficiaries in the second year minus those in the same beneficiary cohort in the previous year (who are one year younger) and minus those among the same cohort who have died within the year.

In addition, data from 2001 is used to estimate age-sex profiles of average retirement, widow(er) and dependent benefits relative to other benefits--those not subject to reduction for early collection (such as mother and father benefits and benefits for dependents who care for children etc.). In addition the fraction of the population at each age and sex who collected benefits in 2001 has been calculated. These frequencies of benefit collection, fraction of new beneficiaries, and average benefits at each age and sex are combined with Social Security's benefit reduction formulae for early collection of retirement, widower, and dependents' benefits to estimate the changes in age-sex profiles in each successive year. The calculations indicate that the transition from the currently prevailing relative benefit profile to those that will prevail once the higher FRA has been fully phased in (by 2023) will be completed within a few decades thereafter. Hence, the procedure to adjust relative profiles for increasing FRA is carried forward until the year 2080. Appendix D documents the precise adjustment procedure for each type of benefit that is subject to an early retirement reduction.

All the benefit data are from 2000 and 2001. Estimating the relative decline in benefits at all ages and by sex in future years does not yield the per capita benefit levels at each age and sex in those future years. Each future year's age-sex Social Security benefit profile is derived from data from 2000 and 2001 and is normalized by dividing every value by that applicable to a 40-year-old male in that year. This yields the desired relative profiles of benefits by age and sex. To calculate benefits per capita, these relative profiles are used to distribute the projected Social Security benefits applicable to corresponding years in the future.

Take, for example, the calculation of per capita benefits for 2030. The sum over the product of year 2030's projected population and relative profile values by age and sex yields the number of units into which 2030's projected aggregate benefit must be divided to yield the per-capita benefit of a 40-year-old male. The product of this per-capita value with other age-sex relative benefit values yields the per-capita benefits at those age sex values for 2030. This calculation is implemented for each year for which OMB projections are available to obtain benefits per capita at each age and sex in these years.

The profile of benefits per-capita by age and sex calculated for OMB's terminal projection year is multiplied by a growth factor to obtain successive years' benefit levels. The growth rate applied equals 1.7 percent—OMB's real GDP growth per capita in the terminal year. This procedure is detailed in Appendix E.

Methodology for Projecting Medicare Revenues and Outlays:

Medicare Part A revenues are distributed by age and sex according to relative wages by age and sex. Average wages by age and sex are estimated from the Current Population Survey's (CPS) March 2001 supplement that contains data for the year 2000. Relative wage profiles by age and sex are obtained by normalizing average wages by age and sex to those of 40-year-old males. The relative profile for distributing Medicare Part B premiums is the distribution by age and sex of Medicare benefit recipiency relative to the total population by age and sex—also estimated from the CPS.

The relative profile of Medicare (Parts A and B) outlays is constructed using SSA's population projections and coefficients of relative Medicare expenditures in Lee, Skinner, and McClellan (1999). Lee, Skinner, and McClellan provide estimates of Medicare benefits received by age and sex. Separate estimates are provided for those who survive for at least one year after the current year ("survivors") and on those who die within the year ("decedents"). The profiles of benefits by age and sex normalized to those of a 65-year-old male survivor are constructed from these data (see Appendix Table 1).

Medicare Part A and B outlays for those aged 65 and older are modeled as the sum of average outlays times the number of individuals in the two survivorship categories mentioned above: SSA's population projections are used to determine the number of individuals in these two categories at all ages and for both sexes in every future year. Projected Medicare expenditures on the elderly through OMB's terminal projection year are distributed across their populations in these years using the aforementioned relative benefit profiles.

For those aged 0-64 (mostly disabled individuals and eligible survivors), benefits per capita are calculated by distributing their share of Medicare outlays according to their relative benefit profiles by age and sex. These average benefits by age and sex are also obtained from Lee, McClellan, and Skinner (1999) and the relative values are shown in Appendix Table 2.

The shares of Medicare expenditures on the young and the elderly are obtained by applying to projected total Medicare outlays the projected share of expenditures on those aged 0-64. This share is provided by the Congressional Budget Office (CBO) through 2070 and is extrapolated through 2080 according to its trend between 2061 and 2070.

For years beyond OMB's terminal projection year, the terminal year's per capita benefits are extended by applying two growth factors. The first factor equals an assumed growth rate of per-capita Medicare benefits at a rate equal to the rate of labor productivity growth—1.7 percent per year. The second factor is designed to capture the impact of projected mortality—specifically, changes through time in the number of retirees by age and sex that are projected to die within one year relative to those projected to survive for more than a year. The precise details of the procedure are documented in Appendix F.

Estimating Fiscal Imbalance for the Rest of the Federal Government:

The fiscal imbalance measure for the "rest of federal government" used OMB projections extended beyond their terminal year using the procedure described below.

Distributing and Projecting Federal Outlays:

For those years where outlay projections are available, outlays are distributed by age and sex across the populations alive in corresponding years. SSA's extended population projections are used in doing so (see the section describing the method for extending SSA's population projections).

The method for distributing federal outlays distinguishes between two types: Outlays that are not intended to benefit a specific subset of the population and those that are. The first category includes items such as national defense, the administration of justice, international affairs etc. Such items are distributed equally across the entire population in corresponding years for which aggregate projections are available.

Yet other federal outlays provide direct payments to individuals—by way of income support, educational subsidies, child-care benefits, health and retirement benefits etc. These outlays are distributed by age and sex according to age-sex relative profiles constructed from micro-data sources that are publicly available—such as Survey of Income and Program Participation, the Current Population Survey, the Panel Survey of Income Dynamics, etc. Outlay aggregates distributed in this manner include federal civilian retirement, federal employee life insurance, railroad retirement, veterans' benefits, DC pension fund, supplemental security income, workers' compensation, military retirement, unemployment compensation, general assistance, Women, Infants and Children, food stamps, Medicaid, child care, coal miners' benefits, earned income credit, and child tax credit outlays. Federal outlay aggregates by category are distributed by age and sex for years 2003-80—the years for which projected aggregate outlays are available. Beyond 2080, outlays per capita by age and sex are projected by applying a per-capita growth rate to each age-sex value and summed across the projected populations for future years.

Distributing and Projecting Federal Revenues:

The method for distributing Federal revenue aggregates is similar to that of distributing federal outlays. OMB projections are used through the terminal year of those projections. The projections are extended beyond that year using the following procedures. In general, age-sex relative profiles are estimated from micro-data surveys (the Current Population Survey, the Survey of Consumer Finances, and the Consumer Expenditure Survey). In each case, weighted averages are calculated for each item and the age-sex profiles are smoothed using age-centered moving averages.

Relative profiles and population projections are used to distribute the OMB's projected revenue aggregates. Beyond the terminal year of those projections, tax payments per capita are obtained by applying a per-capita growth factor to the OMB terminal year per capita amounts and summed across age and sex after weighting with the corresponding year's population for each age-sex category.

Through OMB's terminal projection year, total income taxes are divided between those falling on labor income and those on capital income. The division is done according to the estimated share of labor income in net national income averaged over the years 1990-2001. Labor income taxes are distributed using the age-sex wage profile obtained from the CPS for the year 2001, and modified by the age-sex relative profile of average tax rates, also estimated from the CPS. Similarly the sum of capital income taxes and corporate taxes is distributed according to a relative profile of wealth holdings by age and sex estimated from the Survey of Consumer Finances. The wealth profile is also modified by the CPS-derived relative profile of average tax-rates by age and sex.

Social insurance contributions on account of railroad retirement and federal civilian retirement are distributed using age-sex relative profiles estimated from the CPS. Employer-paid unemployment insurance taxes are distributed according to the CPS relative wage profile. Excise taxes and customs duties are distributed according to the relative age-sex distribution of consumption estimated from the Consumer Expenditure Survey (see next section for a description).

Estate and gift taxes are distributed by age and sex according to the SCF wealth profile modified by the probability of death by age and sex in each future year. Age and sex specific projected mortality rates are used for each future year to implement the modification. This modification of wealth holdings by age and sex yields the relative age-sex profile of decedent's wealth. Finally, the category of 'miscellaneous receipts' is distributed equally across the population through OMB's terminal projection year.

Estimating Consumption Profiles by Age and Sex:

The Consumer Expenditure Survey consists of two components, a quarterly Interview Survey and a weekly Diary Survey, each with its own questionnaire and sample.   For the most part, these two surveys cover different expenditure items, but there is some overlap. An internal procedure provided by the Bureau of Labor Statistics is used to generate a unique list of expenditures. This procedure is adjusted to allocate expenditure items between male and female household members, and between adults and children defined as members aged 16 through 18. Because these profiles are to be used to distribute excise and customs taxes, no expenditures are allocated to children aged 15 or younger.

Appendix C
Methodology for Extending SSA's Population Projections

Population projections

Population projections are extended beyond SSA's projection horizon (the year 2080) using SSA's terminal-year fertility, immigration, and mortality assumptions. The following methodology is used to extend the projections.

Let $p^x_{b,t}$ stand for the year-*t* population of individuals of sex *x* (=*m, f*) born in period *b* (*b*=*t,…t–100*). Values of $p^x_{b,t}$, *t*=2002…2080, are provided by SSA. Each year's value of $p^x_{b,t}$ for "100-year-olds" (*b*=*t*–100) includes the population of those who are aged 100 or more.

To extend the population projections to *t*=2081, we first obtain the population of newborns. This is done by applying the terminal-year female age-specific fertility rates f_a to the population of females, $p^f_{b,2080}$, *b*=0…100. The resulting births are split into male and female newborns applying the historical norm of male newborns to total newborns $\alpha = p^m_{t,t} / (p^m_{t,t} + p^f_{t,t})$ =0.5122. This yields the populations of newborn males and females in 2081:

(C1) $$p^m_{2081,2081} = \alpha \bullet \sum_{b=1980}^{2080} f_{2080-b} \bullet p^f_{b,2080},$$

and

(C2) $$p^f_{2081,2081} = (1-\alpha) \bullet \sum_{b=1980}^{2080} f_{2080-b} \bullet p^f_{b,2080}.$$

Next, the 2081 population of individuals older than newborns is obtained by applying mortality rates by age and sex, $\delta^x_{a,t}, a = 0,...100; x = m, f$ and SSA's terminal immigration rates by age and sex, $\beta^x_a, a = 0,...100,$ to the previous year's population. Thus,

(C3) $$p^x_{b,2081} = (1+\beta^x_{2080-b}) \bullet (1-\delta^x_{2080-b,2081}) \bullet p^x_{b,2080}, \qquad x=m, f;\ b=1981,\ldots 2080$$

The mortality rates $\delta^x_{a,t}, a = 0,... 100; x = m, f$ for t>2080 are projected using SSA's mortality rates by age, sex, and cause of death. Mortality rates are assumed to decline at SSA's cause-of-death-specific annual rates of decline by age and sex.

The survival rate for "100-year-olds" is computed as follows: The "100-year-old" population is the sum of those aged 100 and more. As a first approximation, it is assumed their population is divided between ages 100 through 119, in the same proportion as their cumulative survival probabilities to particular ages within that interval conditional on having survived to age 100. Hence, it is assumed that there are 1/S 100-year-olds, $(1-\delta_{100})$/S 101-year-olds, $(1-\delta_{100})$* $(1-\delta_{101})$/S 102-year-olds, etc., where S is the sum of terms 1, $(1-\delta_{100})$, $(1-\delta_{100})$ $(1-\delta_{101})$, …etc. The fraction of 100-year-olds that survive is, of course, $(1-\delta_{100})$. Hence $(1-\delta_{100})$/S 100-year-olds survive; $(1-\delta_{100})$ $(1-\delta_{101})$/S 101-year-olds survive;…etc. Hence the survival probability of the "100-year-old" group is the sum of such terms:

$$\text{(C5)} \qquad \sum_{a=100}^{119} \frac{\prod_{s=100}^{a} (1-\delta_s)}{1+\sum_{a=100}^{119} \prod_{s=100}^{a} (1-\delta_s)}.$$

The values of δ_a^x, a=0,…100 are taken from SSA's sex-specific mortality table for 2080.

This procedure [equations (1) through (5)] is applied successively to generate a population through the year 3500.

Assumptions and Definitions

Fertility. Terminal-year female fertility by age is assumed to remain constant. Newborns are split by sex using the rule of 105 males per 205 births.

Immigration: Levels of legal and illegal immigration are assumed to remain constant.

Mortality: Weighted average of SSA's terminal year mortality rates by cause of death. Mortality rates are assumed to decline at SSA's terminal constant annual rates of decline by cause of death.

Appendix D
Methodology for Projecting Social Security Age-Sex Benefit Profiles

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Current Social Security benefit eligibility rules specify prospective increases in the full retirement age (FRA)—the age of eligibility to unreduced benefits. This implies that age-sex benefit profiles derived from past data on the distribution of benefits per capita are not appropriate for distributing future projected benefit outlays by age and sex. This appendix describes the adjustments made to retirement, widow(er) and dependent benefit profiles based on the Social Security Administration's published data on average benefits and number of beneficiaries for 1999 and 2000.

Additional widow(er) reductions at ages 60-61 to adjust profiles for advancing FRA.

$$\beta_{a,t} = \frac{B_{a,t}}{P_{a,t}} = \frac{\beta^w_{a,t} p^w_{a,t} + \beta^o_{a,t} p^o_{a,t}}{P_{a,t}}$$

$\beta_{a,t}$ = Social Security benefits per capita for people aged a in period t

$B_{a,t}$ = total Social Security benefits for people aged a in period t

$P_{a,t}$ = total population of beneficiaries aged a in period t

$\beta^w_{a,t}$ = average widow(er) benefits for *beneficiaries* aged a in period t

$\beta^o_{a,t}$ = average "other" [non-widow(er)] benefits for *beneficiaries* aged a in period t

$p^w_{a,t}$ = population of widow(er) beneficiaries aged a in period t

$p^o_{a,t}$ = population of "other" beneficiaries aged a in period t

The Annual Statistical Supplement (ASS) contains data on benefits by type of benefit, age, and sex. Using data for *t–1*=1999 and *t*=2000, compute widow(er) benefits for *new* beneficiaries aged *a* in period *t*, $\beta^{w,N}_{a,t}$, as

$$\beta^{w,N}_{a,t} = \frac{\beta^w_{a,t} p^w_{a,t} - \beta^w_{a-1,t-1} p^w_{a-1,t-1}(1-\delta_{a,t-1})}{p^w_{a,t} - p^w_{a,t-1}(1-\delta_{a,t-1})}.$$

Here, $\delta_{a,t}$ refers to the mortality probability of those aged *a* in period *t*. ASS includes information for calculating average (across beneficiaries) of other [non-widow(er)] benefits, $\beta^o_{a,t}$. This provides the ratio $\beta^{w,N}_{a,t} / \beta^o_{a,t} = b^{w,N}_a$; a=60, 61. Using data on the population of beneficiaries by benefit-type, age, sex and SSA-provided data on total population in *t-1* and *t*

- Compute ratios $p^w_{a,t} / P_{a,t} = \pi^w_a$ and $p^o_{a,t} / P_{a,t} = \pi^o_a$ for a=60, 61
- Compute $\eta^w_a = Min\{0,[(p^w_{a,t} - p^w_{a-1,t-1}(1-\delta_{a,t-1})]/ p^w_{a,t}\}$—the fraction of widow(er) beneficiaries that are new, for a=60, 61

For t>2000 and a=60, 61.

1. Obtain the profile for other benefits in t=2001 by growing the t=2000 benefits: The growth factor used equals SSA's real-wage growth assumption: $\beta^{o}_{a,t} = \beta^{o}_{a,t-1}(1+\gamma)$
2. Use the ratio $b^{w,N}_{a,t}$ defined above to obtain $\beta^{w,N}_{a,t}$ --average widow(er) benefits that would have resulted in the absence of the scheduled *additional* early widower reduction at age *a* for new widow(er)s at that age.

3. The average (real) benefits of those who are already receiving widower benefits and those receiving other benefits are assumed to remain at the previous year's level.

4. Average benefits per capita in *t*=2001 are given by

$$\beta_{a,t} = \frac{\beta^{w}_{a-1,t-1}(1-\eta^{w}_{a})\pi^{w}_{a}P_{a,t} + \beta^{o}_{a,t}b^{w,N}_{a}\theta^{w}_{a}\eta^{w}_{a}\pi^{w}_{a}P_{a,t} + \beta^{o}_{a,t}\pi^{o}_{a}P_{a,t}}{P_{a,t}}$$

$$= \beta^{w}_{a-1,t-1}(1-\eta^{w}_{a})\pi^{w}_{a} + \beta^{o}_{a,t} \bullet [b^{w,N}_{a}\theta^{w}_{a}\eta^{w}_{a}\pi^{w}_{a} + \pi^{o}_{a}]$$

Here, the first term represents widower benefits at age a for those who received such benefits prior to year *t*. Of course, at a=60 this term is zero because $\eta^{w}_{a} = 1$. The second term imputes reduced widow(er) benefits for those who begin claiming such benefits in year *t*. In this term, the factor is θ^{w}_{a} is the *additional* widow(er) reduction to be imposed on new beneficiaries because of advancing FRA. This factor is computed as the ratio of a) the widow(er) reduction *including* additional months of early benefit receipts to b) the reduction *excluding* additional early months of benefit receipt. For example, let U be the unreduced benefit and α the original reduction factor for early claimants. Then, the reduced benefit in the absence of advancing FRA would be Uα (estimated as $\beta^{o}_{a,t} \bullet b^{w,N}_{a}$ in the second term above). If δ (<α) represents the new reduction factor (including additional months of early benefit receipt because of advancing FRA), the new reduced benefit is Uδ. To get the latter from the former we compute Uδ = Uα×(δ/α) = Uαθ.

<u>Widow(er) Benefit Reduction</u> at age *a*, is computed as product of the *monthly reduction amount* times the number of months prior to FRA that widow(er) benefit will be collected—age *a* through FRA. The *monthly reduction amount* equals 28.5 percent divided by the *number of possible months* of early retirement—from age 60 through FRA.

<u>Retirement Benefit Reduction</u> at age *a* equals 0.0056 percent times the number of months prior to FRA.

<u>Husband's and Wife's Benefit Reduction</u> at age *a* equals 0.0069 percent times the number of months prior to FRA.

Finally, retain the value $\beta^{w}_{a,t} = \pi^{w}_{a}[\beta^{w}_{a-1,t-1}(1-\eta^{w}_{a}) + \beta^{o}_{a,t} b^{w,N}_{a} \theta^{w}_{a} \eta^{w}_{a}]$ for the next period's calculations.

Additional OASI benefit reductions--ages 62-66 to adjust profiles for advancing FRA.

$$\beta_{a,t} = \frac{B_{a,t}}{P_{a,t}} = \frac{\beta^{r}_{a,t} p^{r}_{a,t} + \beta^{s}_{a,t} p^{s}_{a,t} + \beta^{w}_{a,t} p^{w}_{a,t} + \beta^{o}_{a,t} p^{o}_{a,t}}{P_{a,t}}$$

$\beta^{r}_{a,t}$ = average retirement benefits per capita for people aged *a* in period *t*

$\beta^{s}_{a,t}$ = average husbands/wives benefits per capita for people aged *a* in period *t*

$\beta^{w}_{a,t}$ = average widow(er) benefits per capita for people aged *a* in period *t*

$\beta^{o}_{a,t}$ = average other [non-retirees, non-spouses, non-widow(er)s] benefits per capita for people aged *a* in period *t*

$p^{r}_{a,t}$ = population of those receiving retirement benefit aged *a* in period *t*

$p^{s}_{a,t}$ = population of those receiving husbands/wives benefit recipients aged *a* in period *t*

$p^{w}_{a,t}$ = population of those receiving widow(er) benefits aged *a* in period *t*

$p^{o}_{a,t}$ = population of those receiving other [non-retirees, non-spousal, non-widow(er)] benefits aged *a* in period *t*

Set t=2000

Benefits by type, age, and sex→compute ratios $b^{r,N}_{a}$, $b^{s,N}_{a}$, and $b^{w,N}_{a}$ for ages *a*=62, 100 in the manner described above.

Again, using ASS beneficiary data and SSA's population projections compute

- ratios π^{r}_{a}, π^{s}_{a}, and π^{w}_{a} for *a*=62, 100
- η^{r}_{a}, η^{s}_{a}, and η^{w}_{a}--fractions of new beneficiaries at *a*=62, 100 (as defined earlier)

For t>2000 and *a* =62-100.

1. Obtain the profile for other benefits in t=2001 by growing the t=2000 benefits: The growth factor used equals SSA's real-wage growth assumption: $\beta^{o}_{a,t} = \beta^{o}_{a,t-1}(1-\gamma)$

2. Use the ratios $b^{r,N}_{a}$, $b^{s,N}_{a}$, and $b^{w,N}_{a}$ defined above to obtain $\beta^{r,N}_{a,t}$, $\beta^{s,N}_{a,t}$, and $\beta^{w,N}_{a,t}$ respectively—average benefits for new beneficiaries that would have resulted in the absence of the scheduled *additional* early retiree, spousal, and widow(er) reductions at age 62.

3. Average benefits per capita in 2001 are given by

$$\beta_{a,t} = \frac{\beta^{r}_{a-1,t-1}(1-\eta^{r}_{a})\pi^{r}_{a}P_{a,t} + \beta^{o}_{a,t}b^{r,N}_{a}\theta^{r}_{a}\eta^{r}_{a}\pi^{r}_{a}P_{a,t} + \beta^{s}_{a-1,t-1}(1-\eta^{s}_{a})\pi^{s}_{a}P_{a,t} + \beta^{o}_{a,t}b^{s,N}_{a}\theta^{s}_{a}\eta^{s}_{a}\pi^{s}_{a}P_{a,t}}{P_{a,t}}$$

$$+ \frac{\beta^{w}_{a-1,t-1}(1-\eta^{w}_{a})\pi^{w}_{a}P_{a,t} + \beta^{o}_{a,t}b^{w,N}_{a}\theta^{w}_{a}\eta^{w}_{a}\pi^{w}_{a}P_{a,t} + \beta^{o}_{a,t}\pi^{o}_{a}P_{a,t}}{P_{a,t}},$$

$$= \beta^{r}_{a-1,t-1}(1-\eta^{r}_{a})\pi^{r}_{a} + \beta^{s}_{a-1,t-1}(1-\eta^{s}_{a})\pi^{s}_{a} + \beta^{w}_{a-1,t-1}(1-\eta^{w}_{a})\pi^{w}_{a}$$
$$+ \beta^{o}_{a,t} \bullet [b^{r,N}_{a}\theta^{r}_{a}\eta^{r}_{a}\pi^{r}_{a} + b^{s,N}_{a}\theta^{s}_{a}\eta^{s}_{a}\pi^{s}_{a} + b^{w,N}_{a}\theta^{w}_{a}\eta^{w}_{a}\pi^{w}_{a} + \pi^{o}_{a}]$$

Here, θ^{r}_{a}, θ^{s}_{a}, and θ^{w}_{a} are additional retiree, spousal, and widow(er) reductions respectively, imposed because of advancing FRA. See earlier discussion for details.

In each period and for each age, average benefits by type are calculated and stored for carrying forward into the next period's calculations:

$$\beta^{r}_{a,t} = \pi^{r}_{a}[\beta^{r}_{a-1,t-1}(1-\eta^{r}_{a}) + \beta^{o}_{a,t}b^{r,N}_{a}\theta^{r}_{a}\eta^{r}_{a}]$$
$$\beta^{s}_{a,t} = \pi^{s}_{a}[\beta^{s}_{a-1,t-1}(1-\eta^{s}_{a}) + \beta^{o}_{a,t}b^{s,N}_{a}\theta^{s}_{a}\eta^{s}_{a}]$$
$$\beta^{w}_{a,t} = \pi^{w}_{a}[\beta^{w}_{a-1,t-1}(1-\eta^{w}_{a}) + \beta^{o}_{a,t}b^{w,N}_{a}\theta^{w}_{a}\eta^{w}_{a}]$$

Appendix E
Calculating and Projecting Social Security Taxes and Benefits Per Capita

Let $\rho^x_{b,t}$ stand for the average amount of Social Security benefits received in period *t* by persons of sex *x* born in period *b* relative to the average benefit received by 40-year-old males in period t (for whom *b*=–40). That is, $\rho^x_{b,t}$, $b = -\Delta,\ldots 0;\ x=(m,f)$, is the relative profile of Social Security benefits for those alive in period t. Similarly, let $\lambda^x_{b,t}$, $b=-\Delta,\ldots 0;\ x=(m,f)$, represent the relative profile of payroll (OASDI) taxes. The values of $\rho^x_{b,t}$ are calculated from data on average benefits and number of recipients for each type of OASDI benefit by age and sex reported in the Annual Statistical Supplement for year 2000 published by the Social Security Administration. Values of $\lambda^x_{b,t}$ are obtained from the Current Population Survey (CPS) for the latest available year 2001—containing data pertaining to the year 2000.

Let B_t represent the total amount of Social Security outlays in the base year (t=2002). The average benefit paid to male 40-year-olds equals

$$\text{(E1)}\qquad \beta^m_{-40,t} = \frac{B_t}{\sum\limits_{b=-\Delta}^{0} \sum\limits_{x=m,f} \rho^x_{b,t} P^x_{b,t}}$$

Finally average Social Security benefits by age and sex in year t are calculated as

$$\text{(E2)}\qquad \beta^x_{b,t} = \beta^m_{-40,t} \bullet \rho^x_{b,t}, \qquad b=-\Delta,\ldots 0, \qquad x=(m,f).$$

An analogous procedure is used to calculate $\lambda^x_{b,t}$, $b=-\Delta,\ldots 0,\ x=(m,f)$.

The relative profiles of Social Security benefits and payroll taxes are used to obtain per-capita benefits and taxes using this procedure for each year in Social Security's projection horizon of 75 years. The base-year relative profile for payroll taxes is used for each year. The relative profile of Social Security benefits is adjusted, however, to account for the scheduled increase in the full retirement age (FRA) over the next two decades. The method for adjusting each year's relative Social Security profile is detailed in Appendix C.

Appendix F
Derivation of Age-Sex Profiles for Medicare Revenues and Outlays

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The relative age-sex profile of Medicare Part A revenues is the same as that used for OASDI revenues in the base year—the taxable-ceiling-limited wage profile by age and sex normalized to its value for 40-year-old males. This profile was estimated from the Current Population Survey (March 2001) supplement containing data on wages and salaries for the year 2000.

The relative profile of Medicare Part A outlays is constructed using SSA's population projections and coefficients of relative Medicare expenditures in Lee, Skinner, and McClellan (1999). Lee, Skinner, and McClellan provide estimates by age and sex of Medicare outlays on those who survive for at least one year after the current year ("survivors") and on those who die within the year ("decedents"). The profiles of outlays by age and sex relative to outlays on a 65-year-old male survivors constructed from these data is shown in Table 1. In the following description, these relative values are denoted by ε_a^x, where a denotes age *(a=65,…100)* and x denotes sex *(x=m, f)*.

Table 1. Relative Profiles of Annual Medicare Outlays For Survivors Beyond One Year And Decedents Within One Year

Age	Male-survivors	Female-Survivors	Male-decedents	Female-decedents
65-69	1.0000	0.9092	6.2971	7.4775
70-74	1.2902	1.1761	6.3186	7.3520
75-79	1.5740	1.4552	6.3009	6.5755
80-84	1.8552	1.7495	5.6441	5.3562
85-89	2.0228	1.9616	5.1568	4.6760
90-94	1.8701	1.9345	4.1062	3.4136
95-100	1.8701	1.9345	4.1062	3.4136

Source: J. Lee, Mark McClellan, and Jonathan Skinner "Distributional Effects of Medicare" Tax Policy and the Economy, August 1999

For people aged a of sex x alive in year t, total Medicare Part A (HI) outlays are modeled as the sum of average outlays, $m_{a,t,c}^x$, times the number of individuals, $p_{a,t,c}^x$, in two survivorship categories, c: Those who will survive for at least 1 more year and those who will not.

Let the year-t populations of those aged a and of sex x belonging to the two survivorship categories be denoted by $p_{a,t,1+}^x$, and $p_{a,t,0}^x$ respectively. Using SSA's population projections (and abstracting from complications introduced by immigration) one can determine the number of individuals in the two categories at all ages for both sexes in future years t:

$$\text{(F1)} \quad \left.\begin{array}{l} p^x_{a,t,1+} = p^x_{a,t+1} \\ p^x_{a,t,0} = p^x_{a,t} - p^x_{a,t,1+} \end{array}\right\} \qquad \text{for } a=65,\ldots 98;\ x=m,f$$

For the populations aged 99 and 100 in all future years, it is assumed that the ratio of survivors to decedents equals that calculated for age 98. As mentioned earlier, total Medicare Part A expenditures on people aged a and of sex x in year t, $M^x_{a,t}$, can be expressed as:

$$\text{(F2)} \quad M^x_{a,t} = m^x_{a,t,1+} p^x_{a,t,1+} + m^x_{a,t,0} p^x_{a,t,0}.$$

Noting that $m^x_{a,t,c} / m^m_{65,t,1+} = \varepsilon^x_{a,t,c}$, represents the relative outlay for people in year t aged a of sex x and belonging to survivorship category c, we can rewrite equation (3) as

$$\text{(F3)} \quad M^x_{a,t} = m^x_{a,t} \bullet p^x_{a,t} = m^m_{65,t,1+} \bullet [\varepsilon^x_{a,t,1+} p^x_{a,t,1+} + \varepsilon^x_{a,t,0} p^x_{a,t,0}].$$

Summing over all ages and both sexes in year t, we obtain total Medicare Part A outlays for people 65 and older in year t as

$$\text{(F4)} \quad M_{65+,t} = m^m_{65,t,1+} \bullet \sum_{a=65}^{100} \sum_{x=m,f} [\varepsilon^x_{a,t,1+} p^x_{a,t,1+} + \varepsilon^x_{a,t,0} p^x_{a,t,0}].$$

Equation (5) can be solved to obtain the average expenditure on 65-year-old male-survivors in year t as

$$\text{(F5)} \quad m^m_{65,t,1+} = \frac{M_{65+,t}}{\sum_{a=65}^{100} \sum_{x=m,f} [\varepsilon^x_{a,t,1+} p^x_{a,t,1+} + \varepsilon^x_{a,t,0} p^x_{a,t,0}]}.$$

Finally, expenditures per capita on individuals aged a and of sex x in year t are calculated from equation (4)--

$$\text{(F6)} \quad m^x_{a,t} = \frac{m^m_{65,t,1+} \bullet [\varepsilon^x_{a,t,1+} p^x_{a,t,1+} + \varepsilon^x_{a,t,0} p^x_{a,t,0}]}{p^x_{a,t}}.$$

Medicare Part A expenditures on the elderly in future years t are obtained by applying to projected total Medicare Part A outlays the projected share of expenditures on those aged 0-64. The projected share of outlays on young individuals through 2070 was obtained from the Congressional Budget Office (CBO). These projections were extended through 2080 using the trend in the share between 2061 and 2070.

For those aged 0-64 (young spouses and survivors eligible for Medicare benefits), benefits per capita are calculated by distributing their share of Medicare outlays according to their relative benefit profiles by age and sex. Table 2 shows the relative benefit profile values obtained from by Lee, McClellan, and Skinner (1999).

Table 2. Relative Medicare Benefit Profiles for Individuals Aged 0-64

Age	Male	Female
0-35	0.1391	0.1101
36-45	1.0000	0.7420
46-55	1.4522	1.1159
56-60	1.8957	1.7855
61-64	3.9942	3.7855

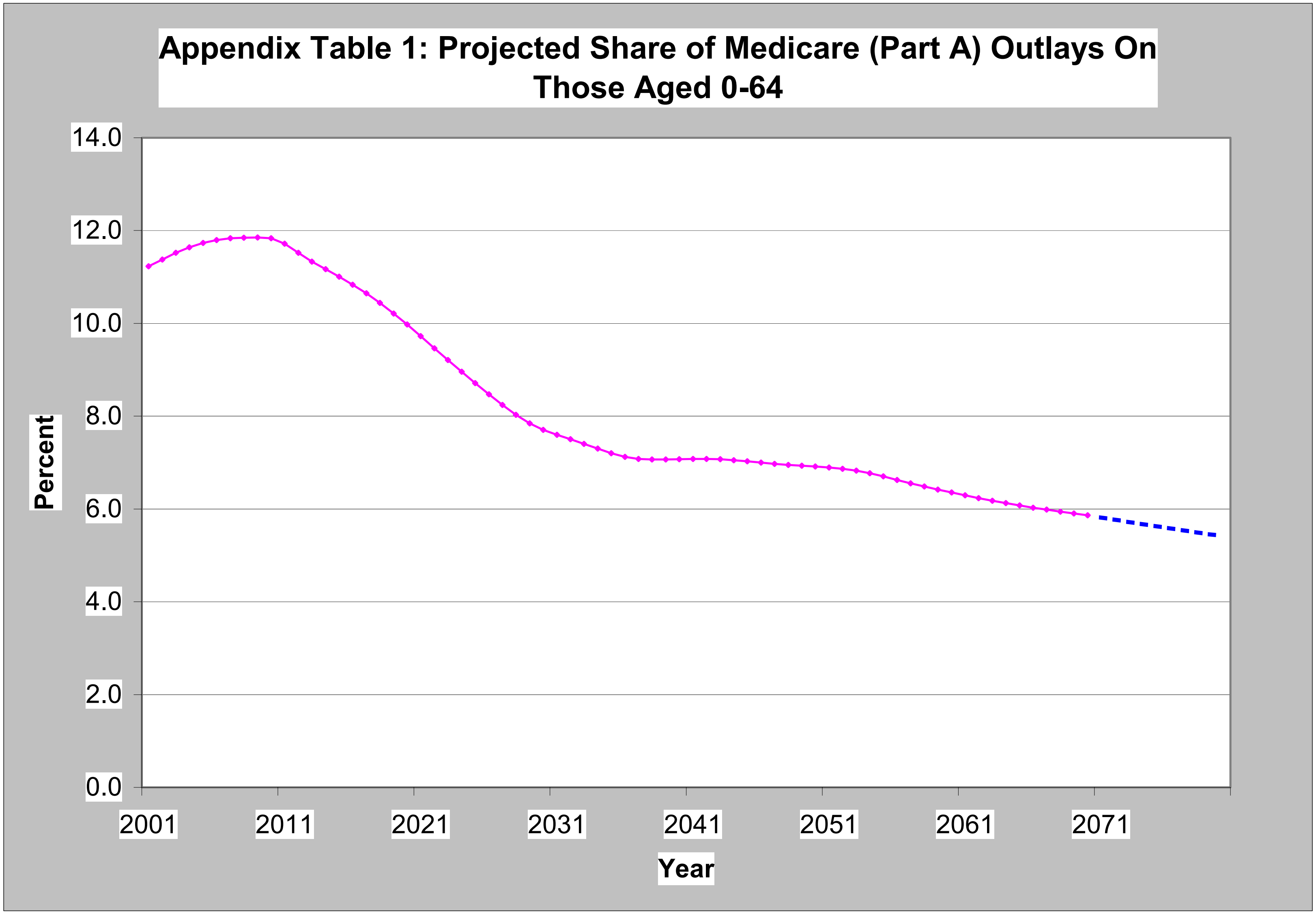
Source: J. Lee, Mark McClellan, and Jonathan Skinner "Distributional Effects of Medicare" Tax Policy and the Economy, August 1999

For years beyond 2080, year-2080's per capita benefits are extrapolated by applying two growth factors. The first factor equals an assumed growth rate of per-capita Medicare benefits, g_h, due to non-demographic factors such as larger demand and greater intensity of use of medical services due to economic growth. The second factor is designed to capture the impact of projected mortality—specifically, changes through time in the number of retirees by age and sex that are projected to die within one year relative to those projected to survive for more than a year. This factor, g_d^x, is calculated separately for both sexes as

(F7) $$g_d^x = \frac{(1/p_{a,t+1}^x) \bullet \sum_{a=65}^{100} [\varepsilon_{a,t+1,1+}^x p_{a,t+1,1+}^x + \varepsilon_{a,t+1,0}^x p_{a,t+1,0}^x]}{(1/p_{a,t}^x) \sum_{a=65}^{100} [\varepsilon_{a,t,1+}^x p_{a,t,1+}^x + \varepsilon_{a,t,0}^x p_{a,t,0}^x]} - 1.$$

Given year t's benefits per capita by age and sex, year $t+1$'s benefits per capita are calculated as

(F8) $$m_{a,t+1}^x = m_{a,t}^x (1 + g_d^x)(1 + g_h).$$



Source: Congressional Budget Office and author's projections.