NBER WORKING PAPER SERIES

THE RISK OF SOCIAL SECURITY BENEFIT RULE CHANGES: SOME INTERNATIONAL EVIDENCE

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Working Paper 7031
http://www.nber.org/papers/w7031

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
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March 1999

My thanks go to John Campbell, Martin Feldstein, Estelle James, and Janos Kornai for very helpful comments. A special thanks goes to the discussant David Wise for his suggestions and encouragement. The comments of participants at the Reform of the Welfare State seminar at Harvard University, the pre-conference in Cambridge, and the actual conference in Florida are also appreciated. The views expressed in this paper are those of the authors and do not reflect those of the National Bureau of Economic Research.

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ABSTRACT

Against a background of projections of sharply increasing elderly dependency rates, workers in the major industrial economies are apprehensive that their social security benefit entitlements will be cut before or after they retire, leaving them with inadequate retirement income. This paper looks at recent benefit rule changes in the G7 countries to see what can be learned about such *political risk* in PAYG pension systems. From this small sample, I find that projections of rising costs under current rules are inducing reforms, and that these reforms often have a major impact on the present discounted value of promised benefits for middle-aged and younger workers. Usually, however, the benefits of the retired and those nearing retirement are protected. The phasing in of benefit cuts raises the question as to why younger workers are willing to take significant cuts in their implicit wealth while protecting the currently old. One possible answer is explored through a simple model: these workers fear even larger cuts in their benefits if the tax burden on future workers rises too high.

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1. Introduction

Issues of risk are, understandably, receiving a lot of attention in the debate over the relative merits of investment-based (IB) and pay-as-you-go (PAYG) social security systems. The risks to retirement income associated with IB systems are well known, and at least partly offset the attractiveness of their higher expected returns relative to a PAYG system.[2] Yet PAYG systems are not free from risk either. An important source of risk associated with these more traditional social security systems is commonly referred to as *political risk*—defined here to be the risk that benefit rules will be changed through the political process before or during your retirement, thereby changing the value of retirement benefits. For the United States, evidence that people perceive such a risk comes from opinion surveys that show low confidence in the ability of Social Security to pay them the benefits due to them under current rules, although those surveyed do expect to receive some benefits (see Reno and Friedland, 1997).[3] It is also interesting to note how the reform debate has been framed in terms of "saving Social Security," especially after President Clinton's 1998 State of the Union speech, which had saving the program as its centerpiece. In part, this is an attempt to take make use of risks people perceive about the sustainability of current rules to spur reform.

Under the social security benefit rules for current retirees, the share of state-funded pension expenditures in GDP are set to rise as populations in the major industrial

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[2] See Geanakopolos et al. (1998) and Feldstein and Ranguelova (1998) for different perspectives on how risk affects the attractiveness of IB systems.

[3] Interestingly, although respondents claimed to have low confidence in Social Security, they still expressed strong support for the program.

economies become older.[4] Population aging is most pronounced for Germany and Italy, where it is projected that there will be one person over 65 for every two people of working age by 2030, compared to roughly one in four at present. If current high levels of pension generosity were maintained,[5] old age cash benefits would grow to account for almost one quarter of GDP in both countries. In the other G7 countries, were projected aging is not as pronounced and/or current pension benefits are less generous, projected GDP shares are lower, although the increases are still considerable in some cases. These projections of more costly state pension programs have led to concerns about increased labor market distortions (including higher unemployment), inadequate national saving and declining returns on contributions for future generations of workers. Another possibility, however, is that greater costliness under current rules will lead to changes to those rules and, unless replacement provision is made, inadequate retirement incomes for current workers. Indeed, rule changes that reduce future benefits are not just something that might happen in the future. A number of countries, including Germany and Italy, have already responded by legislating downward adjustments to future benefit generosity.

While reasonably easy to describe, political risk of this kind is hard to quantify. The problem is similar to the problem of estimating credit (or default) risk on fixed-income assets; history is a poor guide to the probabilities and sizes of infrequent discrete adjustments. Nonetheless, given the importance of political risk to economic

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[4] Population aging will become pronounced after about 2010 because of the retirement of the post-World War II baby boom generation and the fall in fertility rates in recent decades. Populations are also aging because of increased longevity.

[5] Generosity is defined here as the ratio of the average benefit per elderly person to GDP per working age person. I elaborate on this in Section 2.

comparisons of risky retirement income systems *and* to an understanding of the political economy of reform, it is important to have at least a sense of what these risks are.[6]

This paper takes a small step in assessing political risk. To see what can be learned about the effect on future benefits of the type benefit reforms that have been pursued in recent years, I examine redefinitions of PAYG benefit rules in the G7 countries from the mid-1980s through the mid-1990s. Until recent decades, rule changes tended to make systems more generous rather than less. This was possible because favorable demographics (as baby boom generations entered the labor forces) and the immaturity of earnings-related pension systems made obligations under existing rules easily affordable.[7] Now that rapid population aging is on the horizon and most systems are mature, reform efforts are now aimed at curtailing program costs. Recent rule changes have included increases in retirement ages (especially for women), changing the way post-retirement benefits are indexed, and increasing the number of years of earnings included in the calculation of the initial benefit.[8] To gauge the impact of these reforms,

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[6] A common measure of the return (or money's worth) on PAYG contributions is the ratio of the present discounted value of benefits to the present discounted value of contributions (see Geanakoplos et al. (1998). From the perspective of a worker at a particular point in time, there are a number of factors that make this return uncertain. The worker does not know with certainty his or her subsequent earnings profile, date of retirement, tax rates, length of life, rules for defining benefits, and so on. For this paper, I concentrate on the numerator of this return measure—the present discounted value of the stream of benefits. Moreover, to focus on the effects of changes in benefit rules, I assume fixed expectations for the earnings profile, retirement date and length of life. The extent of this political risk depends, then, on the impact of various discrete rule changes on the stream of benefits and the probabilities of those changes.

[7] Small numbers of people were eligible for full pensions, while the contributor pools were large. As a consequence, low tax rates could support quite generous state pensions.

[8] In this paper, I concentrate on reforms to the benefits rules of PAYG systems in the G7. Other major reforms aimed at curbing future tax increases include efforts to pre-fund future benefit obligations (Canada, Japan, and the United States) and allowing workers to
Continued . . .

my approach is to estimate the *change* in the present discounted value of the benefits an "average" household can expect to receive—or gross social security wealth (*SSW*)—as a result of a reform.

The results from this small sample show that benefit rule changes that substantially reduce *SSW* are not unusual responses to projections of sharply rising costs 15 to 30 years into the future. In some cases, the reforms do reduce the *SSW* of workers who are already at retirement age, although the sizes of the reductions are typically small. More often, however, the reforms are phased in so that their main burden does not fall on the currently retired or those close to retirement. Young and middle-aged workers appear to be willing to accept large reductions in their gross social security wealth while protecting the currently old. Assuming the reforms are fully phased in by the time the worker retires, reductions in *SSW* of between one quarter and one third have not been uncommon. For middle-aged workers, this almost certainly means a loss of net social security wealth as well,[9] since they are unlikely to benefit to a great extent from resulting lower contribution rates given how the benefit cuts are phased in. One possible explanation for this apparent sacrifice is that these workers see future political risk as related to the size of future contribution rates. By reducing the burden on future generations of workers through legislated future benefit cuts (and/or pre-funding through tax increases as in the U.S.), it might be that they hope to stem even more draconian cuts later on.

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partially opt out of the state system into occupational and personal saving schemes (United Kingdom).

[9] Net social security wealth is defined as the difference between the present discounted value of expected benefits less the present discounted value of the expected future social security taxes (see Feldstein, 1974).

These calculations show that governments have responded to projections of sharp increases in dependency rates by curbing future benefit promises. It is not clear, however, how much of the adjustment to the projected demographic trends have already been made, and what further adjustments are still to come. A number of factors point to the likelihood of significant further cuts. First, even with the recent reforms, the costs of state pension systems are still projected to rise steeply in most countries. Second, governments have proved willing and able to curb future benefit promises when they threaten to become too costly—which is probably the main message of this paper. And third, proposals for additional reforms are being formulated and debated in most countries.[10]

The paper is organized as follows. Section 2 outlines how demographics and the maturing of benefit systems are creating financial problems in industrial country social security systems, and documents that these looming strains have not significantly reduced the generosity benefits for current beneficiaries. Section 3 then describes the mainly forward-looking reforms that have taken place in the 1980s and 1990s, and estimates their impact on *SSW*. In Section 4, I use a simple political economy model to help think about the puzzle of why self-interested current workers are willing to accept large cuts in their benefits while protecting the currently old. Section 5 concludes with some comments on how the response to population aging of cutting PAYG benefits might affect the adequacy of retirement income in the future, and on the possibility of replacing rather than simply reducing retirement income using a mandatory IB system.

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[10]When assessing the overall risk of future benefit rule changes, we must also keep in mind that, while we are sure that dependency rates will increase sharply over the next 30 years, there is uncertainty about what the exact dependency rates will be.
Continued . . .

Section 2. Demographic Trends, Pension Generosity and Fiscal Strains

It is well known that under current benefit rules spending on state pensions as a share of economy will grow dramatically as populations age.[11] This will impose a heavy burden on future workers if they are willing to meet this higher cost, in part because of the expanded distortions brought about by the higher required taxes. If they are not willing to meet this tax burden, future retirees (that is, current and future workers) are faced with the prospect of having inadequate retirement incomes. One might expect that this prospect would lead to a cut in the generosity of *current* benefits. Such a cut would free up tax revenues to use to pre-fund future benefits, or at least provide a better return on the taxes that are paid (for any given future benefits).

Figures 1a to 1g show that there has not been any significant scaling back in the generosity of benefits during the 1980s and 1990s. The figures use the fact that the cost rate for state pensions (i.e., the state pension expenditure to GDP ratio) can be decomposed into the product of the elderly dependency rate and the benefit rate. The elderly dependency rate that is used is the ratio of the population aged 65 or older to the population aged between 15 and 64. And the *implied* benefit rate is then the ratio of the benefit per elderly person to GDP per working age person.

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[11] See, for example, OECD (1997) and the papers collected in Bosworth and Burtless. (1998).

$$(2.1) \qquad \frac{\text{Expenditure}}{\text{GDP}} = \frac{\text{Elderly Population}}{\text{Working Age Population}} \times \frac{\text{Expenditure/Elderly Population}}{\text{GDP/Working Age Population}}$$

$$= \text{Dependency Rate} \times \text{Benefit Rate}$$

Care must be taken in interpreting the benefit rate as a measure of generosity. The denominator in the average benefit expenditure calculation is the number of elderly (defined as those 65 and over) and not the number of retirees. Of course, people younger than 65 can be retired and receiving benefits and not all of those over 65 are retired. This broad generosity measure has the advantage, however, that it captures both the ease of eligibility for benefits (including the ability to access benefits at younger ages) and the average level of benefits paid to those who are actually retired. To see this, note that that the broad generosity measure can be decomposed as,

$$(2.2) \qquad \text{Benefit Rate} = \frac{\text{Expenditure/Elderly Population}}{\text{GDP/Working Age Population}}$$

$$= \frac{\text{Retirees}}{\text{Elderly Population}} \times \frac{\text{Expenditure/Retirees}}{\text{GDP/Working Age Population}}$$

Other things equal, the system will tend to become more generous if there is a trend toward early retirement[12] and/or if the benefits paid to the retired rise relative to income per working age person.

[12] Gruber and Wise (1998) document a strong trend toward early retirement in the industrialized economies.

The expenditure data used in the calculations are from the OECD Social Expenditure (SOCX) database, and include all public old age cash benefits. Survivors' benefits are not included for these calculations, although I consider them briefly below. For the United States, to take an example, this comprehensive measure includes retirement benefits paid by the Social Security and public employee retirement systems, means-tested benefits paid under Supplemental Security Income (SSI), and benefits paid through a number of smaller programs.[13]

[Figures 1a to 1g about here]

Over this period, the implied generosity of benefits has been in a range of 20 to 25 percent in Canada, Japan and the United States, a bit more than this in the United Kingdom, and in a higher range of 35 to 50 percent in France, Germany and Italy. The most generous benefits in this sample were recorded in Italy in 1993 at almost 50 percent. The least generous were in Canada in 1980 at just less than 20 percent. Generosity in Canada, France and Italy has risen over the period (in the latter two quite sharply), has been reasonably stable in Germany and Japan, and has fallen in the United States.

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[13] These expenditures are only part of the state expenditures that are set to rise as populations become older. Another important category of spending that is positively related to the elderly dependency rate is medical care. Kornai and McHale (1999) present time series and cross section evidence that the total health spending per person is positively related to the elderly dependency rate with an elasticity of between 0.1 and 0.2. They also report regressions that show that the share of total health spending undertaken by the public sector is positively related to the elderly dependency rate. A one percentage point increase in the elderly dependency rate is associated with roughly a 3 percentage point increase in the share of total spending undertaken by the public sector, although the size of the coefficient is sensitive to specification.

Generosity ended up higher in the United Kingdom, following an increase rise in the implied benefit rate between1988 and 1991. [14]

The combination of generosity and demographics led the expenditure to GDP ratio to drift upwards or remain stable in all countries. The real action, however, is still to come as post-war baby boomers begin to retire. Table 1a shows what projected increases in elderly dependency rates would imply for the cost of old age benefits *if 1995 benefit rates were maintained.* (Table 1b shows how adding in survivors' benefits changes these projections.) These mechanically projected trends in this cost rate are quite startling in some cases. At 1995 levels of generosity, old age benefits account for close to a quarter of GDP in Germany and Italy. In France, given somewhat less pronounced aging, these pensions account still account for more than 17 percent of GDP. The shares in 2030 are considerably lower in the remaining four countries, primarily because they start with lower shares; although even for these countries, there is close to a doubling of the share of the economy devoted to state pensions. Japan is an interesting case because the aging of its population leads the other countries, but the severity of its problem is still notably less than the large continental European countries by 2030.[15]

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[14] Given that benefit generosity is usually based on a comparison of benefits with the wages rather than GDP per working age person, it is helpful for getting an intuitive sense of the generosity involved to divide the benefit rate by the labor share of GDP. The result can be interpreted as the ratio of the benefit per elderly person to the wage per working age person. I calculate this labor share as 1 minus the capital income share as reported by the OECD (1998). For 1995 the labor shares were: 0.677 for Canada, 0.589 for France, 0.637 for Germany, 0.577 for Italy, 0.682 for Japan, 0.676 for the United Kingdom, and 0.638 for the United States. The implied benefit rates expressed as a percentage of wage income per working age person were: 36.7% for Canada, 75.7% for France, 71.3% for Germany, 81.8% for Italy, 39.4% for Japan, 39.3% for the United Kingdom, and 43.7% for the United States.

[15] OECD projections for Japan after 2030 indicate that the share of state pension expenditure continues to rise until 2050, reaching about 16 percent of GDP (OECD,
Continued . . .

[Table 1a about here]

[Table 1b about here]

These mechanical projections are based on the assumption that the cost rate rises at the same rate as the elderly dependency rate. To get a better sense of how the cost rate has varied with the dependency rate across the OECD over the recent past, I used a simple log-linear OLS regression using a the SOCX data for a pooled sample of OECD countries for the period 1980 to 1995. The basic regression equation is:

$$(2.3) \qquad \mathrm{Log}\left(\frac{Exp}{GDP}\right)_{it} = \mathrm{Constant} + \beta \mathrm{Log}\left(\frac{\mathrm{Population} \geq 65}{15 \leq \mathrm{Population} \leq 64}\right)$$

The results are reported in Table 2. The coefficient on the demographic variable is highly significant in the regressions without country dummies.[16] The addition of other potential determinants of generosity—GDP per capita, the share of the population living in urban areas and the share of women in the labor force—have little effect on the size or significance of the demographic variable. The regressions (without country dummies) show that a 10 percent higher elderly dependency rate is associated with a more than 16 percent higher expenditure to GDP ratio. This non-linear relationship might be explained

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1997). For the other G7 countries the OECD projections show a leveling off or even a fall in this share after about 2040.

by the increased political influence of the elderly as they grow in numbers—an influence that is surely set to grow. However, given what this relationship implies about the future share of total income going to state retirement benefits, it is hard to believe that such a relationship can persist. For instance, if this relationship were to hold for Italy, the share of old age cash benefits alone would rise to 36 percent of GDP by 2030! Nonetheless, the regression results do suggest how difficult a task it will be to hold the growth the expenditure share below the growth in the elderly dependency ratio.

[Table 2 about here]

[Figure 2 about here]

The main focus so far has been on recent trends in state pension spending, and the future implications for this spending if current levels of generosity are maintained. The picture of limited reform hides the anticipated impact of already legislated on future benefits and thereby on future generosity. In the next section, I will attempt to estimate the impact of these reforms on the social security wealth for certain stylized individuals and households. Before doing so, it is instructive to look at the projected aggregate implications of the legislated future changes. This is done in Table 3. For each country the first line shows the percentage change in the expenditure to GDP ratio for various years relative the level of that ratio in 1995. The second line shows the OECD projections of the percentage change in the ratio *taking into account changes to benefit*

[16] With country dummies the coefficient is significant at the 5 percent level, but size of Continued . . .

rules that have been already legislated. Caution must be used in interpreting this comparison since the definitions of state pensions used do not coincide exactly (see the note to the table). The basic trend is clear, however: already legislated changes appear to have significantly curbed the future expansion of state pensions as a share of the economy. What are these legislated changes? And what impact do they have on the benefits that people can expect to get when they retire? I provide tenative answers to these questions in the next section.

[Table 3 about here]

Section 3. Recent Reforms, and their Impact on Social Security Wealth

3.1 Assumptions

My goal in this section is to get a sense of the magnitudes of changes to *SSW* that have resulted from recent reforms. Of course, a given reform will affect different people differently, depending on such factors as gender, age, dependents, place in the earnings distribution, age-earnings profile, and so on.

The approach I adopt is to look at the impact on some "average" households. Characterizing these individuals requires a number of assumptions, and thus should be only seen as suggestive of the impact of the reform on workers around the middle of the earnings distribution. I make six main assumptions:

1. The worker earns the average production wage (as defined by the OECD) at age 45.[17]

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the coefficient on the dependency rate variable is much smaller.

[17] The OECD defines an Average Production Worker (APW) as "an adult full-time production worker in the manufacturing sector whose earnings are equal to the average

Continued . . .

2. The worker's age-earnings profile is based on that estimated by Mincer (1974)[18] using cross sectional U.S. data.[19] Mincer's cross sectional estimate is combined with Assumption 1 and data on real earnings/wage growth from the IMF's *International Financial Statistics* (or the World Bank's *World Tables* for Italy), to produce a stylized age-earnings profile.[20] It is important to have some estimate of the age-earnings profile, since different countries use different averaging procedures in assessing relevant lifetime earnings.[21]
3. Expected length of retirement (assuming retirement at the standard retirement age) is based on average life expectancy for workers of given ages at the age at the time of the reform, and is taken from the United Nations Demographic Yearbook (1996) or the OECD Health Data (1998).
4. The household is not entitled to any means-tested retirement benefits. This allows us to concentrate on universal flat-rate benefits and earnings-related benefits. Since I concentrate on workers earning the average production wage, this is probably realistic in most cases. Clearly, my estimates are a poor guide to the effect of reforms on low-

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earnings of such workers [male and female]" OECD (1995). The values for the wage of an APW are taken from the OECD publication *The Tax/Benefit Position of Production Workers*, various editions.

[18] Also see Berndt (1991, Chapter 5)

[19] The assumed profiles are based on the following equation: $\ln Earnings = k + 0.081 Age - 00012 Age^2$. To determine the value of k, the earnings of an average production worker and an age equal to 45 are substituted into the equation. Given this value of k, the profile is traced out by varying the age.

[20] The real earnings growth is based on actual numbers up to 1996. From 1997 onwards, real earnings are assumed to grow at a rate of 1 percent per year for all countries.

[21] The limitations of this assumption are obvious enough. First, age-earnings profiles differ between countries, depending, in part, on such institutional features as union density and deferred compensation arrangements. (See Koike, 1988, for example.) Second, age-earnings profiles tend to be steeper for high than for low lifetime earners. Continued . . .

income individuals, for whom means-tested benefits are likely to provide a significant portion of their retirement income.

5. The worker retires at the standard retirement age, and has sufficient years of contributions to be eligible for full (flat and earnings-related) social security benefits. The worker is not affected by maximum or minimum limits for earnings-related pensions.
6. The real discount rate for discounting future benefits is 3 percent.

With these assumptions, I look at the impact of the reforms on the *SSW* of single men and women who are 45 at the time of the reform. For the countries where a non-means-tested dependent spouse allowance is available, I also note the impact on a 45-year old man with a dependent spouse. In addition, I look at the impact of the same reforms on men and women at their respective standard retirement ages, again assuming that these individuals earned the average production wage when aged 45.

3.2 Stylized Benefit Formulas and Their Use in SSW Calculations

Formulas for calculating retirement benefits differ significantly from country to country. Nonetheless, there are a number of common elements. I will focus on three: the standard retirement age (*R*); the calculation of the benefit at the time of retirement; and the post-retirement indexation of benefits. Of these, the calculation of the initial benefit is the least straightforward. Following the approach of the OECD (1988), I model the calculation of the initial benefit as the sum of a flat-rate (lump sum) benefit and an

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Indeed, the hump-shaped profile that I assume, tends to be more pronounced for low income workers.

earnings-related component. The benchmark benefit equation at the initial retirement age is,

$$(3.2.1) \qquad B(R) = B_f + \beta E^a,$$

where $B(R)$ is the benefit at retirement age R, B_f is the flat-rate benefit, β is the replacement rate,[22] and E^a is assessed earnings. E^a is some function of the annual earnings of the various years of the individual's working life. There are two key elements to this calculation: first, the years that are included; and second, how the earnings are revalued based on average earnings growth. Other things equal, the greater the weight given to peak earning years (roughly the worker's fifties given my assumed age-earnings profile), and the more completely earnings are revalued in line with national earnings growth (assuming this is positive), the more generous is the benefit formula.

Once the initial benefit is set, I assume that future benefits can be calculated based on a simple indexation rule. The benefit h years into retirement is given by,

$$(3.2.2) \qquad B(R+h) = B(R)\prod_{t=R+1}^{R+h}\left(1+i(t)\right),$$

[22] The concept of the replacement rate—i.e., the relevant earnings that are to be replaced—being used here is thus country specific. Since most countries under study use earnings over a significant portion of the workers life in the calculation of assessed earnings, the replacement rate concept is typically close to the fraction of lifetime earnings that are being replaced. The significant exception is Italy before the 1992 reform, where assessed earnings are based only on the earnings for the five years prior to retirement.

where $i(t)$ is the real indexation factor for year t. When benefits are indexed to consumer prices, the benefit will be constant in real terms.[23] When benefits are indexed to nominal wages, the benefit will rise at the rate of real wage growth.[24]

My approach is to calculate gross social security wealth (*SSW*) for a given benefit formula viewed from a given age, *T*, during the worker's life. *SSW* is the present discounted value of implied future benefits, evaluated at the given point in the worker's life. Looked at from this age, *SSW* is affected by changes in the retirement age, the benefit formula, and the post-retirement indexation of benefits. (In addition, of course, to the discount rate for future cash flows and the expected years of retirement.) This simplified case should give us an idea of the magnitude of wealth changes brought about by changes in the definition of benefit rules.

Letting *H* be the duration of retirement and *d* the discount rate, the equation for *SSW* at age *T* is,

$$SSW(T) = \sum_{h=0}^{H} \frac{B(R+h)}{(1+d)^{R-T+h}} . \qquad (3.2.3)$$

This formula calculates *SSW* based on the simplification that the length of remaining life in known with certainty, where that length is set equal to the average remaining life for someone of age *T*. Of course, a person's remaining life is rarely known with certainty. In

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[23] From the viewpoint of a given age during the workers life, the discounted real benefit falls with the length of the individual's retirement.

[24] The real discounted benefit will rise (fall) with the length of the retirement if the real wage grows at a faster rate (slower rate) than the discount rate.

Appendix 1, I discuss how the certain life-span assumption can lead to a biased estimate of *SSW* when the length of remaining life is uncertain.

3.3 Recent Benefit Formula Reforms in the G7 Countries and their Impact on *SSW*

Over the last decade and a half or so, six of the seven major industrialized countries have significantly redefined their retirement benefit formula. The exception is Canada. Among the six, the reforms I will consider are France (1993), Germany (1992), Italy (1992), Italy (1995), Japan (1994), United Kingdom (1986), United Kingdom (1994), and United States (1983).[25] These reforms range from the relatively major (e.g., Italy (1992) and (1995) and the United Kingdom (1994)) to the relatively minor (e.g., Japan (1993) and the United States (1983)).

The stylized benefit formulas prior to the reforms used in the calculations are outlined in Table 4. Table 5 then outlines the reforms. It is worth noting once again that only a subset of possible reforms are being focused on; *to wit,* changes to the standard retirement age, the initial benefit formula for a worker earning the average wage with a full contribution record, and the post-retirement indexation of benefits. For example, the effects of changes eligibility conditions for a full pension, in the maximum or minimum pension, in the generosity and eligibility for means-tested benefits, in early retirement

[25] Since the mid-1980s, a number of other OECD countries have also reformed their defined benefit retirement systems. Significant reforms were introduced in Australia (1992), Austria (1985, 1988, and 1993), Greece (1990 and 1992), Portugal (1993), and Sweden (1994).

benefits and conditions, in accrual rates for later retirements, and so on, are not included.[26]

[Table 4 about here]

[Table 5 about here]

As can be seen from the first column of Table 5, a number of countries (Germany, Italy, Japan [tier 1 benefits], United Kingdom and United States) have raised their standard retirement age, although typically with a long lead time. There has also been a tendency for a convergence of the standard retirement ages for men and women (Germany, United Kingdom, and Italy [Dini reforms]). Thus we will see that women tend to lose more wealth from the reforms than identically situated men.

France, Italy (Amato reforms) and United Kingdom have also significantly changed the way they assess "average earnings" for their earnings-related pensions. In its 1986 reform, the United Kingdom also reduced its replacement rate from 25 percent to 20 percent. The Dini reforms in Italy went even further, by moving from an average earnings-based method for calculating benefits to a contribution-based method.[27] Beyond its impact on *SSW*, this reform has the potential of reducing labor market distortions by strengthening the link between contributions made and benefits received, thereby making contributions seem less like a tax. This reform will have quite different impacts on

[26] The benefit streams are calculated before taxes. Since the United States (1983) reform included a major change in the tax treatment of benefits, I also estimate the impact on the stream of net of tax benefits for that reform.

employees as compared with the self-employed. The reason is that the self-employed faced lower contribution rates under the old system, so that the shift to a contribution-based system will hurt them more.

A number of countries have also changed the way they index benefits after retirement. France and Italy have shifted from wage indexation to price indexation, which leads to cumulative benefit cuts over time when real wages are growing. Germany and Japan (for its tier 2 pensions) have changed from gross wage indexation to net wage indexation. Given that contribution rates are expected to grow over time to meet rising benefit costs, this reform is also a form of benefit cut. Tax rate projections are difficult to make, but given that payroll tax rates must rise substantially (even with recent benefit reforms) it is important to allow for the slower growth of net real wages in the calculations. In Germany, the payroll tax is projected to rise from 18.9 percent in 1995 to 27 percent in 2030.[28] If we assume that the gross real wage rises at an average annual compound rate of 1 percent, this implies that the net real wage (assuming that non-payroll taxes remain constant) rises at a rate of 0.7 percent. For Japan, the contribution rate is projected to rise from 16.5 percent in 1995 to 29.5 percent in 2030.[29] If we again assume 1 percent real wage growth (and constant non-payroll taxes), this implies that the net real wage rises at the rate 0.5 percent per year over this period.

[Table 6a about here]

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[27] Sweden is also moving toward such a notional defined contribution (NDC) system.
[28] Franco and Munzi (1996), based on estimates made by Germany's Social Advisory Board in 1994.

Table 6a contains the estimates of the changes in the present value of *SSW* for single men and women who are 45 at the time of the reform and are earning the average production wage. I assume that all the reforms are fully phased in by the (new) standard retirement age. In most cases this is accurate, but in some cases the lead times are so long that the reforms are still a long way from being fully phased in (e.g., the Italian and US reforms). Given the previously noted differential impact on employees and the self-employed of the second set of Italian reforms, I include separate estimates of the change in *SSW* for these two types of worker.

The estimated losses in *SSW* are substantial, although, as noted above, the range is quite large. The largest change is for men after 1992 Italian reforms (-38 percent).[30] Other big losses occurred for women in the German, Italian and UK reforms. More generally, the impact on *SSW* tends to be especially large when there is a change in the retirement age and when there is a shift from wage to price post-retirement indexation.[31] Given their longer expected duration of retirement, the impact of the latter reform on women tends to be greater than the impact of identically situated men. In addition, given the women in some cases had a lower standard retirement age pre-reform, they have been disproportionately targeted for standard retirement age increases in Germany and the

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[29] These estimates are taken from Takayama (1996).
[30] Male Italian employees retiring at the standard retirement age appear to have gained back some wealth in the 1995 reforms. On the other hand, women and the self-employed—especially the latter—suffered further loses in this second round of reforms. Moreover, Hamann (1997) estimates that male employees retiring before 63 are also net losers.
[31] Both of these were part of the Italy (1992) reform.

United Kingdom.[32] The German reform led to just a –7.3 percent change in *SSW* for men, and a –26.2 percent change for women. The corresponding numbers for the 1994 reform in the United Kingdom are -5 percent and -29 percent. On the other hand, an equal increase in the retirement age for men and women tends to hurt men proportionately more. The reason is simply that men have shorter life expectancies, so that the lost benefits represent a larger fraction of the present discounted value of the pre-reform benefit stream. For example, the increase in the retirement age that took place as part of the US reform reduces the *SSW* of men by almost one quarter while reducing the *SSW* of women by 16 percent. These estimates are based on average life expectancies for a 45-year old in the US at the time of the 1983 reform, which were 29 years for men and 34 years for women. If retirement takes place at the standard retirement age (65 prior to the reform), these life expectancies imply pre-reform expected retirements of 9 and 14 years for men and women respectively. Raising the standard retirement age to 67, and continuing to assume that retirement takes place at standard retirement age, lowers the expected retirements by 2 years for both men and women. Given the relatively short expected retirement for men to begin with, the loss of two years means a large percentage cut in the present discounted value of benefits.

Of course, retirement does not always take place at the standard retirement age. Indeed, Gruber and Wise (1998) document that in many countries *most* retirements take place before the standard age, with a large number of people leaving the labor force at the earliest possible date that they can receive benefits. For a number of countries, they also

[32] The shift to a contribution-based system with declining coefficients for earlier retirements in the second Italian reform also disproportionately hurts women, given their earlier retirement age under the older system.

document significant use of disability and unemployment benefit programs to finance early retirement even when state pension benefits are not available. Given this behavior, it is less clear how raising the standard retirement age affects *SSW*. For someone who retirees before the standard retirement age, and continues to retire at the same age after the standard retirement age has risen, we need to know how the increase in the standard retirement age affects the benefits for those taking advantage of early retirement. To take the US as an example once again, retirement benefits are available as early as age 62. A worker availing of early retirement benefits, however, receives just 80 percent of the annual benefit they would have received if they had waited until age 65. As we have seen the 1983 reform will eventually increase the standard retirement age to 67, but a worker will still be allowed to retire at 62 with permanently reduced benefits. The benefit penalty for early retirement is now 30 percent rather than 20 percent, however. By itself, this implies a benefit cut (for men and women) of 12.5 percent. For men in particular, this is a smaller cut than the close to 25 percent cut (which was predominantly due to the increase in the standard retirement age) reported in Table 6a. This demonstrates how the results are sensitive to the assumption we make about retirement behavior, and the reported estimates of the impacts of raising standard retirement ages probably reflect the upper bound of the negative impacts of such reforms.

The second to last column of Table 6a also reports the change in *SSW* as a fraction of the *APW*. This figure gives us another way of gauging the impact of the reform on the worker. For example, the first number in the column can be interpreted as saying that the 1993 reform of the General Regime in France reduced the present discounted value of future benefits (measured in 1993 money units) by an amount equal to 73 percent of the French *APW* in 1993. On this measure, the first of the Italian reforms is shown to have been especially severe, reducing *SSW* (if fully phased in) by more than three times the *APW* for both men and women.

[Table 6b about here]

Table 6b contains estimates of the impact of the reforms on those who retired in the year of the reform at the standard retirement age. With the exception of changes in the form of post-retirement indexing, all the reforms in Table 5 are phased in, and so do not affect the initial benefit of newly retired. For the countries that switched from wage to price indexation—France and Italy—the estimated loss of *SSW* is between 6 and 11 percent, which is certainly not insignificant. Under the assumptions for tax increases discussed above, the shift from gross wage to net wage indexation—Germany and Japan—leads to cumulative losses of about 2 to 3 percent.

Although the estimates of wealth changes should be seen as indicative only, the difference between the impacts on middle-aged and younger workers on the one hand, and the retired and those close to retirement on the other, is striking. What accounts for this difference in treatment? One reason is almost certainly that those who are still some distance from retirement still have the opportunity to save for retirement, so they are in a better position to adjust to the benefit cuts. Yet these adjustments will be painful nonetheless given the magnitude of wealth loss. Putting aside intergenerational altruism, why is it that middle-aged workers are willing to make these adjustments instead of forcing future workers to pay the previously promised benefits? The rhetoric of reform debates suggests the current workers fear that, with rising dependency ratios, overburdened future workers will redefine—or even completely eliminate—PAYG benefit arrangements. With this in mind, the next section explores a simple model in which self interested current workers can actually raise their expected benefits by cutting the benefits they promise themselves.

Section 4. Repudiation Risk as an Inducement to Early Reform: A Simple Model

The reform case studies produced two main findings about benefit cuts: (i) the currently retired and those close to retirement are usually spared; and (ii) middle-aged and younger workers can sometimes face large reductions in their implicit gross SSW. In this section, I briefly explore one explanation for these findings with a simple model. The idea behind the model is that workers bear a fixed cost when they cut the benefits of the old, as well as bearing a (non-linear) cost to paying them benefits. Benefit cuts are avoided unless benefits reach a level that makes it worthwhile to incur the fixed cost. Once benefits are cut, the cuts can be large. If current workers believe that the benefits they are promising themselves will trigger future reform, then it will be in their interests to preemptively cut their own benefits.

This model relies on the self-interest of current workers to explain why they cut their own future benefits. The are of course other reasons to do so, such as a concern for the fairness of the intergenerational distribution (see Kotlifoff, 1992, for a discussion of intergenerational accounting) or a concern for economic efficiency (see Feldstein, 1996, for an overview of the distortions caused by PAYG social security). The costs to current generations of reducing the unfunded liability of social security are often seen, however, as a major obstacle to reform. Thus the model suggests how reforms that are considered good on more impartial grounds might still take place even in a world with quite partial individuals.

The model has the following main elements:

- Current workers promise themselves social security benefits to be paid for by future workers. This is an inherited unfunded liability from the point of view of the future workers.
- The actual level of benefits is chosen by future workers (say because they have a majority). This represents political risk from the point of view of current workers. However, future workers face political (or repudiation) costs when they redefine the benefits that the retired had promised themselves; i.e., when they repudiate on part of the inherited liability. I assume that there is a fixed cost to repudiation and that the cost of repudiation rises linearly with the size of the benefit reduction. We will see that this gives current workers influence over the benefits they will receive. (I take it that the political costs are sufficiently high to prevent cutting the benefits of the currently retired. Attention is thus on the decision of current workers about what benefits to promise themselves.)
- The welfare loss to a future worker of funding benefits rises non-linearly with the PAYG tax they must pay.

To solve the model, I first determine the optimal choice of benefit reduction by the second generation of workers for a given level of the inherited unfunded liability. There will be some maximum level of benefit that they will choose not to repudiate at all. I show that this level is greater than the level that they would choose if they decide to repudiate. Given that current workers anticipate the responses of future workers (there is no uncertainty in the model), it follows that it is optimal for them to promise themselves benefits at this "maximum" level. If the promised benefits are currently higher than this level, it is in their interest to scale them back.

For simplicity, I assume that there is a single member in the (first) generation of current workers. Each generation lives for two periods, working in the first and retired in the second. The population grows at the rate n, so that there are $1+n$ workers in the second generation. This implies that the dependency ratio, D, in the second period is equal to $\frac{1}{1+n}$.

There is a PAYG social security system whereby the working generation is taxed and the tax revenue is paid out as a benefit to the retired. For a given actual benefit payment paid to the retired, $B(1)$, a tax of $D \times B(1)$ is levied on each worker to ensure budget balance.

The current worker knows that a future worker will have utility given by,

(4.1) $$u = k - \frac{a}{2}T^2 - D(F - c\Delta B) \quad \text{with repudiation (i.e., } \Delta B<0\text{)}$$

$$\text{and } u = k - \frac{a}{2}T^2 \quad \text{without repudiation (i.e., } \Delta B=0\text{),}$$

where T the per worker tax, F is the total fixed cost of repudiation, and ΔB is the change in benefits. Note that the adjustment cost ($F - c\Delta B$) is multiplied D (=1/(1+n)) to put it in per worker terms. Writing the benefit as the sum of the inherited unfunded liability, B(0), and the change in that benefit, the constraint faced by the future worker is

(4.2) $$T = DB(1) = D\big(B(0) + \Delta B\big).$$

Assuming that the future worker does repudiate, I can find what the optimal repudiation will be by substituting the budget balancing constraint into the utility function and maximizing with respect to ΔB. The optimal change in the benefit is,

$$(4.3) \qquad \Delta B = \frac{c}{aD} - B(0),$$

so that the actual benefit paid is

$$(4.4) \qquad B(1) = \frac{c}{aD}.$$

The next step is to find out when the future generation will in fact repudiate. I assume that repudiation will take place if it increases utility (taking into account, of course, the costs of repudiation). The repudiation condition is then,

$$\text{repudiate if:} \quad k + \frac{1}{2}\frac{c^2}{a} - DF - cDB(0) > k - \frac{a}{2}D^2B(0)^2,$$

where I assume that $\frac{1}{2}\frac{c^2}{a} - DF < 0$ (which implies that future workers have higher utility by not repudiating when the unfunded liability that they face is very low, as can be seen in Figure 1).

I now turn attention to the current worker's choice of unfunded liability to place on the future worker. The current worker wants this to be as large as possible, so chooses the largest $B(0)$ that is consistent with no repudiation. This can be found by replacing the inequality in the repudiation constraint with an equality and solving the resulting quadratic for $B(0)$. The roots of this equation are: $\frac{c}{aD}+\sqrt{\frac{2F}{aD}}$ and $\frac{c}{aD}-\sqrt{\frac{2F}{aD}}$. Given that I have assumed that $\frac{1}{2}\frac{c^2}{a}-DF<0$, the first root is positive and the second is negative. If I rule out negative benefits, then the optimal unfunded liability to place on future workers is.

$$B(0)^* = B(1)^* = \frac{c}{aD}+\sqrt{\frac{2F}{aD}}, \tag{4.5}$$

That is, the benefit is equal to the repudiation benefit plus a premium that is negatively related to the dependency ratio. The determination of the maximum future benefit consistent with no repudiation is shown graphically in Figure 3.

[Figure 3 about here]

The optimal benefit increases with c and F, and decreases with a and D. Smaller repudiation costs or more distorting taxes will lower the feasible benefit for a given dependency ratio. Most importantly, an increase in the future dependency ratio, D, will cause current workers to cut the benefits they promise themselves.

Figure 4 shows how the actual benefits paid, $B(1)$, correspond to the promised benefits, $B(0)$. The two rise together until the repudiation threshold is reached at $\frac{c}{aD}+\sqrt{\frac{2F}{aD}}$. At that level of the unfunded liability, repudiation occurs, and actual benefits fall to $\frac{c}{aD}$. This is a rather extreme form of debt "laffer curve" (as discussed in Krugman, 1989 [1993]). Debt "forgiveness" in the sense of voluntary reducing the unfunded liability on the next generation can actually raise the benefits received, making both generations better off. The earlier generation receives higher benefits, and the latter generation avoids the unpleasantness of cutting redefining benefits for the old.

[Figure 4 about here]

We can use the PAYG budget constraint to see how the tax rate changes with the dependency rate,

$$T^* = DB(1)^* = \frac{c}{a}+\sqrt{\frac{2FD}{a}}. \quad (4.6)$$

Given our assumptions, current workers know that future workers will be willing to bear part of the burden of an increase in the dependency ratio with higher tax rates. The marginal willingness of future workers to share the burden, however, decreases with the dependency ratio. In other words, when the dependency ratio (and thus the tax rate) is already high, their willingness to increase the tax rate further in response to an even higher dependency ratio is low.

In conclusion, this simple model produces three main results that are not inconsistent with recent reforms. First, repudiation on retirement benefit obligations to the currently retired should not take place even when the dependency rate is high (assuming that this high rate was anticipated). Second, benefit promises should be reformed in anticipation of the high dependency ratio to prevent costly repudiations. And third, an anticipated increase in the dependency rate should lead ultimately to a mix of lower benefits and higher taxes.

Section 5. Concluding Comments

This paper has shown that in response to projections of sharply rising costs of state-provided retirement income, governments have succeeded in legislating significant cuts in future benefits. In most cases, these cuts have not been enough to stabilize the share of GDP being spent by governments on retirement benefits, so it is reasonably safe to predict more benefit cuts if this approach to "saving" social security programs continues to be pursued. Although this paper has focused on attempts to scale back PAYG programs, I conclude with some comments on the alternatives to this approach to curbing the cost to future taxpayers.

There are two main competing approaches:[33] (i) pre-fund (using current taxes) future defined-benefit obligations; or (ii) substitute privately pre-funded defined-contribution (DC) accounts for these obligations—the IB option. What these approaches have in common is that they force current workers to pay for themselves what future workers were to have paid for. This is clear with the pre-funding of existing obligations,

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[33] I ignore large-scale cuts in benefits to the currently or soon to be retired as an option.

but a bit obscured under the privatization option. For the US, where privatization has received a lot of attention, there appear to be two approaches to moving to an IB system. The substitution element is clearest is proposals to increase the payroll tax (or use the budget surplus) to fund accounts from which the proceeds would replace an increasing proportion PAYG benefits over time.[34] The increase in the tax is temporary, as the amount need to fund existing DB obligations declines over time as these obligations are replaced by the proceeds from the DC accounts. The alternative approach is to shift some or all payroll taxes into the funding of private DC accounts and to fund remaining PAYG obligations with a combination of government debt and increases in payroll and non-payroll taxes (such as a consumption tax).[35] How much of the burden falls on current workers depends on the split between tax increases and debt finance.[36]

What I have stressed so far is how these reforms all place a burden on current workers to partly relieve the burden on future workers. One important difference between the cut future benefits and substitute current funding approaches might their effects on the adequacy of future retirement income. It is possible that current workers will respond to large cuts in the benefits they are promised by raising their private saving, thereby maintaining their living standards (without having to work longer) in later life. But it seems unwise to rely on this. In the countries where future benefits rules have already been reformed substantially, do younger workers even know how much the benefits that

[34] See, for example, Feldstein and Samwick (1998)

[35] For a proposal of this type, see Kotlikoff and Sachs (1997).

[36] If current taxes are not raised at all, then future tax-payers are not being helped. Instead of having to meet unfunded social security obligations they will have to meet government debt obligations. Thinking in terms of the model of Section 4, however, there might a difference in the willingness to repudiate on social security obligations and the Continued . . .

they should be anticipating have fallen? The advantage of pre-funding is that an alternative (albeit potentially uncertain) source of retirement income is put in place directly.

This brings back to where I started and the fact that there is risk in both IB and PAYG systems. Although there are different ways to characterize the risk, one aspect is the possibility of having inadequate income in retirement. The main finding of this paper is that politically imposed changes in PAYG benefit rules that have a large impact on the flow of benefits in retirement are not just a possibility—they have already occurred in a number of major economies. And given that costs are still set to escalate substantially, it is almost certain that more are in store. The decision about partially or fully substituting an IB for a PAYG system depends, of course, on more than just risk factors (notably the impacts on economic efficiency and inter- and intra-generational distribution). In considering reform options, however, the vulnerability of existing PAYG defined benefit rules needs to be kept in mind.

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willingness to repudiate on government debt. Thus this form of asset swap could still benefit existing workers.

Appendix 1 A Note on the Bias Induced by the Certain Length of Life Assumption

How serious a limitation is the assumption of a certain remaining lifetime? In general, the expected *SSW* of someone with an uncertain remaining lifetime with an expected duration of *R-T+H* years is *not* the same as the as the *SSW* of someone with a certain remaining lifetime of that length. The two are equal under the following restrictive conditions: (i) the real discounted annual benefit is constant over time (this requires that real benefits grow at a rate equal to the real discount rate); and (ii) the worker is certain to reach retirement age.

The first assumption implies that *SSW* is a linear function of the length of retirement. If the worker is certain to reach the retirement age, but the discounted real benefit falls over time, so that *SSW* rises at a decreasing rate with the length of retirement, then *SSW* will be lower under the uncertain lifetime assumption.[37] In other words, the estimate of *SSW* based on the certain remaining lifetime assumption is biased upward. On the other hand, if the discounted real benefit rises over time (which will be the case if benefits grow at a faster rate than the discount rate), then the estimate is biased downward.

[Figure 5 about here]

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[37] The reasoning here is similar to that which shows that expected utility is less than the utility of the expected income for a risk averse individual. A risk-averse individual has diminishing marginal utility in income. In the case considered here, the individual has diminishing marginal *SSW* in the number of years of retirement. Given this and assuming Continued . . .

A further complication is added if there is a positive probability of not surviving until retirement age. A simple example of with a linear *SSW* schedule is shown in Figure 5. Given the constant discounted real benefit, *SSW* is higher under the uncertain lifetime assumption. The worker will live to A_0 with probability p or A_1 with probability $1-p$, which I assume leads her to expect to live until $R+H$. Note that A_0 is less than R so there is a positive probability of not reaching retirement age. The expected *SSW* given the uncertain length of life is SSW^u, which is a probability weighted average of the zero benefits that are received if the worker does not survive until retirement and the present discounted value of benefits if she survives until A_1. Inspection of the diagram reveals that this level of *SSW* is greater than the *SSW* of someone who is certain of dying at age $R+H$ (SSW^c in the diagram above).[38] Thus the possibility of dying before retirement tends to bias the estimate of social security wealth upwards. Our primary concern, however, is with the percentage change in social wealth that results from a benefit reform rather than with the actual levels of wealth, and there is some reason to hope that the bias is smaller less for this calculation. In the case of a linear *SSW* schedule, for example, a change in

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the individual is certain to reach retirement, then the expected *SSW* is less than the *SSW* at expected remaining length of life.

[38] It is easy to demonstrate that substituting the expected length of life, $R+H = p A_0 + (1-p) A_1$, into the equation for the dashed upward sloping line linking the points (A_0, 0) and (A_1, $SSW(A_1)$), yields a level of *SSW* equal to SSW^u. Thus a graphical comparison shows that, with a linear *SSW* schedule, a positive probability of early death means that expected *SSW* is greater than the *SSW* at the expected lifetime. That is, the latter is a downward biased estimate of expected *SSW*. Of course, if the marginal social security wealth is diminishing with the length of the retirement, it is still possible that *SSW* at the expected lifetime is upward biased.

the level of the (constant) discounted real benefit level will lead to an equal percentage changes in *SSW* under the certain and uncertain lifetime assumptions.[39]

Summing up, the assumption of the fixed remaining length of life assumption does introduce a potential bias in estimates of *SSW*. It is not obvious, however, which way the bias goes. A positive probability of not reaching retirement leads to a downward bias, while the likelihood that the real benefit growth rate is less than the discount rate (which is assumed to be 3 percent for the calculations in the paper) leads to an upward bias. Finally, if the benefit growth rate and the discount rate are reasonably close, there is reason to hope that biases in the percentage *change* calculations that are the focus of the paper are less serious.

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[39] Let b be the initial discounted value of the social security benefit for all periods after retirement, and b^* be the benefit after reform. For a retirement with a certain length of H, the relative change in *SSW* is equal to the relative change in the benefit, $\frac{b^* - b}{b}$. For an uncertain retirement of length H, and with a positive probability of dying at the pre-retirement age A_0, some geometry reveals that the relative change in expected *SSW* wealth is,

$$\frac{\left(b^* - b\right)\left(\frac{(A_1 - R)(R + H - A_0)}{A_1 - A_0}\right)}{b\left(\frac{(A_1 - R)(R + H - A_0)}{A_1 - A_0}\right)} = \frac{b^* - b}{b}.$$ Thus, even though making the lifetime uncertain raises the social security wealth for a given benefit level and expected life-span,
Continued . . .

the relative change in wealth that results from a change in the benefit level is, under our special assumptions, the same in each case.

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Figure 1a
Canada: Old Age Cash Benefits
OECD Expenditure (SOCX) and Demographic Data

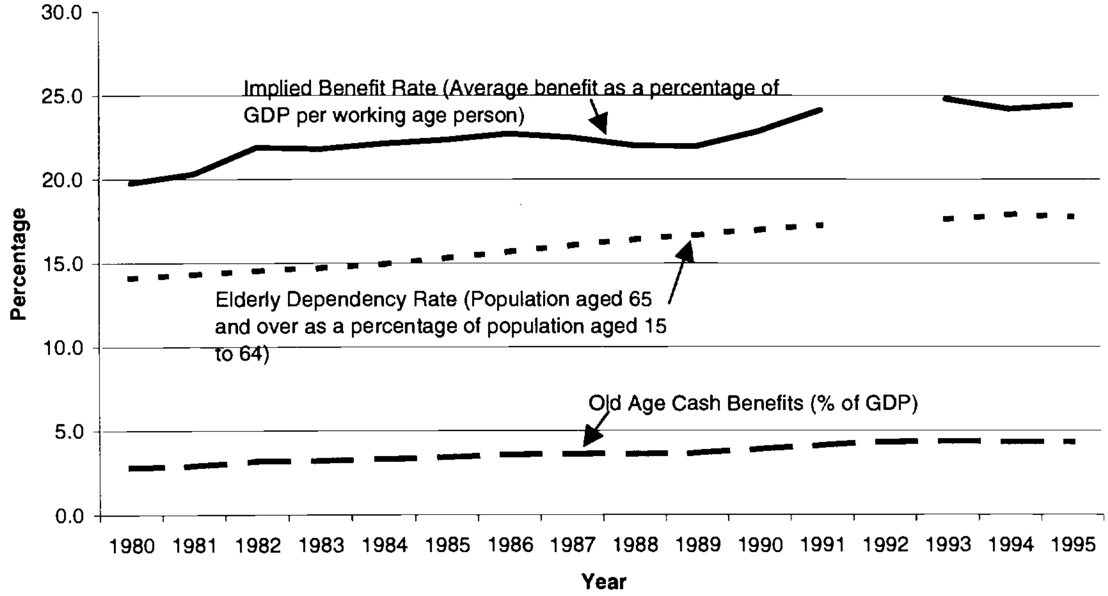

Figure 1b
France: Old Age Cash Benefits
OECD Expenditure (SOCX) and Demographic Data

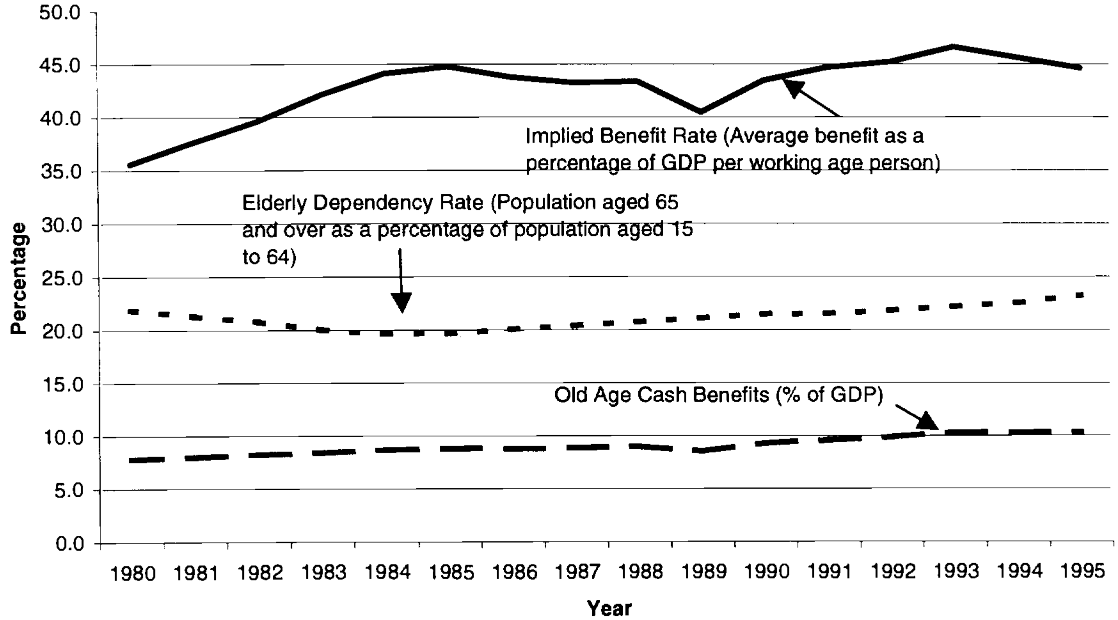

Figure 1c
Germany: Old Age Cash Benefits
OECD Expenditure (SOCX) and Demographic Data

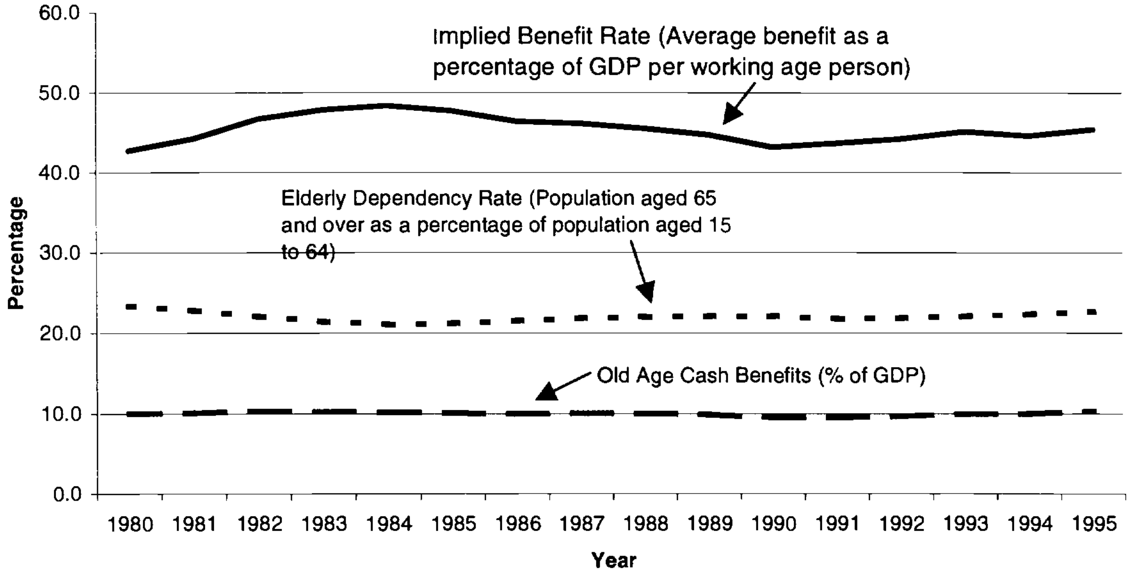

Figure 1d
Italy: Old Age Cash Benefits
OECD Expenditure (SOCX) and Demographic Data

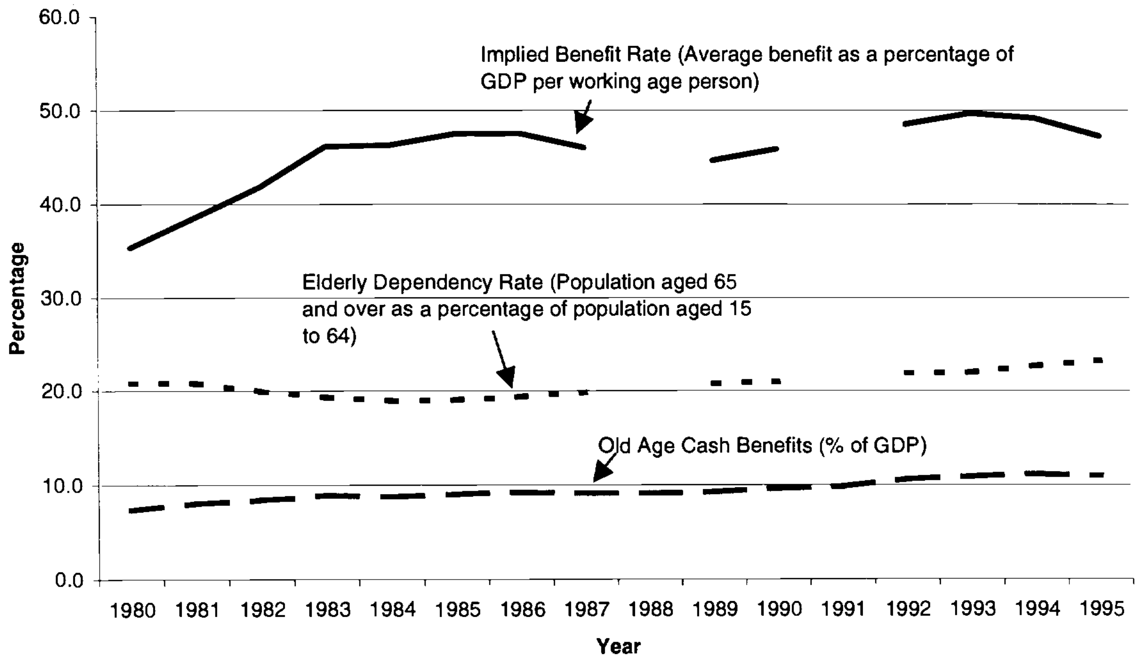

Figure 1e
Japan: Old Age Cash Benefits
OECD Expenditure (SOCX) and Demographic Data

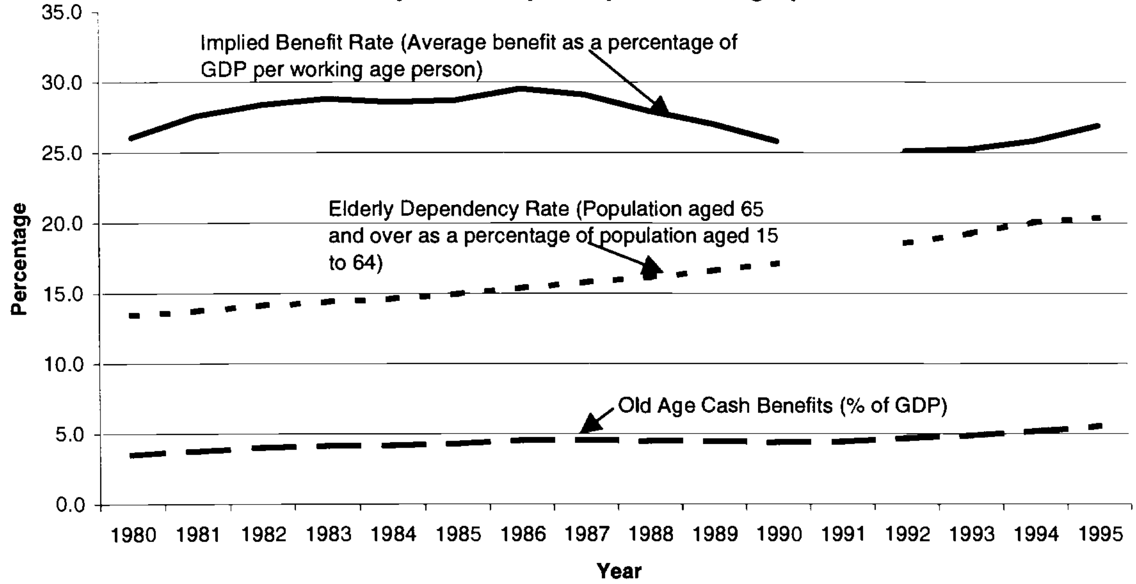

Figure 1f
United Kingdom: Old Age Cash Benefits
OECD Expenditure (SOCX) and Demographic Data

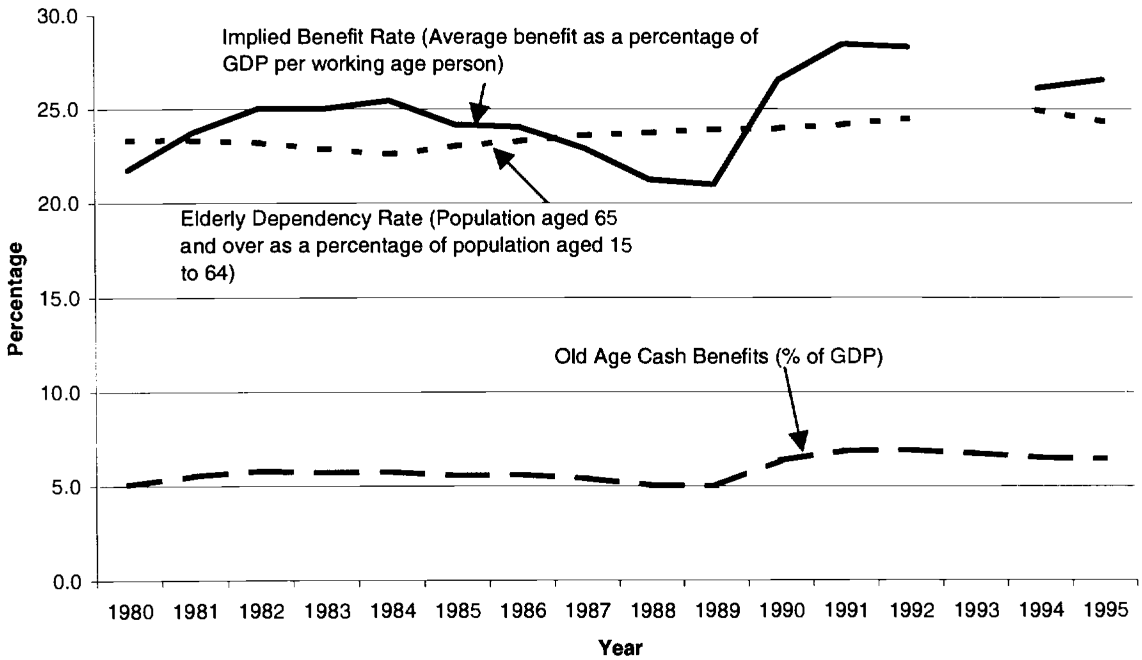

Figure 1g
United States: Old Age Cash Benefits
OECD Expenditure (SOCX) and Demographic Data

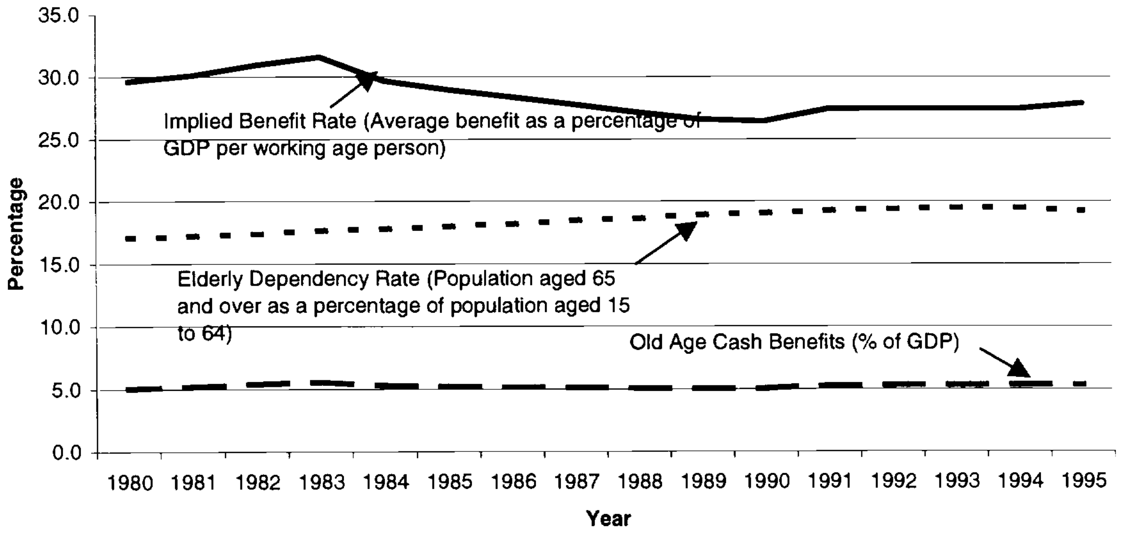

Table 1a.
Total Public Expenditure on Old Age Cash Benefits
Assuming Benefit Rate (Average Benefit / GDP per Working Age Person) at 1995 level
OECD Social Expenditure (SOCX) Data Base (all public programs)

	1995	*2000*	*2010*	*2020*	*2030*
Canada					
Dependency Rate	17.7	18.2	20.4	28.4	39.1
Benefit Rate	24.5	24.5	24.5	24.5	24.5
Expenditure to GDP Ratio	4.3	4.5	5.0	6.9	9.6
France					
Dependency Rate	23.2	23.6	24.6	32.3	39.1
Benefit Rate	44.6	44.6	44.6	44.6	44.6
Expenditure to GDP Ratio	10.4	10.5	11.0	14.4	17.4
Germany					
Dependency Rate	22.7	23.8	30.3	35.4	49.2
Benefit Rate	45.4	45.4	45.4	45.4	45.4
Expenditure to GDP Ratio	10.3	10.8	13.8	16.1	22.3
Italy					
Dependency Rate	23.3	26.5	31.2	37.5	48.3
Benefit Rate	47.2	47.2	47.2	47.2	47.2
Expenditure to GDP Ratio	11.0	12.5	14.7	17.7	22.8
Japan					
Dependency Rate	20.4	24.3	33.0	43.0	44.5
Benefit Rate	26.9	26.9	26.9	26.9	26.9
Expenditure to GDP Ratio	5.5	6.5	8.9	11.6	12.0
United Kingdom					
Dependency Rate	24.3	24.4	25.8	31.2	38.7
Benefit Rate	26.6	26.6	26.6	26.6	26.6
Expenditure to GDP Ratio	6.5	6.5	6.9	8.3	10.3
United States I					
World Bank Demographic Projections					
Dependency Rate	19.2	19.0	20.4	27.6	36.8
Benefit Rate	27.9	27.9	27.9	27.9	27.9
Expenditure to GDP Ratio	5.4	5.3	5.7	7.7	10.3
United States II					
Social Secuity Administration Demographic Projections					
Dependency Rate	19.2	18.7	19.1	24.8	31.9
Benefit Rate (1995)	27.9	27.9	27.9	27.9	27.9
Expenditure to GDP Ratio	5.4	5.2	5.3	6.9	8.9

Note: Expenditure to GDP Ratio = [(Dependency Rate)(Benefit Rate)]/100
Sources: OECD Social Expenditure (SOCX) Data Base; OECD (1997); and Bosworth et al. (1998).

Table 1b.

Total Public Expenditure on Old Age and Survivors Benefits
Assuming Benefit Rate (Average Benefit / GDP per Working Age Person) at 1995 level
OECD Social Expenditure (SOCX) Data Base (all public programs)

	1995	*2000*	*2010*	*2020*	*2030*
Canada					
Dependency Rate	17.7	18.2	20.4	28.4	39.1
Benefit Rate	27.2	27.2	27.2	27.2	27.2
Expenditure to GDP Ratio	4.8	5.0	5.6	7.7	10.6
France					
Dependency Rate	23.2	23.6	24.6	32.3	39.1
Benefit Rate	52.6	52.6	52.6	52.6	52.6
Expenditure to GDP Ratio	12.2	12.4	12.9	17.0	20.6
Germany					
Dependency Rate	22.7	23.8	30.3	35.4	49.2
Benefit Rate	47.9	47.9	47.9	47.9	47.9
Expenditure to GDP Ratio	10.9	11.4	14.5	17.0	23.6
Italy					
Dependency Rate	23.3	26.5	31.2	37.5	48.3
Benefit Rate	58.7	58.7	58.7	58.7	58.7
Expenditure to GDP Ratio	13.7	15.6	18.3	22.0	28.3
Japan					
Dependency Rate	20.4	24.3	33.0	43.0	44.5
Benefit Rate	30.7	30.7	30.7	30.7	30.7
Expenditure to GDP Ratio	6.3	7.5	10.1	13.2	13.7
United Kingdom					
Dependency Rate	24.3	24.4	25.8	31.2	38.7
Benefit Rate	29.9	29.9	29.9	29.9	29.9
Expenditure to GDP Ratio	7.3	7.3	7.7	9.3	11.6
United States I					
World Bank Demographic Projections					
Dependency Rate	19.2	19.0	20.4	27.6	36.8
Benefit Rate	32.9	32.9	32.9	32.9	32.9
Expenditure to GDP Ratio	6.3	6.2	6.7	9.1	12.1
United States II					
Social Secuity Administration Demographic Projections					
Dependency Rate	19.2	18.7	19.1	24.8	31.9
Benefit Rate (1995)	32.9	32.9	32.9	32.9	32.9
Expenditure to GDP Ratio	6.3	6.2	6.3	8.2	10.5

Note: Expenditure to GDP Ratio = [(Dependency Rate)(Benefit Rate)]/100
Sources: OECD Social Expenditure (SOCX) Data Base; OECD (1997); and Bosworth et al. (1998).

Table 2.

Pooled OLS Regression for State Pension Expenditure as a Share of GDP

OECD Countries, 1980-1995

Dependent Variable = Log(Pension Expenditure/GDP)	(1)	(2)	(3)	(4)	(5)
Independent Variables:					
Log(Elderly Dependency Rate)	1.64	1.63	1.63	1.64	0.20
	(24.94)	(19.57)	(19.23)	(24.50)	(1.98)
Log(GDP Per Capita)		0.01	-0.06		
		(0.08)	(-0.73)		
Log(Urbanization Rate)			0.11		
			(1.06)		
Log(Female Share of LF)			0.22		
			(1.03)		
Time Dummies				Yes	
Country Dummies					Yes
Constant	-3.10	-3.14	-3.85	-3.16	1.07
Adjusted R-Squared	0.65	0.64	0.64	0.63	0.96
No. of Observations	343	343	343	343	343

t-statistics are in parentheses

Figure 2. Aging and Public Pension Spending
OECD Countries, 1980 - 1995

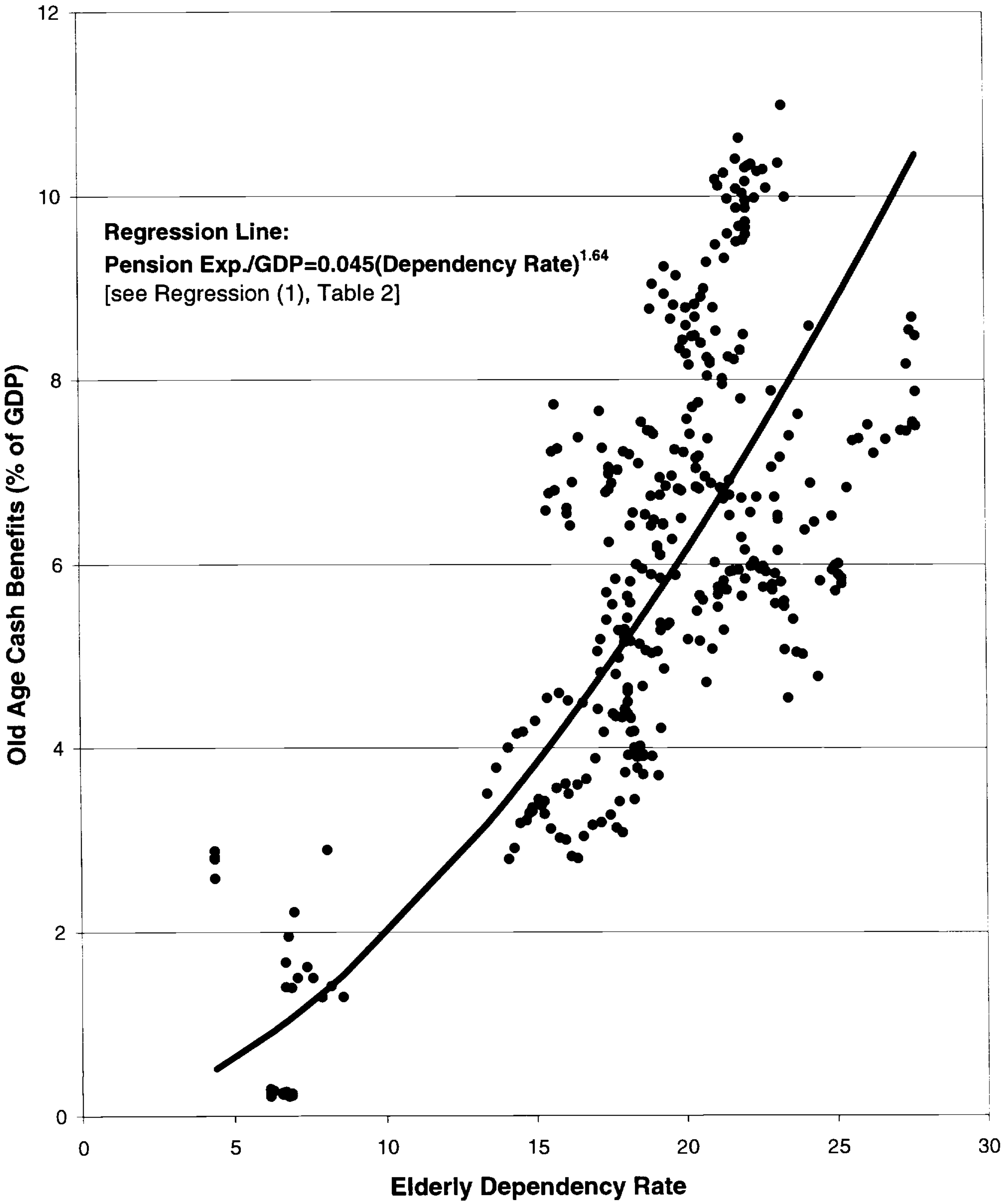

Table 3.
OECD Estimates of the Impact of Legislated Reforms
Percentage Change in Expenditure to GDP Ratios Relative to 1995 Ratio

	2000	*2010*	*2020*	*2030*
		% Change		
Canada				
Assuming Constant 1995 Benefit Rate (From Table 1)	2.6	14.9	60.0	120.3
OECD Estimates Given the Impact of Legislated Reforms	-3.8	1.9	32.7	73.1
France				
Assuming Constant 1995 Benefit Rate (From Table 1)	1.6	5.9	39.1	68.4
OECD Estimates Given the Impact of Legislated Reforms	-7.5	-8.5	9.4	27.4
Germany				
Assuming Constant 1995 Benefit Rate (From Table 1)	10.9	41.1	64.9	129.2
OECD Estimates Given the Impact of Legislated Reforms	3.6	6.3	10.8	48.6
Italy				
Assuming Constant 1995 Benefit Rate (From Table 1)	13.9	34.1	61.1	107.5
OECD Estimates Given the Impact of Legislated Reforms	-5.3	-0.8	15.0	52.6
Japan				
Assuming Constant 1995 Benefit Rate (From Table 1)	19.2	61.9	110.9	118.3
OECD Estimates Given the Impact of Legislated Reforms	13.6	45.5	87.9	103.0
United Kingdom				
Assuming Constant 1995 Benefit Rate (From Table 1)	0.3	6.1	28.3	59.1
OECD Estimates Given the Impact of Legislated Reforms	0.0	15.6	13.3	22.2
United States				
Assuming Constant 1995 Benefit Rate (From Table 1)	-1.2	6.1	43.5	91.4
OECD Estimates Given the Impact of Legislated Reforms	2.4	9.8	26.8	61.0

Note:
The measure of pension expendiuture used in OECD (1997) for their estimates does not exactly match the measure based on all state old age cash expendiutures from the OECD Social Expenditure (SOCX) database used in Table 1. Thus the comparision of percentage changes with and without legislated reforms should be seen as indicative only. Both sets of estimates are based on the World Bank demographic projections.

Source: OECD (1997) and author's calculations.

Table 4. Stylized Benefit Formulas *Prior* to Recent Reforms

	Retirement Age Men/Women	*Tier 1* Flat-Rate Benefit	*Tier 2* Assessed Earnings for Earnings-Related Pension	*Tier 2* Replacement Rate[1]	*Tier 2* Post-Retirement Indexation
France (1993) *[Regime General]*[2]	60/60	No universal flat-rate benefit (A means-tested benefit does exist)	10 highest years, revalued for nominal wage inflation	50%	Gross wage inflation
Germany (1992)	63/60	No universal flat-rate benefit (A means-tested benefit does exist)	Average earnings, revalued for nominal wage inflation	60% (Based on 40 years of coverage at 1.5% per year)	Gross wage inflation
Italy (1992) *[Prior to Amato reforms]*	60/55	No universal flat-rate benefit (A means-tested benefit does exist)	Last five years of earnings; earnings for first 3 years indexed for inflation	Progressive formula; 80% at APW	Gross wage inflation
Italy (1995) *[Prior to Dini reforms]*	65/60 (being phased in)	No universal flat-rate benefit (A means-tested benefit does exist)	Lifetime earnings (being phased in)	Progressive formula; 80% at APW	Price inflation
Japan (1994)	60/60 (effective)[3]	National Pension Program—Old Age Basic Pension: 737, 300 Yen per Year ($5967.62)	Average lifetime earnings, revalued for nominal wage inflation	30% (based on 40 years of contributions at 0.75% per year)	*Tier 1*: Price inflation *Tier 2*: Gross wage inflation[4]
United Kingdom (1986)	65/60	Old Age Pension: Basic component £1861.60 ($2233.92)	Average earnings (between upper and low limits) of best 20 years, revalued for nominal	25%	Price Inflation

[1] Assuming full eligibility for an earnings-related pension.
[2] Most of the population are covered by a two-pillared system comprising of the Regime General and a complementary scheme organized on a socio-professional basis. Analysis of the french system is complicated by a number of *regime speciaux,* which substitute for the regime general for some workers. The 1993 reform was limited to the regime general and some related schemes, so I concentrate on that plan here.
[3] The formal retirement age for *Tier 2* benefits is 65, but workers can retire at 60 without loss of benefits (see Takayama, 1996).
[4] Updated every five years rather than annually.

			wage inflation		
United Kingdom (1994)	65/60	Old Age Pension: Basic component £2185.80 (4266.36)	Average earnings (between upper and lower limits[5]) of working life, revalued for nominal wage inflation	20%	Price Inflation
United States (1983)	65/65	No universal flat-rate benefit (A means-tested benefit—Supplementary Security Income (SSI)—does exist)	Average covered earnings of best 35 years, revalued for nominal wage inflation	Progressive formula, 43% at APW based on 1983 bend points	Price Inflation

Sources: Disney (1996), Franco and Munzi (1996), Hamann [IMF] (1997), Leibfritz et al. [OECD] (1995), OECD (1988), Takayama (1996), U.S. Social Security Administration (Various Years)

[5] The upper and lower limits are indexed to price inflation.

Table 4. Stylized Benefit Formulas *Prior* to Recent Reforms

	Retirement Age Men/Women	*Tier 1* Flat-Rate Benefit	*Tier 2* Assessed Earnings for Earnings-Related Pension	*Tier 2* Replacement Rate[1]	*Tier 2* Post-Retirement Indexation
France (1993) *[Regime General]*[2]	60/60	No universal flat-rate benefit (A means-tested benefit does exist)	10 highest years, revalued for nominal wage inflation	50%	Gross wage inflation
Germany (1992)	63/60	No universal flat-rate benefit (A means-tested benefit does exist)	Average earnings, revalued for nominal wage inflation	60% (Based on 40 years of coverage at 1.5% per year)	Gross wage inflation
Italy (1992) *[Prior to Amato reforms]*	60/55	No universal flat-rate benefit (A means-tested benefit does exist)	Last five years of earnings; earnings for first 3 years indexed for inflation	Progressive formula; 80% at APW	Gross wage inflation
Italy (1995) *[Prior to Dini reforms]*	65/60 (being phased in)	No universal flat-rate benefit (A means-tested benefit does exist)	Lifetime earnings (being phased in)	Progressive formula; 80% at APW	Price inflation
Japan (1994)	60/60 (effective)[3]	National Pension Program—Old Age Basic Pension: 737, 300 Yen per Year ($5967.62)	Average lifetime earnings, revalued for nominal wage inflation	30% (based on 40 years of contributions at 0.75% per year)	*Tier 1*: Price inflation *Tier 2*: Gross wage inflation[4]
United Kingdom (1986)	65/60	Old Age Pension: Basic component £1861.60 ($2233.92)	Average earnings (between upper and low limits) of best 20 years, revalued for nominal	25%	Price Inflation

[1] Assuming full eligibility for an earnings-related pension.
[2] Most of the population are covered by a two-pillared system comprising of the Regime General and a complementary scheme organized on a socio-professional basis. Analysis of the french system is complicated by a number of *regime speciaux,* which substitute for the regime general for some workers. The 1993 reform was limited to the regime general and some related schemes, so I concentrate on that plan here.
[3] The formal retirement age for *Tier 2* benefits is 65, but workers can retire at 60 without loss of benefits (see Takayama, 1996).
[4] Updated every five years rather than annually.

			wage inflation		
United Kingdom (1994)	65/60	Old Age Pension: Basic component £2185.80 (4266.36)	Average earnings (between upper and lower limits[5]) of working life, revalued for nominal wage inflation	20%	Price Inflation
United States (1983)	65/65	No universal flat-rate benefit (A means-tested benefit—Supplementary Security Income (SSI)—does exist)	Average covered earnings of best 35 years, revalued for nominal wage inflation	Progressive formula, 43% at APW based on 1983 bend points	Price Inflation

Sources: Disney (1996), Franco and Munzi (1996), Hamann [IMF] (1997), Leibfritz et al. [OECD] (1995), OECD (1988), Takayama (1996), U.S. Social Security Administration (Various Years)

[5] The upper and lower limits are indexed to price inflation.

Table 5. Selected Reforms to State Retirement-Income Systems

	Retirement Age	*Tier-1* Flat-Rate Benefit	*Tier- 2* Assessed Earnings for Earnings-Related Pension	*Tier-2* Replacement Rate	*Tier-2* Post-Retirement Indexation
France (1993)			Assessment period, 10 → 25 years (phased in by 2008)[1]		Wage indexation → price indexation[2]
Germany (1992)[3]	Men: 63 → 65 years (by 2009) Women: 60 → 65 years (by 2018)				Gross wage indexation → net wage indexation
Italy (1992) [Amato Reforms]	Men: 60 → 65 years (over 10 years) Women: 55 → 60 years (over 10 years)		Assessment period: 5 → 10 years (over 10 years); lifetime for younger workers. Revaluation of past earnings: inflation plus 1%		Wage indexation → price indexation
Italy (1995) [Dini Reforms]			Lifetime earnings, revalued at inflation plus 1% → contributions over working	New System:[4] For those retiring at 65, benefits are equal to 6.1% of capitalized contributions.	

[1] In addition, the number of years required for a full pension is to be gradually raised from 371/2 years to 40 years.

[2] In fact, pensions had been indexed to prices since 1987, with wage indexation being suspended on a yearly basis. The reform institutionalized the new indexation procedure.

[3] Other reforms not included here include: more strict rules on early retirement, reduced pension credits for years in higher education, and increases in pensions for low wage workers.

[4] Since employees pay a higher contribution rate than the self employed, the shift from average earnings-based benefits to contributions-based benefits means that the reform has a more negative impact on the self-employed. Employees currently face a contribution rate of 32 percent, as compared to a 15% rate for the self employed. In fact, the benefits are calculated using "notional" contribution rates of 33 and 20 percent for employees and the self employed respectively. Thus, even though the self-employed take a bigger hit from the change of system, they continue to receive a subsidy (see Hamann, 1997).

	•		life, revalued at the growth rate of a five-year moving average of nominal GDP	Smaller coefficients apply to earlier retirements.[5]	
Japan (1994)	60 → 65 years, for *Tier-1* pensions (by 2014 for men and by 2019 for women)				Gross wage indexation → net wage indexation for *Tier 2* pensions
United Kingdom (1986)[6]			Assessment period, 20 best years → all working years	25% → 20% (phased in for those reaching retirement age between 1999 and 2009)	
United Kingdom (1994)	60 → 65 years for women (phased in by 2020)		Lower earnings limit (LEL) in year prior to retirement subtracted from revalued earnings → revalued LEL subtracted from revalued earnings.[7] (starting in		

[5]For those retiring at 60, the coefficient is 5.1 percent. The earliest allowable retirement age is 57, at which the coefficient drops to 4.7 percent (Hamann, 1997). The stated intention is that these coefficients will be periodically adjusted downwards in response to lengthening life expectancy.

[6] Other reforms of the earnings related pension (SERPS) include a reduction of the survivor's pension from 100 percent to 50 percent of the pension that was to be paid to the deceased contributor and an extension of arrangements for contracting out of earnings-related pensions.

[7] The lower earnings limit (LEL) is set equal to the flat-rate basic benefit, and is thus adjusted only for price inflation. When real wage growth is positive, this seemingly minor technical adjustment can lead to a substantial benefit cut over time (see Disney, 1996).

			2000)		
United States (1983)[8]	65 → 67 years by 2022 (for workers reaching the early retirement age of 62)			Benefits not subject to income tax → benefits subject to income tax in certain circumstances[9]	One-time six month delay in the cost-of -living adjustment (COLA)

Sources: Disney (1996), Franco and Munzi (1996), Hamann [IMF] (1997), Leibfritz et al. [OECD] (1995), OECD (1988), Takayama (1996), U.S. Social Security Administration (Various Years)

[8] Other reforms not treated here include increased taxation of benefits, expansion of the program to include new federal employees, and a small payroll tax increase.

[9] If a taxpayer's combination of adjusted gross income, interest on tax exempt bonds, and 50 percent of Social Security benefits exceeds certain threshold amounts, benefits equal to the lesser of 50 percent of benefits or 50 percent of combined income over the threshold amount is subject to income tax. The additional revenue is added to the trust funds. The taxation of benefits was further modified in 1993, when a secondary (higher) threshold was introduced. An amount equal to 85 percent of combined income over the secondary threshold is now added to the benefits that are subject to income tax. The additional tax revenues are added to the Medicare health insurance trust fund.

Table 6a. Impact of Selected Benefit Reforms on Social Security Wealth (*SSW*)
45 year old worker earning the average production wage
(Assuming reforms are fully phased in by standard retirement age)

	Average Production Wage (*APW*)	Pre-Reform *SSW* as % of *APW*	Post-Reform *SSW* as % of *APW*	Change in *SSW* as % of *APW*	% Change in *SSW*
France (1993)					
Men	113200 FF	543%	469%	-74%	-13.5%
Women	113200 FF	680%	576%	-104%	-15.3%
Germany (1992)					
Men	49904 DM	354%	328%	-26%	-7.3%
Women[1]	49904 DM	596%	438%	-158%	-26.2%
Italy (1992)					
Men	28302000 Lire	841%	525%	-316%	-38%
Women	28302000 Lire	1374%	975%	-399%	-29%
Italy (1995)[23]					
Men (retiring at 65)					
Employee	31599600 Lire	470%	580%	+110%	+23%
Self Employed	31599600 Lire	470%	352%	-118%	-25%
Women (retiring at 60)					
Employee	31599600 Lire	791%	717%	-74%	-9%
Self Employed	31599600 Lire	791%	420%	-371%	-45%
Japan (1994)[4]					
Men[5]	4064645 Yen	447%	381%	-66%	-14.8%
Women	4064645 Yen	568%	495%	-73%	-12.4%
UK (1986)					
Men[6]		229%	177%	-52%	-22.8%

---

[1] The post-reform numbers are based on the assumption that the increase in the retirement age is fully phased in by the time the worker retires. Since the increase in the retirement age for women (to 65 from 60) is not due to be fully phased in until 2018, these calculations overstate the effect on a worker who is 45 at the time of the reform.

[2] This reform will affect employees and the self employed very differently, so the effects on the *SSW* of these different types of workers are included separately. The reason for the differential effects is that the self employed pay a much low contribution rate than employees. Thus a shift to contribution-based benefits has a larger negative impact on the implicit wealth of this group.

[3] Post reform calculations are based on a real GDP growth rate of 1.5 percent

[4] These calculations are made on the assumption that the worker retires at age 60, but after the reform does not receive tier-1 benefits until aged 65. If the reform leads retirement to be postponed until aged 65, then the benefit losses are larger. Under this assumption, the benefit losses for men and women are 34.9 and 28.7 percent respectively.

[5] A married man with a dependent spouse received benefits with a present value equal to 502 percent of the APW before the reform and equal to 411 percent after the reform (a 18.1 percent reduction in *SSW*).

Women[7]	£9118 £9118	469%	390%	-79%	-16.9%
UK (1994) *Men*[8] *Women*	 £14607 £14607	 201% 374%	 192% 265%	 -9% -109%	 -5% -29%
US (1983)[9] *Men*[10 11] *Women*[12]	 $18357 $18357	 163% 250%	 123% 210%	 -40% -40%	 -24.6% -16.0%

---

[6] A married man with a dependent spouse received benefits with a present value equal to 288 percent of the APW before the reform and equal to 236 percent after the reform (a 18.2 percent reduction in *SSW*).

[7] The post-reform numbers are based on the assumption that the increase in the retirement age is fully phased in by the time the worker retires. Since the increase in the retirement age for women (to 65 from 60) is not due to be fully phased in until 2020, these calculations overstate the effect on a worker who is 45 at the time of the reform.

[8] A married man with a dependent spouse received benefits with a present value equal to 267 percent of the APW before the reform and equal to 258 percent after the reform (a 3 percent reduction in *SSW*).

[9] The post-reform numbers are based on the assumption that the increase in the retirement age is fully phased in by the time the worker retires. Since the increase in the retirement age to 67 is not due to be fully phased (for a worker reaching the early retirement age of 62) until 2022, these calculations overstate the effect on a worker who is 45 at the time of the reform.

[10] A married man with a dependent spouse received benefits with a present value equal to 224 percent of the APW before the reform and equal to 196 percent after the reform (a 20.0 percent reduction in *SSW*).

[11] If the income of the retiree is high enough so that the 50 percent of benefits are now subject to income taxation, then the loss of *SSW* rises to 30.2 percent.

[12] If the income of the income of the retiree is high enough so that the 50 percent of benefits are now subject to income taxation, then the loss of *SSW* rises to 22.3 percent.

Table 6b. Impact of Selected Benefit Reforms on Social Security Wealth (*SSW*)
Worker at standard retirement age who earned the average production wage at 45

	% Change in *SSW*	Reason for Change
France (1993) *Men* *Women*	 -8.5% -10.0%	Wage indexation → Price indexation
Germany (1992) *Men* *Women*	 -2.1% -2.8%	Gross wage indexation → Net wage indexation (assuming gross real wage growth of 1 percent and net real wage growth of 0.7 percent (see text)
Italy (1992) *Men* *Women*	 -3.4% -11.2%	Wage indexation → Price indexation
Italy (1995) *Men* *Women*	 -- --	No change, given the long phase in of reforms
Japan (1994) *Men* *Women*	 -2.5% -3.1%	Gross wage indexation → Net wage indexation (assuming gross real wage growth of 1 percent and net real wage growth of 0.5 percent (see text)
UK (1986) *Men* *Women*	 -- --	No change, given the long phase in of reforms
UK (1994) *Men* *Women*	 -- --	No change, given the long phase in of reforms
US (1993) *Men* *Women*	 -1.7% -1.7%	Six month cost of living adjustment freeze (assuming annual inflation of 3.5%)

Figure 3
John McHale

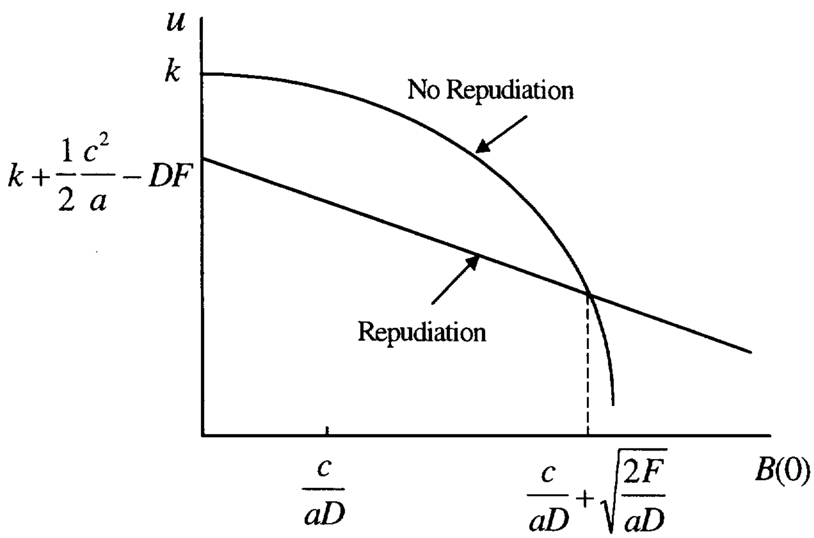

Figure 4
John McHale

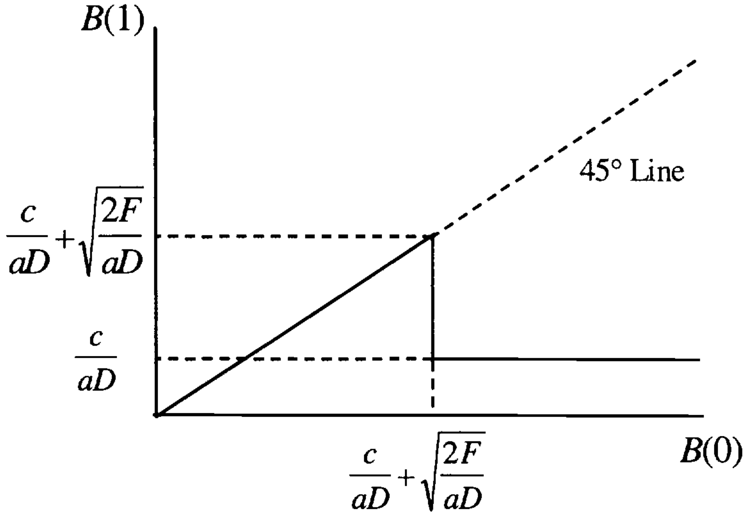

Figure 5
John McHale