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The Pareto Optimality of Existing Pay-As-You-Go Social Security Programs

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# **The Pareto Optimality of Existing Pay-as-you-go Social Security Programs**

## **Abstract**

In recent years, a number of proposals have been advanced for privatizing all or part of the Social Security program in the United States. These proposals range from the immediate abolition to the gradual phasing-out of Social Security taxes and benefits. This paper evaluates several premises that often underlie privatization proposals—that rates of return in the private sector exceed those implicit in the Social Security program, that privatization would lead to an increase in national saving, and that privatization could somehow improve the lifetime welfare of all affected generations. The paper first considers whether rates of return in the private sector actually exceed those implicit in the Social Security program and discusses the conditions required for privatization to lead to an increase in national saving. The paper then demonstrates theoretically that an existing, well-managed, pay-as-you-go social security program is Pareto optimal in an economy with exogenous factor prices, regardless of the extent to which privately available rates of return exceed those implicit in the pay-as-you-go program; i.e., no privatization scheme can be found that benefits at least one present or future generation without harming at least one other generation, and no scheme can be found that allows the winners from privatization to compensate the losers and still come out ahead. The analysis is extended to incorporate the assumption of endogenous factor prices and the possibility that pay-as-you-go social security programs reduce private saving. The theoretical conclusions are illustrated by using a long-run economic projection model to simulate the aggregate economic and intergenerational redistributive effects of two stylized privatization schemes.



## **I. Introduction.**

In recent years, a number of proposals have been advanced by researchers and politicians to privatize all or part of the Social Security retirement program in the United States. Some examples include Buchanan [1968], Friedman [1972], Robertson [1981], Ranson [1983], Ferrara [1983], du Pont [1986], and Gingrich [1986]. Among their criticisms of Social Security, advocates of privatization frequently argue that the pay-as-you-go nature of the present program<sup>1</sup> reduces national saving and generates internal rates of return<sup>2</sup> for new workers that fall far short of the rates of return that they could obtain by saving privately. A variety of privatization proposals have been advanced, ranging from the immediate abolition to the gradual phasing-out of Social Security taxes and benefits.

Rather than analyzing the provisions of specific privatization proposals, this paper examines the validity of several premises that often underlie these proposals. The paper first considers whether rates of return in the private sector actually exceed those implicit in the Social Security program when factors such as risk and liquidity are held constant. The paper also discusses the conditions required for privatization to lead to an increase in national saving. The paper then demonstrates theoretically that existing, well-managed, pay-as-you-go social security retirement programs are likely to be Pareto optimal; i.e., no privatization scheme can be found that benefits

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<sup>1</sup>Although the Old-Age and Survivors Insurance and Disability Insurance (OASDI) trust funds are in the early stages of a projected buildup of substantial proportions, this buildup is only temporary. A subsequent drawdown of the trust funds is also projected, with the funds projected to be exhausted by the middle of the next century. See Board of Trustees [1990] for further detail.

<sup>2</sup>The internal rate of return to Social Security is defined as the interest rate that equates the present values of expected lifetime Social Security benefits and taxes. See the Appendix for additional detail.

at least one present or future cohort<sup>3</sup> without harming at least one other cohort, and no scheme can be found that allows the winners from privatization to compensate the losers and still come out ahead.<sup>4</sup> This result implies that specific intercohort welfare functions must be invoked to support the argument that society would benefit from privatization. Because such welfare functions are not unique in a democratic society, privatization cannot be shown to benefit society unambiguously; consequently, the social desirability of privatization schemes in a democracy can only be established via the ballot box, with some cohorts sacrificing lifetime consumption for the benefit of other cohorts. The paper also demonstrates that these conclusions hold regardless of whether pay-as-you-go social security programs reduce private saving and regardless of the extent to which privately available rates of return may exceed those implicit in the pay-as-you-go program. Finally, these theoretical conclusions are illustrated by using a long-run economic projection model to simulate the aggregate economic and intercohort redistributive effects of two stylized privatization schemes. Because the principles discussed in this paper apply primarily to social security retirement programs, the discussion focusses on the Old-Age and Survivors Insurance (OASI) program.

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<sup>3</sup>The term "cohort" is used throughout this paper to refer to a group of individuals born within a given period of time, such as a year.

<sup>4</sup>The ability of winners to compensate losers is sometimes referred to as the Kaldor criterion in welfare analysis. For generality, this paper treats all such secondary transfers as potentially part of the privatization plan itself. Under this interpretation, the demonstration of Pareto optimality for existing pay-as-you-go social security programs requires that no combination of privatization and secondary transfers can be found where at least one cohort gains without harming any other cohorts.

## II. Social Security and Economic Efficiency.

Two issues of economic efficiency are especially relevant to the privatization debate. The first issue is the efficiency of the pay-as-you-go financing method in terms of direct returns; i.e., whether the internal rate of return to social security falls short of the corresponding market interest rate. The second issue is the potential adverse effect of the pay-as-you-go financing method on national saving and capital formation. Each issue is discussed below in the context of the criticisms raised by privatization advocates.

Current projections suggest a real internal rate of return to OASI tax payments of roughly two percent for new labor force entrants.<sup>5</sup> Critics of pay-as-you-go financing have frequently argued that this rate is well below the market rate that these workers could earn if allowed to save privately for their own retirement or, alternatively, well below the market rate that could be realized in a fully-funded social security program.<sup>6</sup>

In addressing this issue, it is important to distinguish between individual and societal perspectives concerning the appropriate market rate of interest for comparison. The appropriate rate from the individual perspective is typically much lower than from a societal perspective. For consistency with present law, a valid comparison for the individual requires that the market rate be net of any applicable asset income taxes and reflect the same degree of risk and liquidity as that associated with the OASI program; i.e., an interest rate at which the individual can

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<sup>5</sup>This estimate is roughly consistent with unpublished projections of the Office of the Actuary of the Social Security Administration using the intermediate (II-B) assumptions of the annual OASDI Trustees' Report for recent years (e.g., see Board of Trustees [1990]). This estimate is also roughly consistent with projections made by Leimer and Petri [1981] and with the simulations presented in Section IV of this paper.

<sup>6</sup>For example, see Buchanan [1968, 1983], Browning [1979], and Ferrara and Lott [1985].

effectively transform funds over sometimes substantial periods of time with the same assurance of non-default and stability of return as is implicit in that program.<sup>7</sup>

Although no market asset has these particular characteristics, long-term federal government bonds provide a reasonable starting point. Such bonds have historically exhibited a relatively low yield over extended periods. The average of the annual yields realized on long-term U.S. Government bonds over the period 1926-88, for example, was only 1.7 percent after adjustment for inflation; the real geometric mean annual yield over the same period was 1.2 percent.<sup>8</sup> The corresponding after-tax rates would vary by individual and would be significantly smaller in most cases.

Other adjustments in the comparison market interest rate are necessitated by unique features of Social Security. The insurance aspects of the program address certain private market failures and allow individuals to diversify mortality, disability, involuntary early retirement, and human

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<sup>7</sup>This conclusion assumes that, except for its financing basis, the envisioned alternative to Social Security has features similar to those of the present program. What is at issue here is the efficiency of the financing basis of the program, not the fundamental design of the program with respect to compulsion, the timing of contributions and benefits, and so forth. Once the features of the program are decided, the question of whether pay-as-you-go or fully funded financing yields greater returns can be addressed. Note that requiring an equal degree of compulsion and the identical timing of contributions and benefits in the private alternative effectively gives the assets funding the private program the same degree of illiquidity as the implicit net social security wealth assets associated with a pay-as-you-go social security program. The concept of net social security wealth and its relationship to privatization is discussed more fully below.

<sup>8</sup>See Ibbotson Associates [1989]. As in some earlier historical periods, the average of annual yields has been higher in recent years; over the period 1980-89, for example, the annual yield on long-term U.S. Government bonds averaged 8.3 percent after adjustment for inflation. Although this recent experience of relatively short duration is not necessarily a good indicator of future patterns, the Panel of Technical Experts to the 1991 Advisory Council on Social Security [1990] recently recommended an increase from 2.0 to 2.8 percent in the ultimate real interest rate assumed to be earned on U.S. Government obligations held in the trust funds under the intermediate (II-B) projections of the annual OASDI Trustees Report.



capital risks.<sup>9</sup> The automatic inflation adjustment of Social Security benefits provides individuals with unique protection against unexpected inflation.<sup>10</sup> An opposing influence may be provided by individual uncertainty concerning future changes in Social Security tax and benefit provisions.

The net effect of these opposing influences is not clear *a priori*. As indicated above, critics of Social Security generally suggest the use of a relatively high market rate for comparison with Social Security. The use of a high rate is consistent with the assumption that uncertainty about future program provisions dominates for most individuals. Leimer and Richardson [1989] present empirical evidence, however, that the real market interest rate perceived by individuals as appropriate for comparison with Social Security may be close to zero or even negative. This result is consistent with the interpretation that consumer valuation of the insurance and inflation adjustment and other special features of Social Security overwhelms uncertainty about future program provisions. From the individual perspective, then, the rate of return from Social

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<sup>9</sup>See Leimer and Richardson [1989] for a more complete discussion, including literature citations, of the risk diversification provided by Social Security. The terminology "private market failures" is commonly used in reference to certain problems posed by the nature of insurance markets and does not imply any inherent deficiency of private insurance providers. Public insurance programs can mitigate some of these problems by virtue of mandated program size, universality of coverage, reduced information costs, and guaranteed permanence. See Diamond [1977], Feldstein [1977], and Kotlikoff [1987] for further discussion of private market failures in the social insurance context.

<sup>10</sup>Bodie [1990] identifies conditions under which inflation-indexed private securities could be made widely available and notes that a few private financial institutions have issued such securities in recent years. Even if private securities linked to inflation overcome the obstacles to their wide availability, however, such securities would still entail some default risk unless based on inflation-indexed bonds issued or otherwise guaranteed by the government.

Security may exceed the corresponding market alternative by a substantial margin, perhaps explaining, at least in part, the widespread popularity of the program.<sup>11</sup>

Different considerations apply when the question is broadened to a societal perspective. The after-tax market rate of return is no longer an appropriate basis for comparison, because society captures the entire before-tax return. Individuals cannot typically pool risks to the extent that society can, so that private investments with a higher average yield but greater risk to the individual may legitimately be compared to Social Security from a societal perspective.

Indeed, some analysts argue that the rate of return to capital is the appropriate market rate to use in evaluating the pay-as-you-go financing method.<sup>12</sup> Because the rate of return to capital generally exceeds the internal rate of return in a mature pay-as-you-go social security program, pay-as-you-go financing appears to be inferior by this standard. But this comparison ignores the greater period-to-period volatility in the rate of return to capital.

On average, over time, the internal rate of return in a mature pay-as-you-go social security program is given by the rate of growth in its tax base.<sup>13</sup> In the past, earnings-related tax bases have tended to exhibit less intertemporal volatility than have rates of return to capital. Over the period 1929-88, for example, the average of the annual growth rates in real aggregate wages and salaries was 3.3 percent, with a standard deviation of 5.7 percent.<sup>14</sup> In contrast, the average

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<sup>11</sup>See Chapter 6 of Light [1985] for a discussion of public opinion surveys on Social Security issues.

<sup>12</sup>For example, see Browning [1979] and Ferrara and Lott [1985].

<sup>13</sup>See Aaron [1966] for a simple model illustrating this point.

<sup>14</sup>These results are derived from National Income and Product Accounts data on aggregate wages and salaries, deflated by the implicit price deflator for personal consumption expenditures.

of the inflation-adjusted annual total yields on common stocks was 7.6 percent over this period, but with a standard deviation of 20.6 percent.<sup>15</sup>

The higher intertemporal volatility in the rate of return to capital may argue for at least partial pay-as-you-go financing of a social security program, in spite of the generally lower implicit rate of return. Put another way, it does not follow that pay-as-you-go financing is inefficient simply because the growth rate in the social security tax base tends to be lower than the rate of return to capital. The alternative methods of financing social security involve different degrees of risk that should be taken into account. Societies may rationally choose lower expected rates of return in exchange for less risk in the provision of retirement incomes.<sup>16</sup>

The second issue of economic efficiency addressed in this paper is the potential adverse effect of the pay-as-you-go financing method on national saving and capital formation.<sup>17</sup> Some

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<sup>15</sup>See Ibbotson Associates [1989]. Ideally, the comparison here would be between the rate of return to capital and the growth rate in an earnings-related tax base. Because an appropriate rate of return to capital series was not available, however, the common stock series was used for comparison. As a cross check, some rough tax rate and inflation rate adjustments were made to the nominal after-tax rate of return to capital series presented in Fraumeni and Jorgenson [1980]; the results support the general conclusion that both the mean and variance of a before-tax real rate of return to capital series would likely exceed that for a series of real growth rates in an earnings-related tax base.

<sup>16</sup>There are, of course, other ways besides pay-as-you-go financing to reduce intertemporal volatility in retirement incomes in exchange for lower expected rates of return. A policy of overfunding might be adopted, for example, at the start of a funded program; i.e., tax contributions could be invested in a capital fund, but benefit payouts made at a lower rate than the fund actually experiences, at least for some initial period, until a reserve fund of sufficient proportions is achieved. In this case, no initial cohorts would receive the large lifetime wealth increments associated with the start-up of a pay-as-you-go program.

<sup>17</sup>This discussion implicitly assumes that consumption behavior is not of the intergenerational type that offsets government transfers and associated taxes through changes in private transfers.

critics of Social Security have argued that the pay-as-you-go financing method has reduced private saving and see privatization as a way of restoring the capital stock.<sup>18</sup> An extensive literature has developed examining the potential effect of Social Security on private saving. While this literature offers a number of theoretical reasons why Social Security may not have had an adverse effect on private saving, the empirical evidence has been inconclusive.<sup>19</sup> Even if Social Security has reduced private saving, it does not follow that national saving has been reduced. The effect of Social Security on national saving depends on its interaction with monetary and fiscal policy.<sup>20</sup> As such, assessing the historical effect of the program on national saving requires speculation concerning the counterfactual monetary and fiscal policies that would have obtained in the absence of the program.

In a broader context, then, a pay-as-you-go social security program is just one of many public and private influences on monetary and fiscal policy, albeit a large influence. By the same reasoning, the national saving effect of a fully funded retirement program, whether public or private, also depends on the response of monetary and fiscal policy. In particular, had our own Social Security program been instituted and maintained as a fully funded program, the

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<sup>18</sup>See Ferrara [1983]. Analyses examining the potential reduction in private saving occasioned by Social Security have typically portrayed this reduction as an inefficient distortion of the private consumption decision. This interpretation provides a basis for policy designed to remedy the reduction in saving. It is also possible, however, that Social Security has allowed individuals to increase their lifetime consumption by providing an alternative to imperfect private annuity and insurance markets; the associated reduction in private saving, then, would represent an increase, rather than decrease, in economic efficiency. Leimer and Richardson [1989] present empirical evidence consistent with this latter interpretation, which, by itself, provides no basis for policy designed to remedy the reduction in saving.

<sup>19</sup>Lesnoy and Leimer [1987] provide a review of both the theoretical arguments and empirical evidence.

<sup>20</sup>See Eisner [1983] for an elaboration of this point.

associated fiscal drag may have forced a commensurate easing of fiscal policy, with a net effect on national saving not unlike that actually experienced. In that event, both the Social Security trust fund and national debt would be larger in offsetting amounts, but the capital stock and aggregate output unchanged.

Similar considerations apply to determining the effect of privatization on private and national saving. Privatization plans can result in no change or even decreases in national saving, depending on the state of the economy and the response of monetary and fiscal policy. As an example, consider a plan that effects privatization by simply converting the implicit net unfunded liability<sup>21</sup> of the social security program into explicit, newly issued, public debt; future social security taxes and benefits are abolished, and workers are required to save privately for retirement an amount equal to what their social security taxes would have been. In effect, public debt is issued to all holders of positive net social security wealth and, symmetrically, one-time taxes are levied on all holders of negative net social security wealth, in the amount of their net

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<sup>21</sup>In this context, a "closed group" definition of unfunded liability is appropriate; i.e., the present value of expected lifetime benefits less taxes for all present participants in the social security program, evaluated using the interest rates expected on trust fund assets, less the value of the assets presently held by the trust fund.

holdings of such wealth.<sup>22</sup> Based on these transactions alone, the expected wealth, and therefore consumption, of all present workers and beneficiaries would be unaffected by the transition; i.e., social security wealth would simply be replaced in consumers' portfolios by increased holdings of public debt or tax liability.

The extent to which national saving is affected by such a privatization plan depends on the debt service policy applied to the newly issued public debt and on how that policy is perceived by consumers. The key is whether the new privatization debt, along with any accumulated interest, is allowed to grow over time at a rate different than would have applied to the unfunded liability of the now-abolished social security program.<sup>23</sup> It is easy to show that the unfunded liability in a mature, pay-as-you-go, social security program tends to grow over time at the rate of growth in the tax base used to finance the program.

To illustrate the linkage between debt service policy and national saving in this example, assume that the interest rate on the new privatization debt exceeds the rate of growth in the tax base. If no new taxes are levied to service the interest on the new privatization debt, the debt

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<sup>22</sup>Net social security wealth refers to the present value of expected future social security benefits less taxes. This and related concepts are defined mathematically in the Appendix. For simplicity, the description of the example privatization plan in the text abstracts from possible differences in the discount rates applicable to the individual and the social security program and from other differences between perceived and realized social security wealth under the pay-as-you-go program. While such differences could lead to additional changes in private consumption and saving, somewhat complicating the argument, the differences would have no effect on the general conclusion. Given these assumptions, then, the unfunded liability, as defined in the earlier footnote, is equal to aggregate net social security wealth less any trust fund assets, where aggregate net social security wealth is simply defined as the present value of expected lifetime benefits less taxes for all present participants in the social security program.

<sup>23</sup>This discussion also abstracts, for the most part, from changes in private saving that result from the distributional effects of the other government and social security tax and benefit changes. Such effects complicate the analysis, but do not alter the general conclusion.

will accumulate over time at the rate of interest; i.e., public indebtedness will increase faster than would have the sum of public indebtedness and unfunded liability under the now-abolished social security program. With no new taxes as an offset, new labor force entrants will have greater expected lifetime wealth, and will therefore consume more than they would have under the social security program. Aggregate consumption will increase, and national saving decrease, as a result of privatization. In this case, then, new workers have greater consumption than under social security, but at the expense of future cohorts, who will have less capital with which to work, and therefore will have lower lifetime incomes.

Alternatively, suppose that new taxes are levied to cover at least part of the interest on the new privatization debt, so that public indebtedness grows less rapidly than would have the sum of public indebtedness and unfunded liability under the now-abolished program. To the extent that the new taxes fall on the cohorts who had participated in the social security program, their expected lifetime wealth, and therefore consumption, will fall relative to that under social security. The consumption of new labor force entrants may be larger or smaller relative to their consumption under the social security program, depending on the distribution and severity of the new taxes. In the aggregate, however, private consumption must be lower than under social security, because we have assumed that the new taxes are high enough to reduce the accumulating privatization debt below what the unfunded liability would have been under the now-abolished social security program. In this case, then, privatization results in some net increase in national saving, with future cohorts made better off at the expense of present cohorts.

In the special case where new taxes are levied so that public indebtedness grows at exactly the same rate as would have the sum of public indebtedness and unfunded liability under social

security, privatization has no effect on national saving, again abstracting from any distributional effects. This could be effected, for example, by placing a tax on the returns to the now-required private retirement saving of new cohorts entering the labor force after privatization<sup>24</sup> and applying the proceeds to fund part of the interest payments on the accumulating privatization debt; if this tax is set so that the net rate of return realized on this required private retirement saving is equal to what these cohorts would have earned under the now-abolished social security program, then national saving would be unaffected and no cohorts, present or future, would be better or worse off than under the social security program.<sup>25</sup> In this sense, then, plans can be found, at least in theory, that effect privatization without changing the lifetime wealth of any cohort.

Some privatization advocates would still favor such a plan because of the potential for greater freedom of choice under a private program. Opponents of privatization would cite private market failures in the provision of certain insurance products, such as fair annuities and protection against unexpected inflation, and the loss of a publicly-accepted vehicle for redistribution on the basis of a lifetime index of equality. These auxiliary issues, while important, are not addressed in the remainder of this paper, which focusses on the effects of privatization on the lifetime income, consumption, and utility of present and future cohorts. The measures of Pareto optimality employed in the paper are limited to those effects.

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<sup>24</sup>Recall that we have assumed under our example privatization plan that workers would be required to save privately for retirement an amount equal to what their social security taxes would have been.

<sup>25</sup>See Leimer [1991 (B)] for a mathematical demonstration of this result.



The privatization plans considered in the remainder of this paper assume a monetary and fiscal policy response consistent with an increase in national saving, since that is typically one of the primary goals of privatization advocates. It is important to keep in mind, however, that privatization, by itself, has no necessary consequence for national saving, even if the plan results in increased private saving. The net effect on national saving also depends on the monetary and fiscal policy response to the particulars of the privatization plan.

### **III. Pay-as-you-go Social Security Programs and Pareto Optimality.**

Even if it is assumed that workers would receive larger retirement incomes if allowed to rely on private saving alternatives, it does not follow that society would be better off privatizing social security. The transition from a pay-as-you-go social security program to private saving alternatives requires that at least some present cohorts suffer a loss in lifetime income and consumption if future cohorts are to gain. Either workers at the time of the transition must provide for at least part of their own retirement as well as pay for the retirement income rights established by earlier cohorts prior to the transition, or these earlier cohorts must forego some of the retirement income that they would have enjoyed under social security.

Some proponents of privatization have suggested that, because privately available rates of return exceed the implicit rate of return from a mature social security program, it may be possible to find Pareto-superior privatization schemes;<sup>26</sup> i.e., schemes may be found in which the winners from privatization can compensate the losers and have some left over besides. Put

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<sup>26</sup>For example, see Buchanan [1979] and Ferrara [1985]. Townley [1981] claims to identify a Pareto-superior scheme for gradually converting a pay-as-you-go social security program to a fully funded basis.

another way, some proponents suggest that, if workers were freed from their social security taxes and allowed to invest those funds privately, the higher private rate of return could allow them to both fund at least part of their own retirement benefits as well as pay for the retirement income rights earned by previous cohorts. The remainder of this section examines the validity of this claim.

For the sake of the discussion, assume initially that 1) there are no administrative or operational costs for either the public or private social security program alternatives; and 2) wage and interest rates would be unaffected by privatization. The latter assumption might be appropriate, for example, in an open economy with exogenous factor prices. In order to establish whether the winners from privatization could compensate the losers, we need to identify the value of continuing the social security program for each present participant, whether worker or beneficiary.<sup>27</sup> Under the assumption of zero administrative costs, this value is given by the amount of net social security wealth perceived by each participant; i.e., since net social security wealth is simply the present value of expected future social security benefits less taxes, it represents the present value of the program to each participant. Those for whom net social security wealth is negative should be willing to pay up to that amount to opt out of the

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<sup>27</sup>For the most part, the discussion in the text focusses on the net value of continuing the program for present participants. The Pareto optimality conclusion reached for present participants remains unaltered, however, when future participants are incorporated into the analysis in conjunction with debt financing of the unfunded liability of the pay-as-you-go program. Leimer [1991 (B)] provides a mathematical demonstration of the Pareto optimality of existing pay-as-you-go social security programs in this expanded context.

program,<sup>28</sup> while those with positive net social security wealth would be willing to abandon their benefit rights only if paid an equivalent present value. The winners from privatization, those with negative net social security wealth, could compensate the losers, those with positive net social wealth, only if aggregate net social security wealth is zero or negative.<sup>29</sup>

As long as workers and beneficiaries have the same perceptions of future taxes and benefits, it is relatively easy to show that aggregate net social security wealth is positive in a pay-as-you-go social security retirement program with zero administrative costs. Since current aggregate benefits equal current aggregate taxes, all present and future taxes to be paid by present workers are necessarily paid out as retirement benefits to persons presently of working age or older. But persons presently of working age or older will also receive additional retirement benefits from persons not presently of working age, most yet unborn. Consequently,

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<sup>28</sup>Net social security wealth for the youngest workers will generally be negative if the internal rate of return to social security taxes is less than the market rate of interest used to discount future taxes and benefits. The Appendix provides greater detail on the relationship between net social security wealth and the internal rate of return.

<sup>29</sup>More generally, any accumulated trust fund assets can also be considered as available to compensate the losers from privatization. By this broader measure, the losers could be compensated only if the unfunded liability of the program, defined as net social security wealth less trust fund assets, is zero or negative. In a fully funded program, for example, the unfunded liability is zero by definition, with net social security wealth equal to the value of the trust fund, assuming individual and program perceptions of net social security wealth are identical. For simplicity, the discussion in the text assumes a strict pay-as-you-go program with zero trust fund assets.

aggregate net social security wealth must be positive, since it is simply the present value of all the benefits less taxes expected by present workers and beneficiaries.<sup>30</sup>

This conclusion remains valid regardless of the size of the market interest rate used for comparison with social security; i.e., regardless of the interest rate used by workers and beneficiaries to discount future taxes and benefits. Again, this follows because all future taxes to be paid by present workers will necessarily be balanced each year by the corresponding benefits paid to persons presently of working age or older. Regardless of how large the market discount rate is, then, future tax liability for present workers is matched each year by corresponding benefit wealth for present participants. As indicated above, additional benefit wealth for present participants is financed by taxes to be paid by persons not presently of working age, ensuring that aggregate net social security wealth for present participants is positive, regardless of the size of the market discount rate.

Even if market interest rates approaching infinity are considered, aggregate net social security wealth remains positive under our assumption of zero administrative costs; i.e., as the discount rate approaches infinity, the present value of all future taxes and benefits approaches zero, so that aggregate net social security wealth approaches current aggregate benefits less taxes. This difference also equals zero, of course, in a pay-as-you-go program with zero administrative costs. Consequently, even if the market interest rate used for evaluating social

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<sup>30</sup>This conclusion is easily extended to include persons presently alive, but not yet of working age, in the calculation. In this case, all present and future taxes to be paid by persons presently alive (even if not yet working) are necessarily paid out as retirement benefits to persons presently alive. Persons presently alive will also receive additional retirement benefits from persons yet unborn, however, so that the present value of all the benefits less taxes expected by those presently alive must be positive.

security approaches infinity, the winners from privatization remain unable to compensate the losers.

Except for poorly managed public programs, introducing administrative costs into the analysis is unlikely to change this conclusion. Actual administrative costs in the present Social Security program are quite small relative to tax receipts and benefit outlays. In 1990, for example, administrative expenses for the OASI program were reported as less than one percent of either contributions or benefits.<sup>31</sup> Administrative costs and operating expenses in the private insurance industry are likely to be higher, reflecting marketing costs, the problem of adverse selection, and the inability to exploit the economies of scale enjoyed by a compulsory, nearly universal, public program. As one illustration, operating expenses for U.S. life insurance companies in 1989 averaged 16.8 percent of policy premiums and 13.8 percent of benefit payments and other policy outlays.<sup>32</sup> As another illustration, administrative costs in multi-employer pension plans averaged 7.8 percent of contributions in 1985; these costs ranged from 23.1 percent of contributions for the smallest plan size class to 6.1 percent for plans with \$20 million or more in contributions, clearly illustrating the effect of economies of scale. Administrative costs tended to be lower for defined contribution plans than for defined benefit plans; the average administrative cost rate for defined contribution plans was 4.0 percent in

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<sup>31</sup>Of course, these administrative costs do not include the associated costs incurred by employers, the self-employed, and the Department of the Treasury in their transactions with the OASI program. While it is difficult to estimate the relative importance of these associated costs, their inclusion is unlikely to change the conclusions reached in the text, because the case for the Pareto optimality of the existing Social Security program is so strong.

<sup>32</sup>See American Council of Life Insurance [1990].

1985, ranging from 10.5 percent for the smallest plan size class to 1.8 percent for one of the largest plan size classes.<sup>33</sup>

While administrative costs for pension plans are higher than they would otherwise be because of government-imposed regulations, similar regulations would presumably be required if Social Security were privatized. The alternative to regulation is increased expenses for rescuing failed plans or covering the basic needs of those who, either personally or through agents, invested unwisely.

The simple net social security wealth measure used thus far to identify the value to each participant of continuing the program must be modified slightly when administrative costs are introduced. Because expected social security benefits and taxes appear directly in the measure, the administrative costs of the social security program are already implicitly incorporated; i.e., expected benefits are already reduced by these administrative costs. The expected administrative expenses of the private alternative can also be incorporated into the measure by adding them to expected social security benefits in each period; i.e., the administrative costs of the alternative private program can be avoided by continuing the present public program, and therefore represent a benefit of continuing the present program when comparing the two alternatives. Using the interest rate available in the private alternative to discount these avoided private administrative costs along with the expected social security taxes and benefits, then, provides a single measure for establishing the present value of the social security program relative to the private alternative.

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<sup>33</sup>These data for administrative costs in multi-employer pension plans are taken from Appendix Table G4 in Turner and Beller [1989].

If administrative costs are identical under both alternatives, then the analysis and conclusions are the same as those reached in the case of zero administrative costs; i.e., social security benefits are reduced by the public administrative costs but then increased by the same absolute amount to reflect avoided private administrative costs. In this case, then, the winners from privatization would be unable to compensate the losers, even if the interest rate available privately were close to infinite. If public administrative costs are less than private costs, the conclusion that the public program is Pareto optimal is even stronger. If public administrative costs are higher than private administrative costs, however, the theoretical possibility emerges that privatization may be Pareto superior to social security.

This case is unlikely to be of practical significance for several reasons. As indicated above, a compulsory, universal, public program tends to have a lower administrative cost rate than private alternatives due to economies of scale and the absence of marketing costs and adverse selection. Moreover, the conclusion that the current winners from privatization would be unable to compensate the current losers remains unaltered for reasonable market interest rates even if the administrative costs of the private alternative are assumed to be much lower than for the public alternative. This result obtains because the relatively small administrative costs experienced in the U.S. program are overwhelmed in the calculation of aggregate net social security wealth by the magnitude of the benefits that will be paid to those presently of working age or older by those not yet of working age.

For example, one estimate of aggregate net social security (OASI) wealth at the end of 1990 for persons of working age and older is \$6311 billion.<sup>34</sup> In order to generate a zero or negative aggregate net OASI wealth estimate at an even remotely plausible private rate of return, private administrative costs must be assumed to be zero; for example, a zero net OASI wealth estimate can be generated using a private real rate of return of about 11 percent if zero private administrative costs are also assumed. But 11 percent is on the high side of estimates for the sustainable real rate of return to capital,<sup>35</sup> and zero administrative costs for the private alternative are clearly unrealistic. Small increases in the assumed private administrative cost rate cause the discount rate required to generate a zero aggregate net OASI wealth estimate to increase rapidly. For example, if private administrative costs as low as 0.1 percent of benefits are assumed, the aggregate net social security wealth estimate remains positive for discount rates as high as about 15 percent; the wealth estimate remains positive for discount rates as high as about 35 percent if private administrative costs of 0.2 percent of benefits are assumed. If private administrative costs equal to 0.3 percent of benefits are assumed, the aggregate net OASI wealth estimate remains positive even if the privately available rate of return is assumed to be infinite.

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<sup>34</sup>This estimate, which implicitly incorporates the administrative costs of the OASI program, is derived from projections of future OASI taxes and benefits for participants of the program in 1990 under the intermediate (II-B) assumptions of the 1990 Trustees' Report (Board of Trustees [1990]). After an initial transition period, the real discount rate used in deriving this estimate is projected to fall to 2.0 percent by the year 2000.

<sup>35</sup>By way of comparison, the average of the inflation-adjusted annual total yields on common stocks over the period 1929-88, for example, was 7.6 percent (Ibbotson Associates [1989]). The average of the nominal after-tax rates of return to capital estimated by Fraumeni and Jorgenson [1980] for the private national economy over the period 1948-76 was 7.1 percent; rough adjustments of the Fraumeni/Jorgenson annual nominal after-tax estimates to account for inflation and taxes suggest that the corresponding estimate of the average real before-tax rate of return to capital remains below the required 11 percent for reasonable tax rate assumptions.



Moreover, this example is biased in favor of the private alternative, because of the effect of the projected OASI trust fund buildup. All of the costs of the projected buildup are included in the net OASI wealth calculation, in the form of higher taxes, while most of the economic returns are not; i.e., only the relatively small returns to trust fund assets are reflected in the net OASI wealth measure, while the full increment to output occasioned by the increase in government saving is not. Incorporating these latter returns into the calculation (or making the calculation for a strict pay-as-you-go program) would further strengthen the conclusion that the current winners from privatization would be unable to compensate the current losers.

This example illustrates the improbability that privatization would enable current workers to both fund without loss their own retirements as well as honor the retirement income rights already established under an existing pay-as-you-go program, even if administrative costs under the existing program far exceed those under the private alternative. Such an administrative cost differential, however, in conjunction with debt financing of the unfunded liability of the existing program, would permit future cohorts to eventually retire this debt without loss and to subsequently gain from the higher rate of return assumed for the private alternative. From the perspective of all present and future cohorts, then, establishing the Pareto optimality of an existing pay-as-you-go social security program requires that administrative costs under the public program not exceed those under the private alternative. As noted above, this condition is likely to be met because of the advantages of economies of scale, avoidance of adverse selection, and absence of marketing costs enjoyed by a compulsory, nearly universal, public program.

This discussion leaves open the possibility that the privatization of poorly managed social security programs may be Pareto superior. Of course, better public management of such

programs would also be Pareto superior, and the preceding discussion suggests the likelihood that improvements in public management could then eliminate the Pareto superiority of all private alternatives.

The conclusion that the winners from privatization would not be able to compensate the losers might not hold for *ex ante* evaluations if different individuals have different perceptions of future taxes and benefits or if social security wealth perceptions are formed in different ways, possibly with different survival probabilities, uncertainty adjustments, discount rates, or perception algorithms. From an *ex ante* perspective, then, a more robust statement of the general conclusion is that no privatization scheme can be found in which the winners are able to compensate the losers, as long as both winners and losers use measures of social security wealth that are rational and consistent across individuals. From an *ex post* perspective, the previous discussion demonstrates that privatization will necessarily disadvantage some cohorts, whether or not they correctly perceive this outcome.

We cannot advantage future cohorts by moving to a private (or funded) system, then, without disadvantaging some present cohorts; i.e., the loss to the losers necessarily exceeds the gain to the winners. This conclusion was reached by noting that the present value of continuing

the social security program is positive when summed over all current participants.<sup>36</sup> This present value calculation assumes that wage rates and interest rates are not affected by any additional capital formation occasioned by the privatization of the social security program. When this assumption is relaxed, the present value measure no longer suffices, because it fails to capture all of the economic effects associated with privatization.

Even in this context, however, relatively simple analysis can establish the likely Pareto optimality of existing, pay-as-you-go social security programs. We have already established that, unless public dissaving is increased, young cohorts must forego some consumption, at least initially, in order to provide for the retirement income of previous cohorts as well as provide for at least part of their own retirement through increased saving. The question remains whether these young cohorts might somehow be able to maintain or even increase their lifetime consumption and utility because of the anticipated increases in the capital stock, wage levels, and the rate of economic growth arising from privatization.

A small increment to the capital stock, such as might be occasioned by the increased saving of one individual, should have no discernable effect on the wage rate or rate of return to capital.

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<sup>36</sup>By itself, this result implies that at least some current cohorts would be worse off under privatization unless new public debt is created to compensate the holders of net social security wealth. Townley [1981] argues incorrectly that this debt could be gradually retired over time without making any future cohorts worse off by merely taxing away the gains that future cohorts would otherwise experience as a result of the privatization. As noted earlier in the discussion of the effect of privatization on national saving, these gains to future cohorts must be taxed away to avoid a reduction in national saving, but these tax revenues are just sufficient to keep the privatization debt accumulating at the same rate as would have the unfunded liability of the social security program. The privatization debt cannot be retired at a faster rate without reducing the lifetime consumption of then current cohorts. Retiring the debt at a slower rate would increase the lifetime consumption of then current cohorts at the expense of later cohorts. In short, no cohort can gain except at the expense of some other cohort.

Consequently, the present value of the returns from this saving exactly offsets the initial foregone consumption, leaving the present value of potential lifetime consumption unchanged. This result must be modified for large increments to the capital stock, such as might result from the increased saving of many individuals under privatization. Large increments will incur diminishing returns to capital when brought into production with a fixed supply of labor, and the rate of return to capital will fall.<sup>37</sup> For simplicity, suppose that capital were able to capture all of the increment to output associated with the increment to the capital stock. Because current present values must now be calculated using the new, lower, rate of return, the present value of the returns from the increased saving will still equal the initial foregone consumption, by definition. In terms of the desired balance between consumption and saving, however, individuals were not initially in equilibrium at the lower rate of return. Evaluated at the original rate of return, at which individuals were in equilibrium, the present value of the returns falls short of the initial foregone consumption; i.e., the present value of potential lifetime consumption is smaller.<sup>38</sup>

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<sup>37</sup>The expression "diminishing returns" is used to refer to the diminishing *marginal* returns that one factor of production encounters when all other factors are held constant. The discussion in the text is consistent with the conceptualization of a simple, two-factor, neoclassical production process where both the capital and labor factors exhibit diminishing marginal returns. The discussion also assumes that, except where indicated otherwise for expositional purposes, these marginal returns determine the rate at which each factor is paid and that these factor payments exhaust output.

<sup>38</sup>For simplicity, this discussion refers to only two interest rates, the original rate and a second, lower, rate resulting from the increase in the capital stock. In fact, each alternative is associated with a time series of projected rates of return. More generally, then, the increase in the capital stock will cause the second time series of rates of return to fall below the original time series. This complication has no effect on the conclusion.

There will also be real redistributive effects between cohorts. For example, labor will capture some of the increment to output resulting from the increment to the capital stock, resulting in a further reduction in the rate of return to capital. Other cohorts besides the cohorts making the original consumption sacrifice, then, will capture much of this incremental return to labor. As such, when evaluated at the original rate of return to capital, the present value of the total returns captured by the cohorts making the original consumption sacrifice necessarily falls short of the foregone consumption as long as labor supply remains fixed; i.e., the present value of potential lifetime consumption necessarily falls for these cohorts when evaluated at the rate of return at which their consumption and saving decisions were originally in equilibrium.

The case can also be made directly in terms of lifetime utility. Even if diminishing returns did not set in, and even if these cohorts were able to capture all of the returns from their initial consumption sacrifice, it is clear that their perceived (*ex ante*) lifetime utility would not be increased by forcing this initial increase in saving.<sup>39</sup> These cohorts are presumably already maximizing their lifetime utility by their current consumption, labor supply, and saving decisions, given their own preferences and market wage rates and rates of return. Forcing them to alter these decisions cannot increase, and would generally decrease, their perceived lifetime utility. The case is made stronger by the recognition that the returns to these cohorts would be even smaller than just described, because of the diminishing returns to capital and the capture of much of the increment to output by other cohorts in the form of higher wages.

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<sup>39</sup>The consumption sacrifice assumed to result from privatization implies an associated "forced" increase in private or public saving. The discussion in the text applies directly for forced increases in private saving, but can be extended to forced increases in public saving if efficient political markets are assumed.

This conclusion is unlikely to be reversed in an *ex post* evaluation or, equivalently, in an *ex ante* evaluation where cohort members act collectively, aware that their collective action would lower interest rates and raise wage rates. If labor supply is fixed, a forced or collective increase in saving cannot increase lifetime utility in either an *ex ante* or *ex post* sense as long as the relevant utility and production functions are concave<sup>40</sup> in their arguments. The concavity of the utility function forces a reduction in lifetime utility as current consumption is traded for future consumption at the current market rate of interest. In the forced and collective action cases, lifetime utility is further eroded by the concavity of the production function, which degrades the terms of trade between current and future consumption and permits other cohorts to capture some of the returns from the increased saving in the form of higher wages.<sup>41</sup>

Even in the context of variable labor supply, it appears unlikely that a forced increase in saving would increase lifetime utility in an *ex post* or collective *ex ante* evaluation, in part because labor supply tends to be relatively inelastic and in part because the associated reduction in the interest rate tends to favor an increase, rather than decrease, in current consumption when labor supply is inelastic. Coupled with diminishing returns and the inability of these cohorts to

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<sup>40</sup>A utility function is described as "concave" when each of its arguments, such as consumption in each period, exhibits diminishing marginal utility; e.g., holding consumption in all other periods constant, each additional unit of consumption in a given period results in successively smaller increments to utility. Similarly, a production function is described as "concave" when each of its arguments or factors of production, such as capital and labor, exhibits diminishing marginal returns when all other factors are held constant.

<sup>41</sup>This conclusion holds even if an attempt is made at maintaining the lifetime utility of each cohort via compensation from subsequent cohorts. Rather than diminishing over time, the required compensation grows without bounds under normal circumstances until it is no longer sustainable. See Leimer [1991 (A)] for a mathematical demonstration of this result in the context of a simple closed economy with overlapping generations and general assumptions about the utility, production, and distribution functions.

capture all of the returns from an initial consumption sacrifice, these effects reinforce the expectation of a reduction in lifetime utility for the cohorts forced to increase their saving.

#### **IV. Simulating the Effects of Two Stylized Privatization Schemes.**

This section uses an economic projection model to illustrate the effect of two stylized privatization plans on the lifetime consumption and economic well-being of present and future cohorts.<sup>42</sup> The model used in these simulations is a long-run growth model of the U.S. economy and its interrelationships with the OASI program. The model was developed to analyze the potential equity and efficiency implications of social security policy in the long run. The model projects demographic and economic variables of interest, including population, labor supply, earnings, private consumption and transfers, OASI taxes and transfers, other government taxes and transfers, wages, prices, and rates of return to various asset types. Where appropriate, the variables are disaggregated by age, allowing the model to incorporate age-specific behavioral effects and to identify the differential treatment of successive cohorts under alternative social security policies.

While fertility rates, labor force participation rates, and OASI retirement rates are exogenous to the model, individual consumption and private transfers are endogenous; they are determined in the simulations by equations that are derived from a standard model of life cycle consumption and bequests. For the simulations presented in this paper, individuals are assumed

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<sup>42</sup>This discussion reinforces the theoretical conclusions reached in previous sections and illustrates some of the implementation difficulties associated with particular privatization plans. Readers not interested in specific examples may skip this section.

to apply a relatively high subjective discount rate<sup>43</sup> to prospective after-tax labor income, public transfers, and private transfers in forming their perceptions of their lifetime wealth available for consumption and bequests. Under this assumption, age-specific consumption functions were estimated from cross-section data and incorporated into the simulation model. As estimated, changes in net OASI wealth affect private consumption to the same degree as do other forms of prospective wealth. The model adopts a neoclassical description of the growth and distribution of output; a relatively detailed social security sector determines OASI taxes and benefits; and a less detailed module determines other government taxes and transfers, including taxes on OASI benefits. A more complete description of the model is provided in Leimer [1991 (C)].

The first privatization plan considered in these simulations effects privatization gradually, by imposing a pre-announced reduction in OASI benefit awards of 5 percent per year, beginning in the year 2000; once beneficiaries are on the rolls, their real benefit levels are maintained by annual inflation adjustments. The reductions in total benefit costs under this plan are reflected in commensurate decreases in OASI payroll taxes. As such, the size of the program gradually diminishes over time, so that tax receipts fall to less than 1 percent of taxable payroll by the year 2065.

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<sup>43</sup>In the simulations, this (*ex ante*) subjective discount rate is assumed to respond over time to changes in the rate of return to capital; except for an initial adjustment period, when the model transits to a long run growth path, the subjective discount rates applied to prospective wealth remain slightly above the after-tax rate of return to capital. A relatively high subjective discount rate was chosen to reduce differences between the *ex ante* and *ex post* evaluations of each cohort's consumption wealth, since, as discussed below, the (*ex post*) market rate of return facing individuals in the simulations is a composite rate close to the rate of return to capital. Under this assumption, then, individuals' *ex ante* evaluations of their consumption wealth turn out to be reasonably realistic.



The second plan effects privatization instantaneously in the year 2000, abolishing the OASI program and "buying out" all of the then current holders of net OASI wealth. Net OASI wealth holdings are established under the buyout plan by discounting projected future taxes and benefits at the (before-tax) rate of return earned by the OASI trust fund. Under this discount rate assumption, all participating cohorts receive positive buyout amounts in the simulation.

Both plans are assumed to be announced in 1995, at which point individuals are free to respond in any way they deem appropriate; i.e., neither plan invokes a mandatory alternative private saving scheme, and individuals are assumed to enjoy full freedom of choice regarding their retirement saving responses. From a financial perspective, these simulations are biased in favor of the privatization alternatives, because zero administrative costs are implicitly assumed for managing the increased private saving that ensues under the plans. Because of its long-run focus, the simulation model also ignores the previously-discussed differences in intertemporal risk between the pay-as-you-go financing method and investment in capital; in particular, the business cycle is not modeled, and the internal rate of return to social security is implicitly compared to a composite rate over all assets that is close to the rate of return to capital. In addition, individual aversion to such risk is not captured in the relative lifetime utility comparisons presented below. On the other hand, any utility gained specifically from the greater freedom of choice in retirement planning under the privatization alternatives (or from any perceived political advantages of the public program) is also excluded from the lifetime utility comparisons.

The simulations adopt a fiscal policy rule that ensures that the privatization plans result in an increase in private saving and that this increased saving is not canceled by offsetting changes

in the other government (non-OASI) deficit. Specifically, the simulations adjust other government taxes over time in an effort to maintain the other government deficit within a relatively narrow range (2.5-3.0 percent) as a proportion of gross national product; i.e., in each simulation year that the other government deficit falls outside of this range, a tax increase or decrease, as appropriate, is instituted for subsequent years.<sup>44</sup>

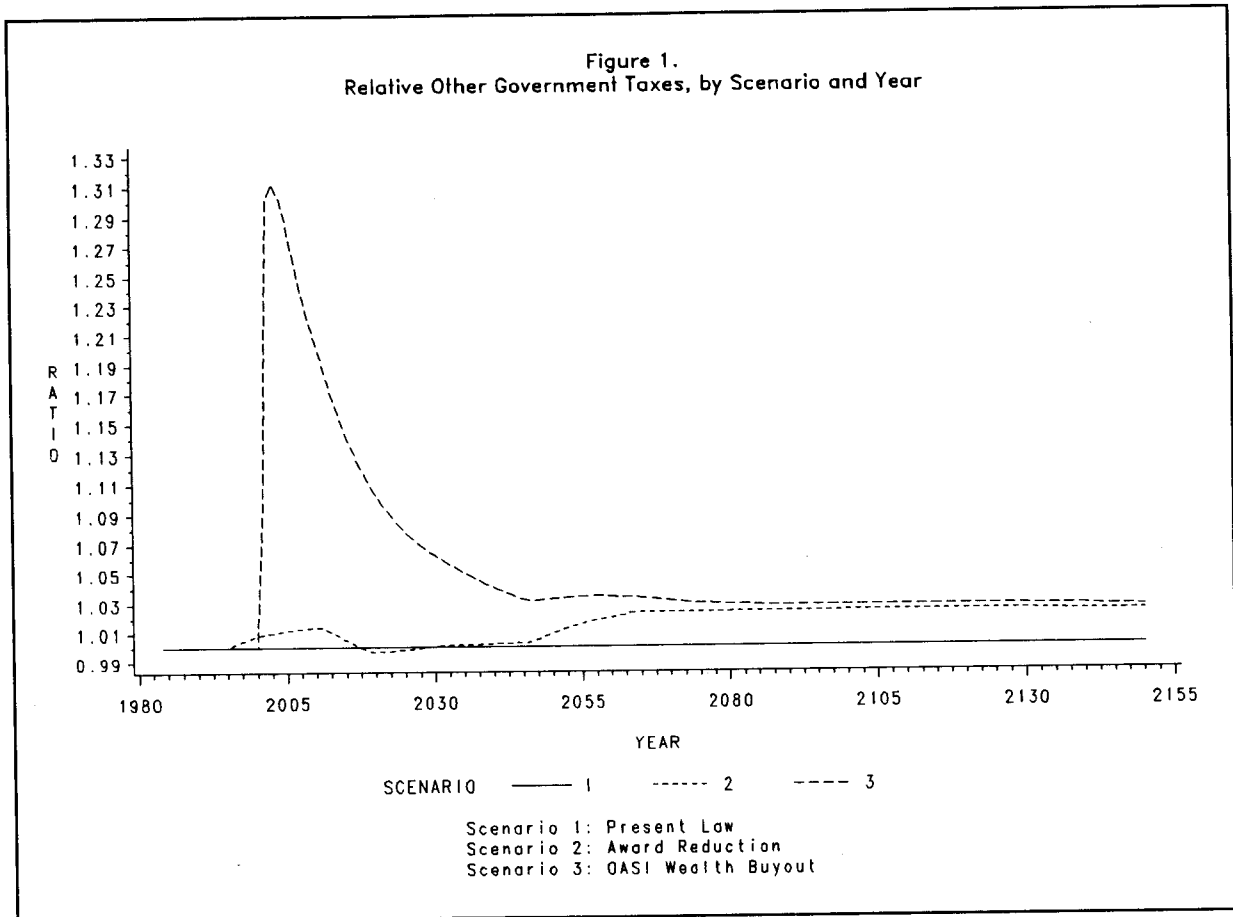
The effect of this assumption is illustrated in Figure 1, which shows other government taxes under the two privatization scenarios relative to the "present law" scenario. Various simulation parameters were adjusted to bring the results of the present law simulation into general consistency with the intermediate (II-B) assumptions of the annual Trustees' report for recent years.<sup>45</sup> The present law scenario differs from the Trustees' projections, however, by assuming a sizeable increase in the OASI payroll tax rate (to a combined 14.27 percent of taxable payroll) in the year 2062. This increase is required as the program returns to pay-as-you-go financing after the drawdown of the trust fund during the retirement years of the baby boom. For consistency, the same fiscal policy rule adopted for the two privatization plans is also adopted for the present law scenario. All simulation parameters except those defining the social security policy alternatives are identical in the three simulations.

Of particular interest in Figure 1 is the sharp increase in other government taxes under the OASI wealth buyout scenario shortly after the buyout takes place. As interest charges from the

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<sup>44</sup>Technically, the other government deficit should remain equal in absolute terms under the privatization scenarios to ensure that the full increase in private saving is carried over into national saving. Maintaining the other government deficit as a proportion of output seems more realistic, however, and suffices in these examples to generate increases in national saving.

<sup>45</sup>For example, see Board of Trustees [1990].

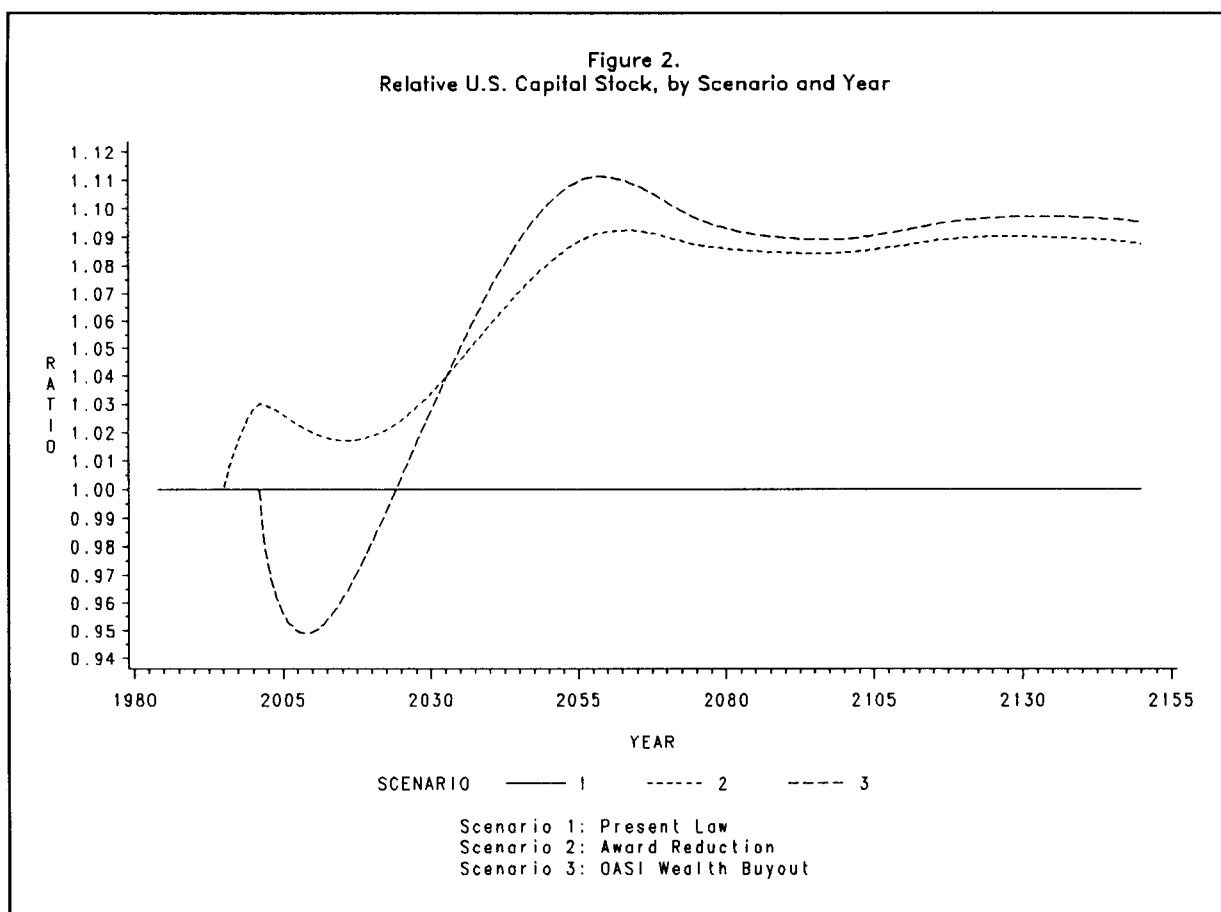


newly issued buyout debt begin to accrue in the other government account, this tax increase reflects the fiscal policy adjustments designed to maintain the other government deficit within its assumed bounds. As indicated in the previous discussion, this particular fiscal policy rule results in increased private saving under the buyout scenario, because the buyout debt interest is not allowed to accumulate over time. In effect, the interest on the buyout debt is taxed away by the increases in other government taxes, reducing the lifetime resources of buyout participants, as compared with the present law scenario. In fact, the simulated operation of the fiscal policy rule results in a higher personal income tax rate under the buyout scenario than under the present law scenario for nearly the entire simulation period. As a consequence, the

initial buyout debt is eventually retired completely, and other government debt under the buyout scenario even falls below that simulated under the present law scenario by the year 2100. The diminution of the buyout debt principal, coupled with the higher growth in output under the buyout scenario for most of the simulation period, allows the required other government tax rate to fall gradually over time. For the most part, the higher level of other government taxes in the most distant simulation years under both privatization scenarios reflects the higher income levels generated under those scenarios, compared to the present law scenario, although other government tax rates in both privatization scenarios remain slightly above those in the present law scenario.

The effects of the two privatization plans on the aggregate capital stock are illustrated in Figure 2, which shows the simulated stock under each privatization scenario relative to the present law scenario. The capital stock begins to increase immediately under the award reduction scenario, as OASI taxpayers perceive a reduction in their net OASI wealth upon the announcement of the plan. As discussed above, the announced reductions in future benefits are not fully offset by the corresponding reductions in future OASI taxes for these workers; i.e., some of the future tax reductions accrue to younger cohorts not yet participating in the program at the time of the reductions. Because the award and tax reductions continue over time, each tax payment, while at a lower rate than the previous year's, is still larger than would be consistent with the expected benefit under a pay-as-you-go program. Consequently, even cohorts entering the OASI program as taxpayers for some time after the start of the privatization plan will suffer losses in lifetime net OASI wealth. These losses in net OASI wealth are translated

into reductions in lifetime consumption for these cohorts. The corresponding increases in saving, then, result in a larger capital stock under the award reduction scenario.



The relatively high subjective discount rate at which consumers are assumed to discount future OASI taxes and benefits causes the local peak that occurs in the relative capital stock curve for the award reduction scenario in 2000, when the plan is actually put into effect. This relatively high discount rate places greater focus on the immediate OASI tax reductions and less on the future benefit reductions. When the tax cuts are actually implemented, then, some workers increase consumption, causing the subsequent local trough in the aggregate curve.

These cohorts must later decrease their consumption, of course, as their horizon shrinks and the discount rate has less effect.

In contrast to the immediate effect of the award reduction plan announcement on individual consumption, the effect of the OASI wealth buyout plan on the capital stock is not realized until the plan is actually put into effect in the year 2000. This delay is due to the way that perceived other government tax liabilities are implemented in the simulation model; in particular, the simulations assume that other government tax changes are not perceived by consumers until they go into effect.<sup>46</sup> As modeled, this plan initially causes an increase in aggregate consumption and a reduction in the capital stock. This initial effect occurs because the net OASI wealth buyout amounts are calculated using the before-tax rate of return earned by the OASI trust fund. This rate is considerably lower than the rate at which individuals are assumed to discount expected taxes and benefits when forming their perceptions of their own net OASI wealth. As a result, the buyout actually increases the perceived wealth of the buyout participants, and they respond by increasing their consumption initially.<sup>47</sup> As the other government tax increases required to service the interest on the increased public debt kick in, consumers adjust their prospective wealth perceptions fairly quickly and begin to consume less, eventually bringing the capital stock to levels well above those projected for the present law scenario and above those projected for the award reduction scenario as well.

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<sup>46</sup>While many of these characteristics of the simulations may be unrealistic to some degree, they have no effect on the general conclusions.

<sup>47</sup>This result illustrates some of the practical difficulties that would be encountered in the design of a "buyout" privatization plan. Differences between the discount rates applicable to the trust fund and individuals, for example, can create unintended changes in economic behavior and perceived instances of unfair treatment, such as the "notch" problem discussed below.

The net effect of each privatization plan on the simulated lifetime utility of individual cohorts is shown in Figure 3, where each curve depicts the lifetime utility of each cohort per initial cohort member under the corresponding scenario relative to the present law scenario.<sup>48</sup> The utility function used to evaluate the lifetime consumption and bequests of each cohort under these simulations is consistent with the consumption function incorporated into the simulation model; the parameters of the utility function were estimated empirically as part of the estimation of the consumption function parameters.<sup>49</sup> Because the utility function specification is arbitrary, however, the scale of the vertical axis in Figure 3 is not of particular relevance—alternative proportions could be achieved by arbitrary transformations of the utility function. The point here is simply to illustrate the potential effect of the alternative plans on the economic well-being of the affected cohorts. The utility calculations for the earliest cohorts

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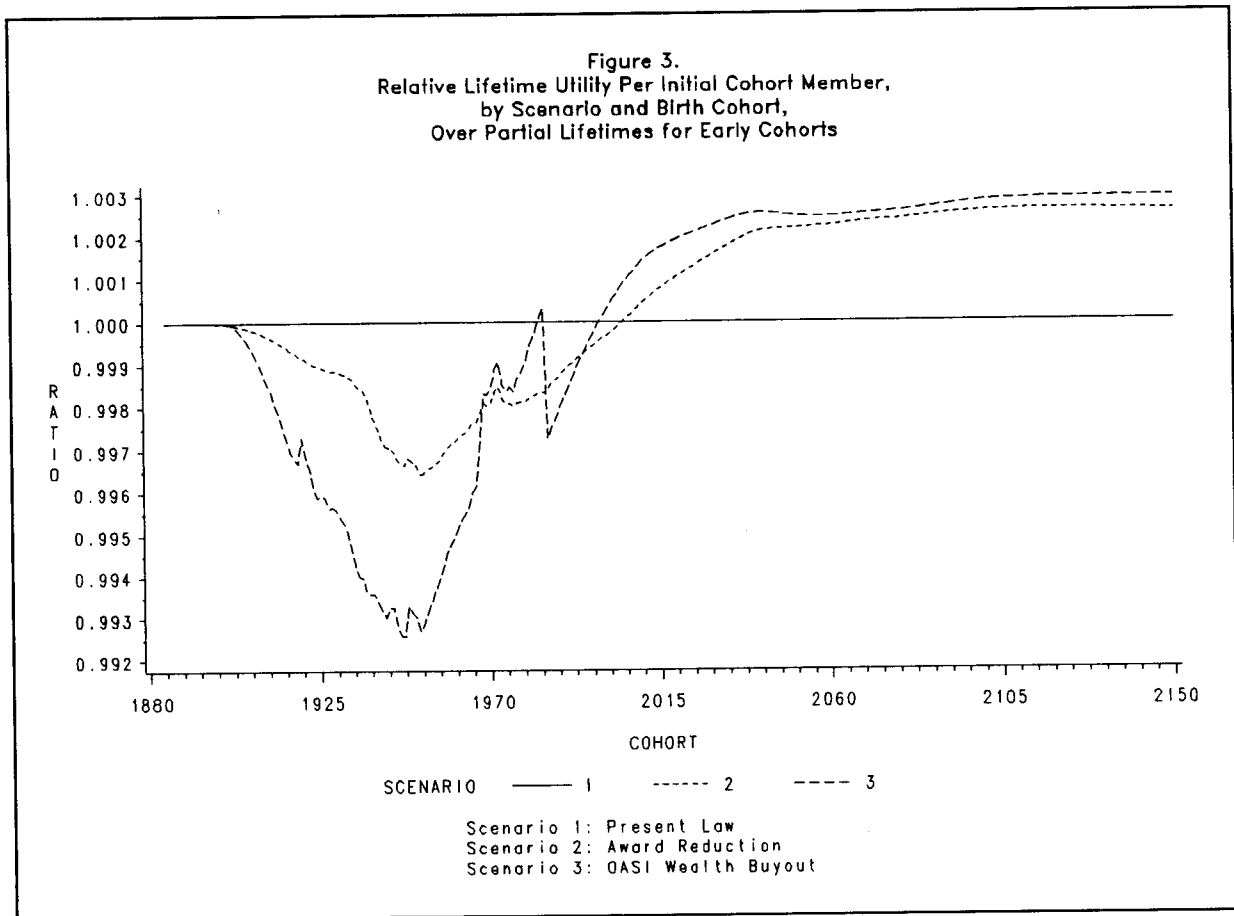
<sup>48</sup>For cohorts born before the start of the simulation (1984), "initial cohort members" refers to those members of the original birth cohort still alive at the start of the simulation. For cohorts born after the start of the simulation, "initial cohort members" refers to all members of the original birth cohort. Since the number of initial cohort members does not differ across scenarios, each curve in Figure 3 could also be described as simply depicting lifetime utility for each cohort under a particular scenario relative to the present law scenario.

<sup>49</sup>For each cohort, the utility function is assumed to be of the form

$$U_t = \sum_{i=B}^D S_{B,i} (1+\rho)^{B-i} \ln c_i + \alpha \sum_{i=B}^D d_{B,i} \ln b_i ,$$

where  $U_t$  is expected lifetime utility for a member of the birth cohort born in year  $t$ ;  $B$  is the first simulation age for this cohort (age 0 or age in the simulation start year if born prior to that year);  $D$  is the last simulation age for each cohort (age 100);  $S_{B,i}$  is the probability of surviving from age  $B$  to age  $i$  for members of this cohort;  $\rho$  is the time preference rate, assumed constant over the life cycle;  $c_i$  is consumption per surviving member of this cohort at age  $i$ ;  $\alpha$  is the relative bequest preference parameter, assumed constant across all ages;  $d_{B,i}$  is the probability for this cohort of dying at age  $i$ , given survival to age  $B$ ; and  $b_i$  is the bequest per member of this cohort who dies at age  $i$ . The evaluation of simulation outcomes in Figure 3 makes use of simulated *ex post* values for the mortality, consumption, and bequest experience of each cohort.

(born from 1884 to 1983) shown in Figure 3 cover only that part of their lifetimes that was actually simulated (1984 until death).<sup>50</sup>



Although the simulation results depend to some extent on the particular implementation of the underlying simulation model, both plans, as expected, reduce the lifetime utility of the cohorts participating in the OASI program at the time that the plans were instituted. Lifetime utility for these cohorts declines, because the privatization plans reduce the amount of wealth available for their lifetime consumption. As a consequence, national saving and capital

<sup>50</sup>Although the start of the simulation period is 1984, historical data are used to provide controls for many of the variables over the period 1984-88.



formation increase, affording subsequent cohorts with larger lifetime incomes, consumption, and utility.

The loss in relative lifetime utility for the earliest cohorts is more severe under the OASI wealth buyout plan than under the award reduction plan. As discussed above, this is not a necessary consequence of a buyout plan compared to an award reduction plan. In these simulations, the greater loss in relative lifetime utility under the buyout plan arises because of the heavy other government tax increases instituted under the adopted fiscal policy rule, leading to a more than full repayment of the OASI buyout debt. In contrast, the gradual nature of the phased reductions in awards under the award reduction plan leaves a small unfunded liability for the OASI program even at the end of the simulation period, and the application of the fiscal policy rule leaves the outstanding other government debt about 7 percent higher under the award reduction scenario than under the present law scenario at the end of the simulation period. Consequently, outstanding government liabilities are substantially larger under the award reduction scenario than under the net OASI wealth buyout scenario at the end of the simulation period. As indicated above, these relative outcomes could be altered by simply choosing alternative fiscal policy rules.

As illustrated in Figure 3, the baby boom cohorts born around 1945-55 are affected most negatively in a relative sense under both privatization plans. These cohorts are aged 45-55, some 10 to 20 years from social security retirement, when the privatization plans are instituted. Although the cohorts just about to retire when the plans are instituted have the most to lose in terms of net OASI wealth holdings, these cohorts also have a shorter period of time over which the award reductions or other government tax increases can take effect. Somewhat younger

cohorts, then, will suffer bigger relative losses in lifetime incomes under the privatization plans than will the cohorts just about to retire when the plans take effect. Still younger cohorts, however, suffer smaller relative losses because they benefit more fully from the increases in the capital stock and because they have less accumulated net OASI wealth at stake, in the case of the award reduction plan, or because they receive generous buyout amounts to offset their increases other government tax liability, in the case of the OASI wealth buyout plan.

Evidence of these generous buyout amounts can be seen in the sharp "notch" observed in the relative lifetime utilities for the youngest cohorts receiving net OASI wealth buyout amounts (i.e., for the 1980-84 cohorts), as compared with the relative lifetime utilities of the immediately succeeding cohorts. This notch occurs because the youngest participating cohorts receive positive buyout amounts, despite the fact that their net OASI wealth holdings are actually negative when evaluated at either their subjective discount rate or at the rate assumed to represent their opportunity costs in these simulations.<sup>51</sup> Although subsequent cohorts are also relieved of their negative net OASI wealth holdings, they receive no positive buyout amount under our stylized buyout plan, because these cohorts are not yet participants in the OASI program at the time of the buyout.

To give a feel for the relative importance of the lifetime consumption differences implicit in Figure 3, the lifetime utility measure for each cohort under each scenario was converted to the constant real lifetime consumption stream that would generate the same lifetime utility,

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<sup>51</sup>Again, the differences in risk between the rate of return to capital and the internal rate of return to social security are ignored in these simulations, and the opportunity cost of funds to individuals is represented by a composite rate, close to the rate of return to capital, across all fungible assets.

assuming that the cohort makes zero bequests.<sup>52</sup> Relative to the present law scenario, the resultant constant lifetime consumption stream for the award reduction plan ranged from a reduction of 4.5 percent for the 1951 cohort to an increase of 2.8 percent for the 2150 cohort. The corresponding constant lifetime consumption stream for the OASI wealth buyout plan ranged from a reduction of 9.3 percent for the 1946 cohort to an increase of 3.1 percent for the 2150 cohort, relative to the present law scenario. These results suggest that both of these privatization plans have the potential for important effects on the lifetime consumption of affected cohorts.

## V. Conclusions.

The case made by privatization proponents sounds compelling on the surface. After all, if the rates of return available privately exceed those implicit in the social security program by a wide-enough margin, wouldn't workers be able to both fund at least part of their own retirements as well as honor the social security retirement income rights of preceding cohorts? Wouldn't privatization also lead to increases in private saving, earnings, and output, further strengthening the conclusion that all cohorts could benefit? The discussion in this paper suggests that this outcome is unlikely.

First, it not clear that private rates of return exceed those implicit in the Social Security program when risk and liquidity are taken into account. It is also not clear that privatization

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<sup>52</sup>That is, the lifetime utility measure  $U_t$  calculated for each cohort, the survival probabilities  $S_{B,i}$  for that cohort, and the time preference rate  $\rho$ , as defined in the earlier footnote, were used to solve for the equivalent constant lifetime consumption stream  $c_t$  in the equation

$$U_t = \ln c_t \sum_{i=B}^D S_{B,i} (1+\rho)^{B-i}.$$

would lead to an increase in national saving. Even if one grants both of these claims, however, it can still be shown that an existing, well-managed, pay-as-you-go social security program is Pareto optimal so long as factor prices can be treated as exogenous. No privatization scheme can be found that benefits at least one present or future cohort without harming at least one other cohort, and no scheme can be found that allows the winners from privatization to compensate the losers and still come out ahead. This conclusion also holds under the assumptions of endogenous factor prices and fixed labor supply. Even in the most general case, with endogenous factor prices and variable labor supply, it appears that a forced increase in saving associated with privatization would decrease the lifetime utility of at least some cohorts except in unusual circumstances. These conclusions are not limited to the specific privatization plans considered in this paper, but apply to all possible plans.

These conclusions suggest the fallacy of one of the rationales often cited for privatization—that it can somehow benefit all cohorts because privately available rates of return exceed those implicit in the Social Security program or because of the increases in private saving that privatization would induce. In fact, privatization appears to involve inevitable costs to some cohorts if other cohorts are to benefit. Moreover, privatization holds no special advantage over more conventional fiscal policy or private saving incentives as a means to increase national saving. Indeed, these other policy alternatives appear to hold the advantages of greater certainty and potency in effect and greater divisibility in scale.

These results do not imply, of course, that privatization is necessarily undesirable. Other rationales for privatization, including greater freedom of choice for individuals in the provision of retirement income security or separation of the welfare and equity components of retirement

income transfers, are not addressed in this paper. Instead of focussing on insupportable claims that privatization would benefit all present and future cohorts, however, the privatization debate should be based on weighing these legitimate rationales against opposing rationales that favor the preservation of a public, pay-as-you-go, social security program.

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### Appendix. Social Security Wealth and Related Definitions.

This appendix provides mathematical definitions of net social security wealth and the internal rate of return to social security and relates these concepts to each other as well as to the associated concepts of accumulated taxes less benefits and the lifetime wealth increment from social security. These latter two concepts are not introduced in the text of this paper, but a discussion of their relationship to the concepts of net social security wealth and the internal rate of return may be illuminating to some readers.

#### Private Accumulation and Discount Factors.

Private accumulation and discount factors, based on the market interest rate used for comparison with social security, are used to derive the accumulated present value of past tax and benefit flows or the discounted present value of future tax and benefit flows. In general, let

$$(A1) \quad f_{t,v} = \begin{cases} \prod_{s=t}^{v-1} \left( \frac{1}{1+r_s} \right) & \text{for } t < v, \\ 1 & \text{for } t = v, \\ \prod_{s=v}^{t-1} (1+r_s) & \text{for } t > v, \end{cases}$$

where  $f_{t,v}$  represents the private accumulation or discount factor between periods  $t$  and  $v$ , and  $r_s$  represents the appropriate market interest rate applicable for period  $s$ . The accumulated present value in period  $t$  of a previous flow  $X_v$ , for example, is given by the expression

$$X_v f_{t,v} = X_v \prod_{s=v}^{t-1} (1+r_s),$$

since  $t > v$ . Similarly, the discounted present value in period  $t$  of an expected future flow  $X_v$  is given by the expression

$$X_v f_{t,v} = X_v \prod_{s=t}^{v-1} \left( \frac{1}{1 + r_s} \right),$$

since  $t < v$  in this case. If the market interest rate is constant over the period spanned by the accumulation or discount factor, equation (A1) simplifies to

$$(A2) \quad f_{t,v} = (1 + r)^{t-v},$$

where  $r_s = r$  for all applicable  $s$ .

### Net Social Security Wealth.

Net social security wealth is simply the present value of expected future social security benefits less taxes. For a given individual or birth cohort, then, net social security wealth in a given period  $t$  can be represented mathematically as

$$(A3) \quad SSW_t = \sum_{v=t}^D (B_v - T_v) f_{t,v},$$

where  $B_v$  and  $T_v$  represent expected future benefits and taxes, respectively, for the individual or cohort, as appropriate, in period  $v$ , and  $D$  represents the last period of expected benefits or taxes for the individual or cohort. Expected future benefits and taxes depend not only on the anticipated tax payments and benefit receipts themselves, but also on the perceived probability that these flows will be realized; consequently, survival probabilities are typically introduced into the definition of social security wealth in addition to the anticipated values of the benefits and taxes.

### Accumulated Taxes Less Benefits.

Although not introduced in the main text of this paper, the concept of accumulated taxes less benefits is a useful concept in understanding the related concept of social security wealth. While social security wealth is a prospective measure, based entirely on expected future benefits and taxes, accumulated taxes less benefits is a historical measure, based entirely on past taxes and benefits. As the name implies, accumulated taxes less benefits in a given period  $t$  can be represented mathematically as

$$(A4) \quad ATLB_t = \sum_{v=E}^{t-1} (T_v - B_v) f_{t,v} ,$$

where  $E$  represents the first period of the life cycle for the individual or cohort, as appropriate.

### Lifetime Wealth Increment.

Another concept related to social security wealth is the lifetime wealth increment. Evaluated as of a given point in time, this measure indicates the expected net increment to the lifetime wealth of an individual or cohort, as appropriate, resulting from lifetime social security tax payments and benefit receipts, both historical and prospective, as applicable. Specifically,

$$(A5) \quad LWI_t = \sum_{v=E}^D (B_v - T_v) f_{t,v} = f_{t,E} \sum_{v=E}^D (B_v - T_v) f_{E,v} ,$$

where  $LWI_t$  denotes the lifetime wealth increment as evaluated in period  $t$  for the individual or cohort, as appropriate, whose life cycle begins in period  $E$ . The expression after the second equal sign in equation (A5) indicates that the value of the lifetime wealth increment does not change over the life cycle if the benefit and tax flows that were expected in previous periods are actually realized as the life cycle of the individual or cohort unfolds, except for the effect of the

changing evaluation date  $t$  on the accumulation factor  $f_{t,E}$ . This characteristic is most relevant to the lifetime wealth increment experienced by a birth cohort; i.e., except for the accumulation factor  $f_{t,E}$ , the present value of a cohort's lifetime wealth increment remains constant over the life cycle of the cohort as long as market interest rates, mortality expectations, and the anticipated benefits and taxes per surviving cohort member are realized. In contrast, the lifetime wealth increment expected by individual *surviving* cohort members tends to change over the life cycle (in addition to the effect of the changing accumulation factor  $f_{t,E}$ ) as uncertain future taxes and benefits are systematically replaced by the corresponding certain past taxes and benefits; i.e., *ex ante* survival probabilities less than one are systematically replaced by *ex post* survival probabilities equal to one.

### Internal Rate of Return.

Given all past and expected social security taxes and benefits, the expected internal rate of return is defined as the constant interest rate  $r^I$  that satisfies the relationship

$$(A6) \quad \sum_{v=E}^D (B_v - T_v) (1 + r^I)^{t-v} = 0 \quad ;$$

i.e.,  $r^I$  is the interest rate that equates the present values of expected lifetime benefits and taxes for the individual or cohort, as appropriate. Note that if expected benefits and taxes are realized as the life cycle of the individual or cohort unfolds, the internal rate of return remains constant over the life cycle. As in the case of the lifetime wealth increment, this characteristic is more relevant to the internal rate of return expected by a birth cohort than it is for the rate expected by individual *surviving* members of the cohort.

### **Some Relationships.**

The first relationship of interest is that between the lifetime wealth increment, the market rate of interest, and the internal rate of return to social security. As defined in equation (46), the internal rate of return is the interest rate that equates the present values of expected lifetime benefits and taxes. In the special case where the market rate of interest used for comparison with social security is constant and equal to the internal rate of return, the lifetime wealth increment, as defined in equation (45), is equal to zero; in this case, lifetime wealth is unaffected by participation in social security. If the market rate of interest deviates from the internal rate of return, however, participation in social security will generally increase or decrease lifetime wealth.

The direction of the increment to lifetime wealth depends on the relationship between the market interest rate and the internal rate of return and can be determined by noting the pattern of taxes and benefits in a social security retirement program. Because the working life precedes the retirement period, tax payments on earnings for each individual generally precede benefit receipts, although a period of overlap may also occur. Because taxes generally precede benefits, an increase in the market interest rate, for example, has the effect of decreasing the present value of benefits in equation (45) relative to the present value of taxes, thereby decreasing the lifetime wealth increment measure. Analogously, a decrease in the market interest rate increases the present value of benefits relative to the present value of taxes, thereby increasing the lifetime wealth increment measure. If the market interest rate exceeds the internal rate of return in every period, then, the lifetime wealth increment measure will be negative, indicating that participation in social security results in a net loss in lifetime wealth. Conversely, if the market interest rate

is less than the internal rate of return in every period, the lifetime wealth increment measure will be positive, indicating that a net increase in lifetime wealth results from participation in the social security program.

A second relationship of interest is that between net social security wealth, accumulated taxes less benefits, and the lifetime wealth increment. Specifically, from (A3) through (A5),

$$\begin{aligned}
 (A7) \quad SSW_t &= \sum_{v=t}^D (B_v - T_v) f_{t,v} \\
 &= \sum_{v=E}^{t-1} (T_v - B_v) f_{t,v} + \sum_{v=E}^{t-1} (B_v - T_v) f_{t,v} + \sum_{v=t}^D (B_v - T_v) f_{t,v} \\
 &= \sum_{v=E}^{t-1} (T_v - B_v) f_{t,v} + \sum_{v=E}^D (B_v - T_v) f_{t,v} \\
 &= ATLB_t + LWI_t .
 \end{aligned}$$

Thus, net social security wealth can also be calculated by accumulating past social security taxes less benefits at the market rate of interest, and adjusting this sum by the increment to lifetime wealth that results from any difference between the internal rate of return to social security and the market rate of interest. If the market rate of interest is equal to the internal rate of return, then the lifetime wealth increment is zero, as noted above, and net social security wealth is simply equal to accumulated past taxes less benefits. If the market interest rate exceeds the internal rate of return in every period, then the lifetime wealth increment is negative, and net social security wealth falls short of accumulated past taxes less benefits. Conversely, if the internal rate of return exceeds the market interest rate in every period, then the resulting positive lifetime wealth increment causes net social security wealth to exceed the accumulated value of past taxes less benefits.