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PENSION FUNDING, PRODUCTIVITY, AGEING AND ECONOMIC GROWTH

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Abstract: A key issue in pension reform is whether such a shift from PAYG to funding is largely a matter of reallocation of the financial burden of ageing (with the risk of a generation paying twice), or whether funding improves economic performance sufficiently to generate the resources required to meet the needs of an ageing population. This paper surveys the literature on the three main aspects of this question, whether pension funding boosts saving, whether it improves the supply of long term funds and whether there are improvements in allocative efficiency in capital and labour markets. It also provides new evidence on the positive benefits of funding for productivity growth, which can offset the deleterious effects on productivity that ageing may have.

Key words: Pension funds, economic growth, productivity, ageing, panel estimation

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1 Introduction

It is anticipated (United Nations 2004) that by 2050, one in four people will be aged above 65 at the world level. This pattern reflects both rising longevity and declining fertility rates over the long term, as well as the exceptional size of the post war “baby boom” generation. Owing to the unfunded nature of pay-as-you-go (PAYG) systems, governments in both OECD countries and some Emerging Market Economies (EMEs) are facing financial difficulties. Typically, countries switch partially or wholly from unfunded systems, e.g. PAYG to funded systems, e.g. the three-pillar World Bank model (1994), or from defined benefit (DB) systems to defined contribution (DC) systems, see the reviews in Hu (2005) and Holzmann and Hinz (2005). Other EMEs are facing the need to set up a pension system de novo and are also often adopting a funded approach along World Bank lines.

A key issue in pension reform is whether such a shift from PAYG to funding is largely a matter of reallocation of the financial burden of ageing (with the risk of a generation paying twice), or whether funding improves economic performance sufficiently to generate the resources required to meet the needs of an ageing population. The underlying issue is that with characteristics such as greater actuarial fairness, transparency and flows of funds to securities markets, a funded system may prompt greater economic efficiency than PAYG, which is of wider benefit to the economy.

There are several aspects to this question, the existing literature on which is reviewed in Section 2 (see also Davis and Hu 2005). One is whether funding leads to an increase in saving which permits higher capital formation, allowing higher growth[2]. A second is whether, independently of the impact on saving, there are effects of funding which lead to higher economic growth, for example via increased long term funding or positive externalities generating more efficient capital and labour markets. A third is whether a direct impact of funding on growth can be discerned.

In Section 3 we seek to break new ground in the pensions and growth debate by investigating empirically the link from pensions to productivity in the light of demographics. Given the various mechanisms highlighted in Section 1, is there a detectable impact of pension funds on total factor productivity growth, even if ageing effects are included? This is a crucial issue for ageing societies where it is widely anticipated that productivity growth will be flat or fall with ageing. We investigate the link of pension funds and ageing to productivity in 72 countries both separately and jointly, taking into account standard macro variables also generally held to influence productivity.

2 Pension funds and economic growth

[2] "Endogenous growth" effects of an increase in capital investment on labour productivity may be particularly powerful in developing countries if a switch from pay-as-you-go to funding induces a shift from the labour-intensive and low productivity "informal" sector to the capital-intensive and high productivity "formal" sector (Corsetti and Schmidt-Hebbel 1997).

We now go on to assess the various ways in which pension funds can relate to economic growth directly or indirectly, that are highlighted in the existing literature.

2.1 Indirect effects on growth via saving

We commence by analysing theory and empirical work on pension funding and saving. It should be noted at the outset that population ageing will of itself generate changes in saving which may have a major macroeconomic impact, see the survey and empirical work in Davis (2006). The basic underlying aspect is that in the life cycle pattern of saving, there is accumulation during working life and dissaving during retirement. Masson et al (1995) found the total dependency ratio to have a significant negative effect on private saving in a panel of both advanced and developing countries, with an elasticity of -1. Later work by Loayza et al (2001) reduced this estimate to around -0.2. McMorrow and Roeger (2003) found an average elasticity of –0.75 across existing studies. Davis (2006) finds that growth in the 65+ cohort reduces saving in both OECD countries and EMEs, while growth in the 40-64 age group boosts saving. These changes in saving rates will undoubtedly be channelled to a considerable extent via pension funds, but pension funds need not be the causal factor.

There are a number of reasons why funding per se would not be expected to affect personal saving. The “Anglo Saxon” countries where pension funds are most important are also known for low personal saving. Indeed, in the UK there is thought to be a major “savings gap”, thought to reflect underestimation of saving needs for retirement (Davis 2004a). There are also theoretical objections, in that under the life-cycle hypothesis (Deaton 1992) individuals choose a lifetime savings pattern separately from its distribution, so a rise in one component of wealth (such as pension funds) should be fully offset by falls elsewhere, either by reducing discretionary saving or by borrowing.

On the other hand Kohl and O’Brien (1998) suggest some circumstances when perfect substitutability may not apply, and hence savings may be boosted by funding: First, pension assets are illiquid and hence may not be seen as a perfect substitute for liquid saving such as deposits. Second, there may be liquidity constraints which imply that any forced saving (such as pension contributions) cannot be offset by borrowing, while households may not have other discretionary saving to reduce. Third, since unfunded social security is typically seen to reduce saving, because it implies an accumulation of implicit claims on future income, a switch toward funding of pensions should increase it. And finally, tax incentives that raise the rate of return on saving via life insurance or pension funds may encourage higher aggregate saving (McCarthy and Neuberger 2004).

As regards empirical work, on balance, research suggests that growth in funded pension schemes does appear to boost personal saving, but not one-to-one. For example, work on U.S. defined benefit funds,

suggests an increase in personal saving of around 0.35–0.5 results from every unit increase in pension fund assets (Pesando 1992). Poterba, Venti, and Wise (1996) suggest that defined contribution 401(k) accounts in the United States have also added to aggregate saving. Tax incentives are one important reason, but employer matching of contributions, payroll deduction schemes, and information seminars may also be relevant factors in encouraging net saving by this route. Concerning adverse effects on personal saving of unfunded systems, Edwards (1995) finds that unfunded social security appears to lower private saving in developing countries. In addition, Feldstein (1995) suggests that personal saving rises 0.5 for every unit decrease in U.S. social security wealth (and vice versa).[3] Rossi and Visco (1995) find a comparable figure of 0.66 for Italy. Cross-section evidence in Samwick (1999), based on data of 1990 and averages of 1991-1994, suggested that countries with PAYG systems had lower national saving rates than other countries.

Reisen and Bailliu (1997), used data from 11 countries including both OECD and non-OECD nations and found that the impact of pension reform on saving is 8 times larger for non-OECD countries, which have more imperfect capital markets, than in OECD countries. In a liberalized financial system such as the US, credit constraints seem to affect lower-income individuals particularly severely, as they are more subject to liquidity constraints. Therefore forced institutional saving will tend to boost their overall saving particularly markedly (Bernheim and Scholz 1992).

Even if personal saving is boosted it may be offset at a national level by government dissaving. A key aspect of this issue is how pension-reforming governments finance existing social security obligations. If the government tries to finance the implicit pension debts by public debts, then public savings would decrease, so the overall national saving rate might be unchanged or even fall (Hviding and Merette 1998). Even tax-financed transitions may, according to some authors, have at most a small positive effect on national saving in the long term (Cifuentes and Valdes Prieto 1997).

Empirically, Schmidt-Hebbel (1999) estimated that between 10% and 45% of the rise in national saving in Chile could be explained by pension reform, with the remaining being explained by structural reform, e.g. tax reform etc. Hu (2005) finds a panel Granger causality relation from pension reform and pension fund assets to both private and national savings across 38 countries. Lopez-Murphy and Musalem (2004) studied 50 countries and found that national saving is boosted where pension funds are the result of a mandatory pension programme, but not when they are voluntary. On the other hand, Samwick (1999), working with a panel of countries, found that no countries except Chile experienced an increase in gross national saving rates after pension reform towards non-PAYG systems. Equally, Bosworth and Burtless (2004) found that OECD countries that seek to prefund

[3] Lower figures than Feldstein's are found by other studies of the United States, such as Gale (1997), who found 0.11, and Hubbard (1986), who found 0.33.

social security obligations such as Japan and the US incur offsetting increases in government borrowing that offset any difference in national saving.

2.2 Indirect effects on growth via financial markets

Even if it does not affect saving, pension reform may aid financial development, which in turn is widely considered to be positively associated with economic growth (Levine and Zervos 1998; Beck and Levine 2004). Effects may be quantitative (e.g. switches from loan to security financing) or qualitative, (e.g. a higher quality of corporate governance exerted via the existing stock of equity).

A quantitative impact of development of pension funds on capital markets requires differences in behaviour between pension funds and the personal sector. This is plausible; pension funds and households have differing time horizons, and pension funds benefit from factors such as economies of scale giving them a comparative advantage in pooling and diversifying risk, lower transactions costs and superior ability to process information (Davis and Steil 2001). Equally, unlike banks, they are not subject to the risk of a "run" so can more freely invest in long term assets (Catalan et al 2000). Accordingly, it is observable that pension funds in most cases hold a greater proportion of equities and bonds than households[4], If these differences are not offset by changes in household portfolios, a switch to funding could increase the supply of long-term funds to capital markets such as equities, long term corporate bonds and securitised debt instruments and a reduction in bank deposits. Note in this context also that ageing itself could affect financial structure, separately from pension funds, see the survey and new evidence in Davis (2006)[5].

As an example of empirical work on the impact of pension funds on financial structure, Catalan et al (2000) investigated the link of contractual savings to stock market capitalisation and stock market value traded across 26 countries, among which 6 are developing countries. They found contractual saving institutions, e.g. pension funds, Granger-cause equity market development, notably in developing countries. Impavido et al (2003) found a positive relationship between contractual saving assets and overall bond market capitalisation/GDP, whereby a 1 per cent increase in the former leads to a 0.4 per cent rise in the latter. Hu (2005) shows inter alia that in a panel error correction model, growth of pension funds stimulates private bond finance, notably in developing countries, both in the short and long run. Prices as well as quantities may benefit from pension fund growth, as shown by a panel study focused on 33 EMEs by Walker and Lefort (2002), which finds that pension fund growth accompanies a decreased dividend yield and increased price to book ratio, implying a drop in the cost of capital. Such quantitative overall shifts to long term assets reducing the cost and increasing the

[4] Differences in portfolios link to a variety of factors, notably regulation and historical developments, see Byrne and Davis (2003).

[5] Notably, we show that as the 65+ cohort grows relative to the 40-64s, there is a relative increase in demand for bonds compared with equities.

availability of equity and long term debt financing to companies may raise productive[6] capital formation and economic growth. For example, Caprio and Demirgüç-Kunt (1998) found that long-term debt finance is correlated with higher growth for manufacturing firms.

Besides inducing shifts to longer term assets, funding may also increase international portfolio investment if permitted. On the one hand, international investment may be seen as a loss of potential to develop domestic capital markets. On the other, by generating inflows of profits, interest and dividends, holdings of assets offshore can actually help to contribute to greater stability of national income (Fontaine 1997). This may in turn benefit economic growth since investment responds negatively to uncertainty (Carruth et al (2000), Byrne and Davis (2005)).

Besides the quantitative effects noted above, the development of pension funds is also likely to trigger qualitative developments in financial markets (Davis and Steil (2001), Davis (2005b)). These may benefit growth via better resource allocation. These effects are in general subject to positive externalities, as once instituted, other investors may also benefit from them. A key qualitative improvement traceable to pension funds is financial innovation, which for developing countries may include equities per se, junior markets, corporate bonds and securitisation. See for example the patterns in financial development observable in Chile after pension reform as outlined in Davis (2005b). In OECD countries, pension funds' need for hedging against shortfalls of assets against liabilities has led to the development of a number of recent financial innovations such as zero coupon bonds and index futures (Bodie 1990).

Modernisation of the infrastructure of securities markets, as required by pension funds, should entail improved clearing and settlement on the one hand, and provide more sensitive price information on the other, thus improving resource allocation. As a consequence, it may help to reduce the cost or increase the availability of capital market funds, and hence aid growth. There may be important indirect benefits in this context, as pension funds press for improvements in the "architecture of allocative mechanisms", including better accounting, auditing, brokerage and information disclosure. Modern banking and insurance supervision, new securities and corporate laws, junior equity markets and credit rating agencies are also stimulated to develop. Such improvements are crucial for financial development and growth more generally.

Development of equity markets and their dominance by pension funds would have implications not just for companies' balance sheet structure - with potentially lower debt-equity ratios - but also for corporate governance, implying a greater degree of control by capital markets and pension funds. As summarised in Davis (2002b), there is a growing literature on the impact of corporate governance

[6] This also requires allocation of funds to their most profitable uses and adequate shareholder-monitoring of the investment projects, which as detailed below should also tend to occur in capital markets dominated by pension funds.

initiatives on performance, albeit mainly focusing on the effects on share prices per se. Positive results may be favourable to economic growth via efficiency gains. For example Wahal (1996), in a sample of forty-three cases, found that efforts by institutional investors to promote organizational change via negotiation with management (as opposed to proxy proposals) are associated with gains in share prices. On the other hand Del Guercio and Hawkins (1999) found no evidence that activism had a significant effect on stock returns over the three years following the proposals. Faccio and Lasfer (2000) show that firms in which UK pension funds have large stakes markedly improve their stock returns. Davis (2002b, 2004b) undertook macro work based on the share of equities held by pension funds and life insurers in the G-7 plus Australia. Davis found results consistent with a disciplining role of institutions in the Anglo Saxon countries, particularly life insurers and pension funds. They exert restraint of investment, and lead to a boost to dividends and to Total Factor Productivity (see also Section 3), while they are favourable to R and D.

An ambiguous aspect of the growth-benefits of funding is pension funds' direct effect on securities market liquidity and price volatility. In principle, pension funds, being willing to trade, having good information and facing low transactions costs, should tend to speed the adjustment of prices to fundamentals (Committee on the Global Financial System 2003). This in turn generates an efficient allocation of funds, and acts as a useful discipline on lax macroeconomic policies, both of which should be favourable to growth. Equally, the liquidity that institutional activity generates may dampen volatility, hence reducing the risk adjusted cost of funds. This is suggested by lower average share price volatility in countries with large institutional sectors[7]. Evidence on average day-to-day asset price fluctuations shows no tendency for such volatility to increase (Davis and Steil 2001). Consistent with this, Walker and Lefort (2002) find that pension fund growth reduces security price volatility for 33 EMEs.

On the other hand, Davis (2004b), using a data set covering both pension and life insurance assets across G-7 countries, found a positive link between equity price volatility and the share of equity held by pension funds and life insurance across both Anglo-Saxon countries and Continental European countries and Japan (CEJ). He notes, however, that such a link might reflect a shift in sectoral holdings of equities rather than institutional holdings per se. Furthermore, history shows some unfamiliar systemic risks in institutionalised and securitised financial systems associated partly with pension funds[8] which will not be captured by econometric assessments depicting long-term average behaviour (Davis 2002a). Such crises are likely to affect growth, inter alia via increased uncertainty. One type of crisis is characterised by extreme price volatility after a shift in expectations and asset allocations (such as the 1987 crash and the 1992 ERM crisis). Another is notable for a protracted collapse of

[7] This is not to deny that markets may be subject to forms of excess volatility relative to fundamentals, but that the scope of average volatility does not seem to be linked to institutionalisation

[8] Note that pension funds are increasingly investing assets in hedge funds so may also be linked indirectly to turbulence that hedge funds may generate.

market liquidity and issuance after similar portfolio shifts (as for Russia/LTCM in 1998). Such periodic market-crisis events were characterised inter alia by features such as heavy involvement of pension funds in both buying and selling waves; international investment, and signs of overreaction to the fundamentals and excessive optimism prior to the crisis. Underlying factors appear to be influences on fund managers that induce herding behaviour (notably the frequency of performance measurement, due in turn to principal-agent incentive problems between the sponsor and the fund manager).

The existence of "multiple avenues of intermediation" (i.e. active securities markets as well as banks) can help to offset the impact of securities-markets based crises by allowing banks to take up the slack when securities markets face difficulties as in the US in 1998. However, Davis and Ioannidis (2004) inject a note of caution, in that there may be an asymmetry – banks can take over from securities markets, but owing to the importance of bank monitoring, closure of banks may lead to extreme caution about new issues in securities markets, as in the US in 1991.

By leading to disintermediation, growth of pension funds is likely to entail increased competition for the banking sector. On the one hand, such competition may lead to heightened efficiency of banks, thus aiding economic development, and there is evidence that institutional growth is linked to lower bank spreads (see Davis 2005b). Impavido et al (2002) test for effects of contractual saving institutions on banks using individual bank data over 1991-2000 in 30 countries. They find that in countries with larger institutional sectors, and allowing for standard determinants of bank performance, banks offer lower spreads and thus more efficient intermediation, while also having higher profits, which the authors suggest is due to lower credit risk[9]. They offer longer maturity loans when pension funds are large, suggesting that there is complementarity in long term finance. Banks also have lower short term liabilities on average. On balance, they suggest banks are shown to be more resilient to credit and liquidity risks when pension funds are present.

Disintermediation, however, may also help to generate banking crises This is because disintermediation of banks historically at times led to increased risk-taking via aggressive balance sheet expansion (e.g. by lending to property developers, see Davis and Zhu 2004) with risk premia which in retrospect proved to be inadequate[10]. These have a major impact on growth (Hoggarth and Sapporta 2001)[11], and notably on investment (Davis and Stone 2004) and consumption (Barrell, Davis and Pomerantz 2006). A related point, also implying decline of the banking sector is of concern, is that

[9] We would caution that the estimation period has not witnessed major banking problems in most countries.

[10] It may be added that rapid economic growth and at times inappropriate monetary policy also played a role in this typical late 1980s pattern.

[11] Hoggarth and Saporta (2001) found that it takes 4.6 years in advanced countries but less in emerging market economies (3.3 years) before the economy returns to trend. They also found that cumulative output losses were much greater in advanced countries (23.8% of GDP) than in emerging market economies (13.9%). Banking crises alone cost 5.6% and twin crises 29.9%.

there is evidence that pension funds are reticent in investing equity in small firms, despite the fact that small firms' potential for innovation, growth and job creation is widely seen as crucial for economic growth[12]. Sias (1996) gives evidence for this in the US. The consequence of neglect of small firms by pension funds (assuming individual investors do not fill the gap) may be biases in the economy towards sectors with larger firms (for even if small firms can obtain bank loan finance, growth potential via debt is likely to be more restricted than with equity in addition). This may be contrary to the comparative advantage of the economy as a whole. It suggests a need for venture capital funds, junior equity markets and appropriate pension fund regulation, as well as an ongoing role for banks.

As is the case for excess volatility as outlined above, regular performance evaluation of pension fund managers by trustees is said to underpin the short-termist hypothesis, (entailing under-valuation of firms with good earnings prospects and willingness of funds to sell shares in take-over battles). This in turn is held to discourage long-term investment or R&D as opposed to distribution of dividends, which would imply a suboptimal transfer and allocation of resources, and hinder growth. Miles (1993) gives some empirical evidence to confirm the existence of short termist effects in the UK, with overvaluation of profits in the short term.

2.3 Indirect effects on growth via labour markets

In many advanced countries there has been a fall in participation rate for those men over state pension age (65+), while early retirement has also become endemic. One contributing factor is the disincentives to labour supply embedded in public pension systems (Blondal and Scarpetta 1998). Such patterns also apply in countries where PAYG is not generous such as the UK. Davis (2004a) suggests that this links partly to social preferences, the relative generosity of the public scheme of disability benefits, and restructuring of manufacturing. But he also suggested that these aspects can interact with early retirement provisions of defined benefit occupational pension schemes. In some cases firms were seeking to avoid the large accrual of benefits in defined benefit funds close to retirement – but most commonly early retirement is used simply to deal with redundancy via voluntary severance, often on actuarially generous terms.

In view of such problems, James (1998) suggests that the close linkage between benefits and contributions, in a defined-contribution funded plan will reduce labour market distortions. It also motivates the defined-contribution PAYG schemes recently introduced in some European countries such as Sweden and Italy. Indeed, it is apparently the type of pension (defined benefit or defined contribution) and not the funding per se that has a key impact on labour supply.

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[12] This tendency may link to illiquidity or lack of marketability of shares, levels of risk which may be difficult to diversify away, difficulty and costs of researching firms without track records and limits on the proportion of a firm's equity that may be held. The development and improvement of stock markets for small company shares is one initiative that may make such holdings more attractive to pension funds.

Regarding the issue of job mobility, recent empirical work by Disney (2004) shows that UK pension reform in the 1980s and 1990s was closely and positively linked to job mobility, i.e. people who opted out of occupational pension schemes (largely defined benefit plans) and switched to personal pensions were more mobile than those who did not.

Disney (2004) argues that public pension contributions can affect not only labour supply but also the demand for labour. If employers view PAYG contributions as one form of payroll tax, they tend to replace labour recruitment with capital investment, therefore reducing labour demand. In an imperfectly competitive product market, the employee can pass through the burden of their pension contribution to consumers, for example via product prices, thus reducing the demand for labour at a given wage. If the labour market is not fully competitive and unions play an important role in setting wages this may affect employment. This effect will be most marked in advanced countries with generous PAYG systems, but is likely to be less important when tax rates are not high, which is most likely when the population is young and only a relatively small proportion of the population are elderly dependents.

2.4 Direct effects on growth

Barr (2000) argues that there are three steps whereby funding could induce economic growth directly; first, pension reform may lead to a higher saving rate (Section 2.1). Second, the higher saving need to be translated into more productive investment (which requires allocative efficiency, notably via financial development see Section 2.2-2.3). Third, that investment results in an increase in output. He argues that all of these three links do not necessarily hold. We have highlighted above possible effects on saving as well as capital and labour market efficiency. In the latter context, adverse effects of pay-as-you-go on growth highlighted in Ehrlich and Kim (2005) may operate in part via negative effects on productivity from reducing human capital formation.

Davis and Hu (2004) used a dataset covering 38 countries to investigate the direct link between pension assets and growth, using the framework of a modified Cobb-Douglas production function with the inclusion of pension assets/GDP as a shift factor. A co-integrating relationship was found between pension assets, the capital stock per worker and output per worker where pension funds and output are positively related. In addition, impulse response tests in the related Vector-Error-Correction-Mechanism show that a rise in pension assets boosts output per worker initially and then follow a gradual decline, but during the whole specified period, the effect remains positive. The positive effect on output per worker of a shock to pension assets is larger in EMEs and also remains significant for longer. Furthermore, a positive average long run relationship between pension assets and output across

four countries is suggested by dynamic heterogeneous models and dynamic ordinary least squares models estimated with the same dataset. Davis and Hu's results are summarised in Table 1.

Complementing this, Hu (2005b) shows that Panel Granger Causality tests do indicate homogeneous causality from pension assets to GDP growth in 38 countries as well as in the subgroups OECD (18 countries) and EMEs (19 countries). Reverse causality is weaker, and notably for emerging markets there is no strong evidence that GDP growth homogenously causes pension assets.

3 Pension funds, demographics and economic growth

In this final part of the paper, we build on and expand the literature on pension funds and growth by focusing on the potential link of pension funds to economy wide total factor productivity in the light of demography. This is of particular relevance given that an ageing population will imply a shrinking workforce in many countries, putting a premium on productivity to maintain output and provide the resources needed to pay for the aged. Furthermore, higher productivity would mitigate the possibility of demand-inflation in the wake of ageing, owing to saving declines and tighter labour markets (Davis 2005a). Accordingly, we first review briefly the existing work on pension funds and productivity, and then look at extant work on demographics and productivity before undertaking some empirical work on this issue.

3.1 Pension funds and productivity

Holzmann (1997) found a positive relationship between pension reform and productivity in Chile. With the simple Solow residual specification of Total Factor Productivity (TFP), he found that improving financial market conditions following the pension funds reform significantly positively affect TFP. Meanwhile, Schmidt-Hebbel (1999) reached the conclusion that pension reform in Chile boosted private investment, the average productivity of capital and total factor productivity (TFP), even after allowing for the rise of each variable attributed to structural reform, (e.g. tax reform).

Hu (2005a) empirically analysed two relationships, first that between pension reform towards the World Bank model and TFP, and second that between pension fund assets and TFP. The logic of separating between reform and asset growth is that reform may have a signalling effect on expectations before assets are built up. Also some reforms do not generate assets (e.g. defined contribution PAYG). Data from 59 countries showed pension reform is negatively linked to TFP (as well as investment and GDP per capita) in the short run, and positively in the long run. This nonlinearity might reflect the fact that people need time to get used to dramatic changes in the public pension systems, and that such reforms may initially engender uncertainty. Where reform is voluntary,

it may for example take a few years to switch people to convert to private systems, i.e. after they are confident about the new system.

Meanwhile, a contemporaneous estimation (for 5 Year averages 1981-2000) favours a strong positive link between pension assets and TFP. Hu suggested that a direct effect (additional to that via financial development) might link to lesser labour distortions following pension reform, and pension funds' increasing participation in corporate governance, thus improving corporate performance at the firm level and economic productivity on the macro level.

3.2 Demographics and productivity

We now review the literature on demographics and ageing, as a counterpoint to work on pension funding.

Some authors suggest ageing slows technical progress as innovation becomes less profitable with a shrinking market for capital goods and owing to the lesser dynamism of an ageing population (Wattenberg 1987). This is consistent with the typical pattern of (manual) worker productivity found by most micro studies, namely that productivity peaks for workers in the mid-40s, declining thereafter (Skirbeck 2003). The extent to which this occurs may be even greater than shown by average wages because young workers tend to be paid less than marginal productivity and older workers more (Kotlikoff and Gokhale 1992). This pattern is confirmed by studies of productivity by age controlling for differences in underlying characteristics of age groups, such as education, firm tenure and plant vintage, as summarized in Australian Government Productivity Commission (2005). These micro studies typically show productivity peaking at between 35 and 40 years. Underlying this, human capital may be accumulated mainly in the early years (i.e. in formal education) and depreciate gradually thereafter, also older cohorts typically have less years of education than younger ones. Older workers may also be inherently less capable of certain (strenuous or intricate) tasks, as well as being less energetic and flexible (e.g. in willingness to move house for higher pay).

Not all studies agree on this point. Cutler et al. (1990) suggest that innovation increases as labour gets scarce. This is consistent with results of studies suggesting an inverse relation between labour force growth and labour productivity growth. Equally, if experience on the job is crucial for human capital formation then the depreciation suggested above could be reversed or at least attenuated.

Empirically, as noted by Sala-i-Martin (1997) the only demographic variables included in macro level growth regressions to that date were population growth and the dependency ratio. Work since then remains sparse and partly contradictory. For example, recent macroeconomic simulations of the global effects of population ageing (focusing both on changing population growth and age structure) such as

Turner et al (1998) of the OECD and McMorrow and Roeger (2003) of the EU Commission do not allow for a link of demographics to productivity. Indeed, it is suggested by Disney (1996) that there is no link detectable from ageing to productivity.

However, other studies have produced more positive results on a link of demographics to productivity. Lindh and Malmberg (1999) looked at the development of labour productivity over 1950-1990 using five yearly data from 21 OECD countries, in the framework of an age-structure augmented neoclassical growth model with gradual technical adjustment. Their estimating equation relates productivity growth to the investment share of GDP (as a proxy for the saving rate), the average growth rate of the work force, the initial level of GDP per worker relative to best practice in the US, and four age group shares in the total population, namely 15-29, 30-49, 50-64 and 65+.

Labour productivity was found to be affected by the age structure, with the group over 65 contributing negatively, while 50-64 was seen to contribute positively. Results were robust to inclusion of other standard variables used in cross country growth comparisons, namely financial development, education and trade structure. “The mechanism behind these age effects is yet to be resolved” they noted, however. Furthermore it can be questioned why the over 65’s which do not participate in the labour force should affect aggregate labour productivity (i.e. employment/GDP). Linking to this work but with a more restrictive formulation, several studies such as Bloom et al (2001) and Koegel (2001) have found a negative relation from the overall dependency ratio to productivity and growth. Persson (2002), like Lindh and Malmberg (1999) finds that the age structure of the whole population affects output.

Feyrer (2004) suggests that workforce composition rather than overall age structure of the population is the appropriate measure for determining productivity growth. His results for 87 countries using 5 yearly data over 1960-1990 suggest that changes in the proportion of workers in the workforce from 40 to 49 is associated positively with productivity growth. A 5% increase in the share of this cohort is associated with a 1-2% higher productivity growth over the succeeding decade. Unlike the work cited above, Feyrer highlights the risk of unit roots and focuses on results in first differences. However, he performs simple regressions of demographic factors on labour productivity and estimates of the Solow residual without any additional control variables, suggesting a risk of omitted variables bias.

Beaudry et al (2005) examine the relation between labour force growth and productivity in the light of the suggestion that there was a technological transition over the late 1970s to the 1990s. Their hypothesis is that the speed with which countries adjusted to the technological transition was linked to growth in labour force, and hence this factor is the main cause underlying differences in growth. Their study would seem to be more restrictive than some of their predecessors in not allowing for compositional as well as size effects of the labour force.

Using annual data for 7 OECD countries from 1950-1999, Davis (2005a) estimated simple causality equations for labour productivity growth and total factor productivity (TFP) growth (as well as inflation, growth and real house price growth) on their own lags in an ARMA process, together with three age structure variables (20-39, 40-64 and 65+, all as a share of total population), first in levels then in differences. In terms of levels, Davis found that over the last 50 years, in line with Lindh and Malmberg (1999), a high proportion of elderly persons has accompanied low productivity growth, implying further risks to performance as the population ages. This is true both of labour productivity and total factor productivity. This is despite the fact that a larger retired share of the population may entail a smaller labour force relative to the population, depending on trends in participation. With levels he found that there is no major differential in effects on productivity between the younger and older working age population, contrary to the idea that older workers are less adaptable. But for difference results the growth as well as the size of the elderly cohort exerts a negative influence on labour productivity and total factor productivity. Also there was a markedly greater positive effect on productivity of the 40-64 cohort compared with the 20-39 one.

3.3 Empirical work on pensions, demographics and productivity

In this section we report results of an empirical investigation of the relationship between pension funds and productivity on the one hand, and demographics and productivity on the other. In line with the pension fund studies cited above, we use total factor productivity as our measure of productivity, derived using the translog production function as described in Hu (2005).

We use annual data from 1960-2002 for 72 countries, of which 23 are OECD countries, 36 are EMEs and 13 are transition economies[13]. We thus capture the 1990s productivity growth acceleration that accompanied the dotcom boom as well as the 1970s productivity slowdown. The dependent variable is the average growth rate of total factor productivity over a five-year period, with other variables measured at the start of the five-year period concerned to capture initial conditions and avoid simultaneity and cyclical biases.

To capture the process of catch-up and convergence to best practice productivity, we include the ratio of income per capita in the US to the country concerned. Development indicators employed are the urbanisation rate (as in Samwick 1999) and the level of real GDP per capita. We also include a 1973 dummy (set to 1 thereafter) to assess whether there was a permanent slowdown in productivity after the first oil shock. Following Lindh and Malmberg (1999) we adopt the 15-29, 39-49 and 50-64 age groups as a proportion of the population – the residual is the dependency ratio. The pension variable

[13] Data are from World Development Indicators and the Financial Structure and Economic Development Database. I am indebted to Yu-Wei Hu for use of the data he has collected.

chosen, in line with other studies, is the stock of pension fund assets as a proportion of GDP. Meanwhile, to capture financial development per se, we utilise the ratio of bank credit to the private sector to GDP. Equations were run by GLS fixed effects estimation. Three specifications were tried, one with demographics only, one with pensions only and one with both.

As shown in Table 2, there is a marked demographic effect on productivity and also from pension fund assets/GDP. We have run the three regressions for each subset – all countries, EMEs (including transition economies) and advanced OECD countries (we included Korea, Mexico and Turkey in EMEs). The GDP per capita variable is significant for all countries and also for EMEs, with a significant negative sign, whereas the variable is small and/or insignificant for the OECD countries (where GDP per capita is more comparable). Countries with a lower level of development have faster TFP growth, especially those with the lowest incomes (Beck and Levine (2004) obtain a similar result). A similar story is told by the "catch-up" ratio of national to US GDP per capita - this variable is most significant for the advanced countries. Technology transfer may be more direct from the US to the OECD countries than to poorer ones. Third, the urbanisation rate is significant and negative, again notably for EMEs. Possibly, urbanisation per se in poorer countries is not conducive to technical advance, given that initial stages of development entail many workers being in shanty towns and the informal sector of the economy. Then the bank credit variable is also always negative (a similar result was found by Hu (2005)), even when pension funds are omitted. This is contrary to the idea that bank-based financial intermediation aids growth. The 1973 dummy is significant for the OECD countries but not the EMEs, where a similar regime shift in productivity growth is not apparent.

Note that although the above results are of interest, the main reason for their inclusion is to correctly calibrate the demographics and pension fund variables, and ensure their significance does not just reflect omitted variables bias. Turning to the variables of interest, we see that pension funds are significant in boosting productivity in all cases. The effect shown is considerably larger in EMEs than OECD countries (by a factor of 8 or so) but always significant for the latter also. Inclusion of the demographic variables reduces the size of the pension variable but does not make it insignificant.

As regards the demographic variables, we see differences between OECD countries and EMEs. In the OECD countries, there is a clear pattern whereby the size of the 30-49 year old generation is most favourable for productivity growth, while the younger 15-29s have a smaller or insignificant effect, and the older 50-64 generation has a zero effect. The implication is that an ageing of the workforce will slow productivity growth in the OECD countries, other things equal. In EMEs the younger generation aged 15-29 has a negative impact on productivity growth, perhaps reflecting lack of training, while as for the OECD the 30-49s have a significant positive effect. The older group from 50-64 has a zero effect without pension funds, but a positive effect with them, which indeed exceeds that for the 30-49s. This could reflect the fact that greater longevity is an indicator of economic efficiency

for EMEs that is not captured by GDP per capita. The EME effect carries over into the all-countries demographic coefficients.

Although further investigation of this relationship is warranted, taking the results at face value, there will be a negative effect of demographic structure of the workforce on productivity in OECD countries that can be offset at least to some extent by pension funding. As EMEs develop their pattern may become more like the OECD countries, implying that they too will suffer adverse compositional effects in the labour force, while pension fund growth has a yet more positive impact on productivity in EMEs than OECD countries.

3 Conclusions

Summarising our work, we first assessed whether a shift from PAYG to funding is largely an accounting matter concerning the allocation of the burden of ageing, or whether funding improves economic performance. We addressed several aspects to this question. One is whether funding leads to an increase in saving which permits higher capital formation. Evidence is strongest for personal saving and emerging market countries. For national saving, empirical results are mixed, and the ultimate impact depends on whether tax or debt finance is chosen to deal with the transition burden. A second issue is whether, independently of the impact on saving, there are effects of funding which lead to higher economic growth via more efficient capital and labour markets.

Our literature survey has indicated that pension reform has strong impacts on capital markets in both quantitative and qualitative matters, again notably in EMEs. The benefits of funding on the qualitative side, among others, include financial innovation, and improvements in the “architecture of allocative mechanisms”. There may also be costs, in terms of financial instability affecting the risk premium, and in the case of a financial crisis entailing direct output losses. In addition, pension reform toward funding leads to lesser labour market distortions, to an extent that depends notably on the degree of actuarial fairness between pension contribution and retirement benefits. A third aspect is whether a direct impact of funding on growth can be discerned. Research on this issue is sparse but broadly favourable. On balance, a direct link between funding and saving/growth has been justified theoretically and validated empirically, across both advanced OECD countries and EMEs, albeit more strongly in the latter.

In the third section we undertook empirical work focusing on the nexus of pension funds, ageing and productivity. Does ageing lead to lower productivity, and can pension funds ameliorate the situation? Using data for 72 countries, we found positive results for pension funds’ impact on total factor productivity, allowing for conventional factors affecting it. We also found an offsetting negative effect on productivity from ageing, which funding is able at least partly to offset, if past relationships

continue to hold. The overall implication for policymakers is that early pension reform towards more funded systems is warranted, not only for fiscal reasons but also in view of benefits to economic growth that funding can bring.

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Table 1. Summary of significant effects of log pension assets/GDP on log of output per worker

Method/specification	All	OECD	EMEs
Dynamic OLS			
1 lead/lag no trend	+	+	+
1 lead/lag with trend	**Ins**	+	+
2 lead/lag no trend	+	+	+
2 lead/lag with trend	**Ins**	+	+
Heterogeneous panel			
Method 1 all countries trend	+	**Ins**	+
Method 2 all countries trend	+	**Ins**	+
Method 1 subset trend	+	+	+
Method 2 subset trend	+	+	+
Method 1 all countries no trend	+	+	+
Method 2 all countries no trend	+	+	+
Johansen			
All without trend	+		
All with trend	+		
Panel 1 without trend		+	+
Panel 2 without trend		+	+
Panel 1 with trend		+	+
Panel 2 with trend		+	+

Source, Davis and Hu (2005). Note: Ins=insignificant

Table 2: Estimates of pension fund and demographic effects on aggregate productivity
(Dependent variable, five year average of TFP growth)

	ALL			EME			OECD		
GDPPC(-5)	**-0.029 (2.4)**	**-0.059 (3.3)**	**-0.029 (1.8)**	**-0.16 (2.5)**	**-0.2 (2.6)**	-0.11 (1.6)	**-0.04 (2.9)**	-0.021 (1.3)	-0.0013 (0.1)
USREL(-5)	**-0.24 (5.1)**	**-0.204 (3.2)**	**-0.22 (3.5)**	-0.11 (0.6)	-0.2 (1.0)	-0.26 (1.3)	**-0.11 (2.8)**	**-0.15 (2.9)**	**-0.2 (2.3)**
URBAN(-5)	**-0.03 (4.5)**	**-0.038 (4.4)**	**-0.024 (4.0)**	**-0.029 (3.2)**	**-0.032 (2.2)**	**-0.023 (2.6)**	-0.0047 (0.5)	**-0.019 (2.8)**	-0.015 (1.5)
15-29 (-5)	**-0.0037 (2.1)**	-0.003 (1.5)		**-0.008 (2.9)**	**-0.0062 (1.8)**		**0.0056 (2.8)**	0.026 (1.2)	
30-49 (-5)	**0.0056 (3.4)**	**0.0079 (3.5)**		**0.0076 (2.9)**	**0.008 (2.3)**		**0.011 (4.5)**	**0.067 (2.4)**	
50-64 (-5)	0.00037 (0.1)	**0.0095 (2.2)**		0.011 (1.3)	**0.018 (1.9)**		-0.0065 (0.2)	0.026 (0.7)	
D73	-0.098 (1.0)	-0.0067 (0.1)	**-0.022 (2.1)**	0.017 (1.3)	0.014 (0.9)	-0.014 (1.0)	**-0.068 (5.5)**	**-0.059 (2.1)**	**-0.059 (4.4)**
BANKGDP(-5)	**-0.0081 (4.8)**	**-0.0079 (3.7)**	**-0.0076 (3.6)**	**-0.0097 (3.7)**	**-0.0091 (2.7)**	**-0.0084 (2.5)**	**-0.0057 (3.2)**	**-0.01 (4.8)**	**-0.01 (5.1)**
PFAGDP(-5)		**0.08 (1.9)**	**0.13 (3.2)**		**0.39 (2.8)**	**0.59 (4.7)**		**0.057 (2.0)**	**0.074 (2.8)**
R2	0.49	0.45	0.44	0.45	0.44	0.43	0.47	0.37	0.37
COUNTRIES	70	68	68	47	47	47	23	21	21
OBS	1858	1578	1580	1177	1015	1019	647	554	557

Key: GDPPC: Real GDP per capita, USREL: Ratio of national GDP per capita to that in the US, URBAN: urbanisation ratio, 15-29 share of 15-29 age group in total population, 30-49 share of 30-49 age group in total population, 50-64 share of 50-64 age group in total population, D73 dummy for the period since the first oil shock, BANKGDP, ratio of bank credit to GDP, PFAGDP, ratio of pension fund assets to GDP