

**Does capital market reform boost savings?**  
**Evidence from the UK Pension Reforms**

**Brigitte Granville and Sushanta Mallick\***

International Economics Programme  
Royal Institute of International Affairs  
10 St James's Square, SW1Y 4LE, London, UK

ABSTRACT

*Doubts about the positive effect of capital market development on private saving extend beyond the ambiguous theoretical link between interest rates and savings, to include demonstrable reduction of private savings as a result of financial developments such as pension reforms and increased household access to credit markets. The empirical validity of the effect of pension reforms on domestic savings in the UK has been investigated using an Auto-regressive Distributed Lag (ARDL) model capable of testing for the existence of a long-run relationship regardless of whether the underlying time series are individually  $I(1)$  or  $I(0)$ . The total savings response to change in pension savings is positive and significant, but an increase in occupational pension saving appears offset by a decrease in other forms of saving. This paper concludes that there is no firm evidence that aggregate savings increase considerably as a result of privately funded pension schemes.*

Journal of Economic Literature Classifications: G23, H55, and C50

Keywords: Population aging, Retirement savings, and Pension funds

Address for correspondence:

Dr. Brigitte Granville  
Head, International Economics Programme  
The Royal Institute of International Affairs  
Chatham House, 10 St. James's Square  
London SW1Y 4LE, UK

Email: [bgranville@riia.org](mailto:bgranville@riia.org)

---

\* 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 and Akiko Nomura, for their comments. We also thank Victor Bulmer-Thomas, Patrick Honohan, and Roman Zyttek. All errors are our own.

## Does capital market reform boost savings? Evidence from the UK Pension Reforms

### ABSTRACT

*Doubts about the positive effect of capital market development on private saving extend beyond the ambiguous theoretical link between interest rates and savings, to include demonstrable reduction of private savings as a result of financial developments such as pension reforms and increased household access to credit markets. The empirical validity of the effect of pension reforms on domestic savings in the UK has been investigated using an Auto-regressive Distributed Lag (ARDL) model capable of testing for the existence of a long-run relationship regardless of whether the underlying time series are individually  $I(1)$  or  $I(0)$ . The total savings response to change in pension savings is positive and significant, but an increase in occupational pension saving appears offset by a decrease in other forms of saving. This paper concludes that there is no firm evidence that aggregate savings increase considerably as a result of privately funded pension schemes.*

### **1. Introduction:**

The purpose of this paper is to investigate the link between capital market reforms and saving, with particular focus on pension reforms in the context of the UK. High saving rates, even if on its own it cannot guarantee growth, are associated with growth performance. While bequest and dynamic motives – i.e. life-cycle retirement motives – are more 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 liberalisation 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 nineties due to a combination of economic, fiscal and demographic concerns. Pension reforms 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, pension reforms contribute to modifying the composition of savings towards long-run contractual savings made possible by the pre-funding arrangements. 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, changes in the rate of population growth and the substitution of (unfunded) social security will not much reduce private saving rates and the introduction of such funded systems cannot be held responsible for reductions in private retirement saving (Deaton, 1999: p.63).

Can such funded pensions contribute significantly to national savings or do they merely represent a transfer of wealth? This study aims to investigate macroeconomic and financial effects of changes in pension systems on national savings in the UK. The notion of whether the accumulation of pension assets helps promote national savings is tested. What happens to private savings when public pensions are cut back? Empirical evidence for these propositions has been mixed in the literature from household-level studies to cross-country studies, with little focus on a macroeconomic time-series study, partly due to absence of any country having long experience with pension reforms (for a cross country analysis, see Bailliu and Reisen, 2000). National accounts data are used in this paper because we intend to investigate the impact of pension reform at a macroeconomic level. The UK was one of the first countries to begin the process of reducing systematically unfunded state provision in favor of funded private provision (beginning in 1980). We are therefore interested in testing the hypothesis at a macro level whether increases in funded pensions have contributed to higher aggregate savings in the UK over the 1978 to 2000 period.

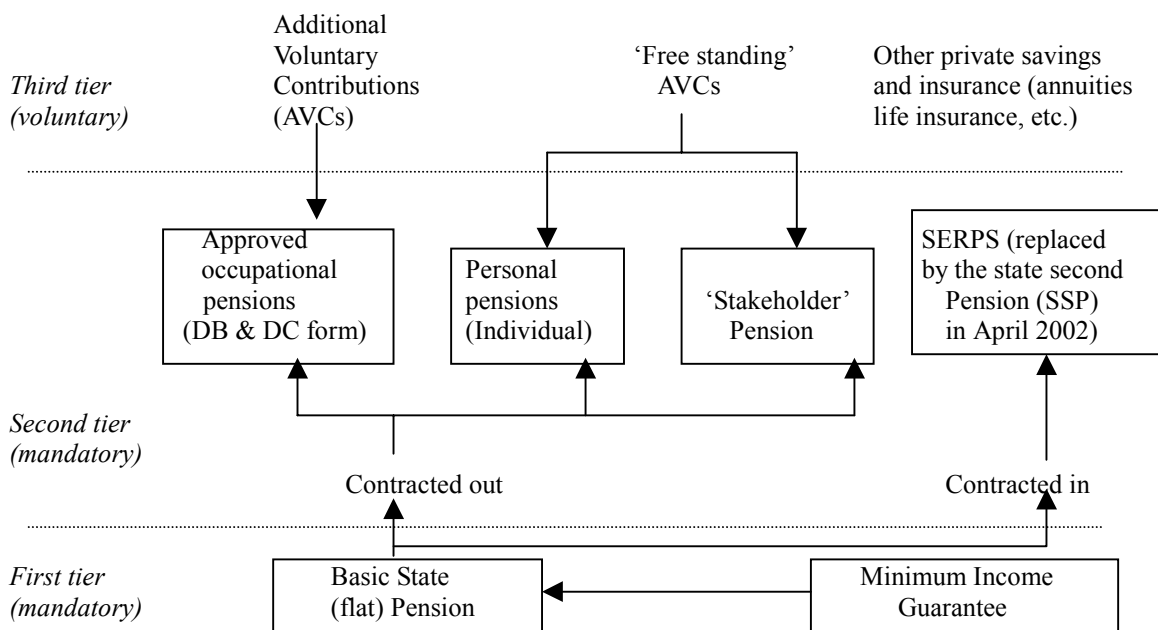
This paper is organised as follows: section 2 reviews the structure of pension programs, section 3 provides an analytical framework for how to model the saving impact of pension privatization, along with the nexus between pension funds and capital markets. Section 4 presents the empirical analysis of whether a higher funded element in pension provision does matter in stimulating national savings, and the final section draws some policy recommendations.

## **2. Pension reforms in the UK – a multi-pillar setting:**

The Financial Services Authority (FSA) – Britain’s main financial watchdog –

continues to emphasize that workers must be forced to save more for their pensions. There have been studies suggesting a big and growing savings gap in the UK (see for example Oliver, Wyman and Company, 2001), which requires regulation to focus on increasing the amount saved rather than optimizing the allocation of existing savings. So far the government has relied on tax breaks and publicity to try to persuade workers to join schemes such as stakeholder pensions to top up the state pension. Since the 1980s, the pension system in Britain has undergone a series of fundamental reforms with the shift from the pay-as-you-go (PAYG), defined-benefit (DB) pensions to individual, private-sector, defined-contribution (DC) pension accounts (for a schematic representation of the UK pension scheme in 2001, see Fig. 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 make private sector provision greater and more effective (Blake, 2000: p.241).

**Figure 1: The pension system in the UK, 2002**



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

The main types of pension provision in the UK are:

- State pension – an unfunded PAYG arrangement.
- Occupational schemes provided by private companies and public sector employers. These are funded schemes and many being DB there is a gradual trend towards DC.
- Personal pensions that can be set up by individuals. Stakeholder pensions – newly

introduced in April 2001 – are very much like personal pensions but every employer is obliged to offer access to a scheme and charges are capped.

PAYG systems are transfer systems—transferring wealth from today’s workers to today’s retirees – through payroll taxes. In case of the DB schemes, the final benefits are agreed based on a formula and the employee does not take direct investment risk. Whereas in DC the final level of benefits is not agreed but the level of contribution, which will then be invested at the risk of the employee. Stakeholder 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 has been encouraged by successive UK governments (see Box 1 for the recent changes).

### **Box 1: Main elements of the pension system and recent changes**

- The first tier provides a minimum pension to all pensioners. Since April 1999, all individuals get a modest flat-rate Basic State Pension (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 benefit from the housing and council tax benefits. To give an incentive to save to people just above the threshold for MIG, the Government has proposed the introduction of a Pension Credit from April 2003.
- The second tier is the most complex, and has been significantly modified by the 1999 Welfare Reform and Pensions Act (WRPA). Until April 2002, employees receiving earnings 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, unless they chose to contract out of SERPS. In this case, they must have joined either their employer’s occupational pension scheme or a personal pension scheme. Then, both employee and employers received a rebate on their national-insurance contributions (NIC). 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 NIC.
- The recent 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 principally intended to give 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 directly contribute from their wage (in return for lower NIC), but employers do not have to make any contribution 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, supported by a preferential tax treatment, as for the other elements of the pension systems.

Coverage of the work force by occupational pension schemes has been fairly static at around 50 per cent since the late 1960s. Of the remainder, about half 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.

- \* 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: OECD, 2002: p.79.

Regulation of pension funds in the UK is undertaken by the occupational pensions regulatory body (OPRA), the Financial Services Authority (FSA) and the Government.<sup>1</sup> Demographic changes and their effect on the social expenditure levels in all the major OECD countries have induced a crisis in public pension programs in OECD countries (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. Changing the structure of the pension systems — that is, to privatize the PAYG schemes, has been advocated as the way of avoiding the ‘pension time bomb’ (see Chown, 2001). But the gradual reduction of the scope of UK public pension means that from the point of view of public spending, the UK will not face the same financing problems as other OECD countries (Bosworth and Burtless, 1998, p.12).

The accounting standard FRS17, which was issued in November 2000 to be fully operational by 22 June 2003, aimed at introducing more stringent, mandatory mark-to-market 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 as the most likely destination for pension funds.

The requirement for companies to show pension valuation swings in their report and accounts, has accelerated the recent trend away from DB or final-salary schemes

---

<sup>1</sup> See Davis, 2001 for more details on regulation of pension funds.

towards DC or money-purchase schemes, effectively transferring the risk from the company (or pension fund) to the individual. Almost half of the companies in the benchmark equity index FTSE 100 now no longer make final salary benefits available to new employees. The pension return in a DC case would depend on the amount contributed both by the employee and the employer and how well the investment has performed.<sup>2</sup>

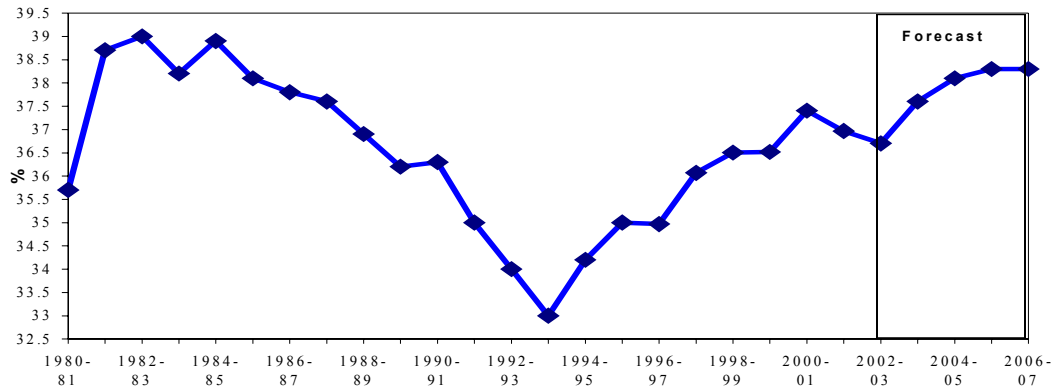
Previously, deficits and surpluses of pension schemes were smoothed out over a number of years similar to the US and Japanese systems producing significantly lower and less volatile reported funding levels. With FRS17, the total value of the deficit – when value of the financial assets cannot cover the liabilities – or surplus has to be reported on the balance sheet. The introduction of FRS17 would not allow ‘smoothing’ which means there would be a need to look at the snapshot fair value at the end of each fiscal year.

Whether the pension schemes are PAYG or funded, ultimately it depends on a sustainable rate of output growth, which in turn depends upon the pace of productivity growth. As suggested by Barr (2002), the choice between government PAYG and funded schemes (whether 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. 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. Increasing taxes may be harmful for growth and Chart 1 shows that the tax to GDP ratio is quite high already.

---

<sup>2</sup> But sharp falls in equities do undermine the corporate schemes many rely on, and scandals in private pensions scheme hurt too.

**Chart 1: Tax-GDP ratio**



Source: HM Treasury

### **3. 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, that is the degree to which an unfunded pension system reduces private saving. For Palley (1998), the best way to finance social security is to cut payroll taxes and finance the public pension system from general tax revenues. If the system is financed through payroll taxes, then wages must grow or if the public pension scheme is financed out of the general income tax, and income tax receipts are proportional to GDP, then the pattern of wage growth is no longer important. Pitelis (1997) however finds that contributions from wage income are seen to reduce private savings in the context of the UK. Ideally, wages should grow in line with productivity growth and hence what matters is GDP growth, and contributions to 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 in the context of the US social security system and investing part of the fund in private equities.

But while theoretical arguments tend to be consistent with the view that funding will be associated with higher saving than PAYG, convincing empirical support is missing (Hemming, 1999). The funded schemes allowing people to invest their social security taxes in financial assets could contribute to higher aggregate savings through the



development of capital markets. The movement of such capital into private markets could have a significant impact on economic growth, provided savings get channeled into their most productive uses. The literature based on cross country empirical studies does not indicate clearly whether growth drives saving or that saving drives growth through the saving-investment link, only that long term saving and investment are positively correlated.<sup>3</sup> The role of pension funds in this context has considerable significance in mobilizing long-term savings and 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% per year between 1987 and 2000 after adjusting for inflation. Holdings in life assurance and pension funds formed the most important component of the net wealth of the household sector in 2000, followed by the value of non-financial assets such as housing<sup>4</sup> (see Table 1). This is a reversal of the position twelve years ago, a result partly of strong growth in the take-up of private pensions and partly the fall in value of owner-occupied housing during the early 1990s. Despite a rise in household wealth, the aggregate household savings ratio in the UK has decelerated in the recent years (see Chart 2). One of the key factors reflecting the decline could be a period of growing consumer confidence partly as a result of easing liquidity constraints or credit market conditions facing households.

**Table 1: Composition of the net wealth of the UK household sector**

<i>Percentages</i>	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
<b>Total (=100%) (£ billion at 2000 prices<sup>1</sup>)</b>	<b>2580</b>	<b>2870</b>	<b>3229</b>	<b>3974</b>	<b>4565</b>	<b>4605</b>

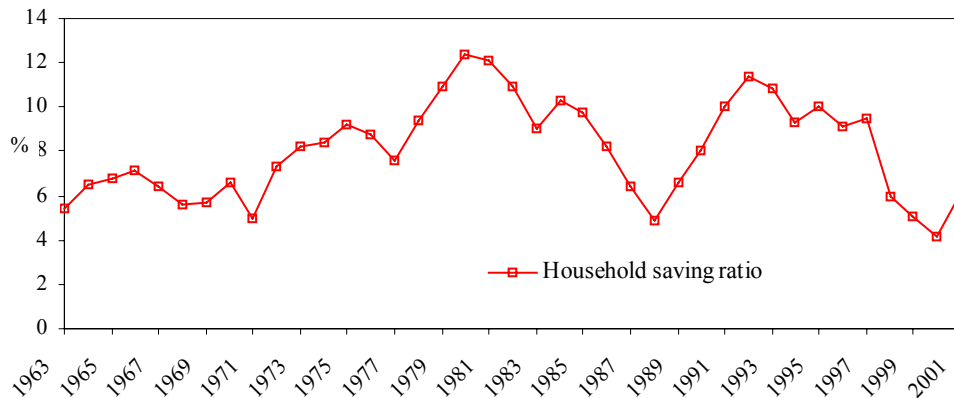
<sup>1</sup> Adjusted to 2000 prices, using the expenditure deflator for the household sector.

Source: Office for National Statistics (ONS): [www.ons.gov.uk](http://www.ons.gov.uk)

<sup>3</sup> See Schmidt-Hebbel, 1999 for a review of the discussion, p.14-15.

<sup>4</sup> "Saving up for house purchase is analogous to saving up for retirement" (Deaton, 1999; p.54).

**Chart 2: Household saving ratio in the UK**



Source: Office for National Statistics (ONS): [www.ons.gov.uk](http://www.ons.gov.uk)

Note: The 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.

There is little evidence that countries that implement defined-contribution reforms have higher trends in saving rates after the reform (Samwick, 2000). One question however is whether retirement savings have responded positively – which could be in part due to the tax incentives and other government measures to encourage saving and investment in the last few years – or whether state pensions crowd out private saving. In addition, whether financial deregulation and heightened competition in the financial services sector, through a rapid expansion of credit, may have eased the liquidity constraints facing households, thus reducing the savings rate.

### ***3.1 An Analytical framework***

In an accounting sense, saving equals disposable income less consumption. Given the impact of pension privatization in affecting capital accumulation, the resulting rise in national income, in turn, may raise savings. Saving function (S) therefore can be written as:

$$S = \alpha_0 + \alpha_1 X$$

where  $\alpha_0$  and  $\alpha_1$  are parameters and X is the vector of exogenous variables.

The composition of saving is  $S = SR + SO$  where SR represents retirement savings and SO refers to other savings. There may be substitution between SR and SO.

Assuming that SR is exogenously determined and there is no perfect substitution between SR and SO, then  $SO = \alpha_0 + \alpha_1 X - \alpha_2 SR$ , where  $\alpha_2 < 1$ . If  $\alpha_2 = 1$ , then pension savings fully offset other savings and total savings are unaffected by increases in pension wealth. After substitution, S can be written as:

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

With pension privatization and the introduction of the FSR17, final salary company pension schemes are being eliminated and state pensions reduced. Consequently, the retirement savings may no longer remain exogenous. We therefore have to determine the factors driving the process of saving for retirement. We do not know of any 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.<sup>5</sup>

Other explanatory variables (X) are described taking into account that differential savings patterns could be due to different macroeconomic environments, habits, policy incentives and so on. 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. The impact of interest rates on household savings is ambiguous because there are both income and substitution effects which work in opposite directions. Higher interest rates increase the opportunity cost of consumption, hence households increase savings (the substitution effect) – the standard neoclassical view, while the rising wealth of positive savers (as a result of the increase in interest rates)

---

<sup>5</sup> For problems with saving data, see Schmidt-Hebbel and Serven, 1999: p.24.

increases consumption (the income effect). In a cross-country context, empirical evidence 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 retired population to the working 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), however, points out that observed declining saving rates in the OECD cannot be attributable to a compositional phenomenon (income going from the young savers to the old dissavers) because: “in the United States and the UK, where it is possible using survey data<sup>6</sup> 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”.<sup>7</sup> Moreover Paxson (1996) seems to find that there is not such a negative correlation between saving and age.

The budget deficit negatively affects the overall saving rate when the savings of the private sector (mostly households) do not fully offset the deficit.<sup>8</sup> Taxpayers could react to government deficits (negative savings) by increasing their saving in anticipation of the higher taxation (stemming from increased debt-servicing costs) or the faster inflation that will eventually occur could make people dissave. Similarly, changes in private savings are likely to offset changes in government savings, but the significance of this offset remains controversial. Chart 3 seems to indicate that the decline in government savings has been the most important factor in explaining the reduction in national savings. On the other hand, the national accounting identity ( $CA = S - I$ ) suggests that the current account surplus (deficit) causes domestic savings rate to rise (fall) and implies savings outflows (inflows of foreign capital).

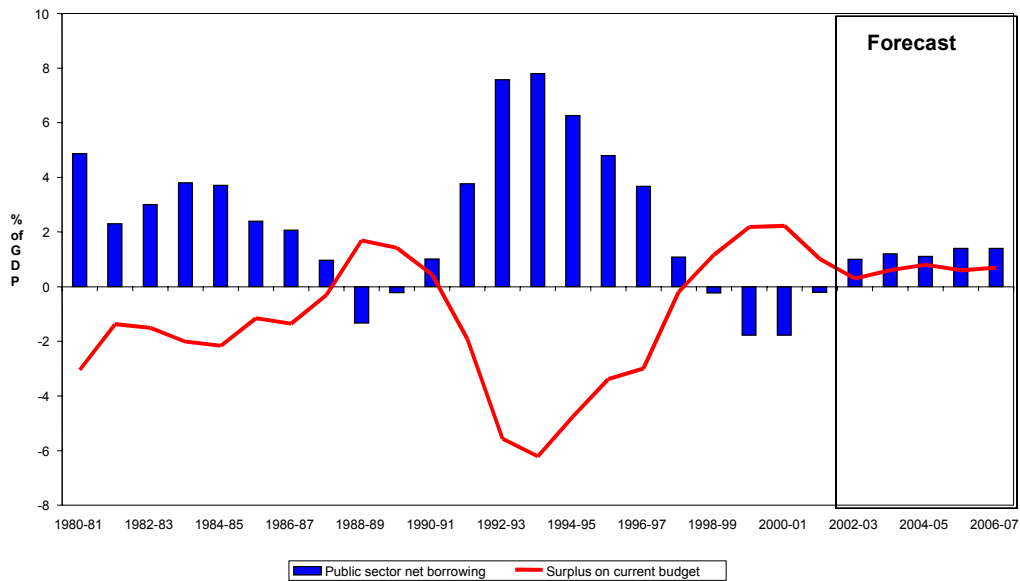
---

<sup>6</sup> For a recent survey on household saving behaviour, see Attanasio and Banks, 2001.

<sup>7</sup> Deaton, 1999: p.45.

<sup>8</sup> This is the notion behind the ‘Ricardian Equivalence Hypothesis’ first proposed by Robert Barro in his 1974 article ‘Are Government Bonds Net Wealth?’ *Journal of Political Economy*, November/December.

**Chart 3: UK Budget Balances**



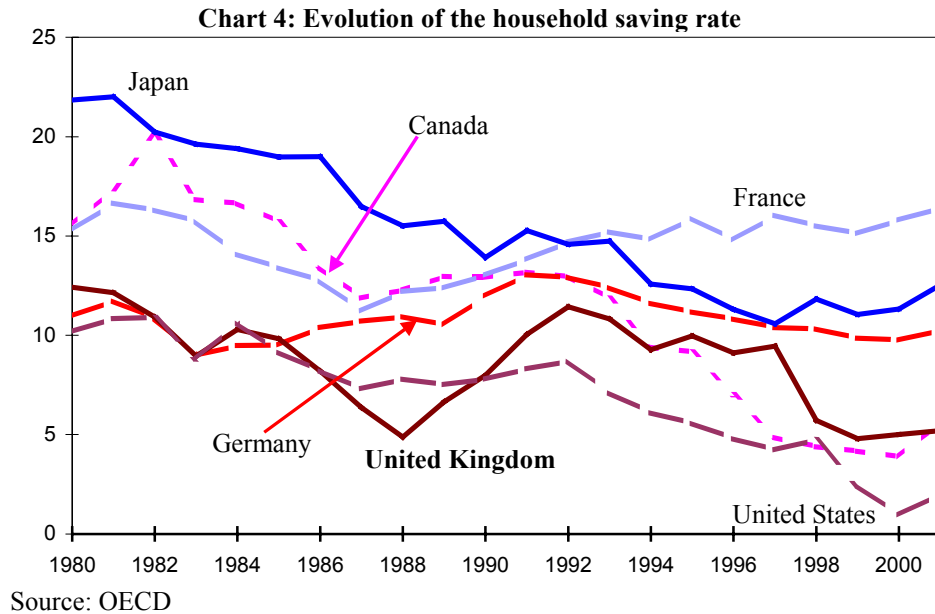
Source: HM Treasury

To summarize, funding pensions may have a positive effect on economic growth and 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). It can have a direct effect on saving in the sense that reducing government debt would raise savings and wealth. It can also indirectly increase saving through two other channels. First, the elimination of the payroll tax may lead to an increase in labour supply (by encouraging low-skilled workers to join the labour force) thus boosting GDP and leading to an increase in saving. Second, this plan may stimulate the capital market, leading to an increase in the efficiency of investment (its rate of return) and thereby to an increase in economic growth and saving, depending on the extent of capital market development prior to the reforms.

### ***3.2 The Pension Fund-Capital Market Nexus:***

In this section, we highlight the benefits that private pension funds can provide in fostering capital market development across debt, equity and bank markets in the UK. Raising long term private saving effectively depends on the growth of long-term instruments like pensions, life insurance and mutual funds. The growth in retirement savings depending on how they are invested could reduce the rates of return and

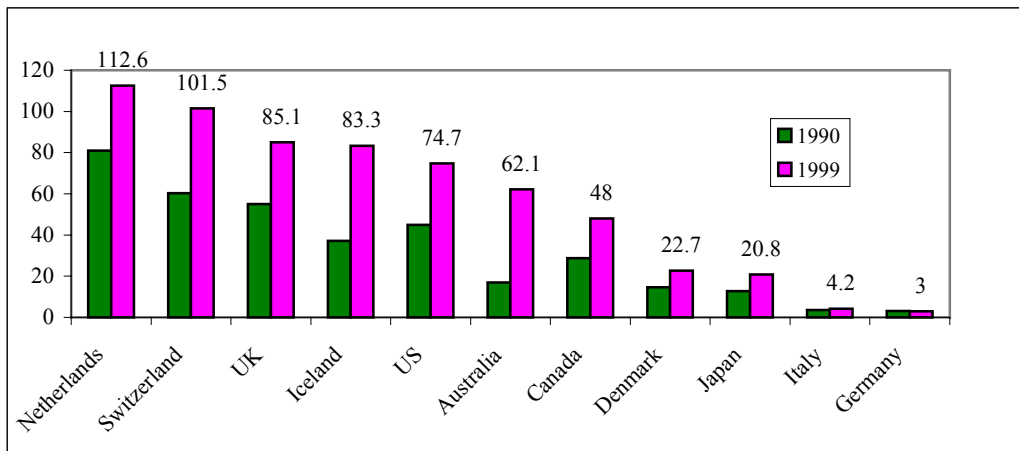
thereby the market value of such assets. According to the OECD (2002, p.81), the switch from social security pension contributions towards private pension contributions over the last decades has not been accompanied either by a significant rise in retirement saving or in total household saving (see Chart 4).



Using a panel data set of ten countries over the 1982-1993 period, Bailliu and Reisen (2000) find that the build-up of pension assets exerts a positive and statistically significant effect on aggregate saving rates, and that this impact differs for OECD and non-OECD countries.

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% in the Netherlands but as low as 3% in Germany. (Chart 5).

**Chart 5: Pension Fund Assets as percentage of GDP – the second pillar**



Source: OECD Institutional Investors Statistical Yearbook, 2000 and 2001

In the UK, pension fund assets accounts for 85.1% with DB schemes accounting for half of the total pension assets. The share of pension 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 the size of the British pension assets is around GBP1.1 trillion<sup>9</sup> or about 2 trillion US dollars (compared to 5.1 trillion US dollars for the US pension assets). There has been a substantial growth in personal pensions over the last twenty years, which increased from 12 to over 20 per cent of total pension assets between 1988 and 1995 (see Sandler, 2002).

The Myners report (Myners, 2001), which has outlined codes of conduct and principles for the UK pensions industry, calls for increased allocation to risky but high yield asset classes including investment in venture capital and private equity. However, the volatility of the equity market combined with frequent changes in pension fund legislation could trigger large-scale asset re-allocation (see Table 2).<sup>10</sup>

<sup>9</sup> Pickering, 2002: p.69

<sup>10</sup> The FTSE 100, the key stock market index in the UK, lost 25% 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% in 2002, following 6.4% return in 2001.

**Table 2: Ownership of UK equities (%)**

	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 (banks, unit and inv. trusts)	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, & pub. sectors, indust. & comm. Companies	8.7	8.9	10.3	8.1	3.2	3.2	2.8	3.5	3.1
Overseas	7.0	5.6	3.6	12.8	16.3	24.0	27.6	29.3	32.4
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
Value of FTSE All-share index (£ billion)	27	45	92	470	690	1209	1334	1732	1452

Source: UBS Global Asset Management

To reduce the volatility of maturing pension fund valuation swings, companies<sup>11</sup> have been switching assets from equities into the government and corporate bond markets<sup>12</sup>. Given that 46% of UK pension funds are invested in UK equities and 25% in overseas equities, (making a total equity exposure of about 70%), this represents a significant risk to the UK equity market if a wholesale portfolio shift takes place (see Table 3). Further, if pension investments earn lower returns than other investments, pensions will be under-funded.

**Table 3: UK Pension holdings as a percentage of the portfolio**

	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
Overseas 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
Overseas 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
Property	9	10	8	7	5	6	5	5	5	5	4	5	6
<b>Total Assets</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Source: UBS Global Asset Management

Because funded pension systems are prone to capital market risks, such as variation in real rate of return, inflation risk if claims are expressed in nominal terms, and the exchange rate risk if claims are denominated in a different currency than consumption. Dutta et al (2000) find that mixed funded-unfunded systems are desirable as they

<sup>11</sup> The UK Boots group with a pension fund valuation of about GBP 2.3 billion sold its entire equities portfolios and switch the allocation into long dated fixed income bonds, including World Bank and European Investment Banks bonds (source: Newswires).

<sup>12</sup> The gilt market is about GBP207 billion and corporate bond market is around GBP11.1 billion in size.



enable risk diversification. Moreover, funded pillars provide benefits that are based on long-term capital accumulation and financial market performance and thus a DC fully funded pillar can play a useful supplemental role in a multi-pillar system for the accumulation of pension 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, introduced special savings programs to encourage a larger participation in securities investment.<sup>13</sup> New stock exchanges were also established to facilitate equity capital raising by venture companies.<sup>14</sup> Regulatory changes are however needed to try and make it easier for people to save money for retirement, beginning with the retirement age of 65 years old and tax-free saving incentives. Booth and Cooper (2002) have considered existing tax regimes for saving (such as the 'ISA' regime) and theoretical regimes (such as a pure expenditure tax and a comprehensive income tax), and compare the costs different tax regimes impose on DC pension schemes. They conclude that an expenditure tax (where investment returns are exempt from tax) 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 people in the owner-occupied sector especially in the UK see their house as the asset for old age, with housing wealth serving as a shield against inflation, although it is exposed to its own variant of capital market risk. Its price may indeed fall relative to consumption (Börsch-Supan and Brugiavini, 2001, p.127). The evidence that both house prices and relative rates of return in housing are forecastable is consistent with the hypothesis that housing markets are far from efficient (Muellbauer and Murphy, 1997).

---

<sup>13</sup> UK's ISA (Individual Savings Account) and France's PEA (Plan d'Épargne en Action) are good examples.

<sup>14</sup> They include AIM (Alternative Investment Market) in the UK, the Neuer Markt in Germany and Nouveau Marche in France. In Japan, the Tokyo Stock Exchange set up a new market called Mother private company started NASDAQ Japan as a joint venture with NASDAQ USA.

The concern over expected rise in population aging could continue to increase the flow of savings into private retirement accounts. 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 institutional investor base, the role of pension funds in promoting contractual savings does contribute to capital market development (or total market capitalization). Using the broader group of OECD countries covered in Davis (1995) to test the main influences on the size of the pension asset/GDP ratio, Davis (1996) finds that: (1) the generosity of social security has a negative effect on the size of pension funds; (2) reducing the favourability 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 however is not clear on the assumption regarding the causality between contractual savings and capital market development, although it has been shown that these contractual savings do contribute to financial and stock market development and thereby its knock-on effects on economic growth (see Catalan, et al., 2000). Using annual time series (1979-94) for Chile, Holzmann (1997) provided preliminary evidence which coincided with the claim that the pension reform contributed to financial market development and a more diversified portfolio, but the direct impact of the reform on saving was low, and initially even negative<sup>15</sup>. Given this unclear picture, we intend to look into whether pension funds assets as an indicator of development of the financial sector causes or offsets higher national savings in the context of the UK.

#### **4. Empirical Analysis**

##### ***Definitions and Time series properties of data:***

Changes in net wealth derived from flow-of-funds data (see Table 1) are defined as capital account measure of saving, while the current account measure of saving is

---

<sup>15</sup> For conflicting evidence on whether a private system increases national saving, see Mesa-Lago, 2002, p.1316-7.

defined as the residual difference between total income and consumption. Since survey data and flow of funds data could be for a limited period or at a particular point in time, we make use of the residual based definition of saving for a time series study. Using annual data compiled from ONS, UK Department for Work and Pensions, and International Financial Statistics of IMF, the following variables are calculated: SAVR, the aggregate saving rate is used in the estimation to reflect the effect on total savings when public pension spending is reduced;

RINT - the real interest rate is defined by the Fisher identity,

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

where  $r$  denotes the real interest rate,  $i$  the nominal interest rate and  $\pi^e$  is the expected inflation rate.  $\pi^e$  is proxied by the current CPI inflation rate and  $i$ , the nominal interest rate, by the T-bill rate;

PAYG - the real public pension expenditure per elderly person is defined as the real benefit expenditure per population aged 65/60 and over;

DEP - the dependency ratio is calculated as the ratio of persons over 64 to persons aged 20–64.

PENSION is defined as the ratio of pension funds net investment over working-age population reflecting growth in pension assets. Such data are published by the ONS in a flow form. Contrary to the data used in Bailliu and Reisen (2000), defining changes in funded pension wealth based on pension funds assets, we chose not to use net pension fund assets data. These data are defined as the market value of net pension fund assets, and therefore include capital gains/losses.

The other variables included in the empirical analysis are: FIS that is fiscal balance, GROWTH, per capita GDP growth and CREDIT domestic credit to the private sector as per cent of GDP.

Performing augmented Dickey-Fuller (ADF) tests over the period 1978 to 2000 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 significance. We performed unit root tests on the first differences of the variables to check for the presence of I(2) processes. The results indicate stationarity in first differences except for PENSION, FIS and CREDIT which were found to be I(2), but because the null hypothesis of a unit root

in their first differences was accepted by a relatively small margin in some cases, all the variables were assumed to be I(1) excluding DEP and PAYG which were I(0). The results are given in Table 4.

**Table 4: ADF Unit root test results**

VARIABLES	ADF in levels		ADF in 1 <sup>st</sup> differences		ADF in 2 <sup>nd</sup> 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)

5%=-3.6454, 1% = -4.4691 (with trend)

### ***Cointegration analysis:***

We use co-integration method to find the existence of a unique long-run equilibrium relationship between the variables. Although strong theoretical reasons do exist for believing that the flow of pension assets and other variables influence savings which in turn impact investment, the existence of some reverse causation cannot be excluded *a priori*. Moreover, there could be important cross effects between pension assets and savings that could be captured by estimating the system as a vector autoregression (VAR) model. Given the limited number of observations, the many variables involved, the Autoregressive-Distributed Lag (ARDL) approach of Pesaran and Shin (1999) was preferred to 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).

First, the existence of the long-run relation is verified 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.<sup>16</sup> 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 is less of a problem although the test statistic rejects the null hypothesis, explaining PENSION, at a higher significance level.<sup>17</sup>

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 run and short-run estimates. The order of the ARDL model is selected by means of the model selection procedures such as Akaike, Schwarz, and the adjusted R-square statistic. We present below the coefficients and their t-values (in parentheses), obtained from the estimation of the selected ARDL (0, 1, 1, 0, 0, 0, 0, 1) model using Schwartz Bayesian Criterion allowing maximum one lag for each variable.

$$\begin{aligned}
 \text{SAVR} = & 36.086 + 0.006 \text{ PENSION} + 0.007 \text{ PENSION}_{-1} - 0.38 \text{ RINT} - 0.25 \text{ RINT}_{-1} - 0.009 \text{ FIS} \\
 & (1.007) \quad (3.221) \quad (3.009) \quad (-3.723) \quad (-2.294) \quad (-0.109) \\
 & + 0.33 \text{ GROWTH} - 0.0123 \text{ CREDIT} - 0.249 \text{ PAYG} + 2.083 \text{ DEP} - 2.671 \text{ DEP}_{-1} \\
 & (4.754) \quad (-1.186) \quad (-1.16) \quad (1.978) \quad (-2.988)
 \end{aligned} \tag{2}$$

Diagnostic Tests:

$\bar{R}^2 = 0.934$ , DW=2.76, SE of regression = 0.3975, RSS = 1.7381,  
 AR1 F(1,10)=2.805 [0.128], Normality  $\chi^2(2)=0.5547$  [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 and has a quite high  $\bar{R}^2$  value. The probability values are reported in the square brackets. The long-run model of the corresponding ARDL model is derived in the equation below, displaying the long-run coefficient estimates with t-values.

---

<sup>16</sup> Similarly,  $\chi_8^2$  (pension| SAVR,...,..) = 39.2262 is greater than the upper bound CV at 1% significance level, while  $\chi_8^2$  (rint| SAVR,...,..)=25.7832 and  $\chi_8^2$  (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:  $\chi_8^2$  (fis| SAVR,...,..)=11.8847;  $\chi_8^2$  (credit| SAVR,...,..) =7.5618;  $\chi_8^2$  (payg| SAVR,...,..)=9.2295;  $\chi_8^2$  (dep| SAVR,...,..)=8.0373.

<sup>17</sup> This however proves that retirement savings can be endogenous and there could be a long-term relation explaining the pension savings.

$$\begin{aligned}
\text{SAVR} = & 36.0857 + 0.013 \text{ PENSION} - 0.633 \text{ RINT} - 0.009 \text{ FIS} \\
& (1.007) \quad (4.094) \quad \quad \quad (-5.066) \quad \quad \quad (-0.1099) \\
& + 0.33 \text{ GROWTH} - 0.012 \text{ CREDIT} - 0.249 \text{ PAYG} - 0.588 \text{ DEP} \\
& (4.754) \quad \quad \quad (-1.186) \quad \quad \quad (-1.160) \quad \quad \quad (-0.489)
\end{aligned}$$

[3]

The sign and magnitude are compatible with the model outlined in this paper. The long run coefficient estimates of PENSION, RINT, and GROWTH in [3] are significant at less than 1% significance level. The null hypothesis of Wald test restriction imposed on PENSION coefficient ( $1-\alpha_2$ ) in equation [1] is rejected [ $\chi^2(1) = 16.76 (0.00)$ ], meaning that the coefficient is not equal to zero, implying less than perfect substitutability between institutional retirement savings and other savings. The coefficient associated with pension savings implies that with one unit (£ million) increase in pension savings per worker, aggregate savings increase by 0.013 per cent, while other savings decline by 0.987 per cent. In other words, there is a more or less perfect substitution between pension funds and other forms of savings, in the sense that any forced saving (such as pension contribution) can be offset either by borrowing or reducing discretionary saving. Also, due to relative illiquidity of pension savings, there could be an offsetting effect with the increase in pension savings.

The additional savings resulting from privately funded pension schemes should ideally find way to the capital market increasing the equity market capitalization. In this context, we used the PENSION variable as a proxy for that part of the market capitalization. Our finding suggests that the pension savings relative to working age population in the long run have positively significant effect on national savings in the UK. And any increase in anticipated pension benefits could also lead to a corresponding reduction in current non-pension savings.<sup>18</sup>

Other results suggest that an increase in government budget deficit tends to reduce national saving but the estimate is insignificant. The rising dependency ratio is negatively related to national saving. Our results support negative responsiveness of savings to an increase in the real interest rate, implying that wealth/income effects

---

<sup>18</sup> 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 households implicitly view social security contributions as part of their compensation in future.

outweigh substitution effects. But as pointed out earlier, the literature presents mixed evidence with regard to the sign of the interest elasticity of saving. The 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.

**Short-run dynamics:**

A short-run error correction model (ECM) of the above ARDL model is presented in equation [4].

$$\begin{aligned}
 dSAVR = & 0.174 + 0.006 dPENSION - 0.289 dRINT + 0.045 dFIS \\
 & (0.133) \quad (3.594) \quad \quad \quad (-2.629) \quad \quad \quad (0.911) \\
 & + 0.353 dGROWTH - 0.041 dCREDIT - 0.084 dPAYG + 2.58 dDEPR - 0.786 EC_{-1} \\
 & (5.329) \quad \quad \quad (-2.971) \quad \quad \quad (-0.486) \quad \quad \quad (3.063) \quad \quad \quad (-4.888)
 \end{aligned}
 \tag{4}$$

where ‘d’ refers to the first difference operator and EC is the error correction term;  $\bar{R}^2 = 0.795$ , DW = 2.5301, SE of regression = 0.0243, RSS = 0.0059.

The coefficient of the EC is found highly significant by using conventional t values and has the ‘correct’ sign. The significance of this coefficient strengthens the result of the cointegration test above. Its magnitude (0.79) indicates quick adjustment to disequilibrium. The contemporaneous short-run effect of PENSION is still positive and has a significant effect on the rate of savings, while the coefficient of changes in PAYG is insignificant, but has the ‘correct’ sign. Results for the effect of dependency ratio on savings provide mixed evidence: positive in the long term and negative in the short term. The short-run effect of RINT, CREDIT, GROWTH remains highly significant and the short run coefficient of FIS remains insignificant, with a negative effect in line with the Ricardian equivalence theory. We can therefore conclude that our findings remain consistent with the long run results when short run effects are taken into consideration.

**5. Concluding remarks**

This paper has attempted to estimate the relationship between aggregate saving rates and changes in funded pension wealth, having controlled for the influences of other regressors such as financial deepening, real interest rates, fiscal deficits, dependency

ratio, and public pension spending. The results however should be treated with caution given the relatively short sample size.

Given growing life expectancy, there is no definitive answer for pre-funding of pension benefits as a valid strategy to cope with population aging and massive fiscal burden.<sup>19</sup> Demographic pressures are likely to reduce savings in the long run, and government fiscal balances seem to be offset by reduction in private savings in the UK. Labour market flexibility could contribute to boost supply of labour and deliver a stable dependency ratio, which remains just under 30 per cent.

Evidence also suggests that privatization may lead to a reduction in the pension burden on the national budget if combined with substantial cuts in benefits. Such reforms leading to reduction in PAYG and FIS may have a positive effect on savings, which could be counterbalanced by the negative ones. 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 finding in this paper, that increased private pension saving offsets other savings, underpins the World Bank (1994)'s recommended three-pillar approach. That is public and private pillars are essential for a well-functioning pension system. Public pillars – 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, PAYG system is needed to continue to supplement the fully funded system. Ideally, pension system could involve a basic minimum from the state, funded by some form of compulsory saving, a higher retirement age, and an encouragement to individuals to top up the package with savings of their own.

Notwithstanding, strong economic growth is the key to boost savings by reducing

---

<sup>19</sup> 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 (Source: Government Actuary's Department, UK).



unemployment related spending. Lower growth in the OECD countries could lead to a surplus of private saving over private investment rather than a shortfall. Concerns about a future shortage of aggregate saving driving up interest rates should focus upon the evolution of government budget balances rather than private behavior (Bosworth, 1995).

The impact of pension reforms on domestic savings may not be uniform across countries. Pension reforms affect the market capitalization through domestic long-term savings being channeled to the capital market. But the same financial-services liberalization underlying private pensions also facilitated access to credit, reducing households' net savings. However, even if increased privately funded pensions have increased aggregate savings marginally, saving in financial assets other than pensions may have increased the share of savings in the capital market. The increased liquidity and capitalization of the stock market meant more efficient resource allocation, thereby promoting growth.

## References

- Attanasio, O.P., and Banks, J., 2001, The assessment: household saving-issues in theory and policy, *Oxford review of economic policy*, Spring, 17 (1): 1-19.
- Bailliu, J. and Reisen, H., 2000, Do funded pensions contribute to higher aggregate savings? A cross-country Analysis, in *Pensions, savings and capital flows: From ageing to emerging markets*, H. Reisen (Editor), Edward Elgar. p. 113-131.
- Banerjee, A., J. Dolado, J.W Galbraith and D.F. Hendry, 1993, *Co-Integration, Error-Correction, and the Econometric Analysis of Non-Stationary Data*, Oxford: Oxford University Press.
- Barr, Nicholas, 2002, *The Pension Puzzle: Prerequisites and Policy Choices in Pension Design*, Economic Issues 29, International Monetary Fund: Washington DC.
- Blake, D., 2000, Two decades of pension reform in the UK: What are the implications for occupational pension schemes? *Employee Relations*, 22(3): 223-245.
- Booth, P., and Cooper, D., 2002, The tax treatment of UK defined contribution pension schemes, *Fiscal Studies*, March, 23 (1): 77-104.
- Börsch-Supan, A., and Brugiavini, A, 2001, Savings: the policy debate in Europe, *Oxford review of economic policy*, 17(1): p. 116-143.

Bosworth, B.P., 1995, *Prospects for Saving and Investment in Industrial Countries*, Brookings Discussion Papers 113, The Brookings Institution: Washington DC.

Bosworth, B. and Burtless, G., 1998, Population aging and economic performance, in Barry Bosworth, and Gary Burtless (eds.), *Aging Societies: The Global Dimension*, The Brookings Institution: Washington DC.

Catalan, M., Impavido, G., and Musalem, A. R., 2000, Contractual savings or stock market development: which leads? *Journal of Applied Social Science Studies*, 120 (3): 445-87.

Chown, John, 2001, *Will the pensions time bomb blow apart EMU?* Chown Dewhurst, July.

Davis, E. P., 2001, *The Regulation of Funded Pensions: A case study of the United Kingdom*, Occasional Paper Series 15, Financial Services Authority: London.

Davis, E. P., 1996, Pension Fund Investments, in B. Steil et al., *The European Equity Markets: the State of the Union and an Agenda for the Millennium*, The Royal Institute of International Affairs: London, 185-223.

Davis, E. P., 1995, *Pension funds, Retirement Income Security and Capital Markets: An International Perspective*, Oxford University Press: Oxford.

Deaton, A., 1999, Saving and Growth, in *The Economics of Saving and Growth: Theory, Evidence, and Implications for Policy*, edited by K. Schmidt-Hebbel and L. Servin, Cambridge University Press: Cambridge, 33-70.

Deaton, A., 1992, *Understanding Consumption (Clarendon Lectures in Economics)*, Oxford University Press.

Diamond, P., 1997, Macroeconomic aspects of social security reform, *Brookings Papers on Economic Activity*, 1997 (2): 1-87.

Disney, R., 2000, Crises in public pension programmes in OECD: what are the reform options? *Economic Journal*, 110 (461): 1-23.

Disney, R., C. Emmerson, and M. Wakefield, 2001, Pension reform and saving in Britain, *Oxford Review of Economic Policy*, 17(1): 70-94.

Dutta, J., Kapur, S., Orszag, J.M., 2000, A portfolio approach to the optimal funding of pensions, *Economics Letters*, 69: 201-206.

Edwards, S., 1996, Why are Latin America's savings rates so low? An international comparative analysis, *Journal of Development Economics*, October, 51 (1): 5-44.

Engle, R.F., and Granger, C.W.J., 1987, Cointegration and Error Correction Representation: Estimation and Testing, *Econometrica*, 55: 251-276.

Feldstein, M., 1996, The missing piece in policy analysis: Social Security reform, *The American Economic Review*, May, 86 (2): 1-14.

Feldstein, M., 1974, Social security, induced retirement, and aggregate capital accumulation, *Journal of political economy*, Sep-Oct, 82 (5): 18-23.

- Gale, William G., 1998, The Effects of Pensions on Household Wealth: A Reevaluation of Theory and Evidence, *Journal of Political Economy*, August, 106 (4): 706-23.
- Hemming, R., 1999, Should public pensions be funded? *International Social Security Review*, 52(2): 3-29.
- Holzmann, R., 1997, Pension reform, financial market development, and economic growth: preliminary evidence from Chile, *IMF Staff papers*, June, 44 (2): 149-178.
- Honohan, P., 1999, Financial Policies and Saving, in *The Economics of Saving and Growth: Theory, Evidence, and Implications for Policy*, edited by K. Schmidt-Hebbel and L. Servin, Cambridge University Press: Cambridge, 71-106.
- Johansen, S., 1988, Statistical Analysis of Cointegration Vectors, *Journal of Economic Dynamic and Control*, 12, 231-254.
- Johansen, S., 1996, Likelihood-based inference in Cointegrated Vector Autoregressive Models, 2<sup>nd</sup> printing, Oxford University Press.
- Masson, P.R., Bayoumi, T., and Samiei, H., 1998, International Evidence on the Determinants of Private Saving, *The World Bank economic review*, 12 (3): 483-502.
- Mesa-lago, C., 2002, Myth and Reality of Pension Reform: The Latin American Evidence, *World Development*, August, 30 (8): 1309-1321.
- Muellbauer, J., and Murphy, A., 1997, Booms and Busts in the UK Housing Market, *The Economic Journal*, 107 (445): 1701-1727.
- Myners, Paul, 2001, *Institutional Investment in the United Kingdom: A Review*, HM Treasury: London, March.
- OECD, 2002, *OECD Economic Surveys: United Kingdom, 2002/1*, OECD: Paris.
- Oliver, Wyman & Company, 2001, *The future regulation of UK savings and investment: Targeting the savings gap*, London, 1-53.
- Orszag, P., and Stiglitz, J., 2001, Rethinking Pension Reform: Ten Myths About Social Security Systems, in R. Holzmann and J. Stiglitz (Eds.), *New Ideas about Old Age Security: Toward Sustainable Pension Systems in the 21st Century*, The World Bank: Washington DC, 17-56.
- Palley, T.I., 1998, The economics of Social Security: An old Keynesian perspective, *Journal of Post Keynesian Economics*, Fall, 21 (1): 93-110.
- Paxson, C., 1996, Saving and growth: evidence from micro data, *European economic review*, February, 40 (2): 255-288.
- Pesaran, M.H. and Pesaran, B., 1997, *Working with Microfit 4.0: Interactive Econometric Analysis*, Oxford: Oxford University Press.
- Pesaran, M.H. and Shin, Y., 1999, An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis, in *Econometrics and Economic Theory in the 20th Century: The*

*Ragnar Frisch Centennial Symposium*, 1998, S. Strom (Editor), Cambridge University Press: Cambridge, Chapter 11.

Phillips, P.C.B., and Hansen, B., 1990, Statistical Inference in Instrumental Variables Regression with I(1) Process, *Review of Economic Studies*, 57: 99-125.

Pickering, Alan, 2002, *A simpler way to better pensions: An independent report*, Department for Work and Pensions, UK, July.

Pitelis, C., 1997, On Kaldor and pensions, *Cambridge Journal of Economics*, 21 (4): 469-482.

Samwick, A., 2000, Is pension reform conducive to higher saving? *Review of economics and statistics*, 2000. LXXXII (2): 264-272.

Sandler, R., 2002, *Medium and Long Term Retail Savings in the UK: A Review*, HM Treasury: London, July.

Schmidt-Hebbel, Klaus, and Servin, Luis, 1999, Saving in the World: The Stylized Facts, in *The Economics of Saving and Growth: Theory, Evidence, and Implications for Policy*, edited by K. Schmidt-Hebbel and L. Servin, Cambridge University Press: Cambridge, 6-32.

Vittas, D., 2002, *Policies to promote saving for retirement: a synthetic overview*, Working Paper No.: 2801, World Bank: Washington DC.

Williamson J.B., 2002, Privatization of Social Security in the United Kingdom: warning or exemplar? *Journal of Aging Studies*, November, 16 (4): 415-430.

World Bank, 1994, *Averting the Old Age Crisis: Policies to Protect the Old and Promote Growth*, Oxford University Press: Oxford.

## 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 criticised 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:

$$\phi(L, p)y_t = \sum_{i=1}^k \beta_i(L, q_i)x_{it} + \delta'w_t + u_t$$

Where

$$\phi(L, p) = 1 - \phi_1 L - \phi_2 L^2 - \dots - \phi_p L^p$$

$$\beta_i(L, q_i) = \beta_{i0} + \beta_{i1}L + \dots + \beta_{iq_i}L^{q_i}, \quad i = 1, 2, \dots, k,$$

L is a lag operator such that  $Ly_t = y_{t-1}$ , and  $w_t$  is a  $s \times 1$  vector of deterministic variables such as the intercept term. Any reparameterisation 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) parameterisation 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<sup>20</sup> 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-parameterisation exercise.

---

<sup>20</sup> 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.