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Abstract

Social Justice in Social Security

A Plan B Paper
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Abstract

By the year 2030 there will be twice as many retirees in the United States as today but only 18 percent more workers. This aging of the population will place considerable financial strain on the United States social security system; relatively few workers will be taxes to pay the benefits of relatively many retirees. Because of this change in demographics, the Social Security Administration will not be able to pay scheduled social security benefits as outlined by current law. Therefore, it is imperative that the government act soon to address the looming fiscal imbalance of the social security program.

The Senate Aging Committee and the Government Accountability Office (GAO) both encourage Congress to take a Rawlsian perspective when evaluating social security reform measures that are intended to cope with changing demographics. In their estimation, a desirable reform should not only balance the budget, but it should also protect benefits for the economically vulnerable.

In this paper, I examine the relationship between John Rawls' theory of social justice and the US social security system. I then provide fifteen possible social security reforms that are consistent with Rawls' theory. I conclude with an analysis of the political feasibility of the various reforms considered. As a special example, the mathematical model used to generate the results for three of the reforms is included at the end of the paper.

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CHAPTER 1.

INTRODUCTION

The United States social security system is one of the largest social insurance programs in the world. Created during the Great Depression, social security has provided a safety net for elderly Americans and disabled workers for over 75 years. Currently, 53 million people receive social security benefits; over two-thirds of the recipients are retired workers and their dependents. "Social insurance programs play a major role in redistributing income; in maintaining the quality of life for the old, sick, disabled, and unemployed; and—arguably—in the United States [social security] does more directly to reduce poverty and inequality than any other government program, including all welfare programs combined and the various targeted deductions of the Federal tax code" (Paden, 1998, p.179).

In 2010, The Senate Special Committee on Aging reported, "44 percent of older Americans would be considered poor by federal standards if they did not receive Social Security benefits, and for the majority of retired Americans, Social Security serves as their primary source of income" (foreword p.v). "Social security is the main source of income for most retirees, providing over 80 percent of the cash income available to at least half of all elderly individuals and couples" (Burtless, 1997, p. 407). Robert M. Ball, while serving as the Social Security commissioner, proudly declared, social security is "America's most successful and—deservedly—most popular social program... No other program so clearly makes the Unites States a better and safer place" (as quoted by Gokhale, 2010, p.167).

Social security started out a relatively modest program that was funded with a 2 percent payroll tax. Congress has increased the generosity of the program by adding new benefits and indexing benefits to the consumer price index. Payroll taxes were increased to finance these changes. The size of social security, as a percentage of GDP, has increased from around 2 percent in 1962 to 4.8 percent in 2009. The program is expected to grow to 6.1 percent of GDP in 2035 and 6.3 percent by 2080 (Congressional Budget Office (CBO), 2009).

Taxes. Social Security in the US is an unfunded, or pay-as-you-go (PAYGO) system. Current workers are taxed to pay benefits to current retirees. The retirement portion of social security (the Old Age and Survivors Insurance or OASI) is financed with a 10.6 percent payroll tax that is split evenly between workers and employers. This tax is levied on all earnings up to an inflation adjusted maximum amount, often referred to as the "tax cap." In 2010, earnings were taxed up to $106,800. Taxable earnings represent only 83 percent of total covered earnings (all earnings for employment covered by social security) (CBO, 2010)[1].

Benefits. In general, workers are eligible to receive full social security benefits when they reach 66 years of age and have paid social security taxes for at least 10

[1]The contribution base increases at the rate of increase in the national wage index only if the Cost of Living Adjustment (COLA) is positive. The COLA is legally calculated from the percentage change in the CPI. Therefore, the following scenario could be plausible:

1.) Wage growth exceeds growth in prices.

2.) Prices don't grow at all meaning that the percentage change in the CPI (the inflation rate) equals zero, yet there is still a positive percentage change in the national wage index since wage growth exceeds price growth.

3.) No COLA results since the percentage change in the CPI equals zero.

4.) Therefore, no increase in the contribution base (tax cap) despite the fact that there was a positive percentage change in the national wage index (Social Security Act, 1983, Sec. 230, United States Senate, 2009, p.2).

years.[2] Workers may choose to retire early and claim a reduced benefit starting at age 62. Initial benefits are based on average lifetime earnings, and increase over time to keep up with the cost of living. A formula, called a benefit-earning rule, is used to translate average earnings into benefits. The US benefit-earning rule is both increasing (benefits increase as wage income increases) and concave (each additional dollar of wage income generates a smaller increase in benefits). The benefit-earning rule is a piecewise linear function with three segments. The threshold at which the slope of the benefit-earning rule changes is called a bend point. The current US benefit-earning rule calculates benefits as 90 percent of average monthly wage earnings up to the first bend point, plus 32 percent of earnings between the first and second bend points, plus 15 percent of earnings between the second bend point and the tax cap. The bend points, like the tax cap, are indexed to wage growth, as calculated by an index created by the Social Security Administration (SSA).[3] The current bend points are $761, and $4,586 (which correspond to $9,132 and $55,032 annually). The bend points occur at approximately the same place in the distribution of earnings each year. The first bend point corresponds to the 11th percentile of earnings; the second bend point corresponds to the 71st percentile. The SSA estimates a worker who had average annual earnings who retires at age 65 in 2010 will receive an annual benefit of $16,500. This amount would replace about 40 percent of her earnings before retirement (CBO, 2010). (See figure 6 for an illustration of the benefit-earning rule).

[2] An increase in the retirement age from 65 to 67, phased in over a two-decade period beginning in 2002 was scheduled as a result of the social security amendments passed in 1983. Thus, the current full retirement age is 66.

[3] For an explanation of the wage index used, see <http://www.ssa.gov/oact/cola/AWI.html>

Budget. The financing of an unfunded social security system can be represented with the simple equation

$$\begin{pmatrix} \text{social security} \\ \text{tax rate} \end{pmatrix} \times \begin{pmatrix} \text{average wage} \\ \text{per worker} \end{pmatrix} \times \begin{pmatrix} \text{number of} \\ \text{workers} \end{pmatrix} =$$

$$\begin{pmatrix} \text{average benefits} \\ \text{per retiree} \end{pmatrix} \times \begin{pmatrix} \text{number of} \\ \text{retirees} \end{pmatrix}.$$

If this simple equation holds at a given point in time, then aggregate taxes paid (left-hand side of the equation) will equal aggregate benefits received (right-hand side of the equation). Rearranging the equation gives

$$\begin{matrix} \text{average benefits} \\ \text{per retiree} \end{matrix} = \begin{pmatrix} \text{social security} \\ \text{tax rate} \end{pmatrix} \times \begin{pmatrix} \text{average wage} \\ \text{per worker} \end{pmatrix} \times \begin{pmatrix} \text{ratio of workers} \\ \text{to retirees} \end{pmatrix}.$$

From this equation it is easy to see that benefits rely directly on the ratio of workers to retirees. On average in the US during the period 2000-2010, the ratio of workers to retirees was approximately 3.3. That number is predicted to fall to 2.0 over the next few decades. (See Figure 1.) The SSA lists three main reasons for this decline: the aging of the baby-boom generation, continuing low fertility rates, and increasing life expectancy (Trustee's Report, 2010). The Chief Actuary of the SSA, Stephen Goss explains that the majority of drop in the ratio of workers to retirees is due to declining fertility rates.

> Had the total fertility rate stayed at 3 or higher, the current 12.4 percent payroll tax rate would be adequate to finance currently scheduled benefits and we would not be discussing future shortfalls. But due to the shift in

birth rates over 30 years ago, we will see the ratio of workers to beneficiaries drop to 2.2 by 2030 and 2.0 by 2040. It is this shift that makes the current law 12.4 percent tax rate insufficient to fully finance the currently scheduled benefits in the long run. (2005, p.1)

Given this decline in workers relative to retirees, "the cost of Social Security will generally increase faster than the program's income" (Trustee's Report, 2010, p. 20). Data from the CBO emphasize the growing cost of benefits given the changing demographics. They explain that between now and 2035, the number of people over the age of 65 will increase by 90 percent, while the percentage of people between ages 20 and 64 will only increase at a rate slightly above 10 percent. By 2035 about 93 million people will collect social security benefits compared to the 53 million today.

Trust fund. The looming demographic crisis is not a surprise. Demographers predicted the aging of the population decades ago. In an attempt to "partially prefund" the increase in costs, the 1983 social security amendments increased payroll taxes, levied taxes on social security benefits of high income earners (these taxes are used to finance social security) and slowly increased the age of retirement.[4] These changes allowed the program to run a surplus every year from 1983 to 2009. The surplus revenues have been used to buy non-marketable Treasury securities. The collective value of these securities,

[4] Although the taxes on social security benefits initially targeted "high income earners" the thresholds established for these taxes are not inflation-indexed. Therefore, every year there is a positive increase in prices (and social security benefit payments), a greater fraction of benefit recipients pay taxes on benefits. Social security benefits are taxed at the federal income tax rate on up to 50 percent of social security benefits for individuals with a "combined income" between $25,000 and $34,000 per year. Individuals with a combined income that exceeds $34,000 per year pay income tax on up to 85 percent of their social security benefits. "Combined income" is defined by the SSA as adjusted gross income plus nontaxable interest plus one half of social security benefits. See <http://www.ssa.gov/planners/taxes.htm> for more details.

called the trust fund, is $2.2 trillion (Gokhale, 2010). 2010 marks the first year that social security did not run a budget surplus. The government predicts that as the economy recovers from the recession that social security tax revenues will once again exceed expenditures, but only until the year 2016. From that date forward, the SSA will need to dip into the trust fund in order to continue paying scheduled benefits. The trust fund will be exhausted by the year 2039 (CBO, 2010, see also Trustee's Report, 2010). Figure 2 depicts social security outlays, revenues, and the size of the trust fund. It is clear from the graph that revenues fall below taxes starting in the year 2016. The difference between revenues and benefits is financed by the trust fund until 2039 when the fund becomes depleted.

While the idea of the trust fund seems straight forward–extra tax revenue has been "saved" for the aging population–in practice, the trust fund is highly contested. Economists agree that the SSA purchased non-marketable securities with the annual social security surpluses. Economists also agree that the Treasury will certainly redeem these securities. Economists, do not agree, however, if the government will be able to do this without raising taxes, increasing government borrowing, or reducing some form of government spending. If the government is forced to borrow or increase taxes in order to redeem the Treasury securities, the result is identical to a counterfactual world in which the SSA does not have a trust fund at all, and the government is forced to borrow or increase taxes to pay benefits after 2016. In many regards, the two scenarios are interchangeable. In each scenario, the government is reduced to borrowing more, taxing more, or spending less in order to finance social security after the year 2016. Kent Smetters explained, "The inter-related issues of whether the [$2.2] trillion trust

fund is 'worth anything' and whether the important date for public policy purposes is the cost-revenue crossover date (2016) or the trust fund exhaustion date (2039) has been a source of considerable debate for many years" (2004, p. 1). President Bush's Commission to Strengthen Social Security released an Interim Report in 2001 that stated, "assets in the trust fund failed to increase national saving and so could not count toward pre-funding of future benefits" (Smetters, 2004, p. 1).

For the purposes of this paper, I will not give a detailed account of the trust fund debate. (See Smetters (2004) for an interesting discussion.) It is sufficient to note that if the trust fund increased national savings, then the fund is (likely) a viable economic asset the government can redeem to pay benefits. If the fund has failed to increase national savings, then it will (likely) be costly for the government to redeem the treasury bonds. If the Treasury has lent the money to Congress, it will not be able to give the money back to the SSA without raising taxes or cutting benefits. In a best-case scenario, the trust fund will be redeemed and benefits will not need to be cut or taxes will not need to raised until 2039. In a worst-case scenario, the government will be forced to cut spending or raise taxes in 2016. In either case, the future benefits as promised by current law, will not be payable given current taxes in the long run.[5] Therefore, the existence (or non-existence) of the trust fund does not change the fundamental, underlying demographic stresses on the social security system. The trust fund can only delay the day of reckoning.

Possible solutions. The SSA and the Senate Aging Committee use the phrase

[5] This is, of course, assuming that the population, wages, and prices all change in a predictable manner. Under extreme, unforeseen conditions, the analysis offered in these two sentences may prove inaccurate.

"fiscal solvency" or simply the word "solvency" to describe the ability of the SSA to pay (expected) benefits as currently promised by law with (expected) tax revenue. For the purposes of this paper, I will use "solvency" to denote this ability to pay scheduled benefits using scheduled revenues. Therefore, in order to maintain long term fiscal solvency given changing demographics, taxes will need to be raised, benefits will need to be decreased, or some combination of both. The SSA estimates that an immediate tax rate increase of 1.84 percentage points, a 12.0 percent reduction in benefits, or a general revenue transfer of $5.4 trillion could restore solvency for 75 years. They note, "Significantly larger changes would be required to maintain solvency beyond 75 years" (p.2). These estimates seem overly rosy.[6] Gokhale definitively states, "social security's financial condition is significantly worse compared to official projections by the program's trustees" (2010, p.5). The mainstream economic literature estimates it would take roughly a 5-percentage point tax increase, or a 20-33 percent reduction in benefits to restore solvency (See Feldstein and Liebman (2002)). The Senate Aging Committee notes that the costs of raising taxes or reducing benefits do not affect all segments of the population evenly. "Efforts to improve solvency may enhance, weaken, or have no impact on Social Security's current level of effectiveness in providing retirement security for all Americans. Improving the adequacy of benefits for vulnerable populations may also have a cost to implement" (p.70).

Reform Goals. The Senate Aging Committee and the Government Accountability Office (GAO) both encourage Congress to consider two goals when evaluating

[6]See Kotlikoff and Burns (2005) Chapter 2 for a discussion of the politics of official government projections.

Social Security reform measures. In their estimation, a desirable reform (i) balances the budget, and (ii) protects benefits for the economically vulnerable. The Committee advises, "Congress should enact modest changes to Social Security in the near future in order to bring its long-term financing into balance and improve benefits for those who need them most" (from website). The GAO uses similar language in the following statement, "Thus, the nation faces the challenge of improving long-term program solvency, while also ensuring benefit adequacy for economically vulnerable beneficiaries" (from electronic summary). The GAO identifies low-income earners, single women, and people over 80 years of age as the economically vulnerable. They note that many beneficiaries fall into more than one of these group; therefore, an effort to protect low-wage earners may also protect single women and the aged. "The impact of benefit reductions made to restore solvency of the Social Security program could be felt acutely by these [vulnerable] beneficiaries" (GAO, 2009, p.3).

I will begin my discussion of social security reform with a careful look at Rawls' theory of social justice (Chapter 2). Then, I will move on to discuss three types of Rawlsian social security reforms (Chapter 3). I will begin with reforms that increase taxes, move to reforms that increase benefits, and finally discuss reforms that decrease benefits for the wealthy. As a special example, I will include a mathematical analysis of changes to the benefit-earning rule that can compensate for the demographic shock in a Rawlsian fashion (Chapter 4). After I have presented these Rawlsian reforms, I will discuss the political feasibility of Ralwsian social security reforms (Chapter 5). The mathematical methods used in Chapter 4 are developed more fully in Appendix A.

CHAPTER 2.

RAWLS: SOCIAL SECURITY AND SOCIAL SECURITY

The desire to protect the most economically vulnerable is consistent with the political philosophy of John Rawls. In his famous 1971 book, *A Theory of Justice*, Rawls argued that a just society would provide a "social minimum" to all members of society. Although Rawls does not explicitly mention a social insurance program in his writings, it is possible to use his logic to justify the existence of a social security program. George Mason philosophy professor Roger Paden believes Rawls' theory can be applied not only to social security broadly, but also to social security reforms that respond to the demographic shock. He explains, "If Rawls' theory is to be applied to the question of Social Security reform, it must be done in at least two stages: First an ideal theory of social insurance must be outlined; Second, that theory must be applied to the current, only partially just, situation" (1998, p.183). Paden develops an "ideal theory" for social security and shows that the current US system is largely justified by Rawlsian thought.

Before I continue, it is useful to draw a distinction between social welfare programs, which Rawls clearly supports, and social insurance programs, such as social security, that I will argue Rawls would also support. A social welfare program is a publicly administered program that distributes benefits—cash payments, health care, or food—based strictly on need. Benefits are not given to all members of society; only those who pass a means test—that is, only to those who are sufficiently poor as defined by the social planner. By providing for the most needy, social welfare programs provide

insurance against destitute poverty. The welfare program is funded through some form of mandatory contribution, such as an income tax. A social insurance program, on the other hand, is a publicly administered program that distributes benefits—usually cash payments—to members of society that reach a certain age or experience a (specified) disability. Thus, with the exception of those who die young, all members of society may receive social insurance benefits. (This is not entirely true of the US social security system that requires recipients to work for a specified number of years before qualifying for benefits). Social insurance provides for both the poor and the wealthy in old age and in times of need. By providing for the wealthy as well as the poor, social insurance programs effectively insure all workers against the risk of outliving their assets or becoming prematurely disabled. The social insurance program is also funded through mandatory contributions.

Paden (1998) offers a concise explanation of Rawls' justification for social welfare and social insurance programs.

> It is clear that, in Rawls' theory, a social insurance program or a social welfare program would count as just only if it followed from the difference principle, which is according to Rawls, the principle that the risk-averse parties to the "original position" would select to govern the economic institutions of a just society (TJ, pp. 152-156). This principle requires that—subject to several constraints—at any particular stage of development, the economic institutions of an ideally just society must be arranged so as to maximize the social and economic position of the least advantaged representative person (TJ, p. 33). As a consequence, when evaluating the relative

> justice of competing economic schemes, the difference principle requires one to attend only to the relative position of the least advantages representative person under those schemes, "as specified by [an index] of income and wealth" (TJ, p. 97, see also pp. 93-100). (p.183)

A social insurance program is desirable, therefore, if it increases the well being of the poorest members of society. Rawls cautions against defining the poor as a specific sociological group, such as unskilled workers, and instead suggests it best to define poverty in terms of an index of income and wealth, such as "all persons with less than half of the median income and wealth (TJ, p. 98)" (as quoted by Paden, 1998, p.184). Rawls explains that during the "legislative phase" risk-averse individuals would find it practical to insure against falling into "certain economic contingencies." To achieve this, they would establish what he calls a "transfer branch" that would maintain a social minimum for all by redistributing wealth from the rich to the poor. A social welfare program that targets benefits to those that fall below a specified fraction of the median wage, could be part of this transfer branch. A social insurance program that distributes progressive benefits may also meet these criteria by giving low wage earners proportionally higher benefits. If the social welfare program is generous enough, it is likely a Rawlsian society may have no need for a social insurance program. This may be, in part, why Rawls failed to directly mention social insurance. (For a discussion of other reasons, see Paden, 1998).

However, in addition to insuring against poverty, Rawls explains that individuals "will not enter into agreements they know they cannot keep, or can keep only

with great difficulty (TJ, p. 145)" (As quoted by Paden, 1998, p.90). Rawls explains individuals will also consider the "strains of commitment" in their decisions. Therefore, although risk-averse individuals may favor a generous welfare program (during the legislative phase), they may also realize it will take considerable strain to maintain that commitment if they become extremely wealthy. Thus, they may rationally favor a less redistributive program. Rawls did not directly address this in his book; the philosopher Nozick detailed this seeming contradiction. Paden explains,

> While the least well off may find it easy to live in a Rawlsian society, naturally talented individuals might find it very difficult. Such individuals, Nozick argues, would believe themselves to be unfairly "used" for the benefit of the least well-off, and would object to having their property redistributed to the least advantaged. As a result, Nozick claims, these more talented individuals would find it difficult to maintain their commitment to a society whose institutions are informed by the difference principle. (p.190)

Paden elaborates, that because the Rawlsian "social minimum" is high, it will act to some degree as a disincentive to work. Some of the poor, perhaps those individuals that place large value on leisure, may choose to live off the generous social benefits instead of working. Under these circumstances, society may not appear just to (some of) the wealthy that work while others reap benefits. Society may fail "to be a cooperative venture for mutual benefit (TJ, 4), because some of the poor would be benefiting, but not cooperating" (Paden, 1998, p.191). Under these pressures, society may opt for (what Rawls would see as) less than desirable levels of welfare. Paden suggests a

solution. "One of the best ways to reduce the strains brought about by the transfer branch while maintaining justice in the system, I would argue, would be to adopt a social insurance program to supplement the required social welfare program" (1998, p.191). Social insurance is desirable, therefore, because it meets the "commitment strains" principle and the difference principle.

Contingent on the arguments listed above, it follows that a social insurance program is consistent with Rawlsian principles. Paden continues in the essay to enumerate the values of the ideal social insurance program. He concludes that an ideal social insurance program would offer high minimum benefits. He does not offer a dollar amount, but notes that "because the average minimum [social insurance] benefits are usually well above those paid by the welfare programs, social insurance programs reduce the need for social welfare benefits" (1998, p. 192). A second virtue of social insurance programs is that the distribution of benefits to all workers who reach old age engenders the view that benefits have been "earned." Even if these benefits are progressive, the link to work reduces the strain wealthier contributors may feel. Paden goes as far as to suggest a social insurance program binds society together "around a common interest" (1998, p.192). He argues that because "everyone has a stake" in a social insurance program, it becomes a very popular program (1998, p.195). Paden believes a social insurance program also increases the incentive for all members of society to work hard. Contemporary economists would certainly disagree with this assertion (See, for example, Feldstein 1996), but Paden believes the promise of future benefits encourages all to work harder to increase the size of their benefit. As a final virtue, Paden notes that social insurance programs not only offer insurance against catastrophic risk, but also

insure "life plans" by protecting against "the possibility of economic decline later in life" (1998, p.194).

Paden concludes that the US social security system closely matches the ideal social insurance program individuals would select in a Rawlsian legislative state. As such, he advocates reform proposals (to cope with the coming demographic shock) that do not change the basic structure of the program, such as increasing the tax base to include all payroll wages (not just those below the taxable maximum) or by gradually increasing the retirement age to 70. He offers poignant criticism of more drastic reform measures, such as moving towards a fully funded, or privatized system. He explains, "Certain types of 'reform' would be unjust. Indeed, I believe that many suggested reforms are not driven by a search for justice, nor even by any problems internal to the social security program, but instead are the result of sloppy and/or ideological thinking" (1998, p.196). I'm not sure Rawls would use such strong language to condemn specific social security reforms. However, I do believe he would agree with Paden that the current US social security system closely mirrors an ideal form of social insurance, and that coupled with social welfare, can insure a tolerable social minimum for all members of society.

Economic theory presents a more systematic approach to evaluating if a social program or reform is consistent with Rawls' philosophy. Using the mathematical maxi-min principle, economists select Rawlsian policy by choosing taxes and benefits to maximize utility, or happiness, for the least well-off individual in the model. This mathematical optimization is called the maxi-min principle because it maximizes the minimum value of a selected variable, in this case, utility. Applying this maxi-min

principle more broadly—that is, without specifying the mathematical form of the utility equation—we can infer a Rawlsian reform is simply a reform that increases the utility of the worst-off member of society. It seems any reform that increases the social security benefits of the poor (by either directly increasing the dollar amount of benefits, or indirectly by extending the period over which social security remains solvent) without increasing the tax burden of the poor would achieve this Rawlsian objective. Of course, we could construct a variety of different utility functions to prove this relationship. As long as we define utility as an increasing function of consumption, then any policy that increases the ability of the poor to consume, either by increasing their benefits or by reducing their taxes, will increase their utility.

I will use the economic maxi-min principle, and the Rawlsian notion of social welfare as a backdrop for evaluating policy. If a specific social security reform does nothing to improve the condition of the poorest individual in society, such as across-the-board benefit cuts, I will rule this reform out as "non-Rawlsian." I will only consider reforms that increase the well being of the poor, or in the words of the Senate Aging Committee reforms that "protect the economically vulnerable" (from Committee Website).

CHAPTER 3.

SOCIAL SECURITY REFORMS

In the remaining sections of the paper, I will present the mainstream social security reforms that are consistent with a Rawlsian perspective. These reforms all take one of two basic forms: tax increases, or benefit adjustments. The reforms I will discuss are, for the most part, minor adjustments that could be made to the current system unlike a serious structural reform such as moving towards a fully funded system. I will begin with a discussion of Rawlsian reforms that increase taxes. All of the tax proposals I will consider involve increasing the tax base by increasing or removing the tax cap on earnings.

Following the tax increase proposals, I will discuss Rawlsian reforms that alter future benefits. Both the Senate Aging Committee and the CBO suggest reforms that would increase benefits for the poor. These types of reform are consistent with Rawlsian philosophy, but they fail to address the financial constraints imposed by the demographic shock. I will include reforms of this type for illustrative purposes. If policymakers choose to increase benefits for the poor as part of a Rawlsian response, this could be financed though an increase in taxes. Thus, it is feasible that a Rawlsian solution could include both tax increases, and increases in benefits for some workers. After I consider reforms that increase benefits, I will examine reforms that make some attempt to address the demographic shock by decreasing future benefits for the wealthy. As a special case, I will present a detailed, mathematical example of three adjustments that can be made to the benefit-earning rule to balance the budget without lowering

the benefits of the poor. One of the adjustments is financed by increasing taxes, the other two are self-sustaining. Not all of the reforms discussed would be implemented along the same timeline. Some offer solutions that are gradually phased in over time. Others offer one-time changes that would improve the long-run solvency of the system. I will indicate the timing of each reform individually, as follows in the paper.

3.1 Rawlsian reforms that increase taxes

The first group of Rawlsian reforms I will consider are proposals to remove the tax cap on the social security payroll tax. Several variations to this basic reform are possible. The cap could be increased, or removed entirely. The additional income taxed could be included in the current calculation of benefits (effectively extending the third leg of the benefit-earning rule to the right), or the additional income could be excluded from benefits. If the additional income is considered for benefits, it could be done using a new benefit-earning rule that pays reduced benefits on the highest portion of income. I will discuss the merits of removing (or increasing) the tax cap broadly first, then I will assess the specific permutations mentioned above.

Motivation. As briefly mentioned in the introduction, social security taxes are levied on all payroll earnings up to a maximum level that increases with inflation. The current maximum amount is $106,800.The payroll tax is levied at a flat rate of 12.4 percent (evenly split between employee and employer). As a result of the cap, lower-income earners pay a higher fraction of their income in social security taxes than do high-income earners. Using the employer and employee share of the social security tax, as well as the Medicare portion of the payroll tax, economist John Irons calculates

that the effective payroll tax for the second quintile (20-40 percent) of wage earners is 10.4 percent. The effective payroll tax rate for the third quintile (40-60 percent) is nearly identical at 10.9 percent. By contrast, the top 1 percent of earners pays an effective payroll tax of only 1.5 percent. The top 0.1 percent of earners pays an effective payroll tax of 0.7 percent. The social security payroll tax is, by virtue of the tax cap, a regressive tax[1]. Irons offers the following illustrative example:

> More concretely, workers making $106,800 or less pay a flat 6.2 percent for Social Security on their earnings, as do their employers. Since the most employees and employers can each owe is $6,622 (6.2 percent x $106,800), the tax rate for someone earning a million dollars per year and their employer is just 0.66 percent ($6,622/$1,000,000), roughly one tenth the rate paid by most workers. (p.3-4)

About 6 percent of the population has earnings above this cap, a percentage that has remained relatively constant since the 1983 amendments. However, the share of earnings that fall above the cap has increased. This is the result of increasing income inequality. "Those with incomes above the cap have seen a faster pace of growth that those with incomes below" (Irons, 2009, p.3). In 1983, 91 percent of US wages fell below the maximum taxable amount. In 2009, only 83 percent of earnings fell below the maximum taxable amount. (See Figure 3). Much of the demographic shock could be absorbed by increasing the tax base to include 90-100 percent of wage earnings.

[1] Although the social security tax is regressive the benefit structure is progressive. However, that progressivity is mitigated by the fact that high wage earners live longer and therefore collect more social security benefits compared to low wage earners. (See Irons, 2009, and Pozen, 2010). Therefore, it is difficult to assess if the program is truly regressive or progressive.

Option 1: Eliminate the cap—do not count the additional earnings towards benefits. The most progressive reform (of those that increase or remove the tax cap) would be to remove the cap entirely without including the additional taxed earnings in the calculation for benefits. This would free up all of the additional taxes collected to finance benefits promised to all workers as currently outlined. The Aging Committee reports, "If all earned income above $106,800 a year were subject to Social Security contributions but did not count toward benefits, Social security would be solvent throughout the long-range projection period" (2010, p.46). Under this option, workers who earn more than $106,800 would pay "considerably more in taxes." The Aging Committee offers the follow example. "A personal making $400,000 per year would pay $18,178 more per year and his or her employer would pay a matching amount, for a total increase of $36,356" (2010, p.46). However, the Committee also notes, "As workers do not generally have high earnings over their entire careers, the total increase in taxes paid by individuals over their working lives would be relatively small with a median increase in lifetime contributions of three percent" (2010, p.46).

Social security's revenues would increase by 0.9 percentage points of GDP in 2040, or by about 18 percent relative to current law. This improves the 75-year actuarial balance by 0.9 percentage points of GDP and extends the trust fund exhaustion date beyond the 75-year mark. This analysis is based on assumption that the cap would be removed in the year 2012 (CBO, 2010, p.18-19, option 6).

Option 2: Eliminate the cap—count the earnings towards benefits. Because social security benefits are distributed using a progressive benefit-earning rule,

it is possible to achieve a net budget increase by taxing earnings above the cap and paying benefits for those earnings. The additional benefits paid out for the wages above the cap will be much smaller than the additional taxes collected on these wages. The Aging Committee states, "If all wages above $106,800 in 2009 were taxed and counted toward benefits, the change would almost make social security solvent through the long-range period, reducing the payroll deficit by 1.89 percent and eliminating about 95 percent of the 75-year shortfall" (2010, p.46). The CBO adds, "This option would improve the 75-year actuarial balance by 0.6 percentage points of GDP and extend the trust fund exhaustion date to 2083." This analysis is based on the assumption the change in taxes and benefits would take place in the year 2012 (2010, p.18, option 4).

Option 3: Eliminate the cap—count earnings towards benefits using a different formula. This slight variation of option 2 allows policymakers to tax all earnings, offer benefits for all earnings, but extend the solvency to the 75-year mark. The Aging Committee gives the example of offering benefits as currently scheduled up to the tax cap, then increasing benefits at 3 percent (instead of 15 percent). Using the current bend points, the new benefit-earning rule would replace 90 of average monthly wage earnings up to $744, 32 percent of earnings between $744 and $4,483, 15 percent of earnings between $4,483 and $8,900, and 3 percent of earnings over $8,900. "This option, starting in 2010 is estimated to eliminate the 75-year deficit, resulting in savings of 2.17 percent of payroll" (Aging Committee, p.47). However, this reform does not guarantee fiscal solvency into perpetuity, it merely delays the exhaustion of the trust fund beyond the 75-year threshold. (This reform is not considered by the CBO).

Option 4: Tax all earnings above the taxable maximum at 4 percent—do not increase benefits. Like the previous examples, this option subjects all payroll earnings to a social security tax, but wages currently above the cap would only be taxed at 4 percent instead of 12.4. The CBO estimates that this reform would increase social security revenues by about 0.3 percent points of GDP in 2040, or by about 6 percent, relative to current law. Because the tax rate is lower, this option would, obviously, generate less revenue. This option would extend the trust fund exhaustion date by twelve years, to 2051. This analysis assumes the law would change in the year 2012 (CBO, 2010, p.19, option 9).

Option 5: Raise the taxable maximum to cover 90 percent of earnings—count all 90 percent of earnings towards benefits. In 1983, 91 percent of earnings were taxed for social security. Increasing the tax cap to once again cover 90 percent of earnings would increase social security revenues by about 0.4 percentage points of GDP in 2040, or by about 8 percent relative to current law according to the CBO. This would extend the trust fund exhaustion date eleven years, to 2050. The Aging Committee suggests gradually increasing the tax cap, by two percent per year above the growth in wages to eventually cover 90 percent of wages. This will take 36 years to achieve. It would reduce the 75-year deficit by 28 percent. This analysis also assumes the law would change in 2012 (CBO, 2010, p.18, option 5).

Additional variations. The Senate Aging Committee and the CBO both offer additional variations of reform that increase the tax base by increasing or removing the tax cap. The fiscal impact of these various adaptations are similar. As one would

expect, the more aggressive the tax increase, the larger the positive impact on social security's 75-year budget. Conversely, the more generous the benefits paid on additional taxes paid, the smaller the impact on social security's budget.

Winners and losers. High wage earners are the clearly lose under any variation of this reform. Those earning above the tax cap would see a potentially large increase in their taxes. Conservatives might add that taxing the wealthy has negative side effects by decreasing the incentives for the wealthy to work (and generate jobs for others). The 94 percent of wage earners who currently fall below the tax cap will benefit relative to the 6 percent whose taxes would increase. The 94 percent will experience higher benefits for a longer period of time than they would without this reform.

Of course, this brief analysis ignores the long-term feedback effects of increasing taxes. At a macroeconomic level, increased taxes can lead to lower levels of savings. Savings fuels capital investment, the purchase of new physical capital. As savings decreases, so can the accumulation of new capital. And, as the level of capital diminishes (or at least grows at a smaller rate), the marginal product of labor–better known simply as wages–also decreases. Therefore, increased taxes could lead to lower wages across the entire economy. Martin Feldstein gives this explanation in the introduction of his book *The Effects of Taxation on Capital Accumulation*

> A high saving rate leads to a high rate of investment in plant and equipment and in housing since the increased flow of saving reduces the equilibrium cost of funds to prospective borrowers... Investment in plant and equipment is a critical aspect of economic activity, for it contributes di-

rectly to raising productivity and therefore to raising the nation's standard of living. (1987, p.1)

A more sophisticated model than anything used in the analysis of this paper would need to be used to incorporate these feedback effects.

Public opinion and politics. Removing the tax cap is one of only two possible reforms that majority of Americans support.[2] 67 percent of respondents to a July 2011 Gallup Poll agree, "requiring high-income workers to pay social security taxes on all of their wages is a good idea." Therefore, it seems politicians may find support for this reform. It is somewhat unlikely that tax increases will be tolerable to the 112th Congress, given the emphasis on cutting government spending and the recent extension of the Bush tax cuts. However, voters may perceive the social security tax different than the federal income tax. The current regressive nature of the tax surely upsets many lower and middle wage earners.

3.2 Rawlsian reforms that increase future benefits

One of the most straightforward ways to increase the utility of the poor, and therefore achieve the Rawlsian goal of increasing the utility of the lowest members of society is simply to redistribute more income from the wealthy to the poor. Paden explains,

> Thus, once it is determined how much money can be raised through taxation, it is only necessary to distribute that money (minus whatever

[2] This may not be a completely fair comparison, as pollsters only asked about six possible reforms. It's possible respondents may favor some other type of reform, but were simply not asked about it.

> expenditures are required by the other principles of justice) to the poorest members of society in such a way as to raise their expectations as high as those revenues allows... one simply distributes the available money, raising the income of the poor to ever-higher levels, while simultaneously increasing the number of people receiving transfers, until there is no more money to distribute. (1998, p.186)

Therefore, the task of the policymaker is fairly simple: she needs only to redistribute as much as possible. If policymakers are not constrained by a balanced budget, social security reforms that increase the level of redistribution by increasing the benefits of the poor can be considered. In isolation, these reforms amplify the demographic shock by increasing future outlays even more than currently scheduled by law. However, if coupled with a sufficiently high increase in taxes, a reform that increases benefits for the poor could balance the budget after a demographic shock. I will present three reform options that increase benefits for the poor by implementing a minimum benefit.

Motivation. Congress created a special minimum benefit in 1972 "intended to increase benefit adequacy for low-earning steady workers" (Aging Committee, 2010, p.56). This special minimum benefit was indexed to prices via the CPI (consumer price index). The regular social security benefit-earnings rule is indexed to wages via SSA wage index. Wages have increased at a faster rate than prices since 1972, therefore regular social security benefits increased more rapidly than the special minimum benefit (Olsen and Hoffmeyer, 2002, note 1 p.13). Each year fewer beneficiaries qualified for the special minimum and received the regular benefit corresponding to their average

monthly wages. In 2010, the standard benefit formula increased enough to finally surpass the special minimum benefit. Thus, no beneficiaries are receiving a special minimum benefit, but all are receiving benefits as calculated by the benefit-earrings rule. If policymakers feel that current benefits for low-wage earners are not sufficiently large (as they thought before implementing the 1972 reform) they could create a new minimum benefit that is higher than the lowest benefit currently paid.

Option 6: Modify the special minimum benefit and index it to growth in wages. The current special minimum benefit (that was surpassed by the standard benefit-earning rule) is equal to 85 percent of the federal poverty line. Proposals to increase the special minimum benefit suggest calculating the benefit as some percentage greater than or equal to 100 percent of the federal poverty line. For example, the CBO suggests a special minimum benefit starting in 2012 of $1,170, which corresponds to 125 percent of the poverty guideline. This benefit could be reduced proportionally for beneficiaries who worker fewer than 30 years. This minimum benefit could be indexed to grow with wages (as are standard benefits) to roughly preserve a minimum benefit for a constant fraction of the population.

Social security's total outlays under this option increase by 0.2 percentage points of GDP in 2040, or by 4 percent of currently scheduled outlays. This option would worsen the 75-year balance by 0.2 percentage points of GDP, and the trust fund would be depleted two years earlier, in 2037. The analysis assumes the reform is phased in, starting in the year 2012 (CBO, 2010, p. 28, option 23).

Option 7: Enhance low-earners' benefits on the basis of years worked. This is an enhancement to the benefit-earning rule proposed by the CBO. They suggest increasing the initial benefit for lifetime workers (those who have worked 20 years or more) by a specified percentage that would depend both on the number of years worked, and the average monthly wage earned. An individual, who worked between 20-40 years and earned less than the average wage, would receive a percentage increase in his or her initial benefit between 0-40 percent. The maximum increase would be 40 percent, and that would be available to those who worked 35 years or more and whose average monthly earnings were less than or equal to the earnings of someone who worked full-time, at the minimum wage for 30 years. The minimum increase would be available for a worker who earned slightly below the average wage and only worked for 20 years.

Under this reform, social security's outlays would increase by 0.4 percentage points of GDP in 2040, or by 7 percent form currently scheduled outlays. This option would worsen the 75-year balance by 0.3 percentage points of GDP, and the trust fund would be exhausted 5 years earlier, in 2034. This analysis assumes the changes would be made in the year 2012 (CBO 2010, p. 29, option 25).

Option 8: Supplementing benefits for low-income single workers. The Senate Aging Committee defines the economically vulnerable as low wage earners, but also emphasizes the economic needs of low-income workers who never married, or divorced before qualifying for spousal benefits. Generally, these beneficiaries are women. Therefore, they consider a reform proposal to directly target low-income single workers. They suggest supplementing benefits for eligible, low-wage, single workers by adjusting

"the first threshold [or bend point] in the benefit formula... so that it increased by one-half from $744 to $1,116" (Aging Committee, 2010, p.58). This would increase the benefit received by extending the 90 percent of the first leg of the benefit-earning rule. To be eligible for this special benefit-earning rule, a worker's average monthly wages would have to be lower than some multiple of the first bend point, such as 150 percent.

This option has not received unanimous support. The committee explains, "While some retirement experts are supportive of this option because it focused on the needs of low-income women, others questions the rationale for basing eligibility on marital status" and suggested expanding the benefit (2010, p.58). The committee does not offer a cost analysis of this reform, noting only that "the extent to which this option affects solvency will depend largely on the number of people who would be eligible for it" (2010, p.58). In any case, it would increase social security outlays without increase revenues and would therefore expedite the exhaustion of the trust fund, if even by a small amount. (This reform is not considered by the CBO).

Winners and losers. The low-income workers who receive larger social security benefits as a result of these reforms appear to win relative to other benefit recipients. However, depending how the increased benefits are financed, the poor who receive larger benefits may also bear a fraction of the cost. As long as the poor did not pay the full cost of increasing benefits, then they would gain relative to other recipients. If revenues are not increased to finance the higher benefits, it is unclear if the poor benefit intertemporally. In the short-run, the poor who qualify for larger benefits would experience increased consumption. However, those who live long beyond the exhaustion of the

trust fund would (presumably) see their benefits reduced. Depending on the intertemporal preferences of the recipients, this reform could increase, decrease, or fail to alter lifetime happiness. For example, if a worker has a low (or possibly negative) intertemporal discount rate, meaning she discounts future consumption very little compared to current consumption, she may not prefer this reform because it increase her current benefits, but causes her future benefits to be reduced sooner. If she has a high discount rate, then she would prefer this reform (even if it is not financed) because it increases her current, or relatively near, consumption.

Workers who do not qualify for increased benefits will experience decreased lifetime consumption regardless of the financing of the reform. If the reform is financed by a tax increase, these workers will pay higher taxes, but will not receive higher benefits. If the reform is not financed, workers who do not receive higher benefits, experience no change in consumption in the short-run. However, in the long-run, their consumption will be lower because the trust fund will be depleted sooner and benefits will fall earlier than without the reform. As in the previous section, this brief analysis ignores the potential feedback effects of changing taxes and benefits.

Public opinion and politics. It is difficult to gauge public support for reforms that increase minimum benefits because we do not have public opinion data on the subject. Given the prevalent concern that future benefits will fall, Pollsters have not asked about reforms that increase future benefits. Presumably reform options that increase benefits for the poor will find support with (some) liberals who worry about providing for the economically vulnerable. However, it seems unlikely liberals could

gather enough political support to increase benefits when program is already expected to run deficits after 2016.

3.3 Rawlsian reforms that change the benefit-earning rule

A third possibility for Rawlsian social security reforms is reforms that modify the benefit-earning rule to balance the budget. The Senate Aging Committee does not directly consider any reforms that alter the shape of the benefit-earning rule. The committee considers multiple reforms that alter the wage indexing of the benefit-earning rule. However, these reforms are not explicitly Rawlsian. In effect, these reforms gradually reduce the bend points of the benefit-earning rule without changing the slopes of the three legs of the rule. These reforms reduce future benefits for almost all workers relative to currently scheduled benefits. The only workers who would not see a reduction in benefits are those who earn below the first bend point in the future. If real wages grow (as many of these reforms assume) and the bend points do not increase (as the reforms might mandate), or if the bend points do not increase as quickly as wages, then the fraction of the population who earn a wage below the first bend point will decline. Therefore, the fraction of the population whose benefits are equal to current law decreases over time. Reforms of this kind gradually decrease benefits (compared to currently scheduled benefits) for a larger and larger segment of the population (assuming real wages grow).

Motivation. It is possible to decrease future benefits for the wealthy while maintaining the current level of benefits for the poor. This could be achieved by

altering the upward section(s) of the benefit-earning rule. The Brookings Institute explains, "Congress could therefore gradually slow the growth of social security benefits for middle and high earner [and] lower-wage earns would receive everything they are now promised" (Pozen, 2011, p.1). The American Enterprise Institute (AEI) uses similar language in advocating social security reforms. They state directly, "social security benefits for high earners should be reduced" (Biggs, 2010, p.1).

Option 9: Reduce the slopes of the second and third legs of the benefit-earning rule. The CBO considers the specific example of reducing the slopes of the second and third legs of the benefit-earning rule from their current values of 32 percent and 15 percent to 20 percent and 10 percent. This is roughly a reduction of one third for the two upper sections of the benefit-earning rule. The benefit reduction under this option is greater for people with higher earnings. The benefits of the wage earners below the first bend point are maintained as currently scheduled by law. Thus, the new benefit-earning rule is more progressive than the current rule.

Under this reform, social security's outlays would decline by 1.0 percentage points of GDP in 2040, or by 16 percent compared to current law. This option improves the 75-year actuarial balance by 0.7 percentage points of GDP and extends the trust fund exhaustion date beyond the 75-year mark. It does not, however, preserve social security into perpetuity. The trust fund would become deleted shortly after the 75-year mark. Unlike previous examples, the analysis of this reform assumes the law would change in the year 2017 (CBO, 2010, p.21-22, option 13).

Option 10: Reduce the slope of the third leg of the benefit-earning

rule. Similar to option 1, this reform reduces the slope above the second bend point from 15 percent to 10 percent. This reform would only affect benefits for those who earn above the second bend point. In 2010, 29 percent of 62-year-old new beneficiaries had an average monthly income above the second bend point. The CBO offers the following example, "in 2017 [the second] bend point would be $5,114 in 2010 dollars, and a worker with average monthly earnings of $6,000 would receive monthly benefits that were $44 lower than under current law" (2010, p.22).

Because this reform protects benefits for a larger segment of the population (benefit are only reduced for those above the second bend point), it has a smaller impact on solvency. Social security outlays would decline by 0.1 percentage point of GDP in 2040, or by 2 percent from currently scheduled outlays. "This option does not significantly extend the trust fund exhaustion date" (CBO, 2010, p.22, option 14).

Option 11: Lower initial benefits for the top 70 percent of earners. This option is often called "progressive price indexing." The name is somewhat misleading, because this type of reform does not actually change the way intial social security benefits are indexed, but rather gradually diminishes the slope of the benefit-earning rule. Under this reform, the scheduled benefits for the bottom 30 percent of earners remain unchanged. The initial benefits of the remaining 70 percent will be reduced by gradually flattening out the upper 70 percent of the benefit-earning rule. The slope for the "top 70 percent of earners would be gradually reduced so that initial benefits for such earners would decline over time relative to those scheduled under current law" (CBO, 2010, p.24). The slopes will be reduced in such a way that initial benefits for

the highest earners would grow with the rate of price, instead of with wages. A critical of assumption of this proposal is that real wages will continue to grow at a higher rate than prices.

The CBO explains that this reform would be implemented by adding a third bend point to the benefit-earning rule that corresponds to the 30 percentile of wage earners. By 2040, "the new bend point would be at about $2,560, between the first bend point at $1,130 and the highest bend point at $6,830." The slope of the line segment between the first bend point and the new bend point would remain at 32 percent. The slope of the two segments above the new bend point would be reduced every year. By the year 2080 both slopes would fall to zero. Figure 4 depicts what the benefit-earning rule would look like in the years 2040 and 2080 under this reform.

The reform option decreases social security's total outlays by 0.4 percentage points of GDP in 2040, or by 7 percent of currently scheduled outlays. This option improves the 75-eary actuarial balance by 0.5 percentage points of GDP, and extends the trust fund exhaustion date for five years, to 2044. The CBO notes that the relative savings of this reform are modest "because it would be phased in slowly." The analysis of this reform assumes the intial changes would take place in 2017 (2010, p.23, option 18).

Option 12: lower initial benefits for the top 50 percent of earners. This option is nearly identical to option 11. The key difference is that benefits are protected for the bottom 50 percent of earners (instead of only the bottom 30 percent). The slopes of the benefit-earning rule for wages for the top 50 percent of the population

would be gradually reduced under this reform. The slopes would adjusted in such a way that benefits for high earners would only increase at the rate of price growth instead of wage growth. Like option 11, this option relies heavily on the assumption that real wages will continue to grow at a higher rate than prices.

A new bend point would be introduced to cover 50 percent of wage earners on each side. The slopes of the benefit-earning rule below this new bend point would remain unchanged while the slopes above the bend point would gradually fall to zero. The two slopes above the new bend point would reach a zero slope by 2057. The CBO explains, "the top two factors reach zero earlier than in [option 11] because the second bend point occurs at a higher level of earnings" (2010, p.24).

Social security's total outlays would fall by 0.4 percentage points of GDP in 2040 or by 6 percentage points compared to current law under this reform. This option improves the 75-year actuarial balance by 0.4 percentage points of GDP and extends the trust fund exhaustion date by four years, to 2043. Like option 11, the analysis of this reform assumes the initial changes take place in 2017 (CBO, 2010, p. 24, option 19).

Winners are losers. The low-wage earners who do not receive benefit reductions under these reforms clearly win relative to current law and relative to high-wage earners. Low wage earners are better off under any of these four reforms compared to current law because the trust fund exhaustion is delayed. They receive the same benefits for an extended period of time without paying higher taxes. This is, of course, made possible by decreasing future benefits for high wage earners. As before, this analy-

sis excluded the feedback effects of changing benefits. Again, this analysis excludes the feedback effects of changing benefits, which may change consumers' spending and savings decisions and indirectly impact capital accumulation and wages.

Public opinion and politics. Reducing future benefits for the wealthy is one of only two reform proposals that a majority of Americans find tolerable. (The other tolerable reform is increasing the tax base to include income above the current tax cap.) 63 percent of respondents in a July 2010 Gallup Poll agree that "limiting benefits for wealthy retirees" is a "good idea to address concerns with the social security system." It seems politicians may find initial support for reforms of this nature as long as they are phased in over time. Any attempt to reduce benefits for those who are about to retire would be met with resistance from older voters. It is important to note that none of the adjustments to the benefit-earning rule discussed in this section would decrease benefits for current retirees. The benefit-earning rule is used to calculate initial benefits, thus, anyone who is currently receiving benefits would not be affected. Older Americans vote at much higher rate than their younger contemporaries (Baumgartner and Francia, 2008), therefore politicians are unlikely to do anything to upset current retirees.

CHAPTER 4.

SPECIAL CASE: THREE ADJUSTMENTS TO THE BENEFIT-EARNING RULE

Thus far in the paper, I have only evaluated reforms originally proposed by the government (either via the Senate Aging Committee, or the CBO). None of the twelve reforms I have discussed are able to fully cope with the coming demographic shock. Option 1 (remove the tax cap, do not count additional earnings towards benefits) and option 3 (remove the tax cap, count all earnings towards benefits using a new rule) both extend the trust fund exhaustion date beyond the 75-year threshold used in government long-term projections. However, neither provides solvency beyond 75 years. The CBO examined 30 reform proposals, and only one produced sustainable solvency. That reform, (their option 17) gradually reduces benefits for all workers and assumes that real wages grow at a rate higher than prices. In the case that real wages do not grow at a higher rate than prices (or if the difference between the two rates is less than the CBO projects) none of the 30 reforms considered would produce long-term solvency.

The CBO explains how long-term solvency might be achieved.

> One way to sustain solvency is to have a trust fund ratio that is positive throughout the projection period and then stable or growing after 75 years. Neither increasing the payroll tax by 2.0 percentage points over two decades nor cutting benefits by 15 percent would result in sustainable solvency; the trust funds would be exhausted around the end of the projection period and the trust fund ratio would still be declining after 75 years. (2010, p.13)

In the following section of the paper I will suggest three new adjustments to the benefit-earning rule that extend solvency beyond the 75-year threshold and into perpetuity. Two of these options are self-sustaining without changing taxes. The third option is sustainable with a specified increase in taxes. In all three cases, I assume the trust fund has already been exhausted. Therefore, the adjustments I consider do require drawing down the trust fund, but can leave it exactly as it is today. I also assume that real wages will not grow in my calculations. If real wages do increase, then the adjustments I suggest will actually lead to social security surpluses. Because my analysis does not use trust fund resources, I do not specify a year for the policy change. I take a worse case scenario and assume the ratio of workers to retirees has already fallen from 3 to 2. Therefore, my analysis holds for any future date as long as the ratio of workers to retirees is at or above 2. Depending on the assumptions about the trust fund and real wage growth that policymakers are comfortable making, they may ultimately wish to implement reforms smaller in scope than those I will present below.

The three adjustments to the benefit-earning rule that I consider, as well as the corresponding theoretical and quantitative results, are taken from the working paper "Rawls, Pensions, and Demographic Shocks" by Frank Caliendo[1] (Utah State University) and myself, Erin Cottle. The theory is developed in the appendix (section 6) of this paper.

In this section I will focus on three concrete adjustments to the current benefit-

[1] With Dr. Caliendo's permission I will reproduce sections of the "Rawls, Pensions, and Demographic Shocks" paper within this document.

earning rule that are naturally easy to understand and technically easy to implement. These three options are designed to meet the goals of the GAO and Senate Aging Committee, and each option keeps the budget balanced under future demographics. In all cases, we[2], assume a large demographic shock (from 3.3 to 2.0 workers per retiree).

Option 13: Protect the benefits of the maximum number of poor individuals without a tax increase. In this option, the policymaker leaves the current benefit-earning rule in place for as many poor earners as possible, and then the benefit rule becomes flat thereafter. In our calibrated model, the benefit rule can be left intact for everyone below 41 percent of the mean wage (about twice the magnitude of the first bend point), which corresponds to protecting benefits for the bottom 20 percent of the population. To then balance the budget without a tax increase, it becomes necessary to completely flatten out the remaining portion of the benefit-earning rule (zero slope after 41 percent of the mean wage). All wage earners who earn above 41 percent of the mean will receive the same benefit as the current benefit of the threshold earner (namely $b(\hat{w}|R)$ in the appendix).

Figure 7 shows the new benefit-earning rule (denoted by $\hat{b}(w)$ in equation (7) of the appendix) which traces the current benefit rule ($b(w|R)$ (equation (6) of the appendix) up to the threshold value and then continues as a flat line. The current benefit rule is shown as the thin line, the new rule is depicted with a thick line. The new rule balances the budget without reducing benefits for anyone with wage earnings below the threshold. A depiction of the wage density function ($f(w)$ from equation

[2] I will use plural pronouns "we" and "our" in reference to the model, because I worked with Dr. Caliendo to develop the theory and results.

(23) in the appendix) has been superimposed over Figure 7 to show the fraction of the population whose benefits remain intact. The area under the left tail of the wage density function represents the fraction of the population whose benefits are preserved. This benefit rule protects the benefits for the bottom 20 percent of the population Thus the policymaker is able to preserve benefits for the poorest 20 percent of the population and balance the budget after the demographic shock without a tax increase.

Option 14: Protect a larger share of the population through a tax increase. Protecting benefits for more than 20 percent of the population while maintaining a weakly increasing benefit-earning rule as in Policy 13 can be accomplished only with a tax increase. As an example, we create a post-shock benefit-earning rule that maintains the current level of benefits for the bottom half of wage earners and is financed with a 5 point increase in the tax rate. Thus, in this option the new benefit-earning rule exactly traces the old rule up to the mean wage (almost up to the second bend point) and then flattens out thereafter.

Figure 8 depicts this adjustment to the benefit-earning rule The baseline ($b(w|R)$ equation (6) in the appendix), the new benefit rule without a tax increase ($\hat{b}(w)$ equation (7) in the appendix) and the new rule with a 5-percentage point tax increase ($b^*(w)$ equation (7') in the appendix) are all graphed together in Figure 8. Both new benefit rules initially trace the baseline rule and then flatten out. The tax increase allows the rule in option 14, to trace the baseline beyond the threshold in Figure 7 up to 94 percent of the mean wage. Beyond this wage, the rule delivers a constant benefit that is equal to the current benefit for 0.94 of the mean wage. It is clear from the graph

that the new rule with a tax increase is able to protect benefits up to a higher wage than the new rule without a tax increase (option 13). A depiction of the wage density function has been superimposed over the graph to show the fraction of the population whose benefits remain intact. The area under the left half of the wage density function represents the fraction of the population protected by this reform. The policymaker is able to preserve benefits for bottom half of wage earners and balance the budget with a 5 percentage point tax increase after the demographic shock.

Policy Option 15: Protect the benefits of the poor and also maintain a strictly increasing benefit-earning rule. As a third option, we show that the benefit-earning rule can be left exactly as it currently is up to the first bend point (90 percent slope up to 20 percent of the mean wage) if the slopes of the second and third legs of the benefit-earning rule drop from the current slopes of 32 percent and 15 percent to the new slopes of 10 percent and 3 percent, respectively. The new rule balances the budget, protects the benefits of the very poorest segment of the population (those below the first bend point), maintains a strictly positive slope, and does not require additional taxes. Of course, if a tax increase is tolerable, then the slopes of the second and third legs can be kept closer to the original slopes. Some variation of this third option may be the most attractive to policymakers since the Senate Aging Committee has advocated the so-called "equity principle," which means that benefits received bear some relationship to the amount of taxes paid.

Figure 9 illustrates the new rule ($b_0(w)$ equation (7”) in the appendix), that protects benefits for individuals below the new threshold and maintains a strictly pos-

itive slope without changing the tax rate. Our new rule traces the original benefit rule up to the threshold and then continues as an increasing function, albeit with a somewhat flatter slope. We consider the example of protecting benefits up to the first bend point in the current US rule, which is 20 percent of the mean wage. (In the model, this is achieved by setting w_0 in equation (7") to w_1 from equation (22), both in the appendix). A depiction of the wage density function has been superimposed over the graph. The area under the left tail of the wage density function shows the fraction of the population whose benefits remain intact. This benefit rule protects the benefits for the bottom 9 percent of the population and maintains the positive benefit-earning link for all wages. This is done without a tax increase.

Figure 10 illustrates a potential future benefit-earning rule that protects benefits for the poor and maintains a strictly positive slope. In an effort to keep the new benefit rule similar to the current US rule, we create a piecewise continuous benefit rule that has the same bend points as the current US rule. This new benefit rule keeps the same slope on the first segment of the current rule, but the slopes of the second and third legs are chosen to best fit the new benefit function $b_0(w)$:

$$\min_{\delta_2,\delta_3} \left[\int_{w_1}^{w^+} \left[b_0(w) - b_{US}(w) \right]^2 dw \right], \tag{26}$$

subject to

$$b_{US}(w) = \begin{cases} w_1\delta_1 + (w - w_1)\delta_2, \text{ for } w_1 \leq w \leq w_2, \\ w_1\delta_1 + (w_2 - w_1)\delta_2 + (w - w_2)\delta_3, \text{ for } w_2 \leq w \leq w_3, \end{cases} \tag{27}$$

$$b_0(w) = b(w_1|R) \left(\frac{w}{w_1} \right)^{\zeta_0}, \tag{28}$$

where ζ_0 solves the balanced budget constraint (See appendix equation (18), and set $w_0 = w_1$). The result is a new benefit-earning rule, which maintains the benefits of those below the first bend point, keeps the slope of every segment strictly positive to maintain the benefit-earning link, and balances the budget after the demographic shock without a tax increase. The result of this process gives slopes for the second and third legs equal to $\delta_2 = 10\%$ and $\delta_3 = 3\%$.

If the drop in the ratio of workers to retirees ultimately is less severe than we are assuming, then more than the bottom 20 percent of the earning distribution can be protected in Option 13, less than a 5 point increase in the tax would be needed to protect the bottom 50 percent of earners in Option 14, and the slopes of the second and third segments of the benefit-earning rule can be greater than 10 percent and 3 percent in Option 15.

Winners and losers. As in the pervious section, the poor whose benefits are protected gain relative to the wealthy whose benefits fall. This also ignores the feedback effects of changing benefits. The assessment of public opinion and politics is likewise similar to the previous section.

CHAPTER 5.

POLITICAL FEASIBILITY

Throughout the paper, I have shown, quantitatively, how to protect social security benefits for a significant share of poor individuals after a demographic shock. However, even the most convincing quantitative results do not guarantee policy change. In addition to being quantitatively feasible, a realistic policy solution needs to also be politically feasible in order to be implemented. Even though I have taken reform proposals directly from the government, and in the special case, have focused on operationalizing an openly stated, government goal, there is no reason to assume such a goal is feasible. Thus, while the primary focus of this paper is to present a menu of Rawlsian social security reforms for policymakers to consider, I want to make sure the suggested policy responses are relevant for real-world policymaking. This requires that I show that the reforms considered throughout the paper are, at least partially, politically tolerable.

There are at least three ways to gauge the political feasibility of policy proposals: (i) by drawing inferences from existing theoretical work in public choice, (ii) by considering the preferences and stated objectives on Congress and other policymakers, and (iii) by considering public opinion. I will address each of these topics in sequence.

5.1 Public Choice Theory

A substantive literature on the political economy of social security has developed in public choice theory. Beginning with Browning (1975), economists have modeled the politically optimal social security tax rate for a pay-as-you-go system, given age (and later labor productivity) heterogeneity. (See Casamatta, Cremer, and Pestieau (2000)

for a discussion of the development of these models). A more recent paper by Galasso, Profeta, Haskel, and Ventura (2004) assesses the political viability of social security under a demographic shock. Their model suggests an increasing dependency ratio (the ratio of retirees relative to workers) will "[induce] agents to substitute their claims towards future pensions with more private savings, and the size of the system should be reduced. Aging, however, also has a direct political impact: as an older electorate increases the relevance of pension spending on the agenda of policymakers, it tends to foster larger and more generous systems" (p.66). They find the latter effect to outweigh the former.

Galasso et al. share an additional insight that is relevant to the model developed in section 4. They explain that, "The key intuition [of their paper] is that the social security systems we observe need not be welfare enhancing: they only need to be sustained politically. In democracies, this support is represented by the approval of a majority of the Parliament or, more directly, of the electorate" (2004, p.78). It is not necessary for a policy to be socially optimal in order to be politically feasible. Throughout the paper, I make no effort to assess the social optimality of the reforms discussed; rather I view my contribution as the operationalization of an already existing governmental desire to maintain benefits for the economically vulnerable in light of a demographic shock. I leave it up to the policymaker to decide if she should implement a one of the reforms. Like the CBO, I simply provide suggestions about the quantitative impacts of such a decision.

These theoretical models provide a useful backdrop for the discussion at hand. The results indicate that an aging population will favor a larger social security program.

However, the theoretical models do not reveal a preference for the shape of the benefit-earnings rule or optimal tax base. Casamatta, Cremer, and Pestieau abstract to a "constitutional phase" when agents express preference not only for the size of the social security program, but also for the level of intra-generational redistribution within the system. They conclude,

> Even from a pure Rawlsian viewpoint, it may be optimal to adopt a benefit rule that is not "too redistributive." Interestingly, the less redistributive than otherwise optimal benefit rule is not (or not only) adopted to mitigate labour market distortions but also to induce a majority to opt for generous retirement benefits. (2000, p.505)

This theoretical result suggests that, at least in the abstracted constitutional state, voters may prefer a benefit-earnings rule similar to options 9, 10, or 15 that maintains a strictly positive slope over a more Beveridgean[1] system.

5.2 Congress

Social security is administered as directed by law. Any change to the social security benefit structure would have to come through legislation. Therefore, it is prudent to discuss the politics of Congress. In his 1998 paper, "The Politics of Reforming Social Security" political scientist Douglas Arnold explains

> Policy analysts often avoid questions of political feasibility, preferring to design programs that they believe will best achieve certain ends, while

[1] For a definition of a Beveridgean system refer to the appendix, section 6.

> leaving it to politicians to "do the right thing." Sometimes this works nicely, and elected politicians enact analysts' handiwork. Quite frequently, however, the absence of early political analysis leads to unhappy outcomes. (p.213)

Social security has long been a hot-button issue in American politics. Conventionally referred to as the "third rail of politics," touching social security can shock a politician's career.[2] Public support for social security has historically been high, and remains so today. Any effort to reform the system will likely be met with resistance.

Unfortunately, it is difficult to directly gauge congressional support for a given social security reform. Politicians give broadly appealing messages and hesitate to say anything that may alienate voters. For example, the Senate Committee on Aging claims, "Social security can be strengthened, benefits for those who need them most can be increased, and long-term solvency can be ensured with just a few, small common-sense changes" (from website). This general statement promises increased benefits and long-term solvency without mentioning sacrifice. It is a politically appealing message that may garner support from most voters. Policy analyst Paul Light explains why legislators favor broadly appealing messages. "The dangers of a mistake [regarding social security] are so great that most members of Congress try to keep their opinions to themselves" (Light, 1985, p.15). A quick browse of current congressional websites reveals that neither the Speaker of the House Boehner, nor the Senate Minority Leader McConnell explicitly mentions social security reform on his "issues" page. House Mi-

[2] For an interesting discussion of the origin of the phrase "third rail" see "Language: Tracking the source of the 'third rail' warning - Opinion - International Herald Tribune" by William Safire published Feb 18, 2007 in the New York Times.

nority Leader Pelosi dedicates a tab on her website to social security, but only promises to fight privatization. (This is substantive policy advocacy, but it is a policy that is clearly opposed by a majority of her constituents, therefore it is not politically risky. She avoids taking a stand on more difficult aspects of social security). Senate Majority Leader Reid is the only one of the four leaders to mention the "long term challenges" facing social security. Yet even he emphasizes "it is not a crisis." Similar language can be found on many congressional web pages. If these politicians have specific opinions on social security reform, they are not sharing them with the public.

Speaking of the 1983 social security reform, (the late) Representative Conable explained,

> We in Congress are very good at giving people relative advantages but incredibly inept at assigning relative disadvantages. In social security, we've run out goodies to pass out, and we have no choice but to ask some part of all the people involved to lower their expectations (Light, 1985, p.15).

Advocating a specific policy reform therefore, puts members of Congress in the difficult situation of denying some constituency its desired political outcome. Thus, a member of Congress may avoid articulating solid reform proposals, opting instead to say meaningless sound bites to please voters and stay in office. A well-established body of literature suggests that policymakers are motivated by re-election (See Downs, 1957 and Fiorina, 1977).

> Legislators are extraordinarily attentive to what they hear from constituents, careful about how they deal with organized interests, and cau-

> tious when they cast major votes, calculating how specific votes might look in the middle of the next campaign if challengers decided to focus attention on them (Arnold, 1998, p.215).

This is potentially devastating for policy. Anthony King explains, "Painfully often the legislation our politicians pass is designed less to solve problems than to protect the politicians from defeat in our never-ending election campaigns. They are, in short, too frightened of us to govern" (1997, p.41).

Therefore, in order to assess congressional appetite for a policy that protects benefits of the poor without (or with a small) tax increase, we must look beyond public statements, and try to decipher what voters want. It follows that politicians will favor a reform that pleases a majority of voters.

5.3 Public Opinion

Voters oppose raising taxes and also oppose cutting future benefits. Only 35 percent of adults surveyed by *ABC News/Washington Post* in March 2011 favor raising the social security tax to address future economic strains on the system. Fewer, 32 percent, favor reducing guaranteed benefits for future retirees to restore fiscal solvency. (See also Sept 2010 *Gallup* poll). Even self-identified Tea Partiers oppose cutting social security benefits in order to reduce the deficit (see Mar 2011 *Wall Street Journal* Poll). At first blush, it appears voters would oppose any effort to balance the social security budget by reducing benefits or increasing taxes. As a result, voters may reject all policies considered in this paper. However, my analysis of public opinion is limited by the questions asked by pollsters. I do not have data for many of the nuanced variations

of social security reform.

In order to approximate the way voters might respond to the reforms presented in the paper, I searched advocacy groups, the political parties, and prominent policy think tanks to see what kinds of policies each group supports.

The first key player I assess is the American Association of Retired Persons (AARP). With over 37 million members, the AARP has long been one of the most influential interest groups on Capitol Hill. Light spoke with a staffer who said "most of the young staffers up there have mothers and fathers who belong to the American Association of Retired Persons. You think that doesn't make a difference?" (1985, p.76). Light further explains that the large size of AARP makes it difficult for the organization to find policy positions that would appeal to a majority of the membership. Currently, the organization does not advocate a specific policy solution for the social security fiscal imbalance, but only urges its membership to "take a stand" against the "dangerous cuts" Congress might make. Their social security webpage and advocacy commercials repeat that Congress should "ensure that future generations get the benefits they've earned." This language indicates AARP's attachment to future benefits. They would not see benefit reduction as a simple policy change, but rather a personal betrayal and the denial of hard-earned benefits. Presumably, they would oppose any of the policy suggestions motivated by the GAO and Senate Aging Committee that involve benefits cuts and would instead favor policy suggestions that protect the benefits of a significant share of the population through tax increases.

Second, I looked to the two major political parties themselves to see if either organization has an ideological response to the looming demographic shock. The De-

mocratic National Committee praises the success of the social security system, acknowledges the future fiscal imbalance, but does not offer any policy solutions. Instead they praise their own efforts to "[beat] back Republican plans to privatize social security." The Republican National Committee simply avoids mentioning the issue altogether. It is unclear if either party would oppose or support increasing the tax base, or modifying the benefit-earnings rule to protect benefits of the poor.

Finally, I evaluate policy think tanks to see what kinds of reforms they each advocate. The Libertarian-leaning Cato Institute has written extensively on social security reform. They consistently advocate moving toward a fully funded system. The Heritage Foundation, a conservative group, also advocates movement towards privatization desiring a "system of voluntary personal accounts within social security." The center-left Brookings Institution believes Congress should "slow the growth of social security benefits for middle and high earners" while still delivering "lower-wage earners" with "everything they are now promised" (Pozen, 2011, p.1). The Center for American Progress, a liberal organization, desires reform that "can offer the best insurance benefits to those who need them most" while making "progressive changes to the benefit formula" (from website). Surprisingly, the American Enterprise Institute, traditionally considered a conservative organization (they prominently note that "Ronald Reagan appointed several dozen AEI scholars and fellows to his administration and to federal judgeships") states that "social security benefits for high earners should be reduced." They elaborate further, "paying $27,000 per year in benefits to a personal who earned over $100,000 per year cannot be our highest priority" (from website).

It would appear from this cursory survey that if policymakers desire a benefit-

earning rule that maintains benefits for the poor without increasing taxes (by reducing benefits for high wage earners), they will find support with left-leaning organizations and with AEI. The (potential) bipartisan support of Brookings and AEI is promising for such a benefit-earning rule. Neither political party has sufficient power to reform the system alone (this is particularly true of the 112th Congress that is controlled by Republicans in the House and Democrats in the Senate). Therefore, any truly feasible solution will need support from (at least part of) each party.

CHAPTER 6.

CONCLUSION

All of the quantitative analysis in this paper, both by government agencies (GAO, Senate Aging Committee, and the CBO) and by Dr. Caliendo and myself (in the special case) assume an exogenous date of retirement. This abstraction allows us to calculate the "first round effects" of the various policy proposals discussed in this paper. The abstraction, however, does not allow agents in the model to respond to changes in taxes or benefits by changing the quantity of labor they supply, in other words, by changing their date of retirement. Econometric data suggest that individuals do change their behavior based on expected social security benefits and taxes. Therefore, the analysis in this paper should not be taken as a final conclusion on the affects of each reform, but rather as a springboard for further investigation. Gokhale uses a similar simplification in his analysis of six social security reforms. He offers the following explanation:

> [Increasing social security taxes] is unlikely to be costless: weakening linkages between work effort and its rewards by levying higher taxes and redistributing benefits to support relatively less productive workers and dependents is likely to reduce economic efficiency over time. Estimating the magnitude of this "feedback" effect remains outside the scope of this book. (2010, 312)

I offer the same caveat to this paper. Estimating the feedback effects of the 15 reforms I consider is important, but beyond the scope of this paper. I hope my paper

serves as a springboard for future discussions of the impacts of social security on the welfare of the poorest members of society.

It is difficult to predict the political success of any change to social security. The public is resistant to both tax increases and benefit reductions. Legislators act as delegates and advocate policies with the greatest public support. Conservative and liberation policy wonks advocate policy that moves towards a fully funded system. Progressive policy experts advocate reform that increases the redistributive element of social security. If the position taken by the Brookings Institute and AEI are representative of a larger political coalition, It is likely that the Rawlsian adjustments to the benefit-earning rule considered in options 11-15[1] may garner enough support to be politically palatable. The Wall Street Journal reported "more than 60 percent of poll respondents [to their 2011 poll] supported reducing Social Security and Medicare payments to wealthier Americans" (King and Greenberg, 2011). This majority coupled with support from AEI and Brookings may be enough to cross the third rail. "The [political] third rail is not like the one in the subway: if a Republican foot and a Democratic foot touch it simultaneously, nothing happens" (Sarfire, 2007). Reducing benefits may gain support of Republicans who wish to see government spending reduced, and maintaining the benefits for the economically vulnerable may gain support of Democrats. Therefore, we may able to step onto the third rail with bipartisan support and restore fiscal balance to social security with a new benefit-earnings rule.

[1]Note, options 12-15 correspond to equations (7), (7'), and (7") in the appendix.

CHAPTER 7.

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APPENDIX A.

APPENDIX: COTTLE, CALIENDO THEORY FOR OPTIONS 13, 14 AND 15

Option 13: Maximum Protection of Benefits to the Poor without a Tax Increase. Age is continuous and is indexed by t. At time zero the individual enters the workforce. Retirement occurs at $t = T$, and the maximum lifespan is $t = \bar{T}$. The probability of surviving to age t, from the perspective of age zero, is $S(t)$. An infinitely divisible cohort of mass N is born at each moment in time. Let N be constant to abstract from changes in population size. Due to the infinite divisibility assumption, $NS(t)$ can be interpreted as the number of age-t people alive at any point in calendar time. We use the term 'demographic shock' to mean an increase in longevity, though the source of the aging of the population (be it increased longevity, decreased fertility, baby boom phenomenon, etc.) is not relevant since our analysis below hinges only on changes in the ratio of workers to retirees, whatever the source of the change.

During the working years, wage income w varies across workers according to the density function $f(w)$, with support $[w^-, w^+]$ where $\int_{w^-}^{w^+} f(w)dw = 1$. The function $f(w)$ is stationary across cohorts. All workers pay social security taxes on wages at rate θ. During retirement and conditional on survival, retirees receive a social security annuity that depends on their wage earnings, $b(w)$. If $b'(w) = 0$, then everyone gets the same benefits and the system is referred to as "Beveridgean." If $b(0) = 0$ and $b'(w)$ is a constant and $b'(w) > 0$, then benefits are the same proportion of earnings for all individuals and the system is "Bismarckian." In this case, the benefit-earning function

is a ray from the origin, whose slope depends on the size of the pension tax rate. We are interested in the space between the extremes, such as the US, in which the pension system is both earnings based and redistributive: $b(0) = 0$, $b'(w) > 0$ (i.e., the system is earnings based), and $b''(w) < 0$ (i.e., the system is redistributive).

In our model we work with a pension system that has a balanced budget. We impose a balanced budget to impose constraints and tradeoffs on the choices available to the policymaker in the model. Thus, aggregate taxes collected equals aggregate benefits received at a moment in time

$$\int_{w^-}^{w^+} f(w)\theta w dw \times \int_0^T NS(t)dt \ = \int_{w^-}^{w^+} f(w)b(w)dw \times \int_T^{\bar{T}} NS(t)dt \ , \tag{1}$$

where $\int_{w^-}^{w^+} f(w)\theta w dw$ is the average taxes paid per worker and $\int_0^T NS(t)dt$ is the total number of workers, and $\int_{w^-}^{w^+} f(w)b(w)dw$ is the average benefit per retiree and $\int_T^{\bar{T}} NS(t)dt$ is the total number of retirees. To compress notation, we define

$$\bar{w} \equiv \int_{w^-}^{w^+} f(w)wdw, \text{ and } R \equiv \int_0^T NS(t)dt \Big/ \int_T^{\bar{T}} NS(t)dt \ , \tag{2}$$

so that (1) can be written compactly

$$\theta \bar{w} R \ = \int_{w^-}^{w^+} f(w)b(w)dw. \tag{3}$$

For convenience, we construct a flexible, single-parameter benefit-earning rule that is continuously differentiable in wages and can be calibrated to closely fit the US rule

$$b(w) = b(w^+) \left(\frac{w}{w^+}\right)^{\zeta}, \text{ for } \zeta \in [0, 1], \tag{4}$$

where ζ conveniently summarizes the degree of redistribution in the pension system: as $\zeta \to 0$, the pension system becomes Beveridgean (everyone receives the same ben-

efits regardless of contributions); as $\zeta \to 1$, the pension system becomes Bismarckian (everyone experiences the same replacement rate); and, for $\zeta \in (0,1)$, $b(w)$ is strictly concave and therefore the pension system is both earnings based and redistributive.

Note that the maximum benefit $b(w^+)$ can be adjusted to ensure the budget balances. Insert (4) into (3) and solve for $b(w^+)$

$$b(w^+) = \theta \bar{w} R \left[\int_{w^-}^{w^+} f(w) \left(\frac{w}{w^+} \right)^{\zeta} dw \right]^{-1}. \tag{5}$$

Inserting (5) into (4) gives a flexible, single-parameter benefit-earning rule that is also consistent with a balanced budget for any value of ζ

$$b(w|R) = \theta \bar{w} R \left[\int_{w^-}^{w^+} f(w) \left(\frac{w}{w^+} \right)^{\zeta} dw \right]^{-1} \left(\frac{w}{w^+} \right)^{\zeta}, \text{ for } \zeta \in [0,1]. \tag{6}$$

The notation $b(w|R)$ is meant to emphasize that the benefit-earning rule is conditioned on the ratio of workers to retirees R. Holding everything else constant (in particular the degree of redistribution and the tax rate), we see from (6) that a demographic shock (a reduction in R) would require a proportional decrease in everyone's benefits.

The goal of a Rawlsian policymaker is to preserve the benefits of the poor in the face of a demographic shock. Let R be the ratio of workers to retirees before the shock and $\hat{R}$ be the ratio of workers to retirees after the shock. If taxes cannot be raised, the policymaker is of course constrained by a balanced budget and so everyone's benefits cannot be maintained. By assumption, the priority of the policymaker is to preserve the benefits for as many people at the poor end of the distribution as possible, without interfering with the earnings-based nature of the system. We restrict the policymaker's choice of how redistributive he makes the pension in response to the demographic shock by forcing the condition that benefits must be weakly increasing in earnings. Let

$\hat{w} \in [w^-, w^+]$ be the threshold wage (i.e., maximum wage), below which the policymaker is able to perfectly maintain benefits without increasing taxes, and above which benefits become constant in earnings in order to finance the benefits of the poor. Thus, the Rawlsian policymaker handles the demographic shock by implementing a new benefit-earning rule

$$\hat{b}(w) = \begin{cases} b(w|R), \text{ for } w \in [w^-, \hat{w}], \\ b(\hat{w}|R), \text{ for } w \in [\hat{w}, w^+]. \end{cases} \tag{7}$$

Notice that the post-shock[1] rule $\hat{b}(w)$ perfectly tracks the pre-shock rule $b(w|R)$ until the threshold wage $\hat{w}$, after which the post-shock rule becomes a flat line at the value $b(\hat{w}|R)$.

The threshold parameter $\hat{w}$ is defined by the balanced budget equation, using the post-shock ratio of workers to retirees $\hat{R}$ and the new benefit rule $\hat{b}(w)$. Thus, $\hat{w}$ is the solution to

$$\theta \bar{w} \hat{R} = \int_{w^-}^{w^+} f(w) \hat{b}(w) dw, \tag{8}$$

which can be rewritten using (7)

$$\theta \bar{w} \hat{R} = \int_{w^-}^{\hat{w}} f(w) b(w|R) dw + \int_{\hat{w}}^{w^+} f(w) b(\hat{w}|R) dw. \tag{9}$$

At this level of generality, (9) cannot be solved analytically for $\hat{w}$. Nor can it be solved analytically when we make explicit but realistic assumptions about the shape of the density $f(w)$. But, equation (9) can certainly be used to numerically approximate the threshold wage $\hat{w}$, after properly calibrating $f(w)$ (see below). This threshold leaves the benefits of those with wages below $\hat{w}$ unaffected by the demographic shock. The

[1] throughout the appendix, the language "post-shock rule" will refer to any reform that changes the benefit earning rule. "Pre-shock rule" refers to the current US benefit-earning rule.

right hand side of (9) is an increasing function of $\hat{w}$. Therefore, the smaller is $\hat{R}$ the smaller will be $\hat{w}$. A big shock would require a small $\hat{w}$. The fraction of the population whose benefits are unaffected by the shock is

$$F(\hat{w}) \equiv \int_{w^-}^{\hat{w}} f(w)dw. \tag{10}$$

Option 14: Increasing Taxes to Protect a Larger Segment of the Population. Next, we consider the case where the Rawlsian policymaker wants to protect benefits among a greater segment of the population than is afforded without changing the tax rate. That is, the policymaker wants to preserve the benefit function beyond the threshold wage $\hat{w}$ to a higher wage, say w^*. The fraction of the population whose benefits are unaffected by the shock would then be $F(w^*) = \int_{w^-}^{w^*} f(w)dw$. Let the mapping $w^*(F)$ be the inverse of $F(w^*)$, where $F \in [0,1]$, and $w^*(1) = w^+$. Therefore, conditional on a chosen value for F, the benefit rule the policymaker wishes to impose after the shock is a modified version of (7)

$$b^*(w) = \begin{cases} b(w|R), \text{ for } w \in [w^-, w^*(F)] \\ b(w^*(F)|R), \text{ for } w \in [w^*(F), w^+] \end{cases}, \tag{7'}$$

which can be financed with an appropriate increase in the tax rate. Replacing $\hat{w}$ with $w^*(F)$ in (9) and solving gives the new tax rate that is needed to protect the benefits of the poorest F percent of the population

$$\theta^*(F) = \frac{1}{\bar{w}\hat{R}} \int_{w^-}^{w^*(F)} f(w)b(w|R)dw + \frac{1}{\bar{w}\hat{R}} \int_{w^*(F)}^{w^+} f(w)b(w^*(F)|R)dw. \tag{11}$$

As expected, in (11) we see that the more severe the shock (i.e., the lower the $\hat{R}$), the larger will be the required tax to protect the benefits of the desired segment of the population.

For the special case where the policymaker wants to preserve the benefits for everyone, i.e., $F = 1$, then

$$\theta^*(1) = \frac{1}{\bar{w}\hat{R}} \int_{w^-}^{w^+} f(w)b(w|R)dw. \tag{12}$$

Noting from (3) that the original tax before the shock, θ, can be expressed as

$$\theta \ = \frac{1}{\bar{w}R} \int_{w^-}^{w^+} f(w)b(w|R)dw, \tag{13}$$

we can write the new tax as a simple function of the old tax

$$\theta^*(1) = \frac{R}{\hat{R}}\theta. \tag{14}$$

But for the more general case where $F \leq 1$, the analysis is not as simple and we must use (11) to numerically approximate $\theta^*(F)$. We do this after calibrating the $f(w)$ density function.

Option 15: Protection of Benefits to the Poor and Preserving the Strict Earnings-Based Feature without a Tax Increase. We now suppose the policymaker has two objectives. He would like to protect the benefits of the poor but he would also like to preserve the benefit-earning link for all wage levels. While the earnings-based feature of the current system is, at least in part, preserved in the above analysis, it can be more explicitly maintained if we take a more narrow definition of the poor.

Suppose the policymaker preserves the benefit function up to some lower point, say $w_0 < \hat{w}$. This frees up extra tax revenue that allows the policymaker to preserve the earnings-based feature of the program beyond the point w_0, unlike the previous two

sections in which the benefit function became perfectly flat after the critical threshold. The fraction of the population whose benefits are unaffected by the shock would then be $F(w_0) = \int_{w^-}^{w_0} f(w)dw$. Let $w_0(F)$ be the inverse of $F(w_0)$ (and therefore the mappings $w^*(F)$ and $w_0(F)$ are the same, and we use the new notation just to stay organized).

We choose a new benefit rule that operates like (7) and (7') before the threshold and it continues to increase (like in (4)) after the threshold, though not at the same rate as before the threshold. This is reasonable because it allows us to protect the benefits of the poor while at the same time preserving the positive benefit-earning link all across the wage domain of the benefit-earning function. Conditional on a chosen value for F, such that $w_0(F) < \hat{w}$, the new benefit rule the policymaker imposes after the shock is

$$b_0(w) = \begin{cases} b(w|R), \text{ for } w \in [w^-, w_0(F)] \\ b_0(w^+)\left(\dfrac{w}{w^+}\right)^{\zeta_0}, \text{ for } w \in [w_0(F), w^+] \end{cases}. \tag{7"}$$

The policymaker chooses F and therefore chooses the threshold $w_0(F)$, and then the parameters $b_0(w^+)$ and ζ_0 are simultaneously chosen to ensure (i) continuity of the benefit-earning function at the threshold $w_0(F)$ and (ii) a balanced budget.

Continuity can be ensured by assuming the new benefit function equals the original function at the threshold $w_0(F)$

$$b_0(w^+)\left(\frac{w_0(F)}{w^+}\right)^{\zeta_0} = b(w_0(F)|R), \tag{15}$$

which gives us the upperbound $b_0(w^+)$ as a function of ζ_0

$$b_0(w^+) = b(w_0(F)|R)\left(\frac{w_0(F)}{w^+}\right)^{-\zeta_0}, \tag{16}$$

and in particular, $b_0(w^+)$ is increasing in ζ_0. The balanced budget equation becomes

$$\theta\bar{w}\hat{R} = \int_{w^-}^{w_0(F)} f(w)b(w|R)dw + \int_{w_0(F)}^{w^+} f(w)b_0(w^+)\left(\frac{w}{w^+}\right)^{\zeta_0} dw. \tag{17}$$

To identify ζ_0, we insert the continuity condition (16) into the balanced budget equation (17) (in which everything but ζ_0 is now given)

$$\theta\bar{w}\hat{R} = \int_{w^-}^{w_0(F)} f(w)b(w|R)dw + \int_{w_0(F)}^{w^+} f(w)b(w_0(F)|R)\left(\frac{w}{w_0(F)}\right)^{\zeta_0} dw. \tag{18}$$

At this level of generality, we cannot analytically solve (18) for ζ_0, though we can characterize how ζ_0 must change when $\hat{R}$ or F change.

Because $w/w_0(F) \geq 1$ for all $w \in [w_0(F), w^+]$

$$\frac{\partial}{\partial\zeta_0}\int_{w_0(F)}^{w^+} f(w)b(w_0(F)|R)\left(\frac{w}{w_0(F)}\right)^{\zeta_0} dw > 0. \tag{19}$$

Therefore, the implicit derivative (from 18) $\partial\zeta_0/\partial\hat{R} > 0$. In words, the larger the longevity shock (meaning the smaller the value for $\hat{R}$), the smaller the ζ_0 will need to be to balance the budget for a given F. This is intuitive because the second leg of the new benefit rule, after imposing the continuity condition, $b_0(w) = b(w_0(F)|R)\,(w/w_0(F))^{\zeta_0}$, is increasing in ζ_0 for all $w \in [w_0(F), w^+]$ and strictly increasing for all $w \in (w_0(F), w^+]$.

Also, if $w_0(F) = \hat{w}$, (18) is

$$\theta\bar{w}\hat{R} = \int_{w^-}^{\hat{w}} f(w)b(w|R)dw + \int_{\hat{w}}^{w^+} f(w)b(\hat{w}|R)\left(\frac{w}{\hat{w}}\right)^{\zeta_0} dw. \tag{20}$$

Insert (9) into (20) and simplify

$$\int_{\hat{w}}^{w^+} f(w)b(\hat{w}|R)dw = \int_{\hat{w}}^{w^+} f(w)b(\hat{w}|R)\left(\frac{w}{\hat{w}}\right)^{\zeta_0} dw, \tag{21}$$

which holds only if $\zeta_0 = 0$, i.e., only if the benefit rule becomes flat after the threshold, which is anticipated from the theoretical results above. For any other $w_0(F) < \hat{w}$, it

must be the case that $\zeta_0 > 0$ in order to balance the budget since a value of $\zeta_0 = 0$ would necessarily leave a budget surplus. And, it must be the case that $\zeta_0 < \zeta$ because the demographic shock leaves the policymaker unable to fund the original benefit rule. Hence, we know for the case of $w_0(F) \in (w^-, \hat{w})$, then $\zeta_0 \in (0, \zeta)$. We will define $\zeta_0(F)$ to be that value of ζ_0 that solves (18). Further, because $b_0(w)$ is strictly increasing in ζ_0 for all $w \in (w_0(F), w^+]$, the balanced budget constraint requires $\zeta_0'(F) < 0$. Thus, the policymaker faces a fundamental tradeoff since higher F comes at the cost of a flatter benefit-earning rule.

1.1 Calibrating the Theory to the US

We assume the survival function $S(t)$ is calibrated to ensure that the ratio of workers to retirees is 3.3, which is approximately the average value in the US during the period 2000-2010, before pension tax revenues began to fall short of benefits paid. Although the ratio of workers to retirees has been falling since the inception of the social security program, we think of the period 2000-2010 as the "pre-shock" period because budget deficits did not materialized until the end of this period.

Before exploring the consequences of the demographic shock, we need to calibrate the model to match the US social security system. We set the social security tax rate θ to the full employer and employee tax of 12.4 percent (the Old-Age, Survivors, and Disability Insurance (OASDI) tax rate since 1990). By including the disability component of the tax (1.8 percent), we are better able to match the scale of the social security benefit rule in the US. This is not central to our analysis; we just need the aggregate level of taxes collected to be sufficient to fund aggregate benefits as they are

constructed in the US.[2] Benefits are a piecewise linear function of earnings,

$$b_{US}(w) = \begin{cases} w\delta_1, \text{ for } w \leq w_1, \\ w_1\delta_1 + (w - w_1)\delta_2, \text{ for } w_1 \leq w \leq w_2, \\ w_1\delta_1 + (w_2 - w_1)\delta_2 + (w - w_2)\delta_3, \text{ for } w_2 \leq w \leq w_3, \end{cases} \tag{22}$$

where w_1, w_2, and w_3 are the "bend points," and δ_1, δ_2, and δ_3 are the slopes of the three distinct segments. Beyond the third point point, the function is flat. We use a conventional estimate of the bend points relative to average wages, $w_1 = 0.2\bar{w}$, $w_2 = 1.24\bar{w}$, and $w_3 = 2.47\bar{w}$ (as in, e.g., Ortiz (2009)).[3] The slopes are $\delta_1 = 90\%$, $\delta_2 = 32\%$, and $\delta_3 = 15\%$.

We use a flexible, quasi-normal function (Caliendo and Findley (2010)) for the wage density

$$f(w) = f_{\max} \exp\left[-\mu\left(\gamma w - 1\right)^2\right], \text{ where } \mu, \gamma \in \mathbb{R}^+. \tag{23}$$

The thickness of this function is controlled by μ, the mode is equal to γ^{-1}, and the extremum is $f_{\max}$. We can ensure that $f(w)$ is a proper density function for any choice of μ and γ (with unit area under the curve, $\int_{w^-}^{w^+} f(w)dw = 1$) by normalizing $f_{\max}$

$$f_{\max} = \left[\int_{w^-}^{w^+} \exp\left[-\mu\left(\gamma w - 1\right)^2\right] dw\right]^{-1}. \tag{24}$$

There are four parameters in the wage distribution that need to be calibrated: w^-, w^+, γ, and μ. We normalize $\bar{w} = 1$. We set $w^- = 0$ and $w^+ = 2.47\bar{w}$ because

[2] In reality some people pay taxes and receive either no benefits or reduced benefits. Examples are those who work for less than ten years in the US and therefore get nothing back, and the working spouse in a two-earner family gets a reduced benefit. Both of these things help to explain why we need a relatively big tax in our model to balance the budget, because in our model everyone who pays taxes gets a full benefit.

[3] When we estimate the bend points from 2011 relative to the national average wage index, as reported by the SSA, we obtain bend points that are slightly different than those used by Ortiz and others. Nevertheless, the magnitude of the discrepancy is not large enough to affect our quantitative results in a material way.

social security benefits and taxes are capped in the US at the third bend point, so that any income beyond the cap is irrelevant to our analysis because no extra taxes are paid and no extra benefits are received for incremental increases in wages beyond the third bend point.[4] This leaves two unknowns: μ and γ. The 2008 US Census Bureau, Current Population Survey, is helpful in pinning down these parameters. We use this data to construct a density function for household income and we find that it is bell shaped, skewed left, and the mode is about 74 percent of the mean. Hence, using the assumption that the mean is one, we set $\gamma^{-1} = 0.74$. This leaves only μ, which we choose to ensure that our assumption of $\bar{w} = 1$ is indeed true. Doing this gives a calibrated value of $\mu = 0.338$ and $\gamma = 1.351$.[5]

Figure 5 is a graph of our wage density function (equation (23)). The density is bell shaped and skewed left. The mode, $\gamma^{-1} = 0.74$, is indicated with a vertical dashed line, as well as the mean wage, $\bar{w} = 1$. The upperbound of the support is truncated at the third bendpoint $w_3 = 2.47\bar{w}$ to reflect the benefit-earning cap.

Now that $f(w)$ is calibrated, we can calibrate the parameter ζ so that the pre-shock social security benefit rule in the model (i.e., equation (6)) carefully fits the actual social security rule (i.e., equation (22)). Let

$$\zeta = \arg\min \left[\int_{w^-}^{w^+} \left[b(w|\zeta, R) - b_{US}(w) \right]^2 dw \right], \tag{25}$$

which gives $\zeta = 0.55$. Our theoretical model provides an excellent fit to the US benefit-

[4] The 2008 U.S. Census Bureau, Current Population Survey shows that households with income more than 2.47 times the mean represent less than 8% of the total population.

[5] The density function $f(w)$ from (23) collapses to the uniform density as $\mu \to 0$, with mean equal to the midpoint of the support. Alternatively, as μ gets large, the density function becomes a spike at the mode, and therefore the mean will equal the mode. As long as the mean that we are targeting lies between the mode and the midpoint of the support, there will be a finite, positive μ that will produce the target mean.

earning rule and has the advantage of summarizing the degree of redistribution in a single, elasticity parameter ζ.

Figure 6 compares the piecewise differentiable US benefit rule, $b_{US}(w)$ (equation (22)), to our calibrated, single-parameter benefit rule, $b(w|R)$ (equation (6)). The graph depicts the annuity value of social security benefits as an increasing, concave function of wage earnings. For convenience, we use the calibrated function as the pre-shock baseline in our analysis. By design, the calibrated rule balances the budget.

After calibrating the model, we are able to study the implications of a Rawlsian response to a demographic shock. We assume the survival function becomes more rectangular so that the new ratio of workers to retirees $\hat{R} = 2.0$, which corresponds to the year 2070 according to the intermediate projections of the Trustee's Report of the Social Security Administration (SSA). The worst case projection of the SSA puts the ratio of workers to retirees at 2.0 in the year 2030. In any case, we are interested in understanding the Rawlsian response to a demographic shift of this magnitude.

1.2 Robustness: Alternative Wage Density Functions

We now consider two alternative density functions as a robustness check, one with a mode of 0.54 and the other with a mode of 0.94. In each case we adjust μ to ensure the baseline mean of 1 is preserved. Figure 11 plots the two alternative density functions together with the baseline function. We then recalibrate the elasticity parameter ζ so that the social security benefit rule in the model (i.e., equation (6)) continues to provide the best possible fit to the actual social security rule (i.e., equation (22)), via the optimization procedure in (25). For the case of the low mode (0.54), ζ

does not change from its baseline value of 0.55. For the case of the high mode (0.94), ζ now equals 0.57. Clearly, major adjustments to the benefit-earning rule in the model are unnecessary.

Next, we use the alternative density functions, together with the new best-fitting values of ζ, to re-estimate the maximum number of poor individuals that can be protected from the demographic shock without a tax increase. This corresponds to $F(\hat{w})$ from Section 6, option 13. Recall, for the baseline wage density function, we previously estimated $F(\hat{w}) = 20\%$. Now, the low-mode alternative gives 22% and the high-mode alternative gives 14%. Clearly, the policymaker in the model will have more difficulty protecting the poor from the demographic shock if we have underestimated the mode of the true distribution. But we would need to have seriously underestimated it, and the census data clearly reports a mode that is significantly lower than the mean. If anything, we believe we have overestimated the mode: we took the baseline mode to be 0.74 because this indeed corresponds to the most common earnings class in the data, whereas a high-order polynomial fit to the census data puts the mode close to 0.5. The discrepancy between the true mode and the mode from a polynomial fit is due to the noise in the density data, which appears to come from the fact that wage salaries are often clustered around nice round numbers (or, at least people report their salaries in round numbers). In any case, recalibrating to a lower mode only improves the options available to the Rawlsian policymaker.

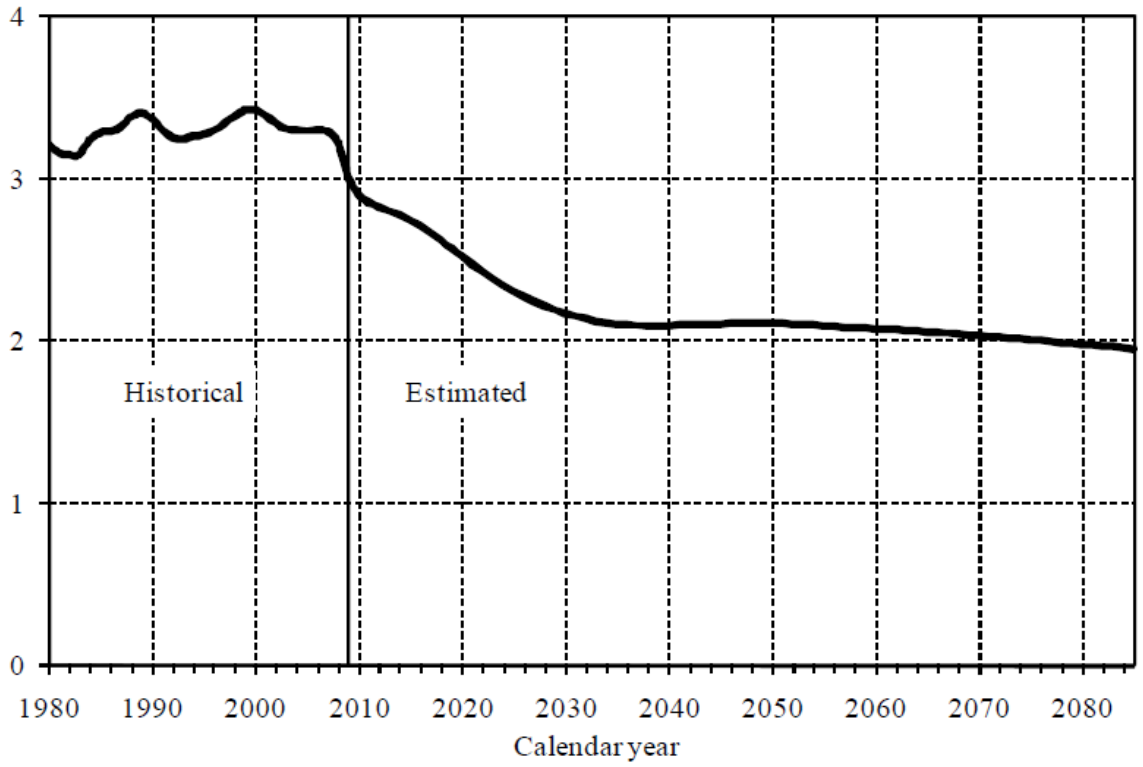
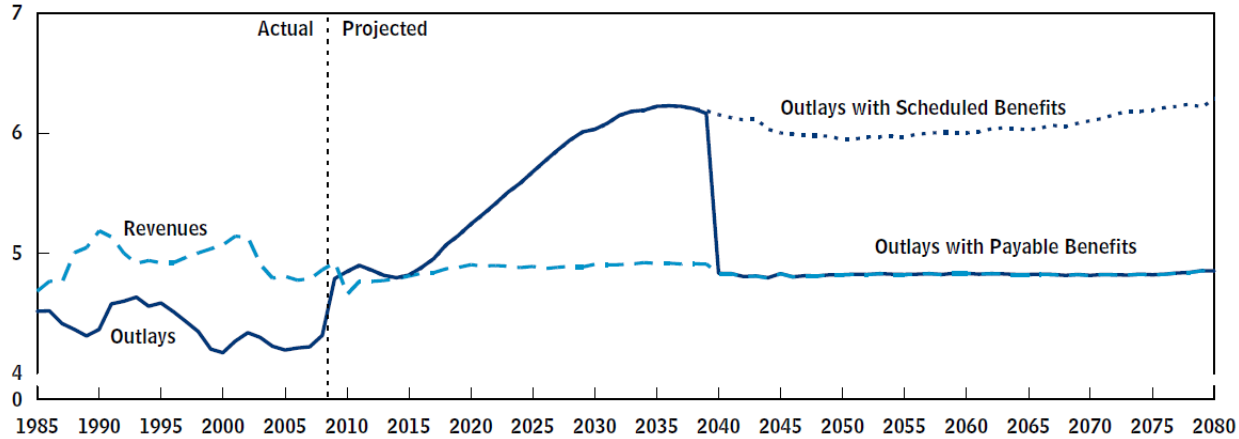


Figure 1. *The ratio of workers to retirees.* This ratio is expected to fall from its current value of about 3.3 workers for each retiree, to about 2 workers for each retiree by 2030.

Source: 2010 SSA Trustee Report.



Source: Congressional Budget Office.

Figure 2. *Social security revenues and outlays.* Social security revenues are expected to fall below outlays beginning in the year 2016. The trust fund will enable the SSA to pay fully scheduled benefits from 2016 until 2039. When the trust fund becomes depleted in 2039, the SSA will not be able to finance fully scheduled benefits. The thick dashed line shows social security revenues. The thin dashed line depicts scheduled benefits. The solid line depicts payable benefits.

The vertical access is measured in percentage points of GDP.

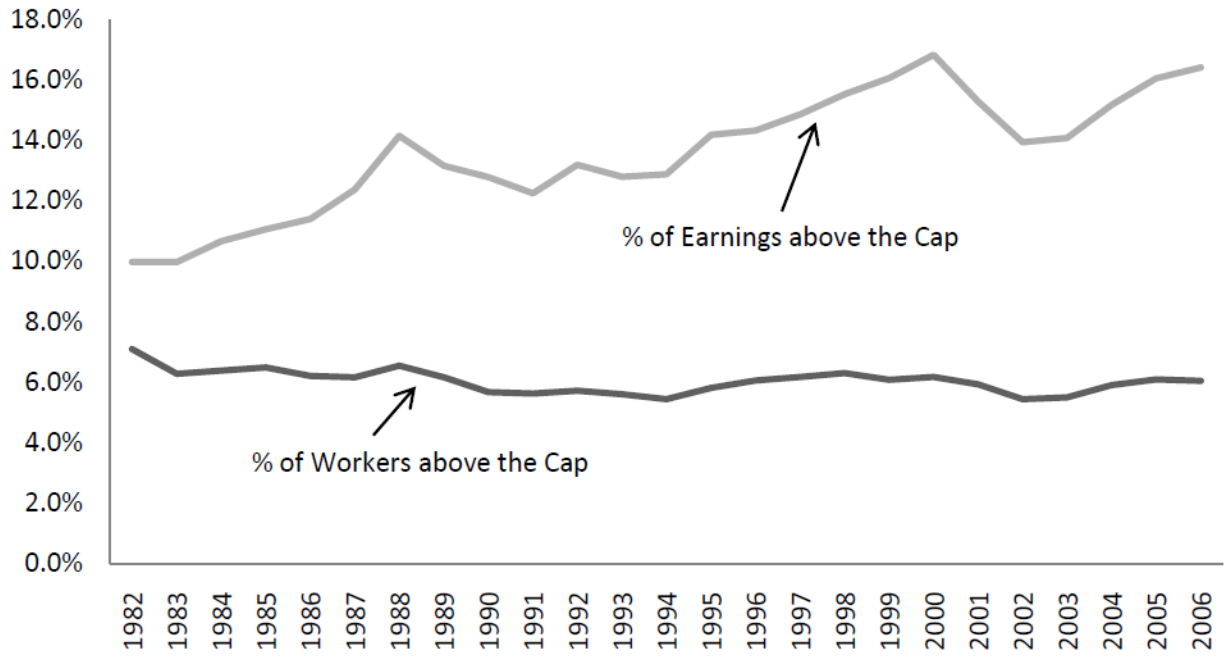


Figure 3. *Percentage of earnings and wage earners above the tax cap.*This graph depicts the percentage of earnings above the social security tax cap, and the percentage of workers who earn wages above the cap. The percentage of workers who earn wages above the social security tax cap has remained constant around 6%. However, the percentage of wages above the cap has increase. This is possible because wages for the highest earners have grown more rapidly than average wages. Source: Irons' testimony before the Senate Aging Committee.

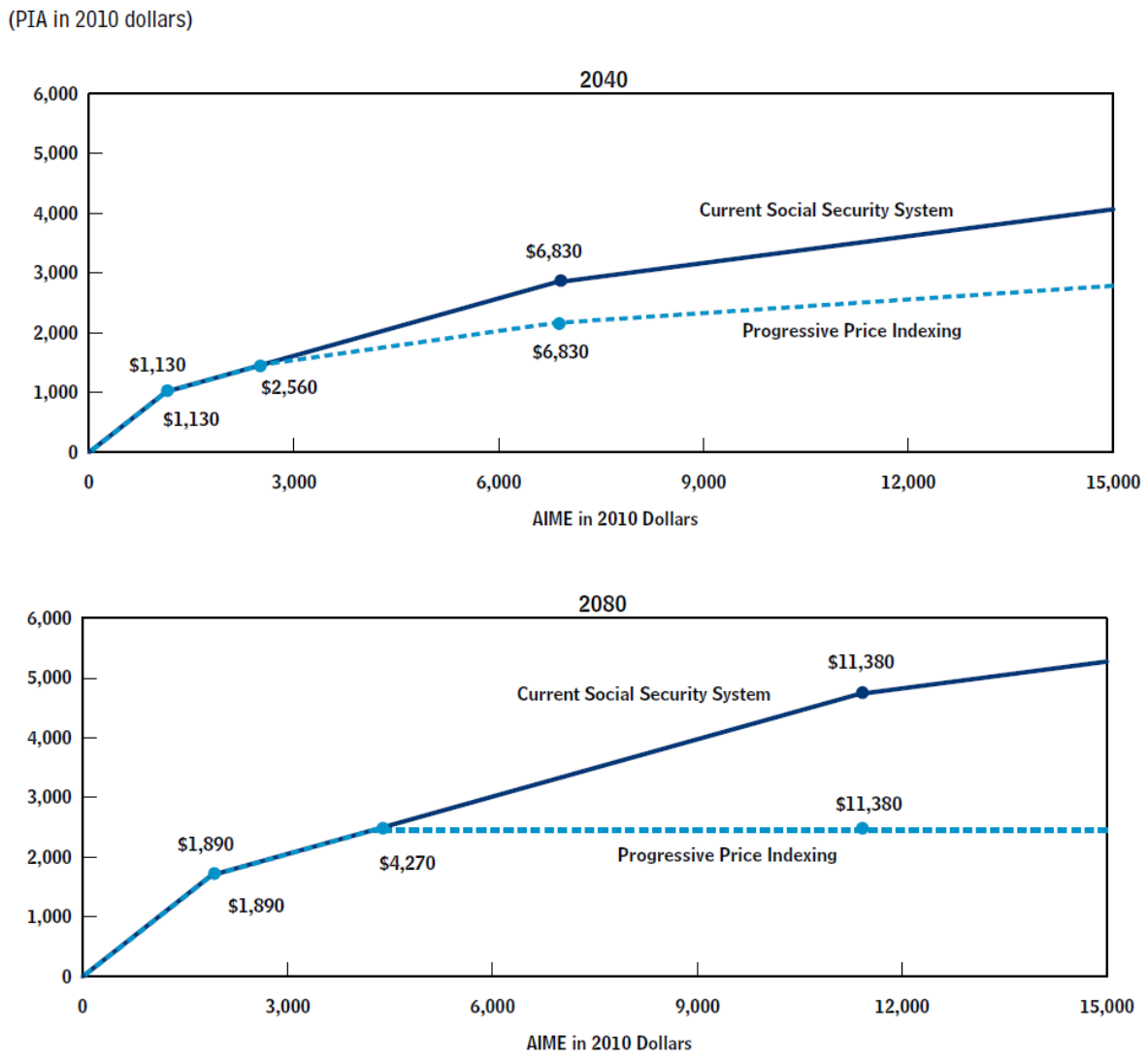


Figure 4. *Option 11, lower initial benefits for the top 70 percent of earner, often called progressive price indexing.* The graph depicts the new benefit-earning rule in the years 2040 and 2080. By 2080, the rule flattens out for the top 70 percent of earners.

AIME=Average indexed monthly income

PIA (vertical axis)=initial benefit

Source: CBO

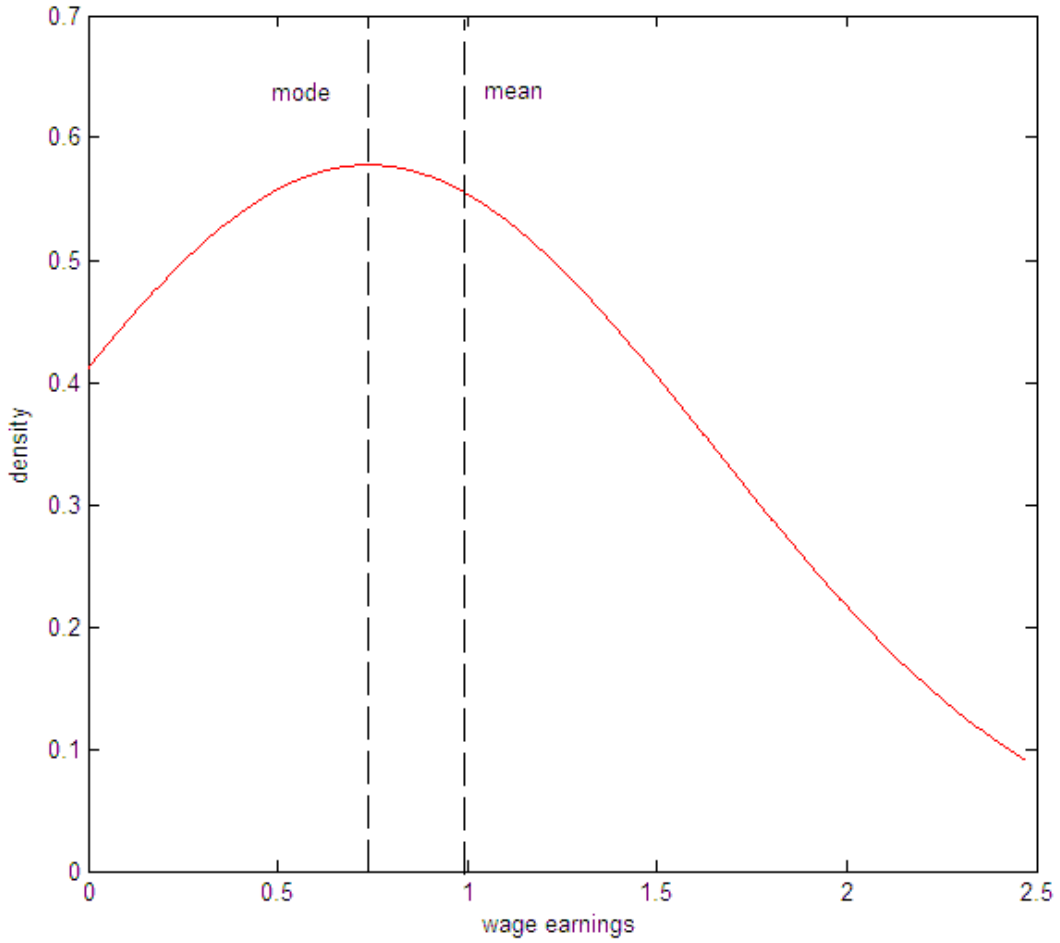


Figure 5. *Calibrated wage density function*. The graph corresponds to equation (23) of the appendix. Source, Caliendo, Cottle (2011).

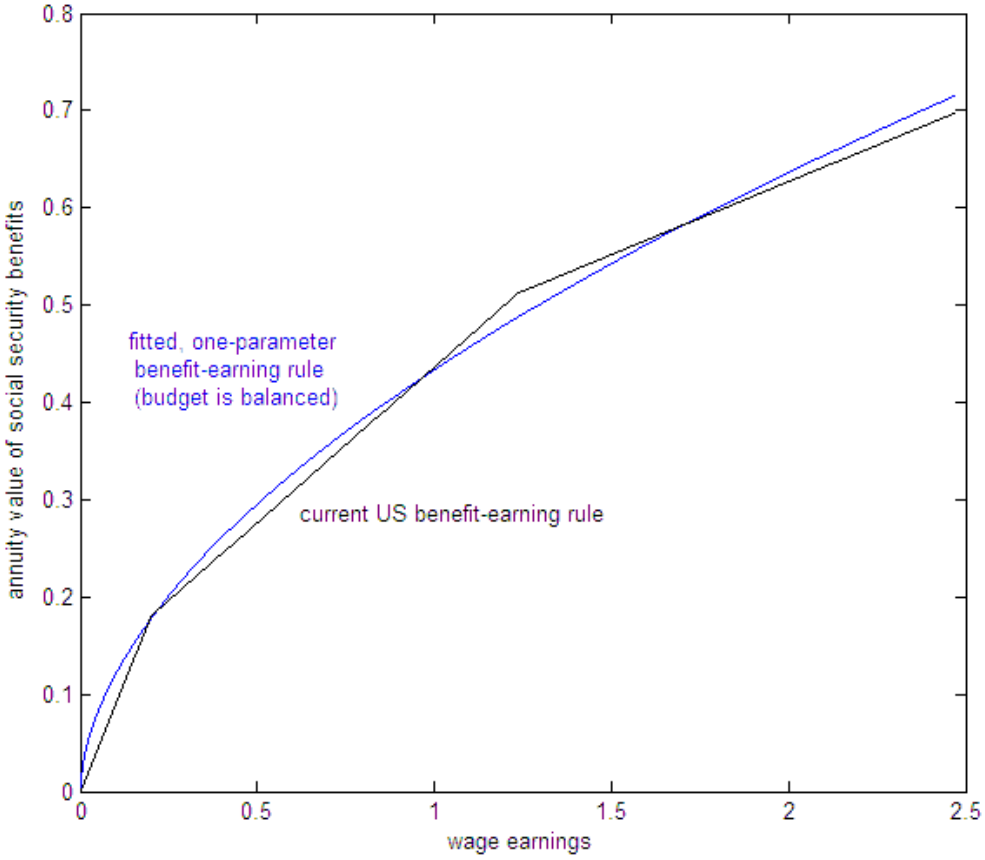


Figure 6. *Benefit-earning rule.* This graph depicts the current US benefit-earning rule, which is a piecewise linear function. The slope of the first segment is 90%, the slope of the second segment is 32%, the slope of the final segment is 15%. The smooth line is the baseline benefit-earning rule used in the model for reform options 12-15. It is also the baseline for all of the quantitative analysis in the appendix. Source: Caliendo, Cottle (2011).

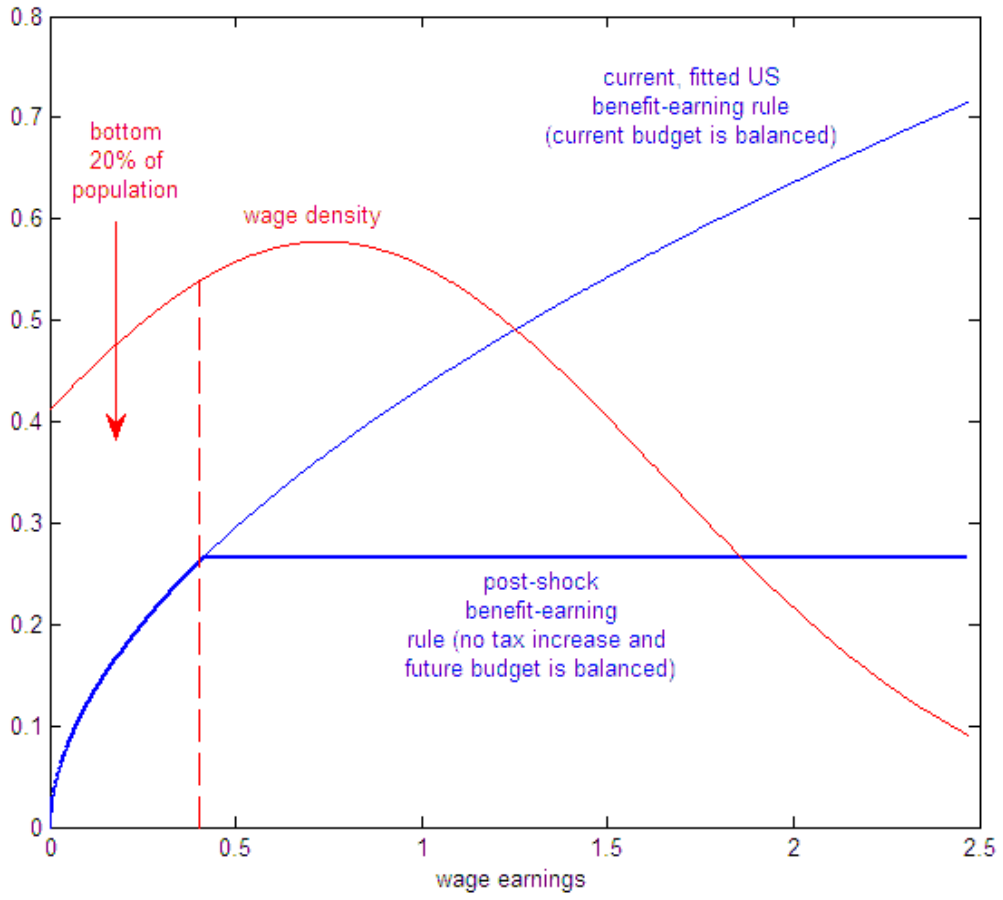


Figure 7. *Option 13: maximum protection of benefits to the poor without a tax increase*. The post-shock benefit-earning rule protects benefits of the bottom 20% of the income distribution without a tax increase. Source: Caliendo, Cottle (2011).

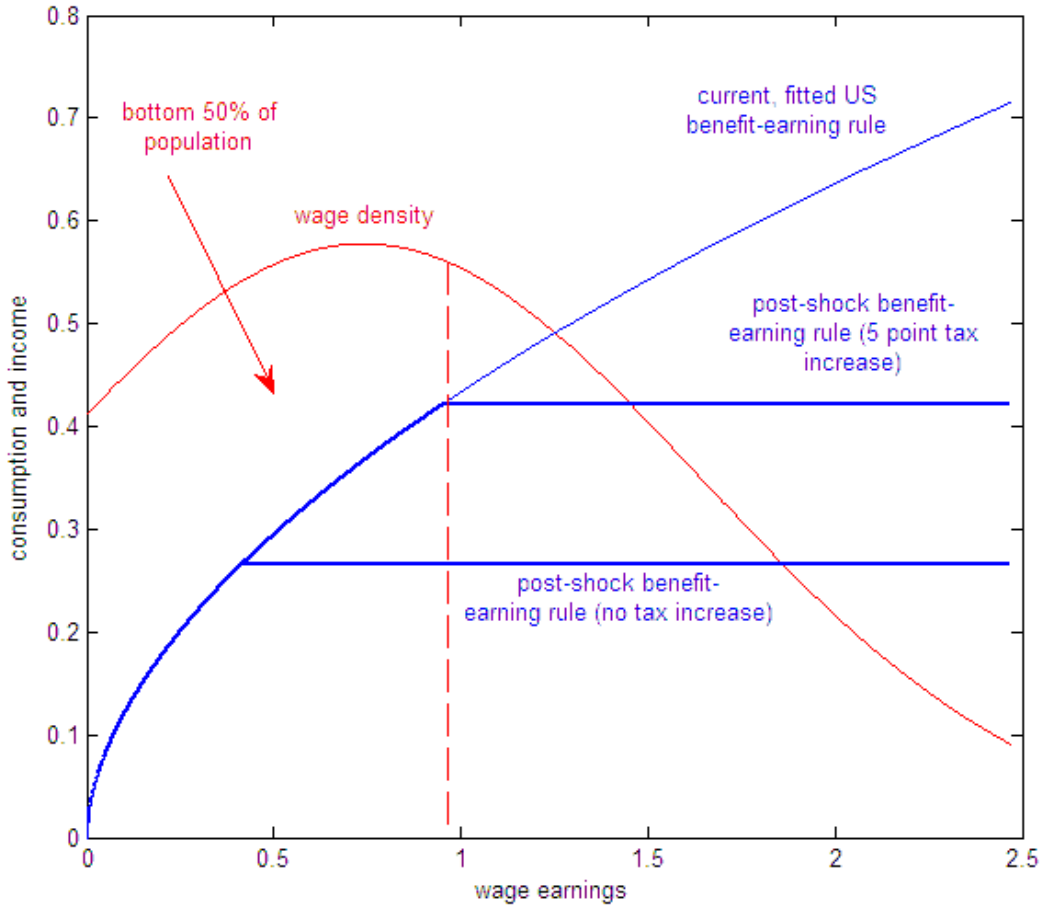


Figure 8. *Option 14: increasing taxes to protect a larger segment of the population.* A 5 percentage point increase in the social security tax allows the policymaker to protect the bottom 50% of the wage distribution. Source: Caliendo, Cottle (2011).

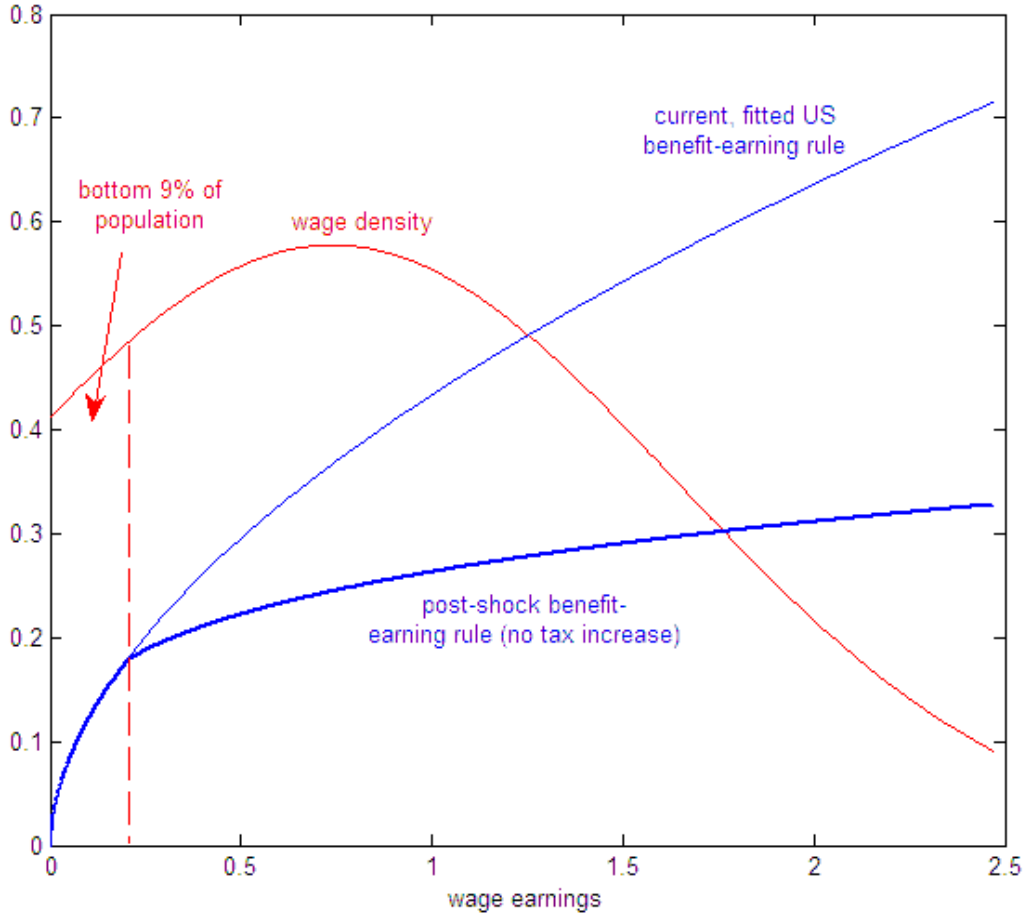


Figure 9. *Option 15: protection of benefits to the poor and preserving the earnings-based feature without a tax increase*. As an example, the post-shock benefit-earning rule tracks the current (pre-shock) benefit-earning rule up to the first bend point (which is 20% of the mean wage). This protects the benefits of the bottom 9% of the population while preserving the positive slope of the benefit-earning rule without a tax increase. Source: Caliendo, Cottle (2011).

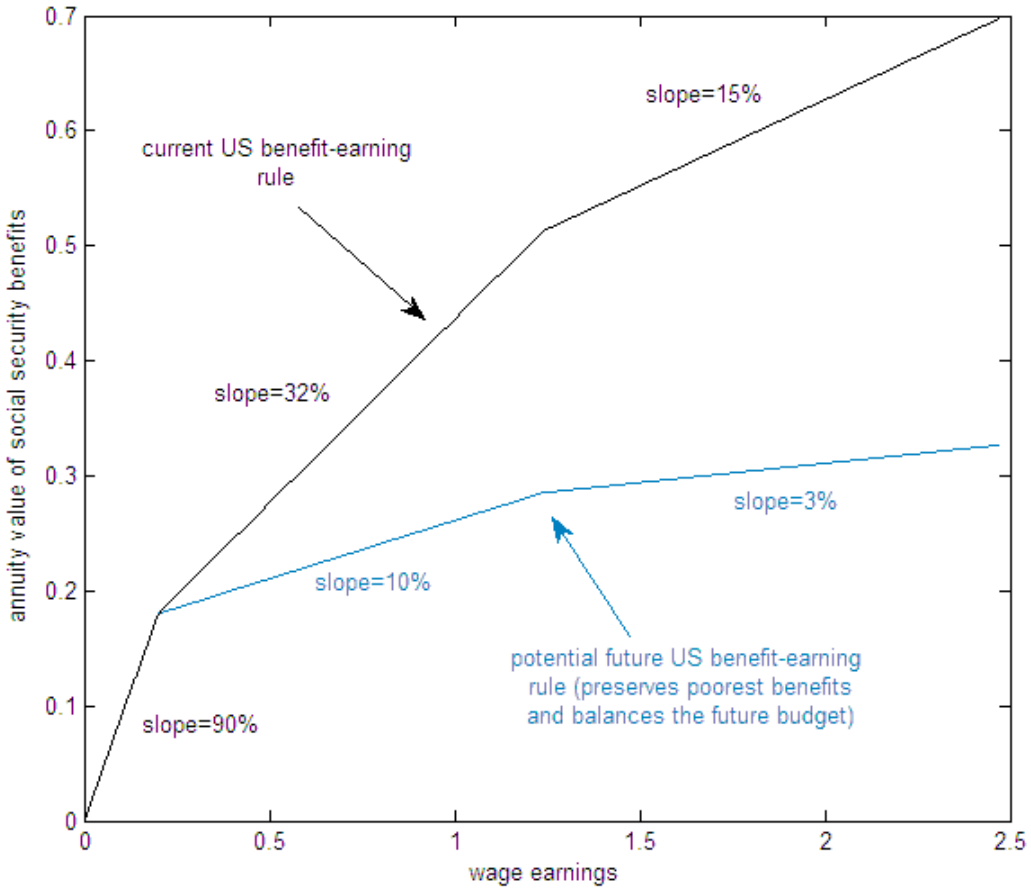


Figure 10. *Option 15 continued: a potential future benefit-earning rule*. This figure corresponds to the optimization procedure in equations(26)-(28). The new rule is a piecewise differentiable version of the rule in Figure 9, in which the original bend points are preserved and the budget is balanced under new demographics. The benefits of those below the first bend point are protected without an increase in taxes. Source: Caliendo, Cottle (2011).

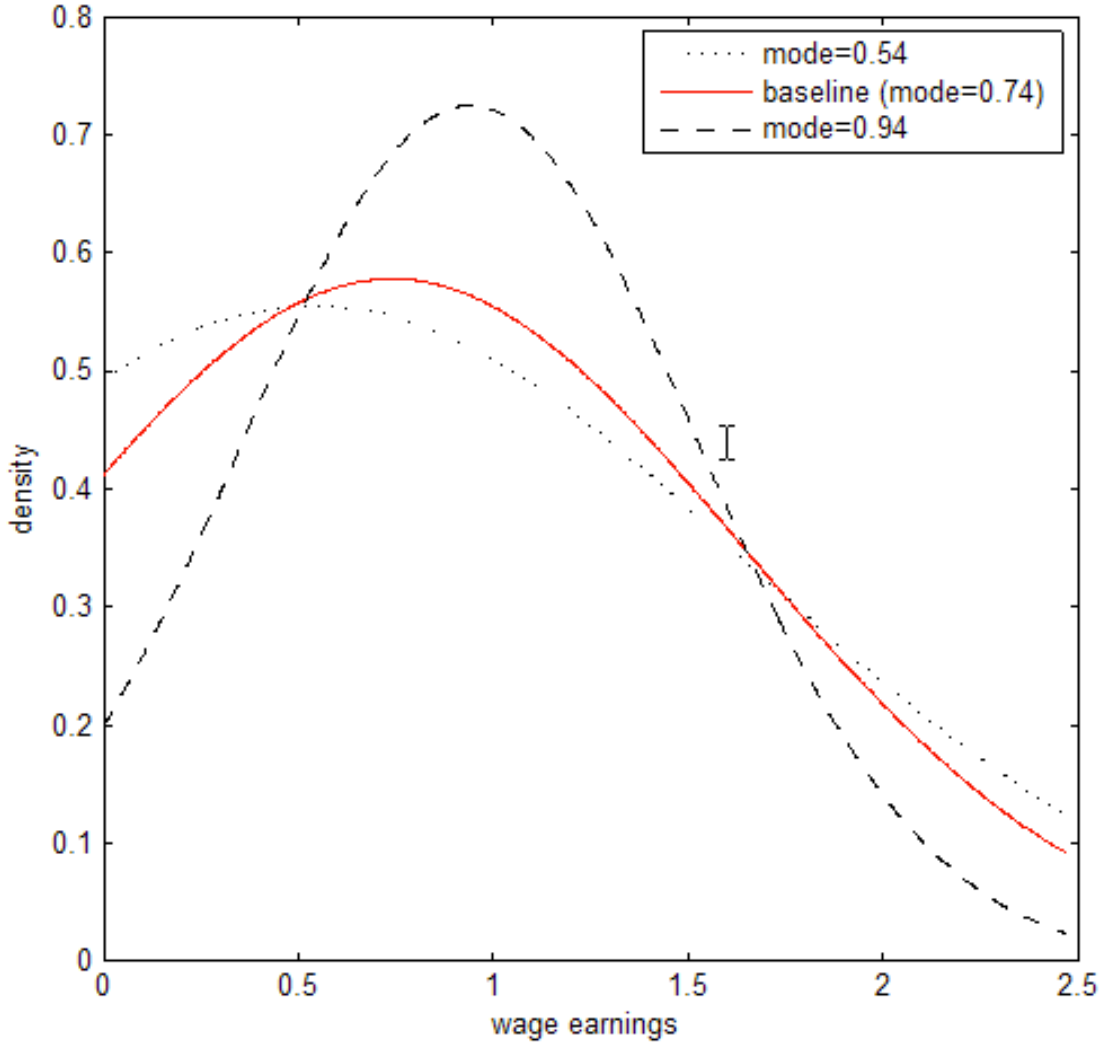


Figure 11. *Alternative Wage Density Functions.* These wage density functions correspond to section 6.2. Each of these density functions preserves the mean of the US wage distribution. The mode deviates from the baseline but the thickness of the bell adjusts to preserve the mean at 1.