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Volume Author/Editor: John Y. Campbell and Martin Feldstein, editors

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Chapter Author: John Y. Campbell, Martin Feldstein

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Introduction

John Y. Campbell and Martin Feldstein

The increasing life expectancy in the United States and in other industrial countries is creating a major problem for traditional unfunded social security pension programs. In such pay-as-you-go programs, the cost of providing any level of benefits varies directly with the ratio of retirees to employees. While the tendency toward earlier and earlier retirement that is encouraged by the social security rules in many countries is exacerbating this problem (Gruber and Wise 1998), the sharp increase in the ratio of the aged to those of working age will increase the cost of pay-as-you-go programs very substantially even if age-specific retirement rates stabilize. The U.S. social security actuaries now project that the cost of providing the benefits implied by the current social security formula will rise from about 12 percent of covered payroll earnings now to more than 17 percent by 2030 and to nearly 20 percent by 2070.

The high cost to taxpayers of obtaining benefits in a pay-as-you-go system reflects the relatively low implicit rate of return that participants earn on the taxes paid in any unfunded system. As Paul Samuelson showed in his famous 1958 paper, the implicit rate of return on the tax “contributions” in an unfunded pay-as-you-go system is equal to the rate of growth of the tax base. Since the U.S. system is financed by a tax on cash wages, it is the future growth of aggregate cash wages that determines the rate of return. The social security actuaries base their calculations of the required future rise in tax rates on the assumption that future reductions in the

John Y. Campbell is the Otto Eckstein Professor of Applied Economics at Harvard University and a research associate of the National Bureau of Economic Research. Martin Feldstein is the George F. Baker Professor of Economics at Harvard University and president of the National Bureau of Economic Research.

growth rate of the population will limit this implicit real rate of return to less than 2 percent a year.

Although the U.S. social security system is essentially a pay-as-you-go program in which each year's tax receipts are used to pay the benefits of concurrent retirees, there is also a trust fund that is invested in government bonds. The rate of return on these bonds affects the amount that is available to pay annual benefits and therefore affects the overall rate of return that participants receive on the taxes that they pay. However, these interest payments are simply a transfer between government accounts. They are therefore of no aggregate economic significance, although they are capable of raising the return on payroll-tax payments at the expense of income-tax payments. But, since the trust fund is relatively small (only about two years' worth of benefits and less than 10 percent of the present value of the obligations of the social security program), the rate of return on the trust fund has very little effect on the overall implicit rate of return that participants receive on their social security taxes. As a practical matter, the implicit rate of return is determined by the rate of growth of the social security tax base, and the system effectively operates on a pay-as-you-go basis.

There are in principle three basic ways that can be used to deal with the problem of the increasing cost of a pay-as-you-go system: benefit cuts, tax increases, and prefunding. These approaches could be used either alone or in combination with each other. Some experts propose cutting future benefits so that future tax rates do not have to rise. These benefit cuts might take the form of changes within the existing structure of social security benefits (increasing the age of retirement, modifying the current post-retirement inflation adjustment, or other, more obscure alterations in rules) or of more fundamental shifts from the existing benefit structure to a uniform benefit system. A second group of proposals would maintain benefits, requiring taxes to rise substantially in the future. Finally, since neither large benefit cuts nor large tax increases are politically appealing, the forthcoming demographic shift has generated substantial interest in the idea of prefunding future benefits by setting aside resources now (through reduced benefits, increased revenue, or transfers from existing funds that would otherwise be used to finance either additional government spending or tax reductions) and investing those funds either collectively or through individual accounts. Although there are many variations of the prefunding proposal, their common feature is increasing national saving and, therefore, the nation's capital stock. The additional national income that would result from the increased capital would be earmarked to finance future retirement consumption, making it possible to maintain benefits without raising taxes.

The idea of prefunding social security benefits was rejected for a long time on the grounds that the transition generation would have to "pay

twice,” that is, would have to pay the pay-as-you-go taxes to finance the benefits of those who are already retired while also saving for their own retirement. With the pay-as-you-go tax now at more than 12 percent of wage income, this “double burden” suggested to some critics that employees in the transition generation might be called on to pay as much as 24 percent of their wages. Not surprisingly, such a plan was rejected as basically unfair, politically impossible, or both.

Fortunately, the extra cost to the transition generation is much smaller than the critics feared. Because the rate of return on real saving is much higher than the implicit rate of return in the pay-as-you-go system, the amount of saving required to fund any given amount of future benefits is much less than the corresponding pay-as-you-go tax rate. Moreover, since during the transition phase retirees would receive some benefits from the funded part of the system, the level of the pay-as-you-go benefits (and therefore of the pay-as-you-go tax) could be gradually reduced during the transition. Feldstein and Samwick (1997, 1998b) showed that a transition from the existing pay-as-you-go system to a pure funded defined-contribution system could be achieved without any reduction in current or future benefits and without increasing the combined amounts of the pay-as-you-go tax and the mandatory saving by more than 2 percent of wage income, that is, from the current 12.4 percent payroll tax to a maximum of 14.4 percent despite the increasing aging of the population. Moreover, after a relatively few years, the declining cost of the pay-as-you-go system that results as funded benefits begin to replace the pay-as-you-go benefits means that the combined amount that individuals would be required to pay (as payroll taxes plus retirement-account saving) would actually be less than the initial 12.4 percent payroll tax in spite of the increase in aggregate benefits as the population ages.

An alternative transition to a mixed system in which investment-based benefits substitute for the increase in the pay-as-you-go tax, that is, in which the current benefit rules are maintained permanently while the payroll tax remains unchanged at 12.4 percent of payroll as the population ages, could also be achieved with no more than an additional 2 percent of payroll (see Feldstein and Samwick 1998a; 1999). The economic studies presented at a 1996 NBER conference (Feldstein 1998) explore other aspects of the transition to a prefunded social security system and discuss how the shift to such an investment-based system was achieved in a variety of different economies around the world.

The fact that a transition to a retirement system that is wholly or partly investment based is feasible does not imply the desirability of such a policy. At a minimum, that depends on the rate of return that is earned on the investments and the effect of the shift to an investment-based system on the excess burdens of the tax system that is used to finance retirement benefits (for a discussion of these issues, see Feldstein and Samwick

[1998b, 1999]). More generally, the appropriateness of such a change depends on three key economic issues as well as on the broader questions about social norms and about the appropriate role of the state. The three issues that must be addressed are the administrative costs of a funded system, the distributional effects of shifting from a pay-as-you-go system to an investment-based system, and the market risks associated with any investment-based system.

Each of these issues is the subject of a separate part of the overall current NBER project on social security reform. John Shoven has organized a study of the administrative costs and brought together a group of experts with practical experience to discuss the issue; their analysis is presented in Shoven (2000). Feldstein and Liebman (forthcoming) have organized a project that compares the distributional effects of the current social security pension system with the distributional effects of alternative investment-based systems. The current volume presents papers dealing with the risk aspects of social security reform.

Each of the three approaches to the cost problem posed by the projected demographic change—reducing benefits, raising taxes, and shifting to some form of investment-based system—involves risks for either future taxpayers or future beneficiaries, or both. Although investment-based plans introduce a new form of risk—the risk of volatility in the market prices of investment assets—that is not present in pay-as-you-go systems, even those plans that would continue to rely exclusively on the traditional pay-as-you-go system imply important risks to future beneficiaries or retirees.

Cutting future benefits as the population ages in a way that keeps the tax rate unchanged inevitably means not only that future benefits would be lower than they would be under current rules but also that those benefits would be much more uncertain, depending on such things as the longevity of the future retirees and the level of future wages. Maintaining benefits at the same future levels as they would be under current law not only raises the expected level of future tax rates but also imposes additional risks on future taxpayers. Future tax rates must rise by more than the expected amount if retirees generally live longer or if the rate of growth of wage rates is lower than currently projected. Retirees and taxpayers are also subject to the political risk that future administrations might change the rules, either reducing benefits or increasing taxes.

Critics of investment-based plans have nevertheless emphasized that, because they involve investing in private stocks and bonds, such plans are risky, especially if individuals own the financial assets instead of investing them in a common government fund that is used to finance defined benefits. If part or all of future social security benefits are converted from an explicit defined-benefit plan provided by the government to some form of defined-contribution system based on individual investment accounts,

future retirees will experience the risk of fluctuations in the market values of stocks and bonds. The extent of this risk can be reduced by using a mixture of defined-benefit and defined-contribution plans, instead of just a pure investment-based defined-contribution plan, or by providing some kind of conditional pay-as-you-go benefit that varies inversely with the performance of the market. In the limit, the government can do the investing in a government fund and provide a defined benefit, thus placing all the market risk on future taxpayers.

A primary purpose of this volume is to assess the magnitude of the risks born by retirees and taxpayers in alternative investment-based systems. The papers discuss issues of the measurement of risk and of how to model the risk that would be borne in different systems.

In thinking about the individual papers, it is important to bear in mind that the basic rationale for an investment-based system is *not* the increase in *financial* return that would be achieved by *shifting* the existing social security trust fund to a mixture of private stocks and bonds. The benefit of an investment-based system is that it involves an increase in national saving and therefore in the national capital stock. The explicit return on that increased capital stock is the source of payments for some or all of future social security benefits. The return on that increased capital is substantially higher than the implicit rate of return in the pay-as-you-go system. Although general equilibrium considerations imply that the rise in the capital stock would eventually reduce the real return to capital, calculations indicate that the decline in the return is small relative to the difference between the return on capital and the implicit return in the pay-as-you-go system. The issue, moreover, is not the uncertainty of the rate of return to the nation as a whole—that is, the uncertain pretax real marginal product of capital—but the riskiness of the return that must be borne by future retirees and taxpayers because the increased national investment is financed through private securities that are subject to substantial price fluctuations.

Each reader must judge the evidence of this trade-off for himself or herself. Our judgment is that the risks are moderate relative to the improved return and to the ability of an investment-based system to adapt to differences in individual preferences and conditions. It is possible, moreover, to modify the basic investment-based plans in ways (explored in some of the papers in this volume) that permit reducing the risk that must be borne by retirees while keeping the risk to taxpayers quite moderate.

Before turning to the individual papers, we now provide a very brief summary of their findings and how they relate to each other.

The strong recent performance of the U.S. equity market has increased interest in proposals to shift some of the social security trust funds from long-term government bonds to stocks. In chapter 1, Thomas E. MaCurdy

and John B. Shoven consider two proposals that maintain a centralized social security system but reallocate its investments in this way. The two proposals, the “maintain-benefits” option of the 1994–96 Advisory Council on Social Security and the plan recently put forward by Henry Aaron and Robert Reischauer, differ in details, but both rely heavily on the equity premium—the average excess return on stocks over bonds—to reduce the seventy-five-year actuarial deficit of the social security system. MaCurdy and Shoven argue that these proposals are fatally flawed because they seek to exploit the equity premium without properly considering the investment risk associated with it. Even if social security equity investments outperform bond investments on average, there is a substantial risk that they will fail to do so over a ten- or twenty-year horizon. For example, a bootstrap analysis—drawing real stock returns randomly from realizations that actually occurred during the period 1927–97—shows that, about 25 percent of the time, equity investments underperform twenty-year inflation-indexed bonds yielding 3.5 percent.

Martin Feldstein, Elena Rangelova, and Andrew Samwick (chap. 2) explore the effects of investment risk on a proposal for prefunding social security put forward in earlier work by Feldstein and Samwick. Feldstein and Samwick examine the effect of adding modest contributions to personal retirement accounts (PRAs)—initially set at 3 percent of earnings. Over a seventy-five-year transition period, as PRA savings accumulate, payroll taxes could decline to zero, and the PRA contribution rate could rise slightly to a steady-state 4.25 percent level. Feldstein, Rangelova, and Samwick also consider a partial transition in which the payroll tax remains at its current level in the steady state. They assume that the PRA portfolio is invested 60 percent in equities and 40 percent in corporate bonds. They suggest that investment risk in this portfolio can be handled by a combination of a higher PRA contribution rate, to shift the distribution of retirement benefits upward, and a government guarantee that total benefits under the new system will be at least as large as those under the current system. In such a system, the probability that the government will have to make good on its guarantee is relatively small, and the expected size of the government guarantee payment, if one must be made, is also small.

Kent Smetters (chap. 3) adopts a different perspective on government minimum-benefit guarantees in investment-based social security systems. He argues that market prices should be used to evaluate the costs of such guarantees. The guarantees are equivalent to put options—social security participants are effectively granted options to put, or sell, their investments to the government at minimum prices—and option pricing theory can therefore be used to value them. Using this approach, Smetters finds significant costs even for guarantees that are extremely unlikely to be activated. The reason is that the guarantees pay off in bad states of the world with low stock prices, and the large equity premium implies that dollars

payable in such states have a high market value today. Smetters also argues that increasing the PRA contribution rate is an inefficient way to address the problem because it increases benefits in good states of the world as well as in bad states. He proposes instead that higher PRA contributions should be used in effect to buy put options on behalf of social security participants. Such a policy differs from an increased PRA contribution rate in that it increases payments to participants only if stock returns turn out to be low, and it differs from a pure guarantee in that participants are asked to buy their put options rather than receiving them as a transfer from the government.

An important question is whether one can use existing market prices to value changes in the social security system. If markets are incomplete, this may not be appropriate because a nonmarginal change in the system can alter market prices. Several other papers in this volume systematically explore the effects of market incompleteness, using the overlapping-generations model as a common framework.

Antonio Rangel and Richard Zeckhauser (chap. 4) consider an overlapping-generations model with randomness in both total endowments and the distribution of endowments between generations. Their model makes the standard simplifying assumption that each generation lives only two periods and that only two generations are therefore alive at any one time. In this setting, a long-lived asset can facilitate intergenerational risk sharing by inducing young generations to pay old generations for their claims to the asset. Unfortunately, this market mechanism breaks down when efficient risk sharing requires the old to make payments to the young. In principle, this problem can be avoided by voluntary-contribution schemes sustained by self-fulfilling expectations or by government intergenerational transfers. Rangel and Zeckhauser argue, however, that voluntary-contribution schemes are unlikely to work in practice and that efficient government intergenerational transfers may be incompatible with a democratic political system since future generations cannot vote to express their interests. Thus, the authors are skeptical about the possibility of sharing risks efficiently among generations. A qualification, however, is that both market and political risk-sharing schemes are likely to work better when generations live more than two periods so that each generation overlaps and can share risks with several others.

Andrew Abel (chap. 5) takes as given the existence of a defined-benefit pension system in which a social security trust fund is accumulated as a buffer between payroll-tax receipts and pension expenses of the system. He uses the overlapping-generations framework to explore the effects of shifting the trust fund from riskless bonds to risky equities. In equilibrium, the trust fund can buy equities only if private investors are willing to sell them. Since today's private investors do not themselves bear the risks of the trust fund portfolio (their pension benefits are fixed, so the trust fund

risks are borne by future generations of taxpayers), they are willing to sell only if the equity premium declines. Abel assumes that the absolute return on equities is fixed by the marginal productivity of capital, so the decline in the equity premium is accomplished by a rise in the riskless interest rate. This, in turn, induces private investors to accumulate capital more rapidly in the short run and, for plausible parameter values, in the long run as well. Abel thus builds a case that investment of the social security trust fund in equities would be good for capital accumulation and economic growth. The effect is quite small in an almost pure pay-as-you-go system of the sort the United States has today but would be larger in a prefunded system with a more substantial trust fund.

Henning Bohn (chap. 6) uses the overlapping-generations framework to consider a different type of risk, the demographic risk that a generation will be unexpectedly large or small. It is often argued that defined-benefit pay-as-you-go retirement systems handle such risks poorly because a small generation that follows a large generation (like the “baby-bust” generation following the “baby-boom” generation) faces high payroll taxes to pay for the fixed benefits of relatively numerous retirees. Bohn points out that this argument ignores a countervailing effect. In a closed economy, a large generation tends to drive down the marginal product of labor and therefore receives relatively low wages; conversely, a small generation tends to receive high wages. Bohn argues that a defined-benefit pay-as-you-go pension system helps generations share this risk more efficiently than defined-contribution or privatized systems. He also considers other types of demographic shocks, including anticipated future demographic changes and shocks to the life span of an existing generation. Results here depend more sensitively on particular assumptions, but Bohn argues that efficient risk sharing often requires the adjustment of current social security benefits in response to news about future demographic trends.

Existing retirement systems around the world are often described as defined-benefit systems since retirement benefits are defined by law. However, this ignores the fact that the systems are frequently reformed, with large effects on benefits. John McHale (chap. 7) undertakes a systematic empirical study of benefit reforms in the G7 countries during the last fifteen years. He finds that projections of rising costs under current law frequently provoke reforms that substantially reduce the benefits promised to middle-aged and younger workers. However, the benefits of citizens who are already retired or are near retirement are typically protected. This contrasts with Bohn’s finding that efficient risk sharing requires adjustments of current benefits in response to demographic information. McHale conjectures that there is a large political cost to changing retirement benefits that had already been promised and are currently payable.

The remaining papers in the volume take a microeconomic perspective. They use expected-utility theory, in the context of financial investment

over the life cycle, to compare alternative portfolio strategies during working life and in retirement.

Zvi Bodie (chap. 8) argues that there is considerable appeal to a system in which investors share the upside potential of risky financial assets, such as equities, but also have a guaranteed minimum level of retirement benefit. Such a system might be justified by investors' own demands for a minimum acceptable level of retirement consumption or by public policy concerns that some people are unable to save adequately or invest competently on their own behalf. Bodie points out that this pattern of benefits need not be financed through pay-as-you-go payroll taxation or through a privatized system with a government minimum-benefit guarantee. Instead, it can be provided privately through pension plans that hold a mix of inflation-indexed bonds and call options on equities or that trade dynamically in the equity market to achieve the same pattern of payoffs.

One of the important functions of a retirement system is the provision of annuities to insure retirees against the risk of unusual longevity. A natural benchmark, comparable to the current social security system, is a real annuity that provides a fixed real stream of income during an investor's lifetime. Jeffrey R. Brown, Olivia S. Mitchell, and James M. Poterba (chap. 9) ask whether real annuities can be provided within a privatized system. They argue that, despite extremely limited current availability in the United States (almost all private fixed annuities make fixed nominal payments, not fixed real payments), experience in the United Kingdom suggests that private markets can provide real annuities at reasonable cost. Brown, Mitchell, and Poterba also argue that only extremely risk-averse investors should hold pure real annuities; most investors should be willing to take on some degree of equity risk in exchange for the higher returns that have historically been available in the equity market.

Marianne Baxter and Robert G. King (chap. 10) broaden the menu of risky assets to include international equities as well as domestic equities. They show that international equities provide significant diversification benefits and should be very attractive to retired investors who are currently holding either the real annuity provided by social security or a risky portfolio of domestic assets. Baxter and King also consider the demand for international assets by younger investors who are currently working. They argue that these investors have a nontraded asset—human capital—that is more highly correlated with domestic financial assets than with international financial assets. Thus, younger investors gain even more than older investors do from the ability to invest internationally.

John Y. Campbell, João F. Cocco, Francisco J. Gomes, and Pascal J. Maenhout (chap. 11) undertake a more detailed study of the demand for financial assets by working investors. They calibrate a model of optimal portfolio choice over the life cycle, using realistic estimates of the age profile of income, its overall risk, and its correlation with financial asset re-

turns for different demographic groups. Households are assumed to be constrained by restrictions on borrowing and short-selling risky assets. The constraints bind on young households, who would like to consume more and take on greater equity exposure. This means that changes in the retirement system that reduce the tax burden on young households and increase their equity exposure can have large welfare benefits. Heterogeneity across demographic groups appears to have important effects on optimal portfolios, suggesting the inadequacy of a “one-size-fits-all” social security system.

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