DOES CAPITAL MARKET REFORM BOOST SAVINGS? EVIDENCE FROM THE UK PENSION REFORMS

Brigitte Granville and Sushanta Mallick[1]

INTRODUCTION

The purpose of this paper is to investigate the link between capital market reforms and saving, with particular focus on whether changes to the state pension system over time have increased savings in the UK. High saving rates, are associated with growth performance, even if they do not on their own guarantee growth. Since bequest and dynamic motives—i.e., life-cycle retirement motives—are important in explaining national saving, there is no reason to expect that population aging will threaten economic growth by limiting the supply of saving to finance investment (Deaton 1999, p.63). Although financial liberalization can enhance the efficiency with which saved resources are channeled into productive use, the suspicion that it may have contributed to the sharp decline in saving ratios observed in many industrial countries has focused attention on the impact of financial sector policy on saving (Honohan 1999, p.71).

Capital market reforms especially pension reforms gained momentum in the 1990s due to a combination of economic, fiscal, and demographic concerns. Pension reforms, namely reducing unfunded, social security-type benefits and encouraging accumulation of savings in funded schemes in the private sector, are likely to facilitate fiscal restructuring by reducing public pension expenditure on the one hand and also to provide new sources of funds for capital market development. In other words, through pre-funding arrangements pension reforms contribute to modifying the composition of savings towards long-run contractual savings. They also intend to improve labor market efficiency and assist in the development and improved efficiency of capital markets, while simultaneously addressing social adequacy and equity concerns (see Orszag and Stiglitz 2001). Because most households are not saving for retirement,

1. We are grateful to the participants of the Tokyo Club Research Conference, held in Tokyo on 3-4 December 2002, especially Barry Bosworth as the discussant of the paper, Akiko Nomura, and Donna

changes in the rate of population growth and the substitution of (unfunded) social security will not reduce private saving rates much, and the introduction of such funded systems cannot be held responsible for reductions in private retirement saving (Deaton 1999, p.63).

This study investigates macroeconomic and financial effects of changes in pension systems on national savings in the UK. It tests the notion of whether the accumulation of pension assets helps promote national savings. Empirical evidence in this regard has been mixed in the literature from household-level studies to cross-country studies (for a cross-country analysis, see Bailliu and Reisen 2000). This paper is organized as follows: the second section reviews the structure of UK pension programs, the third section provides an analytical framework for how to model the saving impact of pension privatization, along with a discussion of the nexus between pension funds and capital markets. The fourth section presents the empirical analysis of the savings relationship and the findings on whether a higher funded element in pension provision does matter in stimulating national savings. The final section draws some policy recommendations.

PENSION REFORMS IN THE UK—A MULTI-PILLAR SETTING

The UK pension system has undergone a number of reforms since the early 1980s. The key reforms include the 1981 decision to index the basic state pension in line with prices rather than the greater of prices or earnings and the 1986 and 1995 Social Security Acts announcing cuts in the State Earnings-Related Pension scheme (SERPs), introduced in 1978, for people reaching the state pension age after 2000. All private-sector pension schemes—whether defined-benefit (DB) or defined contribution (DC)—are financed on a funded basis and the majority of public-sector DB schemes are also financed on a funded basis. There has been a shift from state pay-as-you-go (PAYG) provision to private funded provision, and also a shift from DB to DC.[2]

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2. PAYG systems are transfer systems; through payroll taxes they transfer wealth from today's workers to today's retirees. With DB schemes, an employee's final benefit is based on a predetermined formula and the employee does not take direct investment risk. With DC schemes, instead of the final benefit level, the contribution level is set and is then invested at the risk of the employee. Stakeholder

(For a schematic representation of the UK pension scheme in 2002 see Figure 1.) The effects of these reforms on pension provision have been, first, to reduce the level of benefits from the state schemes and, second, to increase the role and efficacy of private sector provision (Blake 2000, p.241).[3]

In all the major OECD countries, demographic changes and their effect on social expenditure levels have induced a crisis in public pension programs (Disney 2000). An expected decline in the working population in many OECD countries together with a sharp increase in the size of the older population could intensify the public pension cost burden—expressed per head of the working population. Whether pension schemes are PAYG or funded, ultimately their financial viability depends on a sustainable rate of output growth, which in turn depends upon the pace of productivity growth. Barr (2002) suggests that the choice between government PAYG and funded schemes (private or public) matters much less than the capacity of the government to manage the economy effectively, to promote adequate growth of output, and to sustain a stable foundation for whatever pension system is adopted.[4] Increasing taxes to finance pension benefits may be harmful for growth, and in the UK the tax to GDP ratio is high already (Figure 2).[5]

Changing the structure of the pension systems, specifically privatizing PAYG schemes, has been advocated as the way of avoiding the 'pension time bomb' in OECD countries (see Chown 2001). But the UK will not face the same financing problems as other OECD countries because of the gradual reduction of the scope of the UK public pension since the 1980s

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pensions—individual funded accounts intended primarily for people with earnings above £9,000—are part of the more general trend from public to private provision that successive UK governments have been encouraging (see Box 1 for the recent changes).

3. Regulation of pension funds in the UK is undertaken by the occupational pensions regulatory body (OPRA), the Financial Services Authority (FSA), and the Government. See Davis (2001) for more details on regulation of pension funds.

4. To sustain a PAYG scheme, the government can increase taxes, introduce means-test benefits while encouraging private saving by simplifying the tax regime for pensions or/and make people work longer.

5. Increasing taxes might be harmful for growth, and surely it depends on which taxes are increased (lump sum taxes do not cause distortions, just wealth effects) and how the money is spent. The total income to the public sector, 'current receipts', are forecast by the Treasury to rise to 40.8 percent of national income in 2007-08. This is still lower than, for example, every year from 1980-81 to 1987-88. It is also the case that the UK has, and is forecast to have, a smaller public sector than most other EU countries.

(Bosworth and Burtless 1998, p.12).

In addition to demographic pressures on the public budget, another factor influencing the overall structure of the UK pension system is the introduction of the accounting standard, FRS17. FRS17, which was issued in November 2000 to be fully operational by 2005, aimed at introducing more stringent rules for mutual funds to provide more transparency regarding company pension schemes. FRS17 would require pension fund liabilities to be marked to market using the AA corporate bond yield as a benchmark. This would leave few diversification possibilities domestically, thereby making selective international bond and equity markets the most likely destination for pension funds.

Previously, similar to US and Japanese rules, UK accounting rules allowed companies to smooth out any deficits and surpluses in pension liabilities over a number of years, producing significantly lower and less volatile reported funding levels. With FRS17, however, companies must report on the balance sheet the total value of a surplus or deficit—when value of the financial assets cannot cover the liabilities. The introduction of FRS17 would not allow 'smoothing,' which means companies would need to look at the snapshot fair value at the end of each fiscal year.

The requirement for companies to show pension valuation swings in their reports and accounts has accelerated the recent trend away from DB, or so-called final-salary, schemes towards DC, or 'money-purchase,' schemes, effectively transferring the risk from the employer (or pension fund) to the individual. Almost half of the companies in the benchmark equity index FTSE 100 now no longer make final-salary schemes available to new employees. The return in the case of DC pension schemes depends on the amount contributed both by the employee and the employer and how well the investment has performed.

MODELING THE IMPACT OF FUNDED SCHEMES ON SAVINGS

The impact of the pension system on individual saving has been a concern since Feldstein's (1974) pioneering paper, which centers around the funding status of social security and in particular on the degree to which an unfunded pension system reduces private saving. For

Palley (1998), the way to finance social security that has the least effect on private savings is to cut payroll taxes and finance the public pension system from general tax revenues. If the pension system is financed through payroll taxes, then wages must grow as the number of retirees increases, but if the public pension scheme is financed out of the general income tax, and if income tax receipts are proportional to GDP, then the pattern of wage growth is no longer important. For the UK, however, Pitelis (1997) found that compulsory contributions from wage income reduce private savings. Ideally, wages should grow in line with productivity and hence what matters is GDP growth, and contributions to a public pension scheme can continue to grow through taxes on profits. Diamond (1997) examined the idea of raising current taxes to create a larger trust fund for the US social security system and investing part of that fund in private equities.

While theoretical arguments tend to be consistent with the view that higher private savings are associated with funding than with PAYG, convincing empirical support is missing (Hemming 1999). The literature based on cross-country empirical studies indicates only that long-term saving and investment are positively correlated but not whether growth drives saving or saving drives growth through the saving-investment link.[6] Of course, pension funds play a significant role in mobilizing long-term savings and in promoting financial and capital market development.

The net wealth of the household sector in the UK has shown strong growth in recent years, increasing by an average of 4.6 percent per year between 1987 and 2000 after adjusting for inflation. In 2000, the largest component of the net wealth of the household sector was holdings in life assurance and pension funds, followed by non-financial assets such as housing (Table 1).[7] The reversal of the position from twelve years earlier when non-financial assets predominated is the result partly of strong growth in the take-up of private pensions and partly of the fall in the value of owner-occupied housing during the early 1990s. Despite the rise in household wealth, the aggregate household savings ratio in the UK declined during the 1990s

6. See Schmidt-Hebbel, 1999, p.14-15, for a review of the discussion.

(Figure 3).

In general, saving rates in countries that implemented defined-contribution schemes do not appear have risen after the reform (Samwick 2000). We are interested in how national savings in the UK, in particular, responded to such reforms. Along with pension reforms the UK government also introduced tax incentives and other measures to encourage saving and investment and these may have influenced financial market activity. We are also interested in whether state pensions crowded out private saving. In addition, we want to find out whether the easing of liquidity constraints on UK households that resulted from financial deregulation and heightened competition in the financial services sector may have influenced private savings behavior.

An Analytical Framework

In an accounting sense, savings equals disposable income less consumption, and we can write the savings function (S) as:

$$S = a_0 + a_1 X ,$$

where a_0 and a_1 are parameters and X is a vector of exogenous variables, including income. Privatization of the pension system may affect savings by boosting capital accumulation which in turn affects income.

Savings can be decomposed into retirement savings (SR) and other savings (SO): $S = SR + SO$, and there may be substitution between SR and SO. Assuming that SR is exogenously determined, in other words, that retirement saving is determined solely by policy factors as is the case with state PAYG and private DB schemes, we can write

$$SO = a_0 + a_1 X - a_2 SR$$

where α_2 indicates the extent of substitution between SO and SR. If $\alpha_2 = 1$, then retirement savings fully offset other savings and total savings is unaffected by increases in pension wealth. Assuming $\alpha_2 < 1$, i.e., that SO and SR are not perfect substitutes, the savings function S can be written as:

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7. "Saving up for house purchase is analogous to saving up for retirement" (Deaton 1999, p.54).

[1] $$S = a_0 + a_1 X + (1 - a_2) SR$$

In the case of the UK, however, with the reduction in state pension leading to the privatization of pensions and with the introduction of the FSR17 requirements for reporting the value of company pensions leading to the elimination of final-salary company pension, we cannot assume that retirement saving is exogenous. Therefore, we need to consider the factors that drive the process of saving for retirement. We know of no empirical research that has investigated the effect of endogenous retirement savings on total savings in a time-series quantitative framework, which could partly be due to data difficulties inherent in savings measurement.[8]

The set of other explanatory variables (X) takes into account the different macroeconomic environments, habits, policy incentives and so on that could affect savings patterns. People save when they feel insecure or when there is macroeconomic instability or an expected downturn. The systematic determinants of private savings—actual and expected growth rates and the terms of trade—are beyond the direct control of policies. The influences that are controlled most directly by policies—changes in real interest rates, financial reform, and pension reform—could have strong effects on savings behavior.

The impact of interest rates on household savings is ambiguous because income and substitution effects work in opposite directions. In the standard neoclassical view, as higher interest rates increase the opportunity cost of consumption, households increase their savings (the substitution effect); on the other hand, with higher interest rates, positive savers increase consumption because of their rising wealth (the income effect). Empirical evidence from cross-country studies shows that interest rates have little or no effect either on saving (Edwards, 1996; Masson, Bayoumi, and Samiei 1998) or on consumption levels (Deaton 1992).

According to the life-cycle model (LCH), the higher the ratio of the elderly population to the working-age population, the lower will be the aggregate saving rate because the old are retired and do not save while the young work and do save. Deaton (1999, p. 45) points out that

observed declining saving rates in OECD countries cannot be attributed to income going from young savers to old dissavers, though, because: "in the United States and the UK, where it is possible using survey data to give some account of who is doing the saving, the decline does not appear to be a compositional phenomenon; instead, saving fell for all groups."[9] Moreover Paxson (1996) seems to find that there is not such a negative correlation between saving and age, a finding which needs to be tested further.

The budget deficit negatively affects the overall saving rate when the savings of the private sector (mostly households) do not fully offset the deficit.[10] People could react to government deficits (negative savings) by increasing their saving in anticipation of higher taxes (stemming from increased debt-servicing costs) or by reducing savings in anticipation of the faster inflation that will eventually occur. Similarly, changes in private savings are likely to offset changes in government savings, but the significance of this offset remains controversial. Figure 4 suggests that for the UK the reduction in national savings reflects a decline in government savings. On the other hand, the national accounting identity (CA = S - I) suggests that a current account surplus (deficit) causes domestic saving to rise (fall) implying savings outflows (inflows of foreign capital).

Shifting to funding pensions may have a positive effect on economic growth and on the long-term sustainability of the public finances. One of the benefits claimed for the privatized DC pension plan is that it raises national saving (see Feldstein, 1996). Moving away from unfunded public pensions can raise national saving and wealth directly, by reducing government debt. This pension reform can also indirectly increase saving through two other channels. First, the elimination of the payroll tax may lead to an increase in labor supply (by encouraging low-skilled workers to join the labor force) thus boosting GDP and increasing saving. Second, shifting to funded pension schemes may stimulate the capital market, leading to an increase in the efficiency of investment (higher rates of return) and thereby to an increase

8. For problems with saving data, see Schmidt-Hebbel and Serven, 1999, p.24.
9. For a recent survey on household saving behaviour, see Attanasio and Banks 2001.
10. This is the notion behind the 'Ricardian Equivalence Hypothesis' first proposed by Robert Barro in

in economic growth and saving, depending on the extent of capital market development prior to the reforms.

The Pension Fund-Capital Market Nexus

In this section, we discuss the linkages between private pension funds and debt, equity, and bank markets to highlight how the accumulation of pension fund assets could foster capital market development in the UK. Raising long-term private saving effectively requires increasing the assets of long-term instruments like pensions, life insurance, and mutual funds. But, depending on how they are invested, increased retirement savings could reduce the rates of return on such assets, and thereby drive down the market value of long-term savings assets. Indeed, according to the OECD (2002, p.81), the switch from social security pension contributions towards private pension contributions over the last decades has not been accompanied by a significant rise in either retirement saving or total household saving in member countries (see Figure 5).

At the same time, using a panel set of data for ten countries over the period 1982-1993, Bailliu and Reisen (2000) find that the build-up of pension assets exerts a positive and statistically significant effect on aggregate saving rates. Private pension fund assets largely invested in equities have grown in many OECD countries in recent years, although the size of such assets relative to GDP differs widely across countries. Pension fund assets are as high as 112.6 percent of GDP in the Netherlands and as low as 3 percent in Germany (Figure 6).

Pension fund assets in the UK amount to 85.1 percent of GDP, with DB schemes comprising around half of total pension assets (Figure 6). The share of pension funds and life insurance in gross financial saving has risen over the past 30 years, particularly after the sector was opened to the private sector. Currently British pension assets amount to around £1.1 trillion, or about US$2 trillion (compared to American pension assets of US$5.1 trillion).[11] Personal pensions have grown substantially over the last twenty years, increasing from 12 to

his 1974 article 'Are Government Bonds Net Wealth?' *Journal of Political Economy*, November/December.

11. Pickering, 2002, p.69

over 20 percent of total pension assets between 1988 and 1995 (see Sandler 2002).

The Myners Report (2001), which outlined codes of conduct and principles for the UK pension industry, called for increased allocation of pension funds to risky but high yield asset classes including investment in venture capital and private equity. Doing this, however, makes it likely that equity market volatility and changes in pension fund legislation could trigger wide-scale re-allocations of pension fund assets (see Table 2).[12]

To reduce the volatility of maturing pension fund valuation swings, companies have been switching assets from equities into the government and corporate bond markets.[13] Given that 46 percent of UK pension funds are invested in UK equities and 25 percent in overseas equities, (making a total equity exposure of about 70 percent), the UK equity market is at significant risk if a wholesale portfolio shift takes place among pension funds (Table 3).

Because funded pension systems are prone to such capital market risks as variation in real rate of return, inflation risk if claims are expressed in nominal terms, and exchange rate risk if claims are denominated in a different currency than consumption, Dutta, et al. (2000) argue that mixed funded-unfunded systems are desirable as they enable risk diversification. Moreover, because with funded schemes benefits are based on long-term capital accumulation and financial market performance, a DC fully funded pillar is a useful supplement in a multi-pillar system for the accumulation of retirement savings. These funds should be privately managed to minimize dependence on public sector institutions and avoid government dominance of the economy and financial markets (Vittas 2002).

Some OECD countries, including the UK, have introduced special savings programs to encourage participation in securities investment.[14] To make it easier for people to save for

12. The FTSE 100, the key stock market index in the UK, lost 25 percent of its value in 2002 amid fears of global uncertainty, corporate scandals, and economic stagnation, while the benchmark MSCI Euro-sterling Credit Index (ESCI) has given a positive total return of 9.8 percent in 2002, following 6.4 percent return in 2001.

13. According to newswires, the UK Boots group with a pension fund valuation of about £2.3 billion sold its entire portfolio of equities and switched the allocation into long dated fixed income bonds, including World Bank and European Investment Banks bonds.

The gilt market is about £207 billion in size and the corporate bond market around £11.1 billion.

14. The UK's ISA (Individual Savings Account) and France's PEA (Plan d'Epargne en Action) are good examples.

retirement, however, regulatory changes, beginning with eliminating the minimum state pension age of 65 and introducing tax-free saving incentives, are needed. Booth and Cooper (2002) compared the costs imposed on DC pension schemes by existing tax regimes for saving (such as the ISA regime) and by theoretical regimes (such as a pure expenditure tax and a comprehensive income tax. They conclude that an expenditure tax (which exempts investment returns) is an appropriate benchmark tax regime for pension saving, and that other tax regimes impose additional financial as well as administrative costs.

While the risks for funds based on stocks and bonds are reasonably well understood, the risks associated with investment in housing are not. Many owner-occupiers especially in the UK see their house as an asset for old age and see housing wealth as a shield against inflation, even though it is exposed to its own variant of capital market risk. Indeed, house prices may fall relative to consumption (Börsch-Supan and Brugiavini 2001, p.127). The evidence that it is possible to forecast both house prices and relative rates of return in housing is consistent with the hypothesis that housing markets are far from efficient (Muellbauer and Murphy 1997). If people view housing assets as a substitute for retirement savings, then fluctuations in housing wealth will affect how much of their total savings they allocate to pension savings (to private retirement accounts).

The flow of savings into private retirement accounts is likely to continue to increase because of concern over the aging of the population. Given the importance of domestic sources of savings to develop domestic capital markets, pension funds could act as the main source of long-term savings. Pension funds can help to improve transparency as a mechanism to channel funds into markets. With the development of an institutional investor base, private pension funds contribute to capital market development (or total market capitalization) by promoting contractual savings. Testing the main influences on the size of the pension asset/GDP ratio in a broad group of OECD countries, Davis (1996) finds that: (1) the generosity of social security has a negative effect on the size of pension funds; (2) reducing the favorability of tax treatment in pensions reduces the size of funds; (3) mandatory provision increases the size of funds; and (4) system maturity is associated with a larger size of funds.

The literature is not clear, however, on the direction of causality between contractual savings and capital market development, although it has been shown although it has been shown that by contributing to financial and stock market development contractual savings have knock-on effects on economic growth (see Catalan et al. 2000). Using annual time series (1979-94) for Chile, Holzmann (1997) provided preliminary evidence that coincides with the claim that pension reform there contributed to financial market development and to a more diversified portfolio, but he also found that the reform's direct impact on saving was low, and initially even negative.[15]

EMPIRICAL ANALYSIS

As stated earlier, we intend to measure the overall effect of the shift to funded pension schemes on the level of national savings in the UK, taking into account the potential impact both on individual savings behavior and on the capital market. Previous research presents the mixed picture that pension reform has a positive effect on financial market development (and therefore on the allocation of resources), but not on aggregate savings. Since the impact of a shift to funded pensions on the capital market seems to arise more from changes in allocation rather than from changes in the level of savings, we intend to look into whether the level of assets in private pension funds, as an indicator of financial sector development, causes or offsets higher national savings in the UK

Referring back to Equation [1] we had the level of national savings as a function of the level of savings for retirement and a vector of exogenous variables, X.

[1] $$S = \alpha_0 + \alpha_1 X + (1 - \alpha_2) SR$$

Based on our discussion in the previous section regarding the factors that affect savings behavior, X should include the effect of interest rates, credit market development, the government budget, the availability of retirement benefits from the public pension system, and the age composition of the population.

15. For conflicting evidence on whether a private system increases national saving, see Mesa-Lago,

Definitions of Variables and Time-Series Properties of Data

Specifically, we analyzed data on savings and these other factors in the UK over the period 1978 to 2000. We compiled data from the Office of National Statistics (ONS), the UK Department for Work and Pensions, and *International Financial Statistics* published by the International Monetary Fund (IMF) to calculate annual time series for the following variables:

- SAVR is the aggregate saving rate based on the current account definition of savings as the residual difference between total income and consumption. We chose this definition for a time series study, rather than the capital account measure that defines savings as changes in net wealth derived from flow-of-funds data (Table 1), because survey and flow of funds data could refer to a limited period or at a particular point in time.
- PENSION is defined as the ratio of net investment by private pension funds over the working-age population and should reflect the growth in private pension assets with the UK pension reforms. The ONS publishes such pension fund investment data in flow form. This approach contrasts with Bailliu and Reisen (2000) who define changes in funded pension wealth based on assets of pension funds. These data are defined as the market value of net pension fund assets and therefore include capital gains/losses.
- RINT is the real interest rate defined by the Fisher relation,

$$1+r=\frac{1+i}{1+p^{e}} \quad or, \quad r=\frac{i-p^{e}}{1+p^{e}},$$

  where r denotes the real interest rate, i the nominal interest rate and π^e is the expected inflation rate. We use the current CPI inflation rate as a proxy for π^e and the T-bill rate as a measure of i.
- PAYG is defined as the real expenditure on public pension benefits divided by the population aged 65 (men)/60 (women) and over and is a measure of the level of public pension benefits per elderly person.
- The dependency ratio, DEP, is calculated as the ratio of persons over 64 to persons aged 20–64.
- FIS is the government's fiscal balance to control for the effect of government deficits on private savings.
- GROWTH is per capita GDP growth.
- CREDIT is domestic credit to the private sector as a percent of GDP to indicate the liquidity constraint on households

Because we look at the relationship among these variables over time, we need to examine their properties as time-series and choose an appropriate estimation technique. Augmented Dickey-Fuller (ADF) tests suggest that all the variables are non-stationary in levels and that it is not possible to reject the null hypothesis of integration of order one at a high level of

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2002, p.1316-17.

significance. We performed unit root tests on the first differences of the variables to check for the presence of I(2) processes. The results stationarity in first differences for all variables except PENSION, FIS , and CREDIT, which were found to be I(2) (Table 4). Because in some cases the null hypothesis of a unit root in first differences was accepted by a relatively small margin, however, we assumed I(1) for all variables excluding DEP and PAYG, which were I(0).

Since the ADF test is an asymptotic test, it may not be appropriate for our small sample. Nevertheless, because we found the variables in our sample to be of different orders of integration, the ARDL model, as explained below, is most suitable to carry out further investigation. This analysis led us to choose the following general specification of the savings relation for our sample:

$$SAVR_t = f\left(PENSION_{t-i}, RINT_{t-i}, FIS_t, GROWTH_t, CREDIT_t, PAYG_t, DEP_{t-i}\right);\ i = 0,1$$

Cointegration Analysis

We use the cointegration method which establishes the existence of a unique long-run equilibrium relationship between the variables. Although we have strong theoretical reasons for believing that the flow of pension assets and the other variables influence savings , which in turn impacts investment, we cannot *a priori* exclude the existence of some reverse causality. Moreover, there could be important cross effects between pension assets and savings that could be captured by estimating the system as a vector auto-regression (VAR) model. Given the limited number of observations (22) and the many variables involved (8), we chose the Autoregressive-Distributed Lag (ARDL) approach of Pesaran and Shin (1999) rather than the Johansen-type VAR model (1988, 1996). The ARDL approach allows for inclusion of deterministic/exogenous regressors in the cointegrating relation (see the Appendix for a discussion on the methodology). Estimation is carried out using Microfit version 4.00 (see Pesaran and Pesaran 1997).

The first step is to verify the existence of a long-run relation by computing the Wald statistic to test the joint significance of the lagged levels of the variables in the error correction form of the underlying ARDL model explaining SAVR. Since the Wald test statistic [$\chi^2(8) =$

64.8597 (0.00)] exceeds the upper bound of the critical value (CV) band at 1% significance level [24.215 to 34.367], we can reject the null of no long-run relationship between the variables irrespective of the order of their integration.[16] This estimated test statistic implies that there is a stable long-run relationship explaining SAVR. As long as the underlying ARDL model is free of serial correlation (taking the lag structure of the right-hand side variables into consideration), endogeneity of SAVR is not a problem, although the test statistic rejects the null hypothesis, explaining PENSION, at a higher significance level.[17]

Given the existence of cointegration with SAVR as the endogenous variable, the second stage is to estimate the ARDL model in order to derive the long- and short-run coefficient estimates. We determined the order of the ARDL model by means of model selection procedures such as Akaike, Schwarz, and the adjusted R-square statistic. Equation [2] below presents the coefficients obtained from estimating the selected ARDL (0, 1, 1, 0, 0, 0, 0, 1) model using the Schwartz Bayesian Criterion allowing a maximum of one lag for each variable. T-values are shown in parentheses below the coefficients.

[2] SAVR =

36.086	+ 0.006	PENSION	+ 0.007	$PENSION_{-1}$	- 0.38	RINT	- 0.25	$RINT_{-1}$	- 0.009	FIS				
1.007	3.221		3.009		-3.723		-2.294		-0.109					
	+ 0.33	GROWTH	- 0.0123	CREDIT	- 0.249	PAYG	+ 2.083	DEP	- 2.671	DEP_{-1}				
	4.754		-1.186		-1.160		1.978		-2.988					

Diagnostic Tests:

$\overline{R}^2$ = 0.934, DW=2.76, SE of regression = 0.3975, RSS = 1.7381,
AR1 F(1,10)=2.805 [0.128], Normality χ^2 (2)=0.5547 [0.758],
RESET F(1,10)=0.691 [0.425], Heteroscedasticity F(1, 20) = 0.0829 [0.776]

Equation [2] passes all the diagnostic tests reported above (with probability values shown in square brackets) and the $\overline{R}^2$ value is quite high.

16. Similarly, c_8^2 (pension| SAVR,…,..) = 39.2262 is greater than the upper bound CV at 1% significance level, while c_8^2 (rint| SAVR,…,..)=25.7832 and c_8^2 (growth| SAVR,…,..) =27.0712 are less than the upper bound CV (28.421) at 5% level respectively, but in case of all other variables, the test statistic is less than the lower bound of the CV 16.279 at 10% significance level. They are as follows: c_8^2 (fis| SAVR,…,..)=11.8847; c_8^2 (credit| SAVR,…,..) =7.5618; c_8^2 (payg| SAVR,…,..)=9.2295; c_8^2 (dep| SAVR,…,..)=8.0373.

17. This however proves that retirement savings can be endogenous and there could be a long-term

The long-run coefficients corresponding to this ARDL model are shown as Equation [3] below (with t-values in parentheses).

[3]

$$\begin{aligned} SAVR = {} & 36.086 + \underset{(1.007)}{} + \underset{(4.094)}{0.013}\ PENSION - \underset{(-5.066)}{0.633}\ RINT - \underset{(-0.1099)}{0.009}\ FIS \\ & + \underset{(4.754)}{0.33}\ GROWTH - \underset{(-1.186)}{0.012}\ CREDIT - \underset{(-1.160)}{0.249}\ PAYG - \underset{(-0.489)}{0.588}\ DEP \end{aligned}$$

The signs and magnitudes of the coefficients are all compatible with the model of pension savings outlined in this paper. The long-run coefficient estimates of PENSION, RINT, and GROWTH in [3] are significant at less than a 1-percent significance level. The coefficient on PENSION is an estimate of the parameter $(1-\alpha_2)$ in equation [1]. Based on the Wald test, [$\chi^2(1) = 16.76\ (0.00)$], we reject the null hypothesis that $(1-\alpha_2) = 0$, meaning that institutional retirement savings and other savings are not perfect substitutes. The estimated long-run coefficient on PENSION implies that with a one unit (£ million) increase in pension savings per worker, aggregate savings in the UK increases by 0.013 percent, while other savings decline by 0.987 percent. In other words, there is close but not perfect substitution between pension funds and other forms of savings, in the sense that households offset forced saving (such as non-DC-type pension contributions) either by borrowing or by reducing their discretionary saving. Also, due to relative illiquidity of pension savings meaning that such savings cannot be withdrawn until retirement, there could be an offsetting effect on other savings with the increase in pension savings.

Ideally, the additional savings resulting from the introduction of privately funded pension schemes should find its way to the capital market, increasing the equity market capitalization. The PENSION variable is a proxy for that part of the market capitalization. Our finding suggests that, in the long run, higher pension savings relative to the working-age population has a significant positive effect on national savings in the UK. At the same time, it suggests that any increase in anticipated pension benefits could also lead to a corresponding reduction in

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relation explaining the pension savings.

current non-pension savings.[18]

The estimated coefficient on FIS suggests that an increase in the government budget deficit tends to reduce national saving, but the estimate is not statistically significant. A rising dependency ratio (DEP) also has a negative effect on national saving. According to our results national savings is negatively affected by an increase in the real interest rate (RINT), implying that wealth/income effects outweigh substitution effects. But as pointed out earlier, the evidence in the literature is mixed with regard to the sign of the interest elasticity of saving. The estimated impact of CREDIT on savings supports the case of no liquidity constraints in the UK. In other words, easing of credit constraints as a result of financial sector development has contributed to a decline in national savings in the UK. Finally, the estimated coefficient on PAYG suggests that an increase in government spending on pension benefits crowds out national saving, but the estimate is statistically insignificant.

Short-run Dynamics

Equation [4] presents a short-run error correction model (ECM) based on the above ARDL model.

[4] dSAVR =

$$\begin{array}{ccccccccc} 0.174 & + & 0.006 & d\text{PENSION} & - & 0.289 & d\text{RINT} & + & 0.045 \\ (0.133) & & (3.594) & & & (-2.629) & & & (0.911) \end{array}$$

$$\begin{array}{cccccccc} d\text{FIS} & + & 0.353 & d\text{GROWTH} & - & 0.041 & d\text{CREDIT} & - \\ & & (5.329) & & & (-2.971) & & \end{array}$$

$$\begin{array}{cccccc} 0.084 & d\text{PAYG} & + & 2.58 & d\text{DEP} & - & 0.786 & d\text{EC}_{-1} \\ (-0.486) & & & (3.063) & & & (-4.888) & \end{array}$$

Diagnostic Tests:

$\overline{R}^2$ = 0.795, DW = 2.5301, SE of regression = 0.0243, RSS = 0.0059.

Note: d refers to the first difference operator and EC is the error correction term.

The coefficient on the EC term has the 'correct' sign and its magnitude (0.79, i.e., close to 1) indicates quick adjustment to disequilibrium. The fact that this coefficient estimate is highly significant using conventional t values strengthens the result of the cointegration test above. The contemporaneous short-run effect of PENSION is still positive and has a significant effect on the rate of savings, while the coefficient on changes in PAYG is insignificant, but has the

18. This offsetting result partly corroborates existing empirical evidence that there is a considerable degree of private saving displacement by social security wealth (see Gale 1998) in the sense that

'correct' sign. Our results for the effect of the dependency ratio on savings are mixed: the coefficient is positive in the short term and negative in the long-term. The effects of RINT, CREDIT, and GROWTH remain highly significant, and the short run coefficient on FIS, though insignificant, has a negative sign, which is in line with the Ricardian equivalence theory. Overall we can conclude that the short-run effects are consistent with the long-run results.

CONCLUDING REMARKS

This paper has attempted to estimate the relationship between aggregate saving rates and changes in funded pension wealth in the UK from 1978 to 2000, controlling for other factors that influence savings such as financial deepening, real interest rates, fiscal deficits, the dependency ratio, and public pension spending. We found that higher pension assets are associated with a small net increase in national savings. The results should be treated with caution, however, because of the relatively short sample size. Given lengthening life expectancy there is no definitive answer for whether pre-funding of pension benefits offers a valid strategy to cope with the massive fiscal burden associated with population aging.[19] Demographic pressures are likely to reduce savings in the long run, and government fiscal deficits in the UK seem to be offset by reductions in private savings. In this context, labor market flexibility could contribute to boosting the supply of labor and to stabilizing the dependency ratio, which remains just under 30 percent.

Our finding that increased private pension saving largely offsets other savings lends support to the three-pillar approach to pension systems recommended by the World Bank (1994). Both public and private pillars are essential for a well-functioning pension system. Public pillars—whether funded or unfunded—offer basic benefits that are independent of the performance of financial markets. Moreover, from the point of view of maximizing social welfare, a PAYG system is needed to continue to supplement the fully funded system, as we

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households implicitly view social security contributions as part of their future compensation.

19. In 1948, when the state pension was introduced, life expectancy at birth in the UK was 65.8 for men and 70.1 for women, which is now projected by the government to be 77.5 and 81.7 respectively by 2011 (UK Government Actuary Department).

found the impact of PAYG to be insignificant in crowding out aggregate savings. An ideal pension system could include a basic minimum government benefit funded by some form of compulsory saving, a higher retirement age, and incentives for individuals to top up the package with savings of their own.

Notwithstanding, strong economic growth is the key to boosting national savings by reducing unemployment-related public spending. Lower growth in the OECD countries could lead to a surplus of private saving over private investment rather than a shortfall (presumably because of a reduced need for investment). Concerns about a future shortage of aggregate saving driving up interest rates should focus on the evolution of government budget balances rather than on private savings behavior (Bosworth 1995), thereby justifying our approach of examining the aggregate savings behavior. Evidence suggests that privatization of pension savings may lead to a reduction in the pension burden on the national budget if combined with substantial cuts in benefits. Such reforms that lead to reductions in government expenditures on pension benefits and the fiscal balance may have a positive effect on private savings, which could counterbalance the negative effects of privatization. For instance, according to Williamson (2002), the key negatives are higher administrative costs for the pension funds, exposure to stock market fluctuations, increased inequality, and potentially lower pension benefits for many low-wage workers.

The impact of pension reforms on domestic savings may not be uniform across countries. Even though this paper found that increased privately funded pensions in the UK increased aggregate savings marginally, investment in financial assets other than pensions may influence other savings in the capital market. Pension reforms indeed affect market capitalization by channeling domestic long-term savings into the capital market. But along with encouraging the build-up of private pension assets, liberalization of financial services also facilitates households' access to credit, reducing their net savings. Even so, the increased liquidity and capitalization that private pension funds bring to the stock market could ultimately raise the level of national savings by promoting economic growth through more efficient resource allocation.

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APPENDIX

Econometric Methodology: Autoregressive Distributed Lag Model

The methodology used in this paper rests on a combination of Engle and Granger (1987) - hereafter EG, and the ARDL approach of Pesaran and Shin (1999). The main advantage of ARDL procedure is that it can be applied regardless of the stationary properties of the variables in the sample and allows for inferences on long-run estimates, which is not possible under alternative cointegration procedures. Moreover, the number of variables in the model may be large, contrary to the VAR models. EG method has been criticized as sensitive to the endogeneity of the explanatory variables and to serial correlation in the disturbances. The ARDL method includes lagged regressors that proxy dynamic specifications omitted from the model in order to mitigate the effects of serial correlation and functional mis-specification. This method distinguishes between endogenous and exogenous variables and hence avoids the endogeneity problem. Consider the general autoregressive distributed lag model:

$$f(L,p)y_t = \sum_{i=1}^{k} b_i(L,q_i)x_{it} + d'w_t + u_t$$

where

$$f(L,p) = 1 - f_1 L - f_2 L^2 - \ldots - f_p L^p$$

$$b_i(L,q_i) = b_{i0} + b_{i1}L + \ldots + b_{iq_i}L^{q_i}, \quad i = 1,2,\ldots,k,$$

L is a lag operator such that $Ly_t = y_{t-1}$, and w_t is a sx1 vector of deterministic variables such as the intercept term. Any reparameterization of the ARDL model in which there is a one-to-one mapping between the parameters is a valid representation of the underlying model.

Whether the variables in question are trend-stationary or difference-stationary, the ARDL approach is applicable. The EG representation theorem asserts that whenever the level of a set of I(1) variables are constrained by one or more cointegrating relationships then their data generating process may be expressed as an ECM, which is simply one possible (constrained) parameterization of a VAR. Since the separate equations of a VAR are individually ARDL regressions then the representation theorem may be taken as suggesting that cointegrating

relationships, as well as short run dynamics, may be investigated via estimation of ARDL regressions. Pesaran and Shin (1999) argue that unmodified OLS has desirable asymptotic properties when applied to ARDL, provided that the lag lengths are sufficient to proxy for the serial correlation and endogeneity. They further suggest that the choice of estimator for small-sample investigations [20] should be based on Monte Carlo assessment and offer evidence to support a "two-step" strategy. Lag lengths are first determined by the Schwartz Bayesian criterion or by the Akaike information criterion with OLS applied to an ARDL model detailing the short-run dynamics. Recovery of the coefficients of the long run model or of the ECM then follows as a re-parameterization exercise.

20. The small sample properties of OLS estimation of cointegrating regressions may be weakened by, for example, endogeneity of the explanatory variables and serial correlation in the disturbances (Banerjee, et al. 1993). Two strategies have been considered for dealing with this problem: modifying the initial choice of regression model or modifying the initial choice of estimator. In the first case, which includes the ARDL approach, initial models are re-specified to include additional regressors that proxy dynamic specifications omitted from the model. In the second case, exemplified by FMLS (Phillips and Hansen 1990), least squares estimators are modified to produce an alternative with better known distributional properties and robust with respect to non-iid disturbances.

Box 1:

Main Elements of the Pension System and Recent Changes

- The first tier of the pension system provides a minimum pension to all retirees. The Basic State Pension (BSP) was introduced in 1948. All individuals get a modest flat-rate BSP, financed on a pay-as-you-go basis. In addition, those with low-incomes and little wealth are eligible for the Minimum Income Guarantee (MIG) top-up, which currently brings their income up to £92.15 per week for a single pensioner and £140.55 for a couple. They may also receive housing and council tax benefits. To give people just above the threshold for MIG an incentive to save, the government has proposed the introduction of a Pension Credit from October 2003.
- The second tier is the most complex and was significantly modified by the 1999 Welfare Reform and Pensions Act (WRPA). Until April 2002, employees earning within a certain band (£67-£535 per week in FY2000/01) built up entitlements to the State Earnings-related Pension Scheme (SERPS) in addition to the BSP. They could choose to contract out of SERPS if they joined either their employer's occupational pension scheme or a personal pension scheme. Individuals receive a rebate on their national insurance contribution (NIC) (depending on their age and earnings), which is paid directly into their pension. There was no legal obligation for an employer to set up an occupational pension scheme nor for an employee to join. Both the BSP and the SERPS were financed from the NI contributions.
- The reforms spelled out in the WRPA modify this system as follows:

– The SERPS was replaced by a state second pension (SSP) from April 2002. Initially earnings-related, it is proposed to become flat-rate in time, even though contributions will remain earnings-related, a feature intended to provide an incentive to middle and high-income earners to contract out.

– New stakeholder pension schemes (SHPs) were introduced in 2001 primarily as an incentive for middle-income earners to join a private personal pension scheme. All businesses with five or more employees are required to arrange a SHP for their staff. All SHP are registered with the Occupational Pensions Regulatory Authority (OPRA).* Employees may contribute directly from their wages (in return for lower NIC), but employers are not required to contribute on their employees' behalf.

- The third tier consists of other, voluntary private retirement saving, involving additional contributions into occupational pension plans, additional saving through personal pensions, or other financial assets. As with other elements of the pension system, these contributions are supported by preferential tax treatment.

Since the late 1960s about 50 percent of the workforce has been covered by occupational pension schemes. About half the remaining workforce are members of SERPS and half have opted out into a personal pension scheme. On the other hand, self-employed are only required to have a basic pension.

Note: OPRA is responsible for registering stakeholder pension schemes, regulating compliance with the registration requirements, regulating scheme management including the payment of contributions to the scheme, and enforcing the conditions that define a stakeholder pension and allow it to be registered.
Source: updated from OECD, 2002, p.79.

TABLE 1
Composition of the Net Wealth of the UK Household Sector
(Percent)

	1987	1991	1996	1998	1999	2000
Financial assets						
Life assurance and pension funds	24.6	26.8	36.0	37.4	36.9	36.0
Securities and shares	10.0	11.1	13.8	14.8	16.9	16.3
Currency and deposits	15.8	16.8	16.5	14.7	13.3	13.9
Other assets	2.6	2.8	2.4	2.0	1.8	1.9
Non-financial assets net of total liabilities	47.0	42.5	31.3	31.1	31.1	31.9
Total net wealth	100.0	100.0	100.0	100.0	100.0	100.0
£ billion at 2000 prices	2,580	2,870	3,229	3,974	4,565	4,605

Notes: Total net wealth adjusted to 2000 prices using the expenditure deflator for the household sector.
Source: Office for National Statistics (ONS): http://www.ons.gov.uk.

TABLE 2
Ownership of UK Equities
(Percent)

	1963	1975	1981	1989	1994	1997	1998	1999	2000
Pension funds	6.4	16.8	26.7	30.6	27.8	22.1	21.7	19.6	17.7
Insurance companies	10.0	15.9	20.5	18.6	21.9	23.5	21.6	21.6	21.0
Other financial institutions	13.9	15.3	10.7	9.3	10.5	10.7	9.6	10.7	9.8
Individuals	54.0	37.5	28.2	20.6	20.3	16.5	16.7	15.3	16.0
Other personal and public sector companies	8.7	8.9	10.3	8.1	.2	3.2	2.8	3.5	3.1
Foreign	7.0	5.6	3.6	12.8	16.3	24.0	27.6	29.3	32.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Value of FTSE All-share Index	27	45	92	470	690	1,209	1,334	1,732	1,452

Note: Other financial institutions includes banks and unit and investment trusts.
Source: UBS Global Asset Management.

TABLE 3
Composition of UK Pension Portfolio by Type of Asset, 1989-2001
(Percent)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
UK equities	52	52	55	56	57	54	55	53	53	51	51	48	46
Foreign equities	20	18	20	21	24	23	22	22	20	20	24	23	25
UK bonds	8	8	7	6	4	5	6	6	7	9	9	10	10
UK index linked	3	3	3	3	3	4	5	5	5	6	4	6	7
Foreign bonds	2	2	3	3	3	4	3	3	3	4	4	4	3
Cash	6	7	4	4	4	4	4	6	7	5	4	4	3
Real estate	9	10	8	7	5	6	5	5	5	5	4	5	6
Total pension assets	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

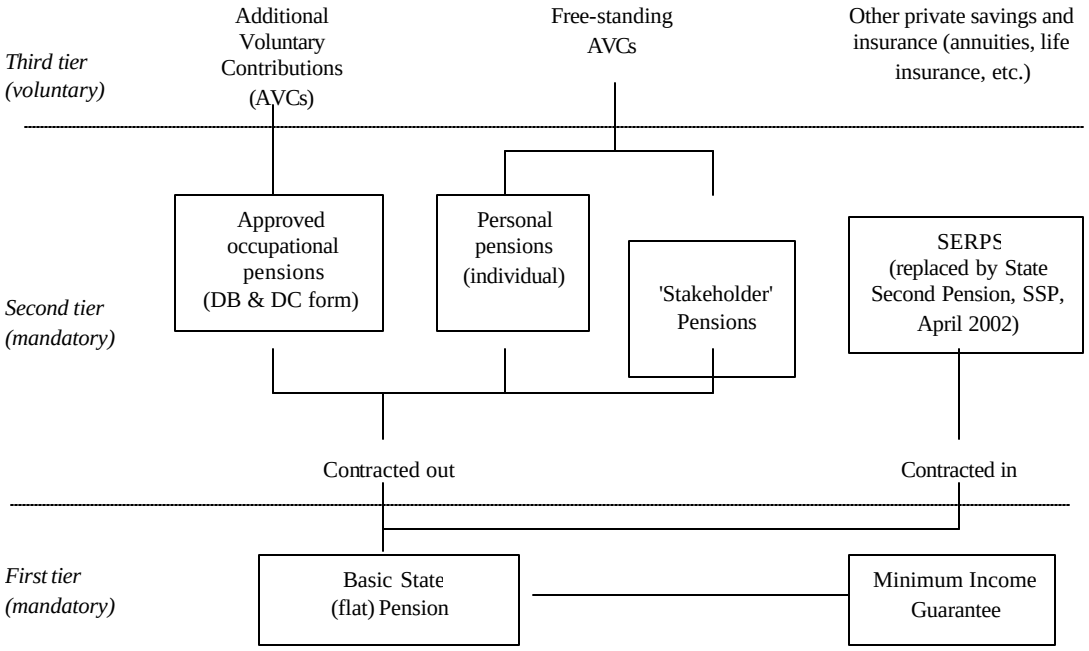
Source: UBS Global Asset Management.

TABLE 4
Results of ADF Unit Root Test

Variable	ADF in Levels		ADF in 1st Differences		ADF in 2nd Differences		~I( )
	Without trend	With Trend	Without trend	With Trend	Without trend	With Trend	
SAVR	-2.177	-2.548	-3.016*	-2.978	-4.369**	-4.345*	I(1)
PENSION	-1.913	-1.988	-2.482	-2.523	-4.236**	-4.103*	I(2)
DEP	-2.606	-4.204*	-1.727	-0.286	-2.033	-4.263*	I(0)
PAYG	-1.920	-4.057*	-2.945	-3.126	-3.664*	-3.469	I(0)
RINT	-2.284	-1.832	-3.596*	-5.033**	-6.076**	-5.775**	I(1)
FIS	-1.902	-1.907	-1.861	-2.014	-3.515*	-3.579	I(2)
GROWTH	-3.651*	-3.749*	-5.067**	-4.947**	-4.651**	-4.389*	I(1)
CREDIT	-1.074	-1.405	-2.437	-2.522	-4.745**	-4.556**	I(2)

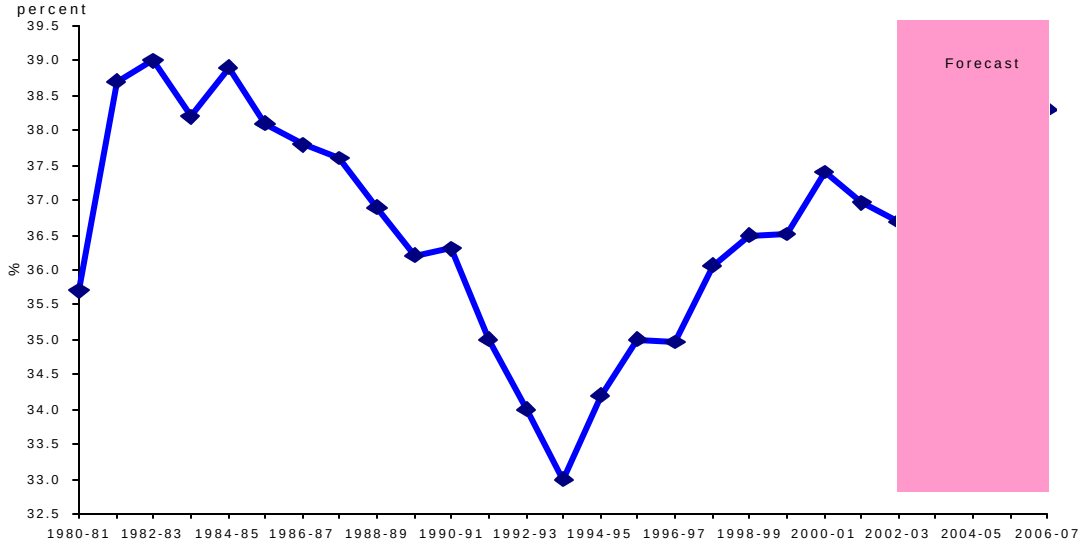
Notes: ADF unit root test is based on one lag except DEP and PAYG, which include 2 lags;
Critical values are: 5%=-3.0114, 1%= -3.7856 (without trend) and 5%= -3.6454, 1% = -4.4691 (with trend).

FIGURE 1
The Pension System in the UK, 2002



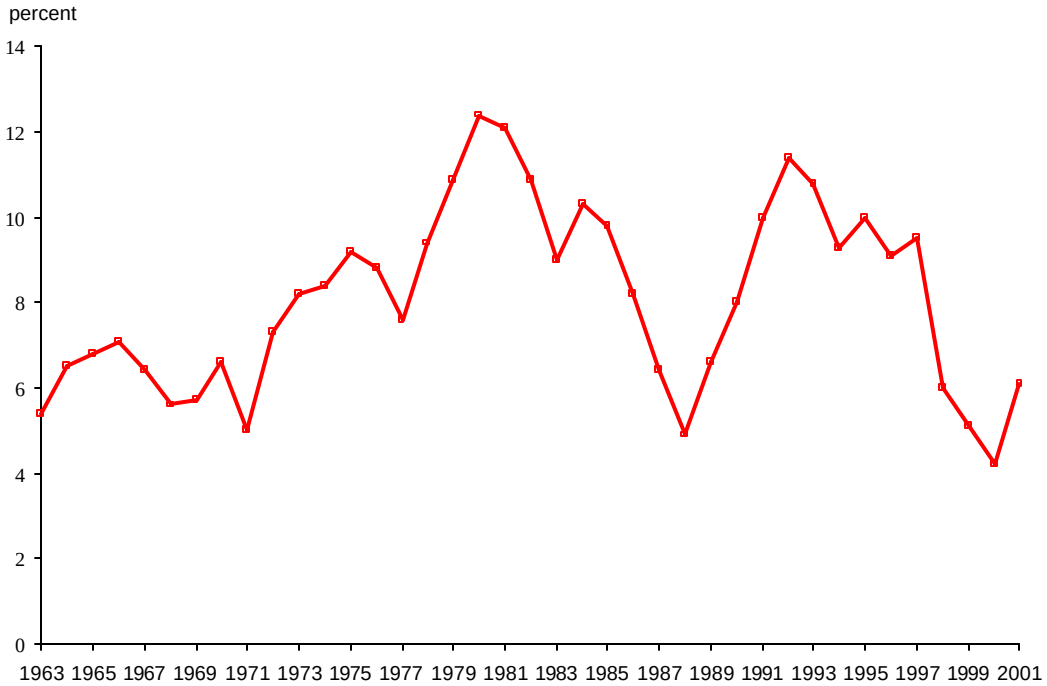
Source: updated from Disney et al., 2001, p.72.

FIGURE 2
Taxes as a Percentage of GDP, 1980-81 - 2006-07



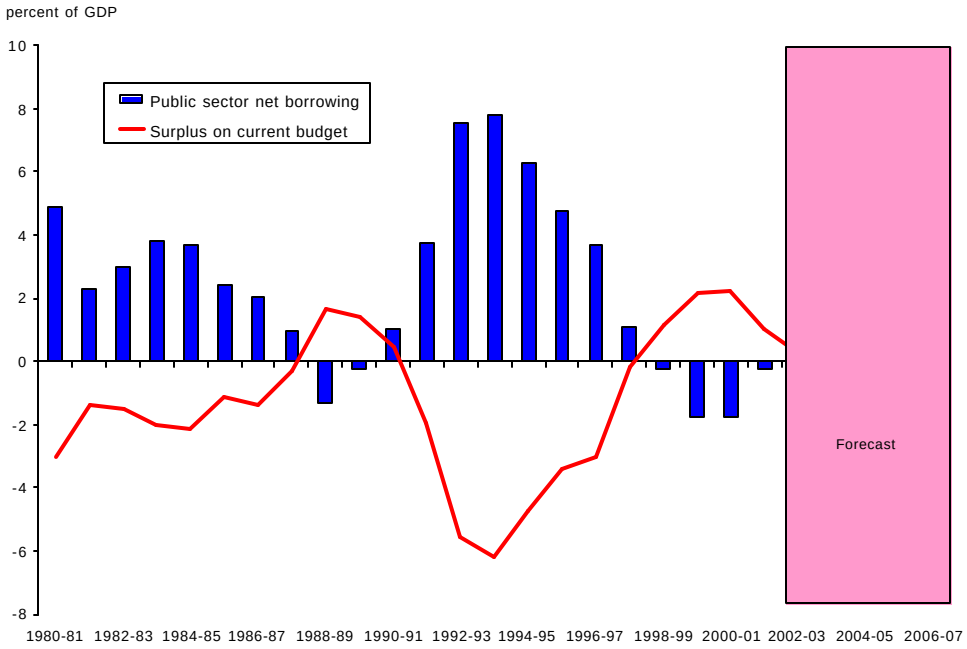
Source: HM Treasury

FIGURE 3
Household Saving Ratio in the UK, 1963-2001



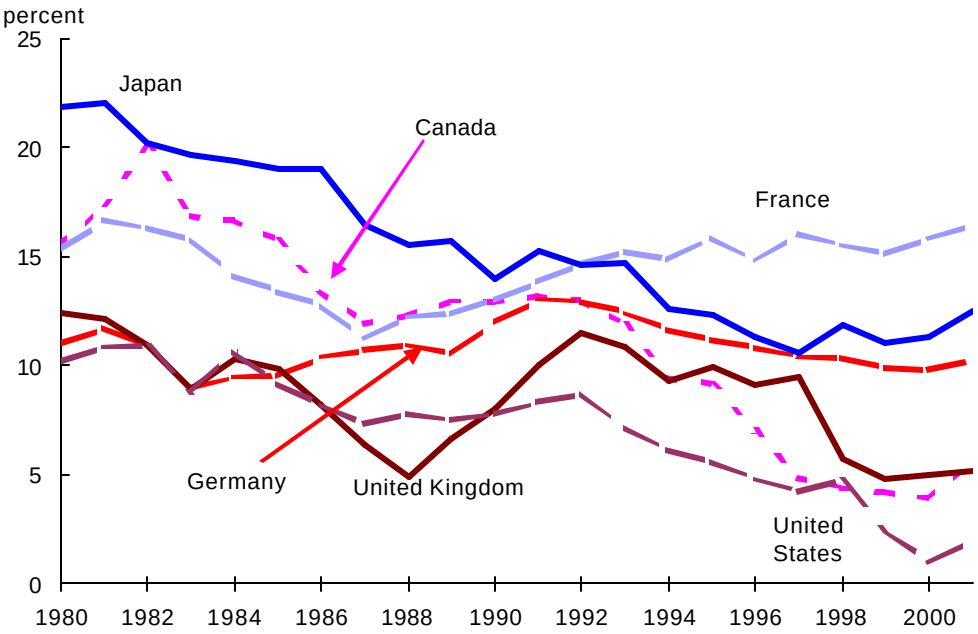
Note: The Office for National Statistics (ONS) compiles the household saving ratio which is household saving expressed as a percentage of total resources—the sum of gross household disposable income and the adjustment for the change in net equity of households in pension funds. Household disposable income is the sum of household incomes less UK taxes on income, and other taxes, contributions and other current transfers. Household saving is what remains of available resources after deducting households' final consumption expenditure
Source: ONS, http://www.ons.gov.uk.

FIGURE 4
UK Budget Balance



Source: HM Treasury

FIGURE 5
Evolution of the Household Savings Rate in Selected OECD Economies, 1980-2001



Source: OECD.

FIGURE 6
Pension Fund Assets as a Percentage of GDP in OECD Economies, 1990 and 1999