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Pension Reform, Economic Growth and Financial Development - An Empirical Study

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Abstract:

Pension reform is one of the biggest challenges facing national governments. How to reform the old pay-as-you-go (PAYG) systems is still under hot debate; one of the most influential funded pension schemes is designed by the World Bank. In the second chapter of this paper, we first review the arguments for and against the PAYG and then critically discuss the World Bank model by drawing on related literature. The third chapter of this paper presents our empirical results. Regarding the link between economic growth and pension reform towards World Bank model, our panel estimation suggests a negative relationship in the short run and positive relationship in the long run, although the results for OECD countries are not very statistically robust. The second empirical work is focused on pension fund assets and economic growth. A positive link between these two variables is found by our standard economic growth specifications; in addition, there is evidence that pensions are a good predictor of economic growth. This result is then consolidated by our Panel Granger causality test. The last empirical work deals with the relationship between pension assets and financial development. On balance, our Panel correction model and Panel Granger causality test suggest that pension funds growth leads financial development, although some sub-group estimations are not strong. In addition, there is evidence that traditional banking industry is declining relative to other financial institutions, but not, even increasing relative to the economy.

Key words: Pension reform, Pension fund assets, Pay-as-you-go, Panel error correction model, Granger causality test

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1 Introduction

The world is aging!

The current global demographic change towards population aging is becoming more apparent. Table 1 reveals that although the world total dependency ratio will drop from 65 per cent to 57 per cent during the period of 1950-2050, the elderly dependency ratio is expected to rise from 9 per cent in 1950 to 14 per cent in 2020, then further to 25 per cent in 2050, a 3 fold increase in total. The trend is more obvious for More developed regions (MDRs) than Less developed regions (LDRs), in that by the mid of this century, the elderly dependency ratio for MDRs is 44 per cent, 2 times higher than the then elderly dependency ratio for LDRs. This long term trend of population ageing across both developed and developing countries is largely caused by rising life expectancy and declining fertility rate (Munnell 2004; House of Lords 2004). Figures 1 and 2 indicate that over the 100-year period from 1950-2050, women have less babies and people live longer. It is anticipated that by 2050, people in MDRs will live up to 81.6 years old while those in LDRs live up to 73.1, a sharp increase from the middle of last century.

Mainly due to rising longevity and declining fertility rate as well as the unfunded nature of PAYG systems, most governments in both OECD countries and Emerging market economies (EMEs) are facing financial difficulties. Public pension systems' generosity also contributes to the current rising public pension liability, i.e. excessive pension benefits have been granted to retirees (see Section 2.1.2.4 for details). Disney (1999a) presents a projection of public pension liabilities across a range of OECD countries. For some countries, e.g. the US where the population is relatively young, public pension payments as percentage of GDP is projected to increase from 4.1 per cent in 1995 to 6.6 per cent in 2030. But on the other side of the spectrum, e.g. Italy this figure was 10.6 in 1995 and 20.3 in 2030. In addition, a recent EU report reveals that public pension expenditure in EU-15 on average amounted to 10.4% of GDP as of 2001 but will peak in 2040 at the level of 13.6 per cent (Oksanen 2004).

Regarding EMEs, except for several Central and Eastern countries (Holzmann et al 2001), the magnitude of public pension liabilities is generally less due to younger population and smaller pension coverage. It is shown that across 35 low and middle income countries, pension spending was at the range of 1 – 5 per cent of GDP for most countries as of 2000 with Uruguary having the highest ratio of 14 per cent (Holzmann et al 2004). The long term demographic transition in EMEs, however, indicates the existence of financial difficulties of unfunded PAYG systems as well. And in some cases, it even leads to the bankruptcy of existing PAYG systems following financial crisis (Queisser 1999), e.g. Argentina in 1994.

Therefore, financial substainability of PAYG systems combined with the prospective ageing population across the world, has led many countries, including both OECD countries and EMEs, to re-think their pension systems. Typically, they switch partially or wholly from unfunded systems, e.g. PAYG to funded systems. Pension reform given its complexity, however, can have potential impact on various aspects of the economy. In particularly, the possible relationship between pension reform,

economic growth and financial development has been receiving great attention from both academia and policy makers across the world.

In general, pension reforms which introduce element of funding can have a positive impact on financial market development because following such pension reforms, the functions of financial markets are improved (Davis 1998). For example, financial systems' function of managing uncertainty and controlling risk could be strengthened with pension funds growth as pension fund managers as portfolio professionals have better expertise knowledge than individual investors.

How pension reform is linked to financial markets development is widely analysed in current literature. Davis (1995, 2000a) presents the impact of pension funds growth on European capital markets, while Walker and Lefort (2002) study the same issue across emerging markets. On balance, a positive relation between pension funds growth and financial development is found. We will discuss this issue in detail in Section 2.2.3.2.

The relationship between pension reform and economic development also is well documented. Holzmann (1997) finds a contribution of pension reform to Chilean economic growth as well as financial markets. How pension reforms contribute to the saving rate is analysed by many researchers (Poterba et al 1996; Disney et al 2001). But the results are mixed. Concerning pension reform's impact on other aspects of the economy, e.g. labour supply, there is also hot debate with mixed findings (Disney 2003; Bosworth and Burtless 2004a). Regarding pension funds' direct economic implications, e.g. via corporate governance, however, the current literature is relatively sparse, although Davis (2003a) looks at pension funds plus other institutional investors and economic performance across 17 OECD countries and finds a positive correlation between pension funds' share of equity and several economic variables.

Regarding the contributions of this paper, we seek first to examine the relationship between pension reform, economic growth and financial development in a more comprehensive - given that pension reform is so complex that it has impact on various aspect of an economy - and consistent than the current literature way. Most current work focuses on only one aspect in one paper and normally different papers have different datasets and econometric specifications. So in this paper, we use the same and larger data set and consistent methodologies to identify pension reform and pension funds' impact on various aspects of the economy, in order to ensure the results' consistency and comparability.

Second, one main weakness related to current literature is that most current empirical work focuses on either emerging markets, notably Chile, or developed, e.g. OECD countries, therefore the findings derived from existing studies might suffer from the drawback of incompleteness. Developed and developing countries are in their different development stages, therefore pension funds growth might entail differential impacts. As Diamond (1995) points out, though the contribution of funding to financial sector growth is not an argument for OECD countries, it is potentially relevant in transition and developing countries. This paper intends to fill in this gap.

Third, many researchers confuse or do not distinguish pension reform and pension funds. These two concepts are closely linked but not identical. In other words, pension

reform does not simultaneously mean pension funds growth, notably in the case of defined contribution PAYG reform; there might nonetheless be a positive effect on the economy. In addition, it might be argued that pension reform provides people with expectations that pension funds will increase and PAYG systems are not sustainable in the long run. Therefore pension reform, particularly towards funded systems could have potential effect, independent of pension fund assets. Hence, in this study, we isolate these two concepts, i.e. pension reform and pension funds, and investigate their contributions to economic growth and financial development separately.

Last, we use various econometric specifications, e.g. panel error correction model and an extension of panel Granger causality tests to look at the long run and short run relations. We view panel analysis as appropriate given the lack of the satisfactory length of dataset about pension funds in many individual countries; also one reform alone cannot give statistical significance.

The rest of this paper is organised into three parts. Part one, as a literature review, first presents the arguments for and against PAYG systems, then critically discusses the World Bank model. In the second part, we undertake empirical work to see how and the extent to which pension reform, pension funds, economic growth and financial development are linked together. The last part concludes this paper.

2 Literature review

2.1 Pay-as-you-go pension systems

Largely since World War Two, mandatory public Pay As You Go (PAYG) systems have been widely adopted across the world (Schwarz and Demirguc-Kunt 1999). Such social security systems are mainly financed through payroll taxes and managed publicly. A number of economic reasons have been identified to justify PAYG systems (See Appendix A for a summary of the basic economics of PAYG systems).

2.1.1 Arguments for PAYG

2.1.1.1 Problems of annuities markets

The annuities market is an important component of pension systems, but it suffers from informational asymmetry problems which plague any insurance market (Rothschild and Stiglitz 1976). Informational asymmetry as one type of market failure[1] in the real world is a very common phenomenon in that it induces well-informed parties with private information to selectively contract with less-informed parties, thus exploiting the latter.

One widely quoted example relevant here is that if it is voluntary to purchase annuities, people who know they would live longer enter into life annuity contracts with insurance companies, thus the latter suffers from annuitants' longevity risk. Awareness of this problem can drive up price of annuities for all individuals as they cannot be distinguished. For example, Poterba (2001) shows that adverse selection leads to a wedge between the effective price of an annuity which would be charged based on whole population's mortality table and the price charged to the representative annuity purchaser. In addition, one recent panel study on nine countries by Mitchell and McCarthy (2002) suggests that there might not exist 'active' adverse selection in annuities markets, but the hypotheses of 'passive' selection could not be rejected[2].

Annuities markets are available in many countries, but historically real annuity markets did not exist (Feldstein and Liebman 2001). Real annuity markets refer to those markets where the annuitants, e.g. the pensioners, could earn inflation-protected retirement payment. Despite the existence of real annuities markets now, e.g. the Treasury Inflation-Indexed Securities (TIPS) in the US (Sack 2002) and inflation-indexed bonds in the UK and Chile, indexed annuities are still not available in many

[1] The other two important types are externality and monopoly (Davis 2002a). In addition, moral hazard and adverse selection also plays a role.

[2] The difference between active and passive adverse selection is first identified by Finkelstein and Poterba (2002). Active adverse selection means that there is a direct relation between participation in annuities markets and private information of mortality, while passive selection refers to the indirect relation between participation in annuities markets and mortality, i.e. there is a direct correlation between employment and wealth – therefore participation in any insurance market – and mortality.

other countries, partly due to non-existence of indexed financial instruments, or are priced prohibitively (Davis 2002a).

The argument for social security pensions is that only government intervention into this market with PAYG systems could eliminate this problem, as pensioners are all forced to participate in the PAYG systems and the benefits and contributions formula are much less linked to people's private information.

2.1.1.2 Inflation risk

Generally, there are three main classes of risks facing pensioners: mortality risk, investment risk and timing risk (Valdes-Prieto 1998).

Mortality risk means that pensioners might outlive their resources. Timing risk is the risk of changing exposure of any previous risk at an undesirable time. For example, a pensioner buys a fixed income portfolio just before interest rates increase. Investment risk is defined as any risk which might affect the purchasing power of the accumulated pension assets. Inflation risk as well as share price volatility is an important contributing factor in this case.

PAYG schemes are generally able to protect pensioners from inflation (Barr 1998). The main underlying reason is that PAYG is financed by taxing the current working population while the funded schemes use the accumulated assets to pay out pensions. Obviously, the issue of inflation exerts a real problem for the latter case, not for the former. Pensioners could purchase inflation-indexed annuities to protect themselves in some way as discussed above, but they are available in only a few countries, and the insurers typically offer indexation up to a pre-specified level, e.g. 5 per cent in practice, the risk above which is still borne by the annuitants.

In addition, it should be noted that the advantage of PAYG over funding is less due to the method of financing per se than to the fact that only the state can guarantee indexed amounts (Barr 1998). For example, funded schemes could protect against inflation risk completely if they buy government guaranteed assets, but such a government promise is most likely paid out from the general tax revenues, i.e. still on a PAYG basis.

This is consistent with Davis's claim (1998) that it is the welfare-based arguments, e.g. myopia assumption (discussed shortly), rather than insurance-based arguments, e.g. market failure which justify PAYG retirement plans.

2.1.1.3 Myopia assumption

This assumption holds that individuals believe the government would not allow them to live in poverty, thus they gamble to save little, if anything, when young, then risk to fall into poverty when old. Diamond (1977) finds that in the absence of social security, a substantial fraction of the population would end up with insufficient amounts of wealth for their post-retirement period. A recent study by Davis (2003b) also indicates the inadequate retirement provision in the UK, in part due to the disincentive to save, e.g. the mean-testing systems.

Therefore, government, with the aim of countering this problem and acting as a trusted agent, collects funds together from current working population and then allocates them to current retirees, a practise commonly referred to as paternalism. It should be noted that the argument of paternalism is also frequently used to justify mandatory saving.

There are three elements underlying the paternalism (Kotlikoff et al, 1982). The first is the irreversibility of the retirement savings. For example, an individual cannot undo any previous consumptions simply due to changing tastes or because he/she need the money which otherwise is saved to cover the post-retirement costs.

Second, people are always reluctant to admit the possibility of forced early retirement or disability one day in the future, or simply long life. Particularly when such contingences are a long time away, then the utility costs of saving a certain amount of incomes just for these unlikely contingencies are greater than the corresponding gains from insuring against these remote contingences. Given this consideration, public pension system is therefore desirable.

Third, it is difficult for the individuals to make rational decisions because of the long lag between actions and consequences. Large number of uncertainties play an important role in this case. Therefore, individuals sometimes make inter-temporal consumption and saving decisions which are not correct, nor desirable. In fact, this myopia assumption also is one of underlying rationales in favour of compulsory savings as well as PAYG systems.

One recent survey study (CRR 2004), i.e. Retirement Confidence Survey (RCS) in the US shows that Americans are too confident about their pension coverage after retirement, when compared with another more comprehensive - therefore more representative/accurate - survey, i.e. Survey of Consumer Finances (SCF) sponsored by the Federal Reserve (2001). For example, RCS suggests that 75 per cent of respondents think they or their spouse will have pension coverage, while the SCF only indicates a 57 per cent of respondents taking the same view. In addition, the RCS gives evidence that survey respondents think they are saving more than they actually.

Bodie and Crane (1997), however, find that individual investors are rational, in that they invest more in proportion of their wealth on safer assets, e.g. bonds and cash when getting older, in line with financial theory. Also, a recent study suggests that individual's asset allocation pattern is consistent with tax-minimising behaviour in the US (Barber and Odean 2004).

2.1.1.4 Redistribution

Government always stand as back-up for her people. Regarding pension systems, it is not an exception. Hence, one of justifications favouring PAYG is that government should distribute income to disadvantaged people[3], be they old or disabled, so as to protect them from suffering (Liebman 2001).

[3] It should be borne in mind that under PAYG systems, what current pensioners received is the funds paid by current workers in the form of payroll tax, rather than the revenues collected by government from pensioners when they were working.

A pension scheme has redistributive effects through three channels, i.e. redistributions from young to old, from rich to poor and from men to women (Barr 1998).

The redistribution from young to old is also frequently referred to as Intergenerational Transfer. It argues that parents make investment in the human capital of their children, by means of education for example and earn return from children when parents are retired and children working (Pogue and Sgontz 1997; Becker and Murphy 1988). Given that children are too young to be parties to a legal contact, government should provide some mechanism, e.g. via PAYG to guarantee this intergenerational transfer to incur. PAYG indeed enables one generation as a whole to receive more than the sum of its past contributions.

The second distributive effect is from rich to poor people, also referred to as Intragenerational Transfer. For many state public pension schemes, the individual A with half income of the individual B normally has more than half pensions of the individual B. Pension Policy Institute (PPI) (2003a) reports that redistribution from workers to poorer pensioners has increased, i.e. the proportion of pensioners in the bottom fifth of the UK's overall income distribution dropped from 47 per cent in 1979 to 26 per cent in 2001/2. Therefore, pensioners do not always tend to be the poorest. On the contrary, single mothers (Johnson et al 2003) and people in non-standard employment (PPI 2003b), among others, are disadvantaged compared with other groups.

Despite this redistributive purpose, however, in the UK there is a growing income inequality among pensioners; the top 20 per cent get on average 87 per cent of average earnings, while the bottom 20 per cent get only 21 per cent of average earnings (Davis 2003b).

Although the mechanism of income tax might have the same effect (Orszag and Stiglitz 1999), or in other words, we do not have to require a PAYG aiming for this redistributive purpose, the existence of differential mortality to some extent offsets the PAYG's tax effect in this context. The reason is that the rich typically live longer than the poor, hence they contribute more but have more time to claim pensions. The main reason, however, has been suggested to be the political framing (Lindbeck and Persson 2003), i.e. from the perspective of political considerations, pension reform might be a more feasible choice for redistribution than general fiscal policy.

The third distribution channel from the men to the women has the same underlying reason as above, i.e. women live longer than men. We simply talk about the issue of intragenerational transfer again but by another dimension. It has been found and worth noting, however, that women in aggregate are under-pensioned in the UK (PPI 2003b; House of Lords 2004), i.e. they receive lower pension income than men; reasons include women are less likely to work full time than men and less likely to be in managerial and professional groups, etc.

Last, it should be emphasised that funded pension systems, e.g. funded defined benefit schemes could have the redistributive effects as well, but the magnitude of such effects is less in comparison with PAYG (Barr 1998) and largely dependable on how the first pillar in the funded systems is designed.

2.1.1.5 Administration costs

Administration costs charged during pension assets accumulation process play an important role in determining how high a pensioner's benefit will be during retirement. It has been estimated that as for two hypothetical individuals, one percent difference of administrative charge when added up over a 40-year work horizon could lead to 27 per cent difference of pension assets when they retired (Bateman et al 2001).

Experience from Australia suggests that the least costly funded pension design is occupational Defined Contribution (DC) plan, while the occupational Defined Benefits (DB) plan and retail pension plans are more costly by the range of 30 – 70 per cent (Bateman and Mitchell 2003). From the point of view of economics, transaction costs associated with private pension schemes are high. And comparatively, government-oriented PAYG programme is much cheaper, because the government enjoys the greatest economies of scale in administration costs (Diamond 1993).

For example, it has been found that the US social security incurred administrative charges at the order of 15-20 US dollars per year per covered employee in comparison with 24 dollars in Malaysia and 30.4 dollars in Chile (Vales-Prieto, 1994). The differences in administrative costs are mainly due to the differential pension systems across these countries. The US social security is run on a PAYG basis, Malaysia offers the provident fund method, i.e. EPF (Employees Provident Fund) where there exists only one single fund (Bateman and Piggott, 1997), and Chile is the pioneer in running a privatised pension system (Diamond 1993).

Despite PAYG's justifications above, however, it suffers from a number of serious problems, thus underlining pressure for reform.

2.1.2 Arguments against PAYG

This section is closely linked to Section 2.2.3, so we will discuss in more detail in that sector shortly, but in order to keep our presentation on PAYG complete, we still briefly review a number of key counter-arguments against PAYG here.

2.1.2.1 Labour markets-supply

Social Security/PAYG systems have been suggested to have an important influence on people's retirement decision (Coile and Gruber 2000). Under PAYG schemes, working populations are taxed to pay current retirees, which induces them to retire earlier, or reduce hours worked, etc., since their pension payments are contingent upon the contribution from future generations and have nothing to do with their current contributions. In other words, the distorted link between contributions and pensions give disincentives for people to work, a problem always referred to as lack of "actuarial fairness" (Lindbeck and Persson 2003)[4].

[4] Actuarial fairness is distinct from actuarial balance. Actuarial fairness implies a close link between pension benefits and contributions at the micro-economic, i.e. individual levels, while actuarial balance (Diamond 2002) is a macro-economic issue where it refers to the pension system's long run viability,

The theoretical models designed by Disney and Whitehouse (1999) show that defined-benefit plans, which shares the distinguishing feature of PAYG schemes, a guaranteeing return, serve as a powerful incentive for employees to leave work as early as possible. This finding is confirmed in the US where workers with generous pensions, e.g. under PAYG plans, retire earlier than those with lower pension benefits (Gusman et al 1993).

Research by Corsetti and Schmidt-Hebbel (1997) and Packard (2001) finds that workers in the Latin American countries move from the informal sector to the formal sector in response to a funded pension reform; in other words, labour supply in formal sector remains at a lower level under PAYG systems and could be increased following pension reform.

Defined-contribution (DC) PAYG systems as introduced in Sweden, Poland and Italy, however, might be able to mitigate the problem of labour market distortion suffered by PAYG systems, in that there exists a closer link between contributions and benefits. We will revisit this issue again in following sections.

2.1.2.2 Labour market-demand

Product markets are very competitive. Any rational employer, therefore, aims to maximise profits. In light of this consideration, PAYG scheme is not the best choice for a country's competitiveness. This issue is particularly relevant for the so-called old industry, e.g. mining, car manufacturing, where there are much more retirees than those in other industries. Consequently, increasing proportion of firm profits has to been used to pay current pensioners.

In addition, under PAYG systems, employers are more likely to substitute capital for labour, thus giving rise to increase in unemployment rate or switching production to younger countries (James 1996). Meanwhile, PAYG systems have incentives for an informalization of production where the productivity is lower, as the population in the informal sectors is younger and it is easy for the employers to evade pensions contributions.

Disney (2003) argues that the distortionary "tax component" of public pension contributions can also affect labour demand if the employee can pass through the burden of pension contribution to consumers, for example via product prices if the market is not fully competitive. In consequence, the product demand falls and producers might consider reducing the demand for labour.

Another point that is relevant here is the "lump of labour fallacy". The lump of labour fallacy is associated with the idea that there is a fixed amount of work available in the world, so for any increase in the amount of work each person can produce, there is a decreasing demand of labour. Given the rapid technological advances since World War Two, many governments intentionally, e.g. France's socialist government tried to create more jobs by reducing the length of workweek and encouraging earlier

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i.e. total contributions in aggregate are sufficient to pay pension benefits in a long run (Lindbeck and Persson 2003).

retirement by providing generous social security provisions, of which PAYG system is particularly relevant.

2.1.2.3 Redistribution

We mentioned in Section 2.1.1.4 that PAYG systems have a redistributive advantage over funding systems in that wealth is transferred from rich people to the poor. But due to some specific institutional arrangements in the real world, e.g. the pensioners' retirement benefits are based on last few years' salary under the PAYG systems, the function of redistribution is sometimes reversed from the poor to the rich, in that those in the highly paid jobs, e.g. senior managers are more likely to have a salary increased during their late years of career, while poor people, e.g. manual workers always have relatively flat salary over their working life. But it should be noted that this argument is only relevant to defined benefit PAYG systems and defined benefit funded systems where pensions are linked to final salaries (see Steurer 2003 for detailed classification of PAYG systems). If there is a benefit ceiling on social security, such worry should not be exaggerated. For flat PAYG systems, the purpose of redistribution within generations is well achieved.

In addition, rich people in aggregate normally live longer than the poor because of better living conditions and therefore lower mortality rate. In consequence, although the rich might contribute more during their working life if pension contribution is proportional of salaries, they get more from the PAYG systems by outliving the poor.

2.1.2.4 Political risk

PAYG systems are subject to political risk and there are four sources of political risk (Diamond 1994). The first one arises from the excessive benefits granted to people retiring when the population is still relatively young; this is exactly what has been taking place in many countries, where retirees could have very generous retirement benefits but this burden is becoming increasingly high. The second results from the excessive benefits promised to future retirees. This could happen, for example when politicians try to obtain more votes/support from voters who will retire in the future, but such promise is not viable in the long run.

The third is the excessive responsiveness of benefits to the short term condition of the government budget and the last one is the excessive responsiveness of benefits to the long term condition of the government budget. The last two risks are closely related to the government budget with one being short run and the other long run. These risks can happen if the pension systems are largely dependent on government financing. Therefore, if the government faces a budget constraint, they might consider cutting pension benefits or raising taxes. All these put pensioners at the risk of adverse government budgeting behaviour.

The political risk is suggested to be more common in developing countries given that politicians there are more likely to be irresponsible, therefore they change pension benefits and/or contributions formula frequently. Public pension systems in developed countries, e.g. the US and the UK, however, are not devoid of political risk either (Blake and Turner 2003). In the UK, the generosity of state pensions has been substantially reduced (Disney et al 2003), for example the basic state pension in 2001-

2002 was around 15 per cent of average male earnings compared with 20 per cent in the early 1980s.

2.1.2.5 Saving rate

Another common argument against PAYG holds the view that personal saving is decreased under an unfunded system. The intuition is that people do not save much under PAYG plans since they think the government will always "bail out" them if they fall into poverty, a form of myopic situation as shown in earlier section. Also, it is maintained that many people view social security systems as implicit wealth if they are confident about their ability of getting benefits later. Therefore, if contributors to public systems perceive they are entitled to secure benefits when retired (Disney 2003), they reduce discretionary savings accordingly.

Empirical results, however, are mixed. Several comprehensive literature reviews (Kohl and O'Brien 1998; Schmidt-Hebbel 1999) show that some studies find a non-significant relationship between social security wealth and personal saving, while some others do reveal the expected negative relation. For example, Feldstein (1977) argues that the public social security programme in the U.S. effectively reduced total private saving by 38 percent and total personal saving by nearly 50 percent during 1960s.

2.1.2.6 Implicit debt

A PAYG programme, by definition, is unfunded. This feature implies that the government has to make up the budgetary hole or implicit debt once pension benefits could not be covered by the accumulated payroll taxes collected. Although the government could increase the contribution rate or reduce the replacement rate, obviously they both are always politically sensitive, particularly because the contribution/replacement rate might have to be raised/reduced to a prohibitably high/level level when working population is very small relative to retired population.

Therefore, PAYG systems could go well during the period where the dependency ratio[5] is low, or in other words, the country is very young. However, when the country is aging as now, this implicit debt problem does adversely affect the net benefit of PAYG retirement plans.

It has been argued that demographic changes should not bear all the blame for the current pension crisis (Persson 2002). The combination of both demography and non-actuarial benefit rules is the main reason. So as long as PAYG is designed on an actuarial basis, our worries on PAYG's unsustainability should be eased. For example, several countries, e.g. Sweden, Italy and Poland have tried to implement Notional Defined Contribution (NDC) systems[6], one main benefit of which is the

[5] Dependency ratio = number of people aged over 65/ number of people aged between 16-65.

[6] With NDC systems, individuals have private accounts which are credited by their contributions and from which they withdraw their pensions when retired. But it should be noted that these accounts are still notional/unfunded and current pension contributions are used to pay current retirees' pensions. Largely due to this point, it has been argued that NDC systems might have positive effect on microeconomic side, e.g labour supply but have less impact on macroeconomics so it cannot be a substitute for funded systems (Borsch-Supan 2003).

close link between pension contribution and benefit and thus more sustainable compared to traditional PAYG systems (Disney 1999b and Williamson and Williams 2003). This model, however, may still have a deficit at macro-economic level, as by definition, it is unfunded. One innovative element of Swedish pension reform is the indexation rule where both the age of retirement and life expectancy are taken into account when calculating pension benefits, the main purpose of which is to position Swedish new pension system better to meet the liability in the long run (Scherman 1999 and Palmer 2000).

2.2 Pension reform-World Bank model

Given the problems related to traditional PAYG systems, economists, policy makers and different multinational organisations around the world have sought to find appropriate old age provision schemes.

The most influential one might be the multi-pillar pension systems designed by the World Bank (Holzmann 1999a; James 1998). However, partly due to the different mandates from those of various other international organisations, e.g. International Labour Office and International Social Security Association (James 1996; Queisser 2000; Gillion 2000), but also from academics and other commentators, the World Bank model has received a considerable critical literature (Beattie and McGillivray 1995; Singh 1996; Kotlikoff 1999).

In this section, we first present the World Bank model, then review pension systems across the world based on our 72 sample countries; last, different arguments regarding the World Bank model are discussed.

2.2.1 Features of World Bank model

The World Bank model comprises three parts:

- A mandatory, publicly managed and tax-financed pillar for distribution
- A mandatory, privately managed and fully funded pillar for savings
- A voluntary pillar for those who want more protection for their post-retirement life

The first pillar resembles the old public unfunded system, principally aiming for redistribution function of social pension as we discussed earlier. In other words, tax-financed funds are used to provide a minimum income level necessary to old people.

Under this heading, there are three variant schemes. The first one is a flat pillar as in the UK, called the basic state pension whereby people receive universally the same benefits after they retire[7] (Whitehouse 1998). There could also be a minimum pension guarantee as in Chile (Godoy and Valdes-Prieto 1997) where the state guarantees a

[7] At the moment in the UK, men need 44 and women need 39 qualifying years to receive full basic State Pension which is universally the same. The qualifying year is the year when national insurance contributions are paid. If qualifying year is less than 44 for men and 39 for women, pensions received are reduced accordingly.

22-25 per cent of the average wage to workers who have contributed to the mandatory systems for at least 20 years.

Last, mean-tested plans are implemented in several countries as in Australia. Supporters of mean-tested proposal argue that government should only pay benefits to those who lack private assets or pension income for post-retirement life, rather than allocate public fund equivalently to every individual regardless of their financial condition as under universal security programme[8] (Feldstein 1987).

The second pillar, as the main ingredient in this innovation plan, shares similar characteristics to defined contribution (DC) plan, whereby the compulsory plan is fully funded and funds are competitively managed by asset managers following the profit maximisation principle.

The third pillar serves as a complementary scheme, targeting those people who want more retirement income after they retired from work.

Given that the most innovative part of the World Bank model is the second pillar, we briefly outline the associated acclaimed merits.

Merits of the Second Pillar

Why mandatory?

Given that people are always short-sighted or simply because they do not have sufficient information to anticipate what will happen in the future, it is advisable to force people to participate in pension schemes. It should be noted that mandatory contribution is also a feature of PAYG systems. Three factors identified by Kotlikoff et al (1982) to justify myopia assumption as shown in Section 2.1.1.3 are relevant here, i.e. irreversibility of the retirement savings, reluctance to admit the possibility of long life and difficulty of making rational decisions.

Why privately managed?

If funds are managed by the government, political corruption often follows. For example, the government, with the purpose of either financing fiscal debt, or reducing investment risk, might ask funds to buy government bonds, which is not always desirable from the economic point of view (Mitchell and Hsin 1997; Mitchell 1998), as government bonds are vulnerable to inflation. Moreover, publicly managed funds are easily engaged in politically natured investments, e.g. infrastructure projects (Vives 2000). If privately managed, funds could alleviate such political corruption as well as inflation risk, thus achieving a higher real rate of return.

Why defined contribution?

[8] However, the existence of adverse selection might imply that people deliberately over-spend before retirement, and then become eligible for mean-tested scheme (Feldstein and Liebman 2001). Also means-tested plans, e.g. in the UK are a disincentive for saving (Davis 2003b), partly due to the myopic reason as we pointed out in section 1.1.3.

Neither the State nor firms could promise to pay guaranteed returns to employees in a financially and actuarially sensible way in the long term (Clark 2002). Therefore, a defined contribution programme is needed, which in turn subjects employees to investment risk and uncertainty.

DC, given its characteristic of actuarial fairness, introduces the strong linkage between contribution and benefit as we briefly talked about earlier. In consequence, the inherent problems associated with PAYG and DB funded systems, e.g. earlier retirement, evasion could be solved or at least mitigated, therefore having economic implications, such as productivity increase.

Why fully funded?

In Section 2.1.2.4, we noted four sources of political risk by Diamond (1994), often arising from the irresponsible and insensible promises from politicians. Prefunding makes the costs clear up front so that politicians' tendency to make promises today which could not be kept in the long term is largely reduced. Second, inter-generational transfer is eliminated, since based on fully funding, people receive what they contributed, plus accumulated profits, after they have retired. In other words, the linkage between contributions and benefits is strengthened. Third, the increase in payroll tax and drop in replacement rate are avoided which otherwise are two options for politicians to delay financial crises under PAYG systems. Fourth, as revealed in Section 2.2.3.2 following, funded systems are beneficial to the development of capital markets as happened in Chile and other countries (Holzmann 1997 and Davis 1995, 1998 and 2003c). The issue will be treated empirically in Part Two, where on balance we found a positive link between pension reform and financial market development.

2.2.2 Pension systems and reforms across the world[9]

Since 1994, when the World Bank's *Averting the Old Age Crisis* was first published, many countries around the world have been shifting towards the three-pillar systems, although the actual designs of pension systems differ across countries. In addition, other pension systems, e.g. notional defined contribution (NDC) systems have been designed and implemented in several countries as well.

The successful introduction and implementation of a private pension system in Chile around 25 years ago has attracted great attention from academics, international organisations and governments. Following Chile, many Latin American countries have introduced or are considering a transition towards the Chilean model, i.e. privatising old public social security systems. Among those countries are Argentina (1994), Bolivia (1997), and recent examples include Costa Rica (2001), Dominica Republic (2003) etc. All of these countries could be defined as structural or systemic reform countries (Mesa-Lago 2002). In other words, they radically changed the public pension system by either replacing it with private schemes or introducing the private scheme which is a significant component of the whole social security systems. In

[9] The discussion of this section, particularly the specific years of reform regarding each country are compiled from a variety of sources, including review papers, national sources, etc. Two of those sources which are in particular helpful and comprehensive are regional survey papers from Vols. 54, 55 and 56, International Social Security Review (2001, 2002 and 2003) and one World Bank paper from Schwarz and Demirguc-Kunt (1999).

contrast, non-structural reform or parametric countries are defined as those which only improve the financial sustainability of the public systems in the long run, e.g. by raising the pensionable age and tightening eligibility etc. A number of countries in Latin America implemented a parametric reform, e.g. Brazil which has nevertheless been considering introducing a systemic reform.

Some countries in Central and Eastern Europe have followed the World Bank model recently, for example Bulgaria in 2000, Croatia in 2002. Moreover, Czech Republic (1994) and Hungary (1997) are two of first pioneers in this region to start implementing structural pension reforms.

Regarding OECD countries, pension reform is less radical compared to Emerging markets. However, some countries, e.g. UK, Switzerland and the Netherlands have been privatising their public systems for a relatively long time. For example, in the UK "Personal pensions" – individual saving accounts similar to IRAs in the US were introduced in 1988. Australia has also privatised its pension systems recently. Many other OECD countries have only conducted parametric pension reforms which are largely focused on raising retirement age, cutting pension benefits, etc. Example of these countries include Germany, France and Norway, etc. Regarding African countries, all of our sample countries are still at the stage of Pay as you go (PAYG) systems, although a number of countries, e.g. South Africa conducted parametric reform.

Beside the PAYG and World Bank models, there are two other important pension systems. The first one is Provident Pension Fund systems, which are mainly set up in former British colonies, e.g. Singapore, Malaysia, etc. A recent example is in Hong Kong which implemented Mandatory Provident Fund Scheme in December 2000 (MPFAHK 2004). Currently around 20 countries operate such schemes (Bateman and Piggott 1997). The other is Notional defined contribution (NDC) system. This system was originally designed by Sweden but first introduced by Latvia in 1996. Sweden, Italy and Poland are three other countries implementing NDC system.

See Table 2 for a summary of pension systems and years of reform for all sample countries.

2.2.3 Debate on World Bank model

Despite the popularity of World Bank's multi-pillar model, the extent to which this model is better than previous plans and whether claimed advantages over PAYG are justifiable are still under hot debate. In this section, we divide current arguments into three categories under the headings of economic issues, financial issues, other issues respectively. In each subsection, we first introduce the arguments favouring the World Bank model, then present the counter-arguments.

Before moving on further, however, we would like to spell out briefly how pension reform, pension fund assets, economic growth and financial market development are linked together with the help of a simplified figure. In general, pension reform has its impact on economic growth directly via arrow a as shown in Figure 3, while pension funds mainly fulfil the same function both directly via arrow c and indirectly through financial markets via arrows d and e, as it has been widely suggested that financial

development are closely linked to economic growth[10]. Regarding the link with financial development, pension funds can have direct effect via arrow d on financial development which in turn affects economic growth via arrow e, while pension reform mainly imposes its impact via pension funds growth through arrows b and d. Figure 3, although very simplified, illustrates current mainstream arguments regarding the relationship between pension reform, pension funds, economic growth and financial development.

2.2.3.1 Economic issues

2.2.3.1.1 Labour markets-supply

As mentioned in Section 2.1.2.1, due to the weak link between pension contributions and benefits under the PAYG systems, there is a tendency towards earlier retirement and job immobility. It has been pointed out that during 1950-1970, there was a very sharp fall in the participation rate for those men over state pension age (65+) in EU countries (Disney 2002). For men aged 55-64, there was a sharp fall during 1970-1990, although this trend was less clear for women aged 55-64.

One contributing factor regarding this low participation rate of the elderly in European countries is the disincentives imbedded in public pension systems (Blondal and Scarpetta 1998). In view of such problems, Estelle James (1998b), the principal author of *Averting the Old Age Crisis,* has written: "the close linkage between benefits and contributions, in a defined-contribution plan is designed to reduce labour market distortions."

Empirical research on the benefits of a shift from the PAYG to funded systems is conducted by Packard (2001). In that paper, data covering a panel of 18 Latin American countries are used. Seven countries are defined as "reformers" if introducing a private pension account, and the rest as "non-reformers". His results show that in the long run, a transition from the PAYG to funded systems gives people the incentives to work in the formal industries by registering with the formal social security systems in Latin America, although there is a disincentive in the short run; this dynamics is explained that people in the reforming countries need time to adjust this change.

Regarding the issue of job mobility, recent empirical work by Disney et al (2003) shows that UK Pension reform from 1980s to 1990s was closely and positively linked to job mobility, i.e. people who opt out of occupational pension schemes (largely DC plans) and switch to personal pensions are more mobile than those who do not. But it might be the reason that those switching to personal pensions were mobile anyway.

Beattie and McGillivray (1995), however, mention that during the 1980s in Sweden where a very generous social security was provided, there was a higher participation

[10]The relationship between financial development and economic growth has been extensively analyzed. See Gallego and Loayza (2000) for Chile; Levine (1997) and Levine and Zeros (1995) for the international empirical evidence; Bencivenga and Smith (1991) and Li (2002) for the theoretical analysis. On balance, a positive association between financial development and economic growth is found.

rate for the population aged 60-64 in Sweden than in France and Germany[11]. Although this example is not sufficient to invalidate the argument that PAYG induces less labour supply, as there might be other driving forces in this case (James 1996), it does indicate the complexity of the relationship between PAYG and labour markets.

Moreover, this issue could become more complicated if we assume that the final aim of pension systems is not to enhance labour supply but to increase social welfare (Orszag and Stiglitz 1999; Barr 2000). Therefore, if the utility gains from earlier retirement exceeds the corresponding costs resulting from less labour supply, PAYG – related schemes are still welfare improving thus desirable. This argument might be correct but early retirement is very costly to the economy; Herbertsson and Orszag (2003) estimate that even if the current participation rate of the elderly does not decrease any further, the cost of early retirement across OECD countries would be 9.1 per cent of GDP in 2010, up from 5.3 per cent in 1980.

2.2.3.1.2 Labour market - demand

As we briefly discussed in Section 2.1.2.2, the underlying theory of how PAYG systems affect the demand side of labour market is that employers view PAYG contributions as one form of payroll tax, so they tend to replace labour recruitment with capital investment, therefore reducing labour demand.

Disney (2003) argues that public pension contributions can affect not only labour supply as we discussed in previous section, but also the demand for labour. The underlying rationale is that the employee can pass through the burden of pension contribution to consumers for example via product prices in the non-competitive product market; because if so, the product prices are higher than otherwise, then producers might consider reducing the demand for labour given the increasing labour costs. It is worth noting that in a labour market which is not fully competitive, wages are partially set by the trade union e.g. in continental Europe, and employers decide employment conditional on the wages. In other words, the labour market is not competitive if the trade union is strong and has power to bargain with employers. Then, it is not easy for employers to change, particularly reduce wages accordingly if labour costs are rising as what is likely to happen when pension contribution payment is obliged for employers. Consequently, employers will consider cutting labour demand as labour costs are high.

In most countries, enterprises are obliged to contribute on behalf of employees, and they normally view such contribution as extra taxes, although they might be able to reduce wages thus contributions if the labour market is competitive. This contribution's impact on labour demand is less obvious when such taxes are not large, which is most likely when the population is young and only relatively small proportion of whole population are elderly dependent. This situation, however, is changing as we discussed earlier, so ageing population will entail larger pension contribution from both employees and employers if purely relying on the public PAYG system. It is this reason which underlines the possible declining labour demand from enterprises.

[11] A recent simulation study, however, does indicate that if the generosity of social security systems is reduced by abolishing early retirement program in Norway, participation rates for both males and females will increase by 5 per cent (Haugen et al 2002).

2.2.3.1.3 Private saving

The World Bank multi-pillar model claims that funded individual account is conducive to higher saving rate. Three relevant theories which capture people's saving behaviour are Life-cycle model, Bequest model and Precautionary motives model (Kohl and O'Brien 1998). The most prominent theory, i.e. life-cycle model (Ando and Modigliani 1963) is based on the assumption that people's primary motive for saving/dissaving is smoothing their lifetime's consumption. They normally accumulate assets during working life and decumulate assets when retired. The Bequest model assumes that individuals have a multi-generational time horizon, i.e. they try to maximise not only their own utilities but also their children's. If people when deciding their saving/consumption put more weight on factors which are uncertain, i.e. high health expenditures, it might be more appropriate to consider the theory of Precautionary motives.

We discussed in Section 2.1.2.5 that empirical results regarding the hypothesis of PAYG reducing personal saving are an array of results ranging from no effects, to negative and even positive effects. If the impacts of PAYG on savings, i.e. under the scenario of no pension reform, are not clear-cut, what would then this relation look like if we consider the reform scenario, i.e. the shift from PAYG to funded systems?

In principle, pension reforms generate increased saving via the following channels.

First, saving rate increases given that Ricardian Equivalence[12] does not hold, which implies that individuals would not reduce their discretionary saving or borrow money on a one-to-one basis for every one unit increase in the pension funds. There are two contributing factors, pension assets' illiquidity and credit constraint.

Due to pension assets' illiquidity, arising from the fact that pension assets normally could not be withdrawn for a long period of time, households do not view such claims as a perfect substitute for liquid savings, e.g. deposits. This argument is valid, for example, given that many pension laws prohibit pensioners from mortgaging their future pension benefits (Cifuentes and Valdes-Prieto 1997).

The existence of credit constraints to individuals, particularly to young people and lower income individuals in EMEs, is especially relevant in this case (Davis 2000b), in that any forced saving, e.g. pension assets could not be fully offset by corresponding decrease in discretionary saving or borrowing.

Second, pension reforms are always accompanied with tax incentives whereby pension assets are free of income and capital gains tax during the period of assets accumulation but assets decumulation is taxed (McCarthy and Neuberger 2004). This tax deferral arrangement is designed to encourage pension saving.

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12 Ricardian equivalence refers to the hypothesis that rational consumers will automatically adjust their personal saving and consumption inter-temporarily so as to smooth their current and future consumption (Seater J J 1993). Empirical woks, however, do not support this hypothesis by evidences from Domenech et.al. (1997) with 18 OECD countries and Edwards with Latin American countries (Edwards 1996).

Third, there might be 'recognition effect' as people who witness the transition of pension reform from PAYG to funded systems realise the importance of saving for retirement whether they are affected by such transition directly or not. In other words, even for those who are given the option to stay in the old pension systems and where the government honours previous benefits, such awareness regarding the pension crisis might encourage people to save more.

Empirically, the effect of IRAs (Individual Retirement Accounts) and 401(K) on personal saving behaviour in the US is widely documented. Poterba et al (1995, 1996) after controlling for household's heterogeneity, conclude that IRA and 401(K) are positive contribution to personal savings. For example, for families with both IRAs and 401(K) between 1987 and 1991, the mean total financial assets increased from $37,882 to $44,432 while there was no decline in their other financial assets. But Hubbard and Skinner (1996) argue that findings by Poterba et al might be biased upward, and the actual contribution to saving is positive but at a lesser extent.

A major empirical international study regarding the issue of pension fund assets and saving rate has been conducted by Reisen and Bailliu (1997), where they use data from 11 countries including both OECD and non-OECD nations. The empirical equation employed in that paper is a relatively simple single-equation regression model as follows:

$$Sav_{it} = \alpha + \beta X_{it} + \lambda W_{it} + \delta t_{it} + \varepsilon_{it} \qquad (1)$$

As usual, i and t proxy country (11) and time (1982-1993). Sav is the private/national saving ratio, X is the indicator of pension wealth (in either stock and flow form), W is vector of control variables, e.g. dependency ratio, real interest rate, etc. t is time trend.

Based on both Ordinary Least Squares and Two-Stage Least Squares estimation procedures, they give evidence that pension assets accumulation has a positive and significant impact on private savings, but such impact shows heterogeneity. For example, their estimations reveal that the impact is 8 times larger for non-OECD countries than OECD countries. But such a large extent of differentials across OECD and non-OECD nations might be a bit high. Therefore, more robust specifications are needed. In addition, they find that the relationship between national saving and pension funds growth is not significant. It might be due to the reason that the government running deficit offsets private saving at the national level.

Recent study by Bosworth and Burtless (2004b) indicates that across 11 advanced OECD countries, growth in pension and life insurance assets reduces private saving by crowding out other forms of and/or discretionary private savings. Their econometric model, however, is relatively simply specified, with only five independent variables, including dependency rate, unemployment rate, etc. In addition, their model is not sufficient to capture the dynamic nature of data generating process, although the lagged independent variable of pension assets is included.

2.2.3.1.4 National saving

Now we turn to the issue of national saving which include both private saving and public saving, where how pension reforming governments finance transition deficits,

i.e. implicit pension debts is crucial in determining the trend of national saving, even if private saving is increased. 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 not be changed or increased (Cesaratto 2003).

For example, a simulation study by (Hviding and Merette 1998) gives evidence that debt financed transition will not have material effects on national saving and output. All that has happened is that the government has altered the form of the debt (Orszag and Stiglitz 1999). However, if such transition deficits are partly financed by tax, it is more likely to increase national saving as public saving would not decline significantly given others equal.

In addition, James (1996), the principal author of *Averting the Old Age Crisis* argues that one main advantage of World Bank multi-pillar model is that national saving could be boosted. And Holzmann from the World Bank (1997) also gives evidence that aggregate savings in Chile grew with pension reform.

Moreover, Schmidt-Hebbel (1999a) estimates that pension reform in Chile spurs the national saving rate. Given the difficulty of pinning down how the pension reform was financed in Chile, Schmidt-Hebbel considers three cases, i.e. fiscal contraction financing of pension reform at the levels of 100%, 75% and 50%. Then with estimates of regression coefficients from two separate equations, one of which includes mandatory savings and the other without, as well as the hypothetical effects of 1984 tax reform on savings, Schmidt-Hebbel suggests that the rise in national saving could be explained by pension reform from 9.8% to 45%, with the remaining being explained by structural reform, e.g. tax reform etc.

Another cross-country study (Bosworth and Burtless 2004b) gives empirical evidence that pension saving reduces non-retirement public saving. Therefore, given that national saving is composed of both private saving and public saving, national saving does not necessarily increase following pension reform toward funding, as public saving might decrease correspondingly. But this reasoning should be taken as caution, as Bosworth and Burthless use the public pension funds to proxy pension saving. Whether private pension assets follow the same logic remains to be seen.

Samwick (1999) with a panel of countries finds that no countries but Chile experienced an increase in gross national saving rates after pension reform towards non-PAYG systems. The model used is as follows:

$$res_t = \beta_0 + \beta_1 year_t + \beta_2 after + \beta_3 (year_t \times after_t) + \beta_4 duing_t + \varepsilon_t \qquad (2)$$

Res is the regression residuals term saved from following Equation 3; year is the sample year; after is a dummy variable representing post-reform years and during another dummy variable representing the reform year.

$$\begin{aligned} Saving_{it} = {} & \beta_1 Income_{it} + \beta_2 IncomeGr_{it} + \beta_3 Credit_{it} + \beta_4 POP_{it} \\ & \beta_5 Old + \beta_6 Young + \beta_7 Urban + \beta_8 EXP + \varepsilon_t \end{aligned} \qquad (3)$$

Saving: Gross national saving (GNS) as percentage of Gross National Disposable Income (GNDI)

Income: Log of per capita income
IncomeGr: per capita income growth
Credit: Private credit to income ratio
POP: Population
Old: Old age dependency ratio
Young: Young dependency ratio
Urban: Urbanisation rate
EXP: Life expectancy

In comparison with saving model of Reisen and Bailliu (1997) in previous section, all control variables are not the same. For example, Life expectancy is used here but not in Reisen and Bailliu. In addition, in Reisen and Bailliu, Dependency ratio (both young and old) is used while Samwick decomposed this ratio into old age and young age dependency ratios.

In addition, cross-section evidences (Samwick 1999), based on data of 1990 and averages of 1991-1994, however, suggest that countries with PAYG systems had lower saving rates than other countries. This finding is consistent with Orszag and Stiglitz's claim (1999) that it is entirely possible that the introduction of a PAYG scheme reduces national saving, but a shift to an individual account does not necessarily increase national saving.

2.2.3.1.5 Capital formation and economic growth

The *Averting the Old Age Crisis* (1994) claims that economic growth is higher in countries with funded systems than those with unfunded pensions schemes via e.g. less labour distortion, higher saving rate and capital formation. Capital formation will be increased following pension reform if the pension assets accumulated are not invested abroad significantly, i.e. such pension savings are used on domestic investment. But it is worth mentioning that investing abroad does not necessarily mean losing national wealth, as residents from the home country can still obtain interest and dividend income[13], and whether to invest abroad to a large extent depends on the development's stages in the particular country.

A tentative empirical study by Holzmann (1997) indicates a positive relationship between pension reform and economic growth in Chile. With the simple Solow residual specification of total factor productivity (TFP), it is found that improving financial markets conditions following the pension funds reform significantly positively affect TFP. But this model suffers from low t values which might result from high multicollinearity between independent variables, e.g. unemployment rate and stock market index.

Meanwhile, Schmidt-Hebbel (1999) reaches the conclusion that pension reform in Chile spurs private investment, the average productivity of capital and total factor productivity (TFP). Always, one single regression is estimated to obtain the coefficients, then these coefficients are used to calculate the rise of each variable, i.e. private investment, average productivity of capital and TFP attributed to structural reform, (e.g. tax reform) and pension reform; estimation of pension reform is based on

[13] Pension funds' international investment is a hot topic and will be investigated in our next study.

three scenarios – large effects, moderate effects and small effects. In all, pension reform in Chile is estimated to have a positive impact on the private investment rate, the average productivity of capital and the TFP growth rate. For example, pension reform contributed to 0.1 - 0.4 per cent of 1.5 per cent increase in TFP growth rate, while 0.4 – 1.5 per cent of the total 13 per cent rise in private investment rate was attributed to pension reform with the remainder being explained by structural reform.

Barr (2000) argues that there are three channels through which funding could induce economic growth; First, pension reform leads to a higher saving rate; this result is mixed as we will show shortly. Second, the higher saving is translated into more productive investment. Third, that investment results in an increase in output. But he argues that all of these three links do not necessarily hold.

Simulation study on 7 OECD advanced countries by Hviding and Merette (1998) shows that fundamental pension reform, (gradual removal of public old-age pensions) has a greater effect than parametric reform, i.e. 20 per cent reduction in the replacement rate. For example, for the United States, per capita GDP could increase 3.6 per cent per year in the long run under the fundamental pension reform, while the figure is 0.6 if under the reform of reducing replacement rate by 20 per cent. Econometric work on a panel of countries to test this, especially the modelling on both OECD countries and Emerging market economies (EMEs), is quite scarce to our knowledge.

An exception is a tentative study by Davis (2003a) who concludes an insignificant direct effect of institutional assets – including pension funds, life insurer and mutual funds - on economic growth for 17 OECD countries, although the banking industry was found to be positively linked to economic growth, consistent with Levine and Zervos (1998). The equation Davis employed is the standard 5-year average economic growth model (King and Levine 1993 and Beck et al 2000), where explanatory variables include Bank lending/GDP, Institutional assets/GDP etc.

2.2.3.2 Financial issues

2.2.3.2.1 Capital markets

One main augment favouring the World Bank model is that pension reform leads to capital markets development. Pension funds and capital markets, especially in EU countries, have been studied extensively by Davis (1995, 1998c, 2000a and 2003c). Pensions funds have advantages over other financial intermediation in that they fulfil the six functions of financial systems (Merton and Bodie 1995) more efficiently.

The six functions are 1) clearing and settling payments; 2) pooling resources and subdividing shares; 3) transferring resources across time and space; 4) managing risk; 5) providing information; 6) dealing with incentive problems (Merton and Bodie 1995). Pension funds managers have been increasingly using derivatives to hedge risk, e.g. currency risk due to international investment. Merton and Bodie argue that the payment system demands of derivatives-based strategies can significantly reduce payment risk due to the drop of occurrence of relatively large funds transfers; therefore function 1 is improved. Pension funds facilitate function 1 here in that they have started using derivatives as one important vehicle of risk management and

diversification. Press coverage and academic works have recently turned their attention into exotic financial instruments, e.g. hedge funds. For example, Rail pension in the UK has recently announced its intention to invest more than 600bn pounds into hedge funds (Financial Times 2004)[14], thus overtaking British Telecom as the UK's largest investor in the alternative products. In addition, Greenspan (2003) mentions that the growing use of derivatives and related techniques is conducive to the stability and resilience of the largest US financial intermediaries, e.g. banks.

Pooling and transferring resources – functions 2 and 3 is the fundamental characteristic of pension funds in that they accumulate assets and smoothe people's consumption over time. Risk – function 4 can also be reduced due to professional risk management e.g. via international diversification (Reisen 1997; Davis 2001 and 2002b). The function 5 can be improved in that there is evidence that pension funds by their superior ability to obtain information decrease market price fluctuation (Davis 1996; Walker and Lefort 2002). The function of dealing with incentive problems can be better served by improvement in corporate governance because more pension funds have realized the difficulty of voting with their 'feet' by selling stock, and instead actively participate in corporate governance issues (Davis 2002c; Clark and Hebb 2002).

Pension fund assets have increased noticeably during the past decades across both OECD countries and EMEs. Figures 4 and 5 clearly reveal the steadily rising trend of total pension assets across all countries (18 OECD countries and 11 EMEs) over the period 1981-2000[15]. In terms of Pension assets to GDP, such a trend is also identified from Figures 6 and 7, with only a few exceptions, e.g. Fiji, South Africa etc.

Regarding the European countries, it has been estimated that in 2005, pension fund assets will be at the level of Euro 3,500bn (Davis 2003c). The pension assets within EU zone might be speeded in coming years, e.g. due to the "stability pact"; because EU member states have committed themselves to refrain from excessive budget deficits in order to comply with the rules of Stability and Growth Pact. In addition, if the government does not reform PAYG systems and attempts to finance such implicit pension debts by issuing bonds, the risk premium required by participants in the financial markets will be higher, as the public is increasingly aware of the unsustainability of PAYG systems (Holzmann 1998; Rother et al 2003). And indeed, credit rating agencies, e.g. Standard and Poors (2002) have started considering the potential impact of population ageing on long term fiscal substainability and tend to lower the credit rating of such governments running deficits (Davis 2004). In all, pension funds are expected to continue their rapid growth in EU countries due to reform pressure; consequently, they will have evolutionary impact on the financial markets (Davis 2000a and 2003c).

Regarding emerging market economies (EMEs), Chile is the most frequently referred to country to justify this benefit. For example, Holzmann (1997) points out that

[14] Pension fund investment, including investing in hedge funds, will be investigated in our next study.

[15] In Figured 4 and 5, we average every 5 year observations over 1981-2000, so total together we have 4 observations for each country. We use 1901 to denote the 5 year average over 1981-1985, 1902 to denote 1986-1990, 1903 to denote 1991-1995 and 1904 to denote 1996-2000. Similar designation has been used by Beck et al (2000). These 5 year average data are also created for our econometric analysis in Part two.

Chilean pension funds grew from zero to 39 per cent of GDP from 1980 to 1995. (The latest statistics from FIAP (2003) show that this figure was over 60 per cent as of 2002), The same trend was found for financial assets, rising from 28 per cent of GDP to 68 per cent from 1980 to 1993 (Fontaine 1997). As of 2000, 65 per cent of government debts, 12 per cent of time deposits and bank bonds, 56 per cent of mortgage bonds, 40 per cent of corporate bonds and 7 per cent of equity were held by pension funds (Walker and Lefort 2002).

But Uthoff (1993) notes that due to the existence of other accompanying factors, e.g. high and stable GDP growth, international capital inflows in Chile, it is difficult to draw a direct effect between pension funds and stock market development. Therefore, pension funds may have to some extent helped the financial development, but they may be in general neither necessary nor sufficient (Singh 1996).

Meanwhile, Catalan et al (2000) seek to identify whether there is a Granger-causality relation between capital markets and contractual savings.

$$y_t = \alpha_0 + \sum_{i=1}^{p} \beta_i y_{t-i} + \sum_{j=1}^{q} \beta_j x_{t-j} + u_i \qquad (4)$$

X and y in Equation 4 are the variables of interest. For example, they could be stock market capitalisation and contractual savings. Based on the above equation, Catalan et al (2000) give evidence that contractual saving institutions, e.g. pension funds, induce capital market's development. But the potential benefits of developing contractual saving sectors are stronger for developing countries than for developed countries.

They use two capital market indicators, stock market capitalisation and stock market value traded across 26 countries, among which 6 are developing countries. Although they find a Granger causality relationship between contractual savings and the stock market, their estimation might suffer from a small number of observations. For example, for the causality regression on Austria, they have only 6 observations which is implausibly few, therefore their results need to be checked by empirical work with more observations. In view of this problem, we, in our empirical section, seek to tackle this issue with more observations when running individual Granger causality tests. In addition, we use panel Granger causality procedure designed by Hurlin and Venet (2001) to complement Granger-causality on individual countries. In this case, many more observations are obtained due to the pooling of cross-country data.

Meanwhile, a panel study focused on 33 Emerging markets by Walker and Lefort (2002) finds that pension funds decrease the dividend yield and increase the price to book ratio, implying a drop in the cost of capital. This result is robust even when pension funds are proxied by four sets of variables, i.e. a) dummy variable, b) share of stock in pension portfolio, c) pension investment in stocks and private bonds to total market capitalisation, d) pension fund assets to GDP. Other explanatory variables are inflation, per capita income, bank assets/GDP and dummy variable-Region. But as admitted by the authors, their generalised least squares (GLS) panel estimator might suffer from problems like measurement errors, etc. This issue has been addressed by researchers, e.g. Impavido et al (2003) as discussed below. In addition, regarding the argument of bank's disintermediation following pension funds growth, their descriptive statistics on Chile, Argentina and Peru do not provide convincing

evidence. For example, in comparison with pension funds, banks are still the primary provider of short-term financing and small firms in Chile.

In terms of bond markets, IMF (1994) reports that in recent years, governments have tried to attract foreign institutional investors by moderning the infrastructure of their public bond markets as well facilitating private bond issuance. For example, Benos and Crouhy (1996) mention that due to the motivation of attracting foreign institutions, French government opened future markets MATIF and introduced such innovations as OATs for its bond markets.

Impavido et al (2003) find a positive relationship between contractual saving assets and bond markets, e.g. a 1 per cent increase in the former leads to 0.4 per cent rise in the latter. Generalised method of moments (GMM) dynamic panel model, developed by Arellano and Bond (1991) is used in their paper.

$$Y_{it} = \alpha Y_{it-1} + \beta' P_{it-1} + \varphi' \Sigma_{it-1} + \phi' Z_{it-1} + f_i + d_t + \varepsilon_{it} \quad (5)$$

Y is vector of financial market indicators, e.g. bond market capitalisation to GDP
P is a variable vector, including real returns on stocks, etc.
Σ is a vector, presenting risk measures for financial assets, e.g. stocks
Z includes relative size of Contractual saving (pension funds and life insurance), etc.
f is the country-specific and time invariant variable.
d is set of year dummies
ε is the error term.

In order to deal with the problems such as measurement errors and endogeneity, and following the methodology of difference GMM estimator, the above equation is first differenced, then following equation is obtained:

$$\Delta Y_{it} = \alpha \Delta Y_{it-1} + \beta' \Delta P_{it-1} + \varphi' \Delta \Sigma_{it-1} + \phi' \Delta Z_{it-1} + \Delta d_t + \Delta \varepsilon_{it} \quad (6)$$

Term f is dropped, as it is not time varying.

Use of GMM estimator is promising in Impavido et al (2003), a large improvement from the methodology of Walker and Lefort (2002), Reisen and Bailliu (1997), etc. as we discussed in previous sections. But a number of areas in our view could be improved or at least complemented. First, they use the value of aggregate outstanding public and private bond issuance to proxy bond market development. This specification might not be able to disentangle the differential impacts of contractual savings on public and private bond markets; it should be noted that private bond market might be more relevant here, as the amount of public bond issuance largely depends on the government's willingness to issue and its fiscal position, while that of private bond is dependable on the thickness and maturity of financial markets where pension funds are supposed to play an increasing important role following pension reform. Second, separate regressions on developed and developing countries ought to be conducted, in order to discern whether the impact of contractual savings is identical across countries. Third, differences of the long run and short run effects might be a concern of policy makers, but unfortunately, it is not available in the specification of Impavido et al (2003).

2.2.3.2.2 Stock market volatility

It has been suggested that growth of institutional investors, e.g. pension funds, has led to heightened stock market volatility and the resultant implication might be increased risk premium and cost of capital (discussed in next section). One main underlying factor is institution's herding behaviour. Simply speaking, herding is defined as behaviour whereby institutional investors seek to buy or sell assets at the same time. There are a number of reasons institutions herd more than individuals. One main contributing factor is the regular performance check on asset managers against the market benchmark from the fund's sponsor (Davis 2000b).

Result from a questionnaire survey circulated to a large number of institutional investors by Davis in 1998 reveals that the most important element in competition in asset management is performance relative to other institutions (Davis and Steil 2001). The herding behaviour also is found by another questionnaire study on Germany fund managers (Lutje and Menkhoff 2003). All of these induce similar behaviour and hence herding to avoid performing significantly worse than the median fund. Consequently, such herding behaviour might drive prices away from fundamental values, thus leading to long run volatility.

But herding does not necessarily leads to volatility. If institutions are rational and professional investors, they will only follow the fundamentals and thus speed the market to a new equilibrium price (Wermers 1999).

Results from empirical work are mixed. Nofsinger and Sias (1999) examine annual changes in institutional holdings and find that herding exists among institutions investors for the period from 1977 to 1996. But Lakonishok et al (1991a) find that the average pension fund is contrarian, e.g. they buy disproportionately stocks that have performed poorly. This behaviour might have the effect of reducing market volatility.

Meanwhile, Walker and Lefort (2002) find that pension fund growth reduces security price volatility for 33 emerging market economies. They use 24 month annualised moving volatility as a proxy for market volatility. Inflation is used to proxy macro-economic stability and bank assets to proxy capital market development. Other independent variables include per-capital income, initial conditions and the region which are used to capture heterogeneity across countries. This negative link between pension funds and market volatility might be justified by such large investors' ability to access more information, thus restraining prices from deviating too far away from fundamentals. It should be noted, however, that when another specification, i.e. using reform indices from Morley et al (1999) is employed to do the same estimation, the relation between market volatility and pension funds are not statistically significant. But Walker and Lefort note that the latter specification might suffer from problems of measurement errors.

Another study is conducted by Davis (2003a) who uses a dataset covering both pension and life insurance assets across G-7 countries. His results suggest 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 mentions, however, that such a link in the G-7 and Anglo-Saxon

countries might be due to the shift in sectoral holdings of equities rather than institutional holdings per se.

In addition, Lakonishok et al (1991b) give evidence that pension fund managers do not herd except in small stocks, and the hypothesis of positive relation between institutional holdings and share price movements does not hold, which might be due to the broad diversity of institutions' trading styles, which to a large extent, cancel out each other's effect. This result in fact is consistent with the words of BIS (1998): a financial system's stability depends on "the coexistence of participants with divergent objectives and mutually complementary behaviour."

2.2.3.2.3 Cost of capital

The aggregate financial market serves as an intermediary channelling funds from savers (households) to users (firms). Given that funded pension systems have positive effects on household saving, Iglesias (1998) maintains that the cost of capital for firms can be reduced following funded pension reform. But as we discussed in section 2.2.3.1.3, evidence to support World Bank model's positive impact on private saving is mixed. Or it could be argued that household saving increases anyway due to current demographic changes towards a larger proportion of the 45-60 cohort, if based on life-cycle model whereby middle-aged population is more likely to save for their retirement. Meanwhile, Walker and Lefort (2002) argue that there are three possible channels whereby the cost of capital could be decreased. The first channel is more developed capital market resulting from pension reforms, thus marking issuance of securities cheaper. Secondly, even allowing for short-term performance evaluation, the expected investment time horizon of pension funds is longer than that of individuals and firms, thus reducing the 'term premium'. Third, the risk premium may be reduced due to pension funds' pooling and professional management. Both the term premium and risk premium's reduction might lead to decreased average cost of capital.

In addition, we might be able to gain some insight on this issue by drawing on relevant financial theories. Based on Modigliani and Miller (1963), the weighted average cost of capital (WACC) is given as

$$WACC = \rho(1 - \tau_c \frac{B}{B+S}) \qquad (7)$$

ρ : Discounted rate for an all-equity firm

τ_c : Corporate marginal tax rate

B: Proportion of bonds

S: Proportion of shares.

Then we can see from the above Equation 7 that given ρ and τ_c do not change, if B increases, e.g. firms issue more bonds as happened in Chile following pension reform, WACC will decrease due to the tax benefits gained from more debt. Results, however, will become less straightforward if more shares are issued with bonds. But pecking-order theory suggests that firms always prefer debt issuance to equity issuance in the first instance.

Graphically, we can see that in Figure 8, the WACC line without introduction of pension funds is to the left of WACC line with introduction of pension funds, so the optimal capital structure of the without-pension-funds scenario takes less bonds than with-pension-funds scenario. Consequently, the cost of capital for the firms moves down from N to N*.

The theory of bankruptcy costs (Copeland and Weston 1992) might also be relevant here. When a firm goes to bankruptcy, the value of this firm is reduced by the fact that payments must be made to third parties other than bond or shareholders. Trustee fees, legal fees, and other costs of reorganisation or bankruptcy are deduced from the net asset value of the bankrupt firm and from the proceeds that should go to bondholders. Consequently, the "dead weight" losses associated with bankruptcy may cause the value of the firm in bankruptcy to be less than the discounted value of the expected cash flows from operations. Therefore, capital providers of the firm have to charge some premium to compensate this contingent loss. Meanwhile, agency costs, resulting from the separation of management and ownership for most modern firms can lead to some extra premium charges as well, because shareholders and bondholders in order to prevent professional managers from mis-management have to incur monitoring costs.

Under the development of pension funds and given that pension funds activism is under way in many countries, particularly in the US, both bankruptcy costs and agency costs can be reduced because pension funds find the increasing difficulty of voting with their feet, i.e. selling in takeover, and thus actively participate in firm's management so as to improve the corporate performance. In consequence, the cost of capital for firms can be reduced and then it might have positive implication on economic growth[16].

Empirical study on the link between costs of capital and pension funds is scanty. Walker and Lefort (2002) using dividend yields and price to book ratios as proxy for cost of capital in 33 emerging markets find that pension funds significantly decrease the cost of capital. But when they change their econometric specification by controlling for the degree of reform in different areas of the economy, the relation becomes insignificant.

2.2.3.3 Other issues

In this section, we outline some arguments for and against World Bank model, which are not directly linked to economic growth and financial development.

2.2.3.3.1 Political risk

As outlined in Section 2.1.2.4, traditional PAYG systems suffer from political risk as politicians may promise benefits which are not sustainable in the long run or simply change the benefit formula for whatever reason. In this context, it is claimed that funded pension systems, e.g. the World Bank multi-pillar model can avoid this problem (World Bank 1994). It is true that funded accounts of each individual make it

[16] It might worth mentioning here that the development of financial markets, notably, equity market has been argued to stimulate and/or forecast the economic growth. Empirical work on this issue, among others, includes Levine and Zervos (1998) and Beck et al (2000).

harder for government to make excessive benefit promises, in that retirees will be paid from their own accumulated accounts rather than from the pool of payroll tax paid by current working population as under the PAYG systems.

But there is still political risk for the funded systems. For example, it is known that most funded pension systems have some elements of PAYG, e.g. the first pillar in the World Bank model, for the purpose of redistribution or risk diversification (discussed in next section). So largely depending on how large the reforming governments want the pillar of PAYG to be, there might be such a risk of increasing retirement age or changed benefit formula as well. In other words, the pillar of PAYG is basically unfunded and it might be used to redistribute wealth inter or intra generation as we discussed in Section 2.1.1.4. If any government is more concerned about wealth equality or it views a higher first pillar desirable, then given the ageing population, e.g. more retirees relative to working population, the government might try to increase statutory retirement age, or decrease pension benefits, etc. The consequence is the same as that under the PAYG systems, although the extent is smaller; the extent is dependant on how the reforming governments design the new pension systems, particularly the pillar having PAYG elements.

Second, it is argued that government is poor at pension funds management, (Wohlstetter 1993), as many public pension managers, e.g. in the US are appointed by the government, thus they might always have political pressure to support local firms and engage in social responsible investing (Romano 1993); consequently, the rate of return is lower (Mitchell and Hsin 1997). Given this problem associated with pension funds' public management, private management is argued to be better insulated from such political risk (World Bank 1994), which is also the basis of the World Bank model. But such lower political risk should be balanced with higher administration costs as we will discuss in section 2.2.3.3.3. In addition, James (1997) stresses that considerable regulations are needed to protect pension assets under the management of private managers who might be fraudulent. Meanwhile, the pension-reforming government might force private pension fund assets accumulated to be invested mainly in government bonds. An extreme case happened in the Argentina financial crisis when pension funds were forced to buy government bonds, which rapidly devalued.

The regulatory capability regarding financial markets in general and fund management in particular in many countries particularly in the developing countries are quite weak (Vittas 2000). Even in the advanced countries, the difficulties of regulating individual accounts are discernable, e.g. the mis-selling controversy in the UK (Orszag and Stiglitz 1999). Given this argument, some authors maintain that some basic preconditions, in the areas of financial market, accounting practice, are needed before introducing private pension accounts[17] (Mitchell 2000; Vittas 2000; Blake 2003).

[17] Many pension researchers agree that a minimal preconditions are required before the positive effects of pension reform towards funded systems could be realised (Vittas 2000, Blake 2003, Davis 1998c). Those preconditions, among others, include a sound banking sector, which is necessary for the settlement, clearing etc, and a strong insurance industry, which is needed in order to develop an annuity market (see Chapter 2 for detail).

2.2.3.3.2 Rate of return and risk

As of a mature PAYG system, the real rate of return is equal to the sum of population and productivity growth rates (Samuelson 1958), while the return for the funding systems is the market return, as the accumulated funded assets are invested in the market. Aaron (1996) outlines an inequality, well known as the "Aaron condition", which is always quoted to compare funded and unfunded pension systems (see Appendix 1 for more details). If we assume that market return is r, wages g and labour n, then we have

$$1 + r \leq or \geq (1 + g)(1 + n) \tag{8}$$

If r, g and n are only slightly different from 1, then equation 2 is reduced to

$$r \leq or \geq g + n \tag{9}$$

Equation 9 is the mathematical expression of the "Aaron condition".

In words, if the market return, i.e. r is less than the sum of growth rates of wages and labour population – $g + n$, then funded systems are less advantageous than unfunded systems, e.g. PAYG. In contrast, if the market return is greater than the sum, funded systems are more beneficial.

The current trend has been increasingly favouring the funded systems, in that g – growth of wages and particularly the n – population growth rate have dropped during the past decades across OECD countries and are expected to continue such trend in the following years in both advanced and many developing countries. Davis (1995) examines this issue across OECD countries while Steurer (2003) undertakes a detailed study using historic data from the US; Both authors confirm the benefit of transferring from unfunded systems to funded systems given the ageing population and higher rate of return of market investment.

In addition, the assumption of dynamically efficient economy (Diamond 1965) holds that the real return on capital is always greater than the growth rate of wage bills, approximated to PAYG return (Corsetti and Schmidt-Hebbel 1997). Then, funded pension systems are preferred to PAYG schemes, especially given the current trend of declining population growth.

But this argument is not immune to problems. First, even if PAYG does offer a lower return as shown from the historic data, it might also have a low covariance with other financial assets (Persson 2002), as the PAYG return is based on labour income tax. The advantage of this feature is that it diversifies a rational individual's portfolio risk. Then, PAYG wealth might still be a desirable asset for the purpose of portfolio risk management. This argument can be used to justify the suggestion that any reformed new pension system should have at least some element of PAYG.

Second, a simple rate of return comparison between PAYG and funded systems is misleading in that it does take into account the administration and transition costs (Orszag and Stiglitz 1999). Regarding administration costs as we will discuss shortly

in next section, normally state managed schemes, e.g. PAYG, are cheaper than private schemes.

As concerns transition costs, if we assume that economy is dynamically efficient, there is no way to improve later generations' welfare without making some or all future generations' worse off. In other words, the "free lunch" to the first generation under PAYG systems is already given, and if we switch from unfunded to funded systems, this gift has to be paid anyway (Persson 2002). It could be paid by either double-taxing current working population, or explicitly recognising this implicit pension debt (IPD) (see Section 2.2.3.3.5 for detail of transition issues) by issuing government bonds. The latter approach is more fair in that this debt is smoothed over and borne by some or all future generations rather than the single current generation as the first one. If such debt has to be paid by the current transition generations, it might have the risk of incurring political opposition.

Third, based on the 'market meltdown' hypothesis[18], Brooks (2000) agues that asset prices might go down if there is a smaller generation of investors for funded pensions to sell assets to given the trend of ageing population. Focusing on 7 industrial countries over the period of 1950-1999, Davis and Li (2003) find that proportion of aged 40-64 has positive effect on real stock prices and negative effect on real bond yields, both effects being statistically significant, while that of aged 65+ is found to be negatively linked to real stock prices and positively linked to real bond yields. Another cross-country study has been done by Cannon (2003), who uses dataset of 16 developed countries over a longer period of 1900-1999[19]. The author, however, does not find a strong association between demographics and returns of equities and bonds, thus making the market meltdown hypothesis problematic. A comparison as of these two studies is shown in Tables 3 and 4.

A case study on the US is also conducted in Davis and Li (2003). They provide evidence that an increase of the aged 65+ cohort in the US does have downward pressure on both bond and equity prices. One important consequence of this finding relevant here is that any pension system with only a funded pillar can put retirees in the future under market risk, as pension assets are all invested in the markets which tend to go down in the long run. On the other hand, Porterba (2001) run regressions of US real returns on stocks, bonds and bills on demographic variables of different age groups, e.g. 20+, 40-64, etc over three different sample periods, i.e. 1926-1999, 1947-1999 and 1926-1975. Overall, he finds that at a macro level in the US, there is less strong evidence than Davis and Li (2003) of a statistically significant relationship between demographic variables and asset returns.

2.2.3.3.3 Administration costs

Despite privatised pension system's benefits - which although are still arguable, one of this system's main drawbacks is high administration costs. For example, Diamond (1993) points to this problem related to the Chilean pension reform and says such

[18] Coined by Poterba (2001) the 'market meltdown' hypothesis says when the baby boomers retire, there is a large amount of assets accumulated in their working period to be sold in the markets. The sell-off of these assets is to finance their consumption across retirement period.

[19] In Cannon's paper (2003), another estimation period from 1950-1999 was also used (see Tables 3 and 4 for detail).

costs are even higher than the "inefficient" system that it replaced. Vales-Prieto (1994) estimates that Chile incurred 30.5 US dollars cost per pension affiliate annually while this cost is 15-20 dollars for the US and 24 dollars for Malaysia.

In addition, Schmidt-Hebbel (1999b) finds that 34 per cent of AFP total revenue in Chile was eaten up by marketing costs in 1997, while this ratio was 10 per cent in 1988. A large number of salespersons were hired by AFPs to lure contributors to change their affiliation, even in some illegal way, e.g. false signature. In Chile, pension fund providers offer free gifts to those people switching pension suppliers. This problem, however, is not unique to Chile, as high-pressure sales tactics have also been used by salespersons in the UK to persuade members of occupational pension schemes (especially older long serving members) to switch to inappropriate personal pension schemes (Blake 1997).

Another international comparison study by Whitehouse (2000) shows that Bolivia and Australia have the lowest charge ratio[20], while many Latin American countries, e.g. Mexico and Chile have much higher ratios. For example, this ratio is 9.8 per cent for Bolivia, 26 per cent for Mexico and 18 per cent for Chile (See Table 5 for details). One major contributing factor is the different pension funds management systems. Note that Bolivia is a pioneer in selecting pension funds managers through international auction in order to minimise asset management fees (Gersdorff 1997).

In addition, for the second pillar of Swedish pension systems, i.e. the privately managed Defined contribution pillar, the Swedish government set up the "clearing house" which keeps all the individual accounts of individual shares and fund share values; the main purpose of it is to reduce administration costs (Palmer 2000). In addition, the Premium Pension Authority (PPA) was established in 1998. One of its core responsibilities is to enter into contracts and negotiate aggregate purchases with participating funds. Therefore, given the benefits resulting from the economies of scale and better bargaining power administration costs will be reduced significantly in comparison with other pension administration systems, like that in Chile.

In view of the criticism of defined contribution individual accounts of social security systems, James et al (2002) argue that by operating in the institutional markets, e.g. where small individual accounts are aggregated into large blocks of money and managed on a centralised basis, individual accounts pension systems can achieve most of the cost advantages of centralised funds but with the additional merit of greater political insulation and responsiveness to workers' preference. It is a cost effective intermediate option in that a single nationally centralised fund, like the Employees Provident Fund in Malaysia has problems of asset misallocation while the individual retail market, e.g. the practice in most Latin American countries incurs substantial administration costs. As for the UK pension fund markets, Blake (2000) raises the issue of economies of scale as well, and recommends the government keep the cost down, e.g. by establishing a central clearing house to channel contributions in the case of DC schemes.

[20] The charge ratio is defined as one minus the ratio of the accumulated pension assets net of charges to the accumulation assets without charges (Whitehouse 2000).

2.2.3.3.4 Annuity markets

Current pension reforms largely focus on the accumulation phase (James and Vittas 1999a), i.e. how to ensure sufficient money is accumulated for the post-retirement period. This is understandable as it is an immediate concern, while the decumulation of capital in workers' saving accounts seems to be far away in the future, especially when old people are normally excluded from participating the new pension schemes. But as pension reforms progress, the second stage of reforms requires the government to pay attention to the issue of eventual decumulation, as one of the main objectives of the pension system is to provide pensioners with sufficient incomes.

There are a number of payout/decumulation options available for pensioners (Valdes-Prieto 1998) among which are lump sum payment, programmed withdrawals and annuity from an insurance company. But given the potential problems associated with the first two options, e.g. people may dissipate their lump sum payment, the third might be the only form of financial contract which avoids longevity risk and guarantees income right up to the point of death (Davis 2002a). Annuities markets play a major role in pension reforms in that they, under defined contribution schemes, provide a good substitute for social security and occupation defined benefits funds.

Annuities markets, however, are still poorly developed in most countries, even in advanced OECD countries (James and Vittas 1999b). The underdevelopment manifests itself in such ways as a) small size relative to other kinds of insurance; b) absence of mortality tables, etc. Contributing factors include worker myopia, the precautionary and bequest motives for saving and the crowding effect by generous social security, etc. (James and Vittas 1999a; Vittas and Skully 1991). In addition, as we discussed in Section 2.1.1.1, indexed annuities do not exist in many countries. Therefore ideal payment methods, i.e. inflation protected retirement payment could not be offered in most countries.

Meanwhile, Davis (2002a) highlights the increasing credit risk and broader systemic risk in annuities markets, for example, the double gearing between banks and insurance companies and book value accounting in Japan. Similar difficulties of life insurers are also existent in other OECD countries, e.g. Italy and France (IMF 2002a). Therefore, "macroprudential indicators" (IMF 2002b) like those developed for banking industry are much needed for insurance companies.

2.2.3.3.5 Transition issue

A big problem associated with the transition from unfunded systems, e.g. PAYG to funded systems, e.g. the World Bank model is the high level of implicit pension debt (IPD) in some countries. IPD is accumulated and made explicit in that under PAYG systems, contributions from current working population are normally used to pay pensions of current retirees with no funds/assets set aside; in consequence, once PAYG is terminated, the government, which has promised to provide benefits to pensioners faces the problem of observable pension debts, as contributions under new funded schemes have to be credited to individual accounts with property rights and no longer be able to be used to pay current pensioners' retirement benefits.

There are a number of different definitions of pension liabilities, among which three main ones are identified by Holzmann (1998) and Holzmann et al (2004). The first one is accrued-to-date liabilities, which refers to the present value (PV) of pension liabilities accrued to a particularly date; future contributions from both current workers and new entrants to job markets are not included. The second one is current workers and pensioner's liabilities. As shown by the name, it includes the PV of liabilities accrued to a particular date by current workers and pensioners, but new entrants are not considered. The logical next step is to include the PV of liabilities of new entrants besides current workers and pensioners, which then is the last definition noted by Holzmann (1998).

Due to the varying definitions and the resulting methodologies, international estimates of pension liabilities across countries differ a lot. Largely in view of this problem, Holzmann et al (2004) design a standardized method of calculating IPD, which is justified on the ground that, among others, projections of many future variables, e.g. projected coverage rate, are not required, thus avoiding questionable/arbitrary assumptions. Based on this definition and a corresponding methodology, the estimates of IPD are quite large for all 35 developing countries but there is a huge difference. For example, based on a 5 per cent discount rate, IPD as a percentage of GDP is 275 per cent for Brazil, while it is 26 per cent for Morocco. But when using 2 per cent as a discount rate, these two figures become 500 and 50 respectively.

If the IPD is large, the next step is to seek a way to reduce or eliminate it. How to finance this huge amount of IPD has provoked a wide discussion and research. In general, there are two ways, i.e. debt financing and tax financing which in turn consists of income tax and consumer tax. If tax financing is used, then the issue of double burden arises where the transition generation pays twice (Davis 1995), once for existing pensioners via PAYG and once for their own pensions via prefunding. The magnitude of the double burden, however, could be mitigated if pension reform is followed by improving economic externalities (Holzmann 1998), e.g. less labour market distortion and higher saving rate as discussed in Section 2.2.3.1 and more developed financial markets as in Section 2.2.3.2.

In addition, Valdes-Prieto (1997) argues that a shift from PAYG to a funded system does not necessarily impose a double burden on the transition generation. In a steady state, an increase in government expenditure following the pension transition must be matched by some sources, i.e. the cash flow from the pension institution. Then in order to keep the accounting identity of the pension system, either pension contributions need to be decreased or pension payments are raised. The second option is rejected by Valdes-Prieto in that it vulnerable to political interference. The first option is appropriate where contributions are decreased, then workers are supposed to have more take-home salary, but in order to keep the accounting identity of the pension system again, the government might levy higher taxes, which can be set to match the budget worsening following pension transition from PAYG to funding systems.

2.2.3.3.6 Corporate governance

Corporate governance deals with the ways in which suppliers of finance to firms assure themselves of obtaining a return on their investment (Shleifer and Vishny

1997). In the past the dispersal of ownership rights in public corporations made collective action problematic as it is very difficult and/or costly to aggregate dispersed shareholders to assume the role of corporate monitoring. The current trend regarding corporate governance, given the rapid growth of pension funds, is toward direct control via equity where the institutional investors, including pension funds, mutual funds and insurance companies play an increasing important role (Davis and Steil 2001).

Given that some of traditional corporate governance strategies have drawbacks, for example takeovers are costly and managers focus on only short-term targets if they have stock-option based compensation, Clark and Hebb (2002) identify four drivers which facilitate pension funds' corporate engagement and even foreshadow the emergence of Fifth Capitalism Stage, particularly based on the increasing role pension funds play in corporate governance. The four drivers are as follows: The first driver is the wide use of indexation techniques in pension funds industry which disenables exit from underperforming companies which are in the index. The second driver is the increasing demand by owners for more transparency and accountability, particularly after Enron and Worldcom scandals. Third, pension funds' pressure to undertake socially responsible investing (SRI). Fourth, pressures to humanize capital with social, moral and political objectives extend pension funds' simple concerns of long-term rate of return.

Corporate governance, however, is argued to be mainly an issue for large and defined benefit public sector pension funds (Clark and Hebb 2002, 2004), e.g. the California Public Employees' Retirement System (CalPERS) in the US and the Universities Superannuation Schemes (USS) in the UK, in addition to many operative large private DB schemes[21]. The main reason is that they can and have aggregated huge amount of assets which then are able to be used as bargaining power to implement corporate engagement in the financial markets. For small pension funds, however, it might be more sensible and economically efficient to sell shares if not satisfied with firms' performance. In addition, objectives of private-sector pension funds may differ, given they are more likely to have different mandates, and consequently investment strategies. Meanwhile, it is due to the fact that this type of fund, i.e. the fund of similar size of CalPERS, has never accounted for a significant proportion of all pension funds in the reality, and together with other counter-arguments (Blair 2002 and Orzag 2002), Engelan (2002) argues that pension fund model proposed by Clark and Hebb (2002), i.e. the dominating position of pension funds in the context of emerging fifth capitalism, is "little more than a fairy tale".

In addition, it has been noted that the current trend is a shift from defined benefit schemes to defined contribution schemes, which almost certainly reduces the average size of pension funds (Blair 2002), in that under DC schemes, pension fund assets are typically individually managed by dispersed fund managers. It is very difficult, if not impossible to accumulate billions of assets, like CalPERS under one single fund[22]. Therefore, some commentator has argued that besides other reasons, one main reason

[21] One issue is that private firms do not expect to have a very large DB scheme, in that if the DB scheme is too large and active, private firms might be prone to possible retaliation, as well as corporate engagement from the shemes. This is what private firms always try to avoid.

[22] Although it is worth noting that in the US some large defined contribution schemes do exist, e.g. TIAA-CREF.

which drives current wide shift from DB plans to DC plans, is the dislike of corporations and executives. In other words, corporate people who do not like pension fund activisms hope to use DC plans to erode investor powers by breading up large pension funds.

DC fund managers are always private firms, which means that they might be less interested in corporate engagement and social responsible investing (SRI) at large, and more concerned about financial targets than large public state pension funds. Therefore, buying and selling shares in stock markets might be a more appropriate choice for them, particularly when they are subject to performance assessment on a regular basis from trustees, and investment risk becomes borne by employees, rather by the plan sponsor.

Also, it is often asserted that in the US in that many public pension funds managers have no proven skills in management and no experience at selecting directors (Wohlstetter 1993). This case will be worse if pension managers are appointed by the government, then they might always have political pressure to support local firms and engage in social responsible investing (Romano 1993). For example, the public managed funds - Public Employee Retirement Systems (PERS) in the US, are mentioned by Mitchell and Hsin (1997) that they operate according to principles different from the private sector. Regarding the private pension fund assets, managers act based on financial criteria, i.e. maximising funds value, but due to the regular performance checks (Davis and Steil 2001), they may not care too much about a firm's long term performance. If they are not satisfied with underperforming firms, they can simply leave the firm by selling shares.

Woikdtke (2002) and Coronado et al (2003) do provide evidence that pension funds operated by local and state governments in the US achieved lower rate of return than private pension funds, and they contribute the lower return to the political intervention regarding funds investment strategies.

In response to the criticism of public pension funds' management, Del Guercio and Hawkins (1999) find that public pension funds activism in the US is in line with the objective of pension funds value maximisation, i.e. fund activists do not pursue objectives other than maximising beneficiary wealth, although they give evidence that there is heterogeneity in fund objectives and concrete tactics employed between different pension funds. In addition, Smith (1996) studies pension funds activism sponsored by CalPERS (California Public Employees Retirement System), and finds that the initial public announcement of targeting by CalPERS has an insignificant impact on stock prices, but during the period of initial and public announcement and the official public announcement of the outcome of the targeting, there is significant rise in stock prices. Moreover, a more extensive empirical research by Wahal (1996) who analyses firms targeted from 1987 to 1993 by a broad sample including not only CalPERS, but also eight other pension funds, suggests that firm performance in terms of long-term stock price and accounting measures was negative during both before and post targeting. But one of his earlier studies finds that institutions with the efforts to promote organisational change bring gains in share prices.

A Event study (Prevost and Rao 2000) on only these firms which had been targeted by public pension funds rather than the coalition of both public pension funds and other

institutions and even interested individuals, shows that such firms which are targeted only once have better long term performance than those firms which are subject to repeated targeting. This conclusion is consistent with the hypothesis that targeting indicates a sign of reluctance by management to negotiate a settlement with the activist pension funds, therefore one-time targeted firms are able to take appropriate – performance enhancing - actions to avoid future targeting, while multi-targeted firms are not.

In contrast to extensive research in the US where most of existing empirical work on pension funds' engagement in corporate governance is conducted, research on other countries are quite few. Pension funds in the UK despite the big size of holdings are not known for the activism and have been criticised of not willing to monitor the governance of corporate they invest in (Myners 2001; FT 2003). Faccio and Lasfer (2001) suggest that occupational pension funds holdings in the UK destroy firm value, for example the Tobin Q ratio – the ratio of market value of equity plus book value of debt over total assets - decreases around 0.04 per cent with the presence of pension fund holdings than without. In addition, pension funds in the UK do not push companies to split the roles of chairman and CEO as recommended by Cadbury (1992) as sign of good corporate governance.

Regarding the relationship between pension funds holdings and long term stock price performance, Faccio and Lasfer find that for the over-performers, defined as firms whose Tobin Q ratios are higher than the median, mean industry adjusted share price return decreased from 62.66 per cent to 18.59 per cent, while this figure increased from –38.96 per cent to 10.25 per cent for under-performers. The differential impacts, although surprising, could be explained in such way that share holding by occupational pension funds has negative effect on over-performers but a positive effect on under-performers. However, it could also be argued that the results are consistent with the hypothesis of mean reversion[23] and have nothing to do with the pension funds holding (Wahal 1996). In other words, there is no a statistically significant association between pension funds holding and stock prices.

There is some evidence of institutional investors activism and the increasing concentration of shareholdings in Italy (Scatigana 2001). For example, among 221 holdings which is larger than 1 per cent, around 60 per cent are concentrated in the hands of five Italian fund managers, which is conducive to the development of pension funds activism, but the negative side is that among 221 shareholdings, only 4 are independent fund managers with the rest being affiliated to bank or insurance groups. This is seen as a big obstacle to the development of pension funds activism, as pension funds compared with other stakeholders e.g. banks, are still impotent. It should be noted that banks have different interests to pension funds. In general, banks might be more concerned about credit claims rather than profitability.

Although empirical results are not strongly in favour of pension funds' beneficial impact on corporate governance, financial regulators and commentators support

[23] The hypothesis of mean reversion is a competing theory to that of random walk. Based on the former, stock prices have tendency to return to their trend path over time, so investors might be able to forecast future returns by analysing past information. In contrast, according to the random walk hypothesis, there is no way for an analyst to predict future share prices as the price level does not have such a tendency to return to its trend path over time.

pension fund activism, particularly after the Enron, Worldcom and Parmalat scandals. But, should corporate governance activism be mandated? In the UK Myners's report (2001), it is recommended that pension fund activism should be included in fund management mandates, as in the US where The Department of Labour (1994) legislates that activism – where it might add value to the shareholders – is part of the fiduciary duty of an investment manager. In addition, Myners recommends that such activism should in due course be more clearly incorporated into UK law. This might reflect Myners's dissatisfaction about institutions' engagement in the corporate governance issue of investee companies on a voluntary basis, and show his intention to remind pension funds of their obligations to vote, rather than walking away by selling shares. A more recent report conducted by UK Investment Management Association (IMA) (2004), however, reveals that UK large institutions have actively and seriously engaged in the issue of corporate governance. For example, it is found that all 33 large fund managers surveyed (as of June 2003) had a policy statement on how they discharge their responsibilities on behalf of trustees, and all managers with corporate engagement as an integrated part of their investment process monitored and interacted with investee companies on an ongoing basis.

Pension funds' activism at a firm level is well documented as we reviewed above, although micro studies on it are largely focused on the US. Davis (2002c; 2003d) argues that complementary studies at the macro level is needed in that effects of governance initiatives from institutions may go wider than "target firms", so institution holdings may have implications on the whole economy. For example, although pension funds activism has direct impact on targeted firms, it might also be able to affect the non-targeted firms as unaffected firms have incentives to improve their performance so as to avoid a threat from pension funds in the future (Marsh 1990). This point might be used to explain why we will not easily find a difference between targeted and non-targeted firms when facing pension fund activism. Therefore, if a significant proportion of firms, directly affected and indirectly affected, in one economy tends to improve better corporate governance and performance, the overall effect might be higher economic growth and productivity for the whole economy.

Second, financial theory – Clientele effect (Miller and Modigliani 1961) – suggest that high tax bracket shareholders prefer the firm to invest more and receive less dividend payment, while low tax bracket shareholders (e.g. pension funds) would prefer less investment and more of dividend payout (Masulis and Trueman 1988). But this lack of unanimity can be solved somehow if investors can self-select into appropriate clienteles, for example, low tax investors, e.g. pension funds purchase shares of high-dividend firms and vice versa (Copeland and Weston 1992). The consequence of this practice is that research using micro data might not find it easy to identify the true association between pension funds and dividend/investment policy; in other words, an ostensible positive relation between pension funds and dividend payout at a micro level might be due to the pension funds' self-selection into these clientele which prefer high dividend firms rather than pension funds leading to higher dividend payment. Therefore, again, one way to get around this limitation is to use macro data.

With the help of econometric modelling, Davis (2002c) using macro data reveals that a higher share of institutional investors in total equity, especially pension funds and

insurance companies, tend to boost dividends payment across both Anglo-Saxon countries and Continental Europe and Japan (CEJ), although the effects differ, while fixed investment is reduced in Anglo-Saxon countries, and this result is mixed for Continental Europe and Japan. Despite the effects' differences in some circumstances between Anglo-Saxon countries and CEJ, Davis (2003c) argues that it should not be overstressed as some factors, e.g. the emergence of EMU have been driving CEJ to converge to Anglo-Saxon systems.

To our knowledge, it is the only empirical work of this kind available at the moment, so more research is needed; for example, more data about emerging market economies (EMEs) could be used to complement findings derived from only advanced countries, and to test whether pension funds' impacts on OECD countries and EMEs are homogenous. In addition, abstracting from the statistical linkage between pension assets and economic growth via corporate governance, a serious investigation is needed as to whether there is a Granger causality relationship between pensions and growth.

2.2.3.3.7 Banking industry

The banking industry has been argued to be positively linked to economic growth and financial development, while pension reform may influence banks' role. A recent comparative study by Barth et al (2004) shows that higher income countries always have a larger banking industry which is proxied by Bank assets to GDP. For example, the average ratio of Bank assets/GDP for high income countries was 343.66 per cent, and this figure was 91.26 per cent, 79.94 per cent and 52.34 per cent for upper middle income, lower upper income and lower income countries respectively.

Cross-country and panel studies on the issue of association between banking industry and economic growth are extensively conducted by researchers, notably Beck and Levine (2004), Beck et al (2000) and Levine and Zervos (1998) etc. Among the commonly used banking indicators are bank assets to GDP, private credit provided by deposit money bank assets to GDP, commercial bank asset to central bank assets, etc. On balance, both standard cross-country and more recent panel analysis confirm a positive correlation between banking, finance and the economy, allowing for not only the traditional determinants of GDP growth, such as the initial school enrolment rate (Beck and Levine 2004; Levine and Zeros 1998), but also the legal origins (Beck et al 2003a), endowment indicators, religious composition, etc (Beck et al 2003b).

The banking sector is important, but since the 1980s, OECD countries have witnessed the pattern of relative decline of banking (Davis 2000a). For example, as a share of financial claims, the volume of deposit and loans has declined while the interest margins narrowed, although Kaufman and Mote (1994) conclude that there is little evidence of an absolute decline in banking taking into account banks' non-interest income. In addition, as the descriptive statistics indicate in our Part two, there is little sign that banking industry is diminishing relative to GDP.

The relative decline of banking since 1980s might be due to the competition from institutional investors. For example, on the liability side, banks have faced strong competition from mutual funds in some countries, e.g. US. mutual funds play a very important role in the US retirement market. Mutual fund share of the US retirement

market[24] in 2002 was 21 per cent at the order of $2,082bn, while mutual funds made up 46 per cent of total IRA assets in the same year (ICI 2003). Mutual funds, given its leaner cost structures can offer a higher return, e.g. due to no capital reserve requirement, is obviously attractive to households. New technology also has helped mutual funds to challenge banks' role in facilitating payments. For example, the cash management accounts offered by mutual funds in the US allow individuals to deposit their salaries and make routine payments (Allen and Santomero 2001). Therefore, there is a clear sign that mutual funds are becoming a challenging substitute for banking liabilities.

In addition, on the asset side, institutional investors have broadened the scope of borrowing options for corporations, then these latter realise that it might be more convenient and cheaper to finance projects via securities markets than via loans. A number of studies (Holzmann 1997) show that corporate bond issuance has increased significantly since 1981 when Chile started its pension reform. On the one hand, pension funds need new investment instruments, like corporate bonds; on the other hand, firms might find it is cheaper to issue debt in the securities markets than borrowing from banks (Davis 2000b)[25]. A three-country comparison study by Schmidt et al (1999) gives evidence that households' claims on banks as a proportion of total financial assets has fallen across all three countries – France, Germany and the UK. Also, Byrne and Davis (2002) reach the same conclusion that the bank deposits holdings in the household's portfolio have declined significantly for EU-4 countries, i.e. the UK, Germany, France and Italy, while holdings of life and pensions assets have increased a lot during the period of 1980 – 2000.

In view of increasing competition from institutional investors, banks in many countries have taken steps to prosper nonetheless (Davis and Steil 2001; Allen and Santomero 2001), e.g. by focusing on off-balance-sheet and fee earning activity and cutting costs. The underlying strategy is to develop new lines of business so as to compensate for the declining business in traditional intermediation. Davis and Tuori (2000) suggest that banks across OECD countries have increased their fee-earning ability. For example, the ratio of non-interest income/asset increased from 0.9 per cent in 1984-1987 to 1.0 per cent in 1992-1995 for EU countries, while this figure was 1.3 and 2.1 for the US.

In addition, banks have comparative advantages which are likely to be durable, e.g. the importance of bank lending relationships to small firms (Hannan 1991). This point is important in that pension funds, e.g. in the UK have shown reluctance to invest in

[24] In the US, total retirement market is consist of IRAs, defined contribution plans, state and local government employee retirement funds, private defined benefit plans, federal defined benefit plans and annuities (ICI 2003). At the year-end of 2002, total asset is $10,150bn.

[25] The increasing popularity of securitization has eroded banking industry on the assets side as well, although it is worth noting that it only reflects the balance sheet size, not necessarily the profitability. The transformation of mortgage is particularly relevant here. Traditionally, mortgages were originated and financed by the bank until it was paid by the households. But now the mortgage can be originated by one firm and then financed by another firm which then aggregates different mortgages into one large pool. The most innovative step here is that the firm partitions the expected cash flow from this pool into marketable securities which then are sold to the investors in the securities markets. The consequence of this mortgage securitization is lower cost from the mortgagee's point of view and bank's deteriorating role in financing. Institutional investors, including pension fudns, mutual funds, etc have play an important role in the rapid development of securitisation.

small firms which although have higher expected return than blue chip companies (Davis and Steil 2001). Therefore, it is argued that banking industry, is in a state of evolution rather than outright decline (Davis 2002a), and will continue playing an important role in modern financial systems.

Due to different financial systems, risk management techniques adopted in the banking industry vary across Anglo-Saxon and Continental European countries and Japan (henceforth CEJ) (Allen and Santomero 2001; Allen and Gale 2001). Based on the model designed by Allen and Gale (1997), banks in the CEJ, notably Germany, France and Japan, due to lack of strong competition from financial markets, e.g. mutual funds in the US, can build up a 'buffer' during good times by paying less while running down this buffer when times are bad, known as intertemporal smoothing or time series risk sharing. This theory explains why households in the CEJ hold large proportion of assets in liquid and low risk assets, which might be viewed as the sign and one of factors contributing to banking's declining in CEJ.

On the contrary, individuals in the Anglo-Saxon countries, e.g. the US and the UK can bear more risk by investing more in equity via cross-sectional risk sharing. In order to meet this end, banks have to employ financial engineering techniques, e.g. swaps and options to share risks among individuals at a given point of time. If they are not serious about risk management and do not undertake cross-sectional risk sharing, it is more likely that individuals would withdraw assets from banks and invest in financial markets which are to be more developed in the Anglo-Saxon countries than CEJ.

Following the competition e.g. from institutional investors, banks have managed to prosper as we discussed above. But is competition always good? The conventional view is that there is a trade-off between competition and financial instability, i.e. competition is desirable but excessive competition might lead to financial instability. Therefore, given the massive and visible loss arising from financial instability[26] to the economy, policy makers always favour concentration, thus financial stability at the expense of competition policy[27]. For example, Beck et al (2003) with a dataset from 79 countries give evidence that countries with higher banking concentration are less likely to incur banking crisis. Theoretical work by Boyd and De Nicolo (2003) shows that the traditional wisdom of a trade-off between competition and instability fails to identify two fundamental incentive mechanisms, which induces banks to take more risk if the markets are concentrated.

Allen and Gale (2004), however, argue that the nature of the trade-off between competition and financial stability is more complicated than was conventionally perceived. For example, they use 6 theoretical models to identify the relationship between competition and financial stability. Some models, e.g. contagion model are consistent with the view of this trade-off relation, while others, e.g. a general equilibrium model, suggest the co-existence of perfect competition and financial

[26] A cross country study by Hoggarth and Saporta (2001) shows that on average, the output loss following financial instability is 15-25 per cent of GDP. In addition, this loss would be much larger if a twin banking/currency crisis occurs together, the cost of which is around 23 per cent of GDP.

[27] It might be argued, however, that concentration and competition can co-exist. The underlying rationale is that competition from institutionalisation leads to bank concentration, as the latter is willing to achieve the economies of scale.

instability to ensure optimal efficiency, thus denying the conventional view of trade-off.

In addition, it has been argued that banking competition, for example, following the emergence of EMU as well as institutionalism (Davis and Steil 2001), has a two-fold impact. On the one hand, a more efficient banking systems could come, which then is beneficial to the financial markets and economic growth via efficient capital allocation. On the other hand, financial systems might be prone to crisis, for example because banks start to seek more profitable but risky business or due to banks' exposure to non.-bank financial intermediaries e.g. hedge funds which are not subject to regulatory requirement (ECB 1999). Moreover, it has been noted that the wide use of financial derivatives is conducive to financial instability and difficulty of financial monitoring and regulation (Large 2004). Greenspan (2003), however, points out that "the use of a growing array of derivatives and the related application of more sophisticated methods for measuring and managing risk are key factors underpinning the enhanced resilience of our largest financial intermediaries".

Empirical work by Davis and Tuori (2000) reveals that institution competition pushes banks towards non-interest income. Meanwhile, they find that small banks in the EU have less ability to earn fee related income than large banks, then they tend to hold more risky assets, the consequence of which might be increased financial instability. They also argue that non-interest income is more stable than interest income in most EU countries, but this story is different in the US where non-interest income is more volatile. For example, the standard deviation of the ratio of non-interest income/assets was 0.35 while it was 0.19 for the ratio of net interest income/assets. Similar results are also presented by Schuermann (2004) for the period of 1997-2002. The differential volatilities related to interest and non-interest revenue might have implication of financial instability if the trend toward non-income earning activities will continue in a long term.

Institutionalisation, i.e. growth of institutional investors, has been argued to affect banking industry in various ways as shown above, but to what extent this effect is and detailed across-countries econometric studies are open to answer and undertake. In particularly, is the impact of institutional investors on banking industry homogeneous across countries? In addition, what are the long run and short run effects and are they same?

3 Empirical work

In Section 2, we reviewed the relationships between pension reform, pension funds, economic growth and financial development in a context of composing a PAYG system and the World Bank Model. In this part, we aim to empirically analyse whether the hypothesised relations exist and if so, to what extent.

Empirical work in this area is well documented, but their research scope is limited to either developed countries or Latin American countries, notably Chile (Holzmann 1997). Our study intends to put them together and include more countries as well as more indicators to cover both economic and financial implications.

Second, many researchers confuse pension reform and pension funds. These two concepts are closely linked (for example, most pension reforms introduced funded elements which are argued to promote pension fund assets), but not identical. In other words, pension reform does not simultaneously mean pension fund growth, particularly for some reforms, like defined contribution PAYG systems, while in other cases, asset growth is very slow. But it might be argued that pension reform provides people with the expectation that pension funds will increase. Therefore, in this study, we separate these two concepts i.e. pension reform and pension funds, and investigate their contributions to economic growth and financial development separately.

Third, this study intends to identify pensions' impacts on various aspects of growth and finance. For example, regarding the economic implications, we seek to look at not only the indirect linkage, e.g. via productivity, investment and savings, but also the direct link by introducing variables, like the GDP growth rate. As of stock markets, we use variables of market capitalisation, stock turnover and total value traded, looking at the size, liquidity and efficiency aspects.

Fourth, we use various econometric specifications, e.g. panel error correction model and an extension of panel Granger causality tests to observe the long run and short run relations. For the latter methodology, i.e. Granger causality test, our estimation can increase statistical significance by pooling observations, which we argue is an improvement on the recent work by Impavido et al (2003).

Last, in this study, we use a dataset covering 72 countries, including both OECD countries and emerging market economies (EMEs). This dataset to our knowledge is larger than that used in most current literature, e.g. in Walker and Lefort (2002). With more data in hand, we hope estimation results will be more robust and accurate.

The rest of this part is split into three sections. The first section presents estimation results of pension reform's impact on economic growth, then the second section focuses on the estimations between pension fund assets and economic growth, and the third section deals with the results of pension funds assets' effect on financial markets. Within each section, we show data sources, variables, econometric specifications and results in sequence.

3.1 Pension reform's impact on economic growth

3.1.1 Data and variables

In this study, we mainly use macro-economic and financial data from a panel of 59 countries, where we have 38 EMEs and 21 OECD countries over the period of 1960 – 2001. As for EMEs, 19 are defined as no reform countries and the rest are reform countries towards World Bank model, while regarding the 21 OECD countries, 13 are non-reform countries and 8 reform ones (see Table 6 for country details)[28]. By passing, it is worth noting that totally in this paper we used 72 countries, which, however, are not necessarily included in every estimation, i.e. different estimations used different groups of countries (see Appendix 2 for detail). In order to consider pension reform impact's heterogeneity, we naturally group them into a) All countries with table heading - All, b) OECD countries with heading - OECD and c) Emerging market economies with heading - EMEs, which are in turn estimated separately.

All data are obtained directly from World Development Indicators 2003 (WDI) database and the Financial Structure and Economic Development database (Beck, Demirguc-Kunt and Levine 2003). But there are two exceptions. First, the private saving rate is obtained from Loayza, Lopez, Serven and Schmidt-Hebbel (LLSS) (1998), where they have a dataset covering 150 countries and spanning 1960 – 1995.

Second, like most studies on growth accounting, total factor productivity growth rate (TFPGR) is calculated, based on a transcendental logarithmic (translog) production function as shown below (OECD 1997):

$$Ln(\frac{Y(t)}{Y(t-1)} = \theta_k \, Ln(\frac{K(t)}{K(t-1)}) + \theta_l \, Ln(\frac{L(t)}{L(t-1)}) + TFPGR_{t-1} \qquad (10)$$

Y, output. GDP measured at 1995 constant prices.
K, input of capital. Measured as the capital stock[29].
L, input of labour. Defined as the total population.
TFPGR, total factor productivity growth rate.

θ_l and θ_k, shares of capital and labour input respectively. Assumed to be 1/3 for capital input and 2/3 for labour input here[30], which is consistent with Davis (2003a).

In order to obtain a comprehensive picture of the extent to which pension reform towards funded systems independently affects economic growth, we use 6 economic indicators; total factor productivity growth rate (TFPGR), GDP growth rate (GDPGR), gross fixed capital formation/GDP (GFCFGDP), private saving rate (private saving/gross national disposable income) (PSR), gross domestic saving/GDP (GDSGDP) and gross national saving/GDP (GNSGDP).

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[28] In addition, in Appendix 2, countries used in our 7 different estimations are detailed in greater length.
[29] Capital stock is calculated based on the perpetual inventory method. Consistent with Luintel and Khan (1999), we used an 8 per cent depreciation rate and averaged the first 3-year growth rate to obtain the initial capital stock.
[30] In fact, a more accurate method is to estimate the share of labour input as the wage compensation as a fraction of GDP at current factor cost, while the share of capital input is the complement of the share of labour (OECD 1997).

The TFP growth rate is calculated based on Equation 10 above and captures the residual contribution which is not due to capital and labour input factors. The GDP growth rate is included here to complement current pension literature whereby this indicator normally is dismissed, i.e. to look at the relationship between pension reform and growth per se. gross fixed capital formation is also called gross domestic investment, comprising the growth in fixed assets of the economy. The private saving rate is residually derived by subtracting government saving from national saving (LLSS 1998). Gross domestic saving is calculated as GDP less final consumption expenditure, while gross national saving is equal to gross domestic saving plus net income and net current transfers from abroad (WDI 2003).

Regarding the explanatory variables, we employ many indicators under different headings as shown in Table 7. The inflation rate (INFL) and real interest rate (INT) are used to proxy macro-economic conditions. INFL is measured by the annual percentage change in the GDP, while INT is the real interest rate, i.e. nominal interest rate minus inflation rate. Also, we include GDP per capita (GDPPC) to measure the level of development, and initial value of GDP per capita (I_GDPPC) to control for convergence; in other words, rich countries are expected to grow less fast than poor countries.

In addition, we use four indicators to proxy financial development. One is liquid liabilities to GDP (LIQUID), equal to currency and interest-bearing liabilities of banks and other financial intermediaries divided by GDP, and another one is domestic credit provided by the banking industry (CREDIT), equal to claims on both private and public sectors by deposit money banks divided by GDP. These two indicators are used to measure the size and activity of financial intermediaries (Beck, Bemirguc-Kunt and Levine 2003). The rest two variables are stock market capitalisation to GDP (STKCAP) and stock market total traded to GDP (STKTRD).

We include some other variables in our regressions for savings. POP15 is the proportion of people aged 15 – 64 to total population, while POP65 is that of people aged 65+ to total population. In addition, URBN is the urbanisation rate, i.e. the urban population as percentage of total population (Samwick 1999, Loayza et al 2000).

Last, YR is a time trend variable to proxy years-since-reform, e.g. 1 for the year of 1981 for Chile, 2 for 1982, etc. YR is used to look at the independent effects of pension reform on various dependent variables (See Table 7 for all variable details).

3.1.2 Econometric specification

In this subsection, we seek to find the impact of social security systems' transition from PAYG schemes towards the World Bank model[31] on economic growth. The general specification we employ is as follows:

[31] World Bank model country here is a general term referred to any country transforming from a purely public PAYG system to a new pension system with a significant funding element, not necessarily the specific three pillar model introduced by the World Bank. For example, the Chilean pension reform in 1981 is not the exactly same as that recommended by World Bank, but we still group Chile into World Bank model. As the positive effect of pension reform is most likely to come from the funded pillar, so

$$LOG(\mathrm{K})_{it} = \alpha + \beta_1 LOG(X)_{it} + \beta_2 LOG(Y)_{it} + \beta_3 LOG(Z)_{it} + \beta_4 YR_{it} + \beta_5 YR_{it} \wedge 2 + \beta_6 YR_{it} \wedge 3 + \varepsilon_i + \upsilon_{it} \quad (11)$$

i = 1,…, N; t= 1,….T. Letter - i denotes 59 countries (21 OECD and 38 EMEs) in this study. Letter - t as usual denotes the time dimension from 1960 to 2001. It is worth mentioning, however, that due to our unbalanced panel methodology, the actual observations we used for each regression estimation might not equal and very likely to be less than the simply (N*T), in that our package, i.e EViews automatically drops those countries which do not have valid observations. This problem exists for all panel regressions in this paper.

The general model we use in this section is a cross-section weighted generalised least squares (GLS) unbalanced panel, and the intercept is specified as fixed effect. The standard errors are White heteroskedasticity consistent. We believe fixed-effects model is better than the random-effects model, as the unobserved individual heterogeneity is more likely to be correlated with our included explanatory variables. However, we assume that across sections have common intercept as well when initial levels of GDP per capita (I_GDPPC) are included into three separate regressions where total factor productivity growth rate (TFPGR), GDP growth rate (GDPGR), gross fixed capital formation/GDP (GFCFGDP) are used as dependent variables respectively. Compared with results estimated from fixed effect model, we found that under this specification, the coefficients of I_GDPPC are negative and statistically significant - consistent with economic theory, and without sizable deterioration of other variables. Therefore, we only report the results estimated from this variant specification and ignore those from fixed effect model.

For pension reform's impact on economic performance, as we mentioned earlier, 6 different dependent variables are used, i.e. total factor productivity growth rate (TFPGR), GDP growth rate (GDPGR), gross fixed capital formation/GDP (GFCFGDP), private saving rate (PSR), gross domestic saving/GDP (GDSGDP) and gross national saving/GDP (GNSGDP), all of which are represented by the vector K as shown in the above equation.

X is a vector of variables controlling for countries' macro-economic conditions, which include inflation (INFL) and the real interest rate (INT). Y is vector of financial development variables, including liquid liabilities to GDP (LIQUID), domestic credit provided by banking industry (CREDIT) and stock market capitalisation (STKCAP), as the positive correlation between finance and growth has been found in empirical studies (King and Levine 1993; Beck et al 2000). Z represents other variables if necessary, for example the proportion of people aged above 65 (POP65) and urbanisation rate (URBAN) are used in our saving regression, because it is mentioned that urbanisation is a proxy to measure precautionary saving effects (Loayza et al 1998) and the variable - POP65 used in view of the life cycle model and precautionary motives model (Kohl and O'Brien 1998). Also, we include GDP per capita (GDPPC) and initial level of GDP per capita (I_GDPPC). These explanatory variables are all

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this simplicification should be able to capture the important points. Meanwhile, we defined DC-PAYG countries, e.g. Sweden as non-reformers, i.e. classified as non-WBM model.

included so pension coefficient does not get significant just due to omitted variables bias.

YR is a time trend variable to proxy years-since-reform. Readers will notice that some countries, e.g. France, Jordan, etc. adopt PAYG systems throughout our whole time dimension, i.e. 1960-2001, while for other countries, pension reform started from some point of this period. The coefficient of YR represents the effects in the short run while the coefficient of YR^2 is the long run effect. Specification in this way is to look at the possible dynamic nature of pension reform, i.e. people need time to familiarise themselves with and get confidence about the pension reform, particularly if it is a radical change compared with the old systems. The same specification has been used by Packard (2003) where he looks at the effect of privatising pension system on labour market across 18 Latin American countries.

In addition, some of our data, e.g. CREDIT, are unsurprisingly non-stationary (see Table 8 for results of panel unit root tests), but we do not detrend them given our main consideration is the long run effect. This similar specification whereby trending data are not differenced to be stationary when looking at the long run relation are employed by many researchers in pension literatures, e.g. Walker and Lefort (2002). Last, we use logarithm of all variables so as to find the elasticity relations. But for some variables, i.e. inflation (INFL) and interest (INT), we use log(1+INFL) and log(1+INT) (Beck et al 2000) in order to increases valid observation as negative values cannot be logged (See Table 7 for all variables used for this and the following econometric work).

3.1.3 Empirical result

Table 9 shows the pension reform's impact on total factor productivity growth (TFPGR). In Column 1 it is indicated that, in the short run the effect is negative at the level of –0.1587 - the coefficient of YR, but it is not significant. In the long run, this effect, i.e. the coefficient of YR^2 turns into positive, which is both meaningful economically, albeit statistically insignificant[32]. As we discussed earlier that due to less labour distortion and asset accumulation etc, productivity is expected to increase following pension reform. Regarding other variables, our estimation looks satisfactory. For example, the coefficient of L(I_GDPPC) is –0.4068, which implies that poor countries can grow faster than rich countries by around 4 per cent. This magnitude is consistent with recent findings by Beck and Levine (2004). Based on different specifications, they find the coefficient to be at the level of –0.002 and –1.066, but most results range from –0.4 to –0.8. In addition, we complement findings by King and Levine (1993) by obtaining a positive coefficient of GDPPC, which indicates the positive relationship between the level of development and the growth. The coefficient of LINFL carries the expected sign, minus, showing the damaging effect of high real interest rate on the growth.

[32] Term YR^3 was also included into our equations mainly for the econometric purpose, so we will not interpret their economic meanings. It shares the same logic behind the dynamic OLS (DOLS) model where lags and leads of independent variables are normally used (Kao and Chiang 2000, Davis and Hu 2005b). In this paper, by including term YR^3, the coefficients of YR and YR^2 are more likely to have results consistent with the economic theory. Same methodology was used in Packard (2003).

When we divide all country into two subgroups, i.e. OECD countries and EMEs, the general impression is that pension reform is not strongly related to TFP growth rate, as our estimation results are not statistically significant. But the signs of YR and YR^2 coefficients for EMEs are as expected, while the results for OECD countries are less straightforward as indicated in Columns 2 and 3 of Table 9. Abstracting from the statistical insignificance, different estimated results of OECD countries and EMEs might reflect the heterogeneity across countries.

In developing countries, there are large portions of informal industry in the economy and they are slow in response to the efficiency gains e.g. in labour market, given that they normally do not participate in the formal social security systems, while for most OECD countries with some exceptions, e.g. Italy and Spain, the informal sector is less significant. Consequently, the coefficient of YR for OECD is positive, while that of YR^2 is negative.

In terms of other explanatory variables, coefficients of L(I_GDPPC) again are negative in both cases and consistent with economic theory, while liquid liabilities as percentage of GDP (LLIQUID) show positive coefficients, indicating the positive effect of financial deepening on economic growth, although it is noted that it is statistically insignificant. Meanwhile, the credit ratio (LCREDIT) tends to have a negative sign in OECD, in contrast to the positive sign in Levine and Zervos (1998). This result, although intriguing, is consistent with the findings by Davis (2003a). In that paper, he argues that a large banking industry in an advanced economy, might a liability by generating macro-economic instability, e.g. via commercial property cycles (Davis and Zhu 2004a, 2004b).

Now, we move on to specifications using 2 other different growth indicators as dependent variables, i.e. GDP growth rate (GDPGR) and gross fixed capital formation/GDP (GFCFGDP) in Tables 9 and 10 respectively. Inclusion of GDP growth rate into our regression complements current literature. As we mentioned in previous literature review part, most pension researchers, e.g. Holzmann (1997) and Walker and Lefort (2002) dismiss this variable in their econometric work, although Davis (2003a) uses such growth rate in one of his work on institutional investors. In our view, it is appropriate to look at the direct relationship between pension reform and growth per se by introducing this indicator. As shown in Table 10, for the regression on All countries, the long run effect is positive at the level of 0.01, which means pension reform towards funded system can contribute to GDP growth by 1 per cent.

Regarding other independent variables, results are generally satisfactory. For example the coefficient of L(I_GDPPC) is –0.4210, nearly same as –0.4068 from previous regression. Interest rate is significant and negative, reflecting the fact that too high interest rates threaten investment, further to economic growth. When this regression is run separately on OECD countries and EMEs, pension reform is found to be positively linked to GDPGR in the long run and negatively in the short run, although it is insignificant. The response lag is consistent with Packard's results and claims (2003) as noted in previous section, that people need time to adjust themselves to new pension systems, particularly when such reform is fundamental. Equations for stock value traded (LSTKTRD), again have the positive sign, consistent with results by Levine and Zervos (1998) and complementary to results by Beck and Levine (2004).

As of the third specification of gross fixed capital formation/GDP (GFCFGDP), we find a positive and significant relationship between pension reform and GFCFGDP for both subgroups. For example, for estimation on OECD countries in Table 11, in the short run, the effect is negative at the level of –0.099, while in the long run, such effect is 0.005. The short term negative impact might partly reflect the restraining effect of pension funds on investment (Davis 2003a). In Davis' paper, he finds that the share of equity held by life and pension funds is negatively linked to real fixed investment in Anglo-Saxon countries at the level of –0.23. The finding might be due to the short-termist hypothesis as we reviewed in section 2.2.3.3.6. Due to the regular performance on pension funds by the trustee, pension fund managers prefer dividend payment to fixed investment, which although is damaging to a firm's development in the long run.

In Table 11, our estimates (not OECD) also tend to have a negative sign for the real interest rate, which as we mentioned earlier, reflects these two variables move in the opposite directions, higher interest rate, less investment. The coefficients for LLIQUID and LSTKTRD are positive, revealing the positive relation between the growth and the liquid liabilities and stock value traded (Levine and Zervos 1998).

Last, we focus on the linkage between pension reform and saving rate. Given the data availability, we use three saving indicators, i.e. private saving rate (PSR), gross domestic saving rate (LGDSGDP) and gross national saving rate (LGNSGDP). Our private saving rate is defined as gross private saving/gross private disposable income, obtained from Loayza, Lopes, Schmidt-Hebbel and Serven (LLSS 1998), which is currently the largest dataset covering private savings. This constructed private saving data are more precise than earlier datasets which have been used by researchers, e.g. (Bailliu and Reisen 1997), as it adjusts for capital gains and losses due to inflation (LLSS 1998). In Table 12, it is revealed that in general, pension reform positively impacts on private saving in the long run. For example, for EMEs, private saving increases by 6 per cent following pension reform in the long term. This might be explained in the way that people normally would not reduce their discretionary savings one by one with increases in pension savings, e.g. due to pension assets' illiquidity (Cifuentes and Valdes-Prieto 1997) and credit constraints to certain groups of population, e.g. young people (Davis 2000b). This private saving increase might be also due to the "recognition effect" as noted in Section 2.2.3.1.3. In other words, people realise the unsustainability of unfunded PAYG systems, thus voluntarily saving for their post-retirement lives. This effect is less in magnitude for OECD countries, although insignificant. This differentials in effect might be due to the less credit constraint in OECD countries, compared to EMEs. Therefore, in OECD countries, people are more easily to reduce other forms of private saving (Bosworth and Burtless 2004a) or borrowing when facing pension savings.

As for many other saving determinants, our regressions show expected results as well. For example, the coefficients of LPOP15 are –0.2106, -0.4518 and 0.6552 respectively for three separate regressions, while only the former two are statistically significant. The results are consistent with Loayza et al (2000), whereby in one of their core regressions using full dataset, this variable is found to be –0.299. Meanwhile, old age population is found to affect PSR negatively in OECD and All,

implying their dissaving behviour based on Life-cycle theory (Kohl and O'Brien 1998).

Last, we use two other aggregate saving ratios on the national level, i.e. gross domestic saving rate/GDP (GDSGDP) and gross national saving rate/GDP (GNSGDP). As shown in Tables 13 and 14, pension reform is found to be associated positively in the long run and negatively in the short run with both GDSGDP and GNSGDP for All countries and EMEs regressions, while this finding is less robust for OECD regressions. The short-term reverse relation might be due to the large amount of debt financing, thus public dissaving by the reforming governments, i.e. government dissaving might crowd out private saving. Based on our estimation, the gross national saving rate could be reduced by 9 per cent at the early stage of pension reform in all our sample countries. However, when the transition issue or implicit pension debt (Holzmann et al 2004) is solved, pension reform would have a long run positive impact on gross savings.

The estimation result for OECD in Table 14 deviates from the theory in that they show a reverse relation between pension reform and the national saving rate in the long run. The result is to some extent consistent with Schmidt-Hebbel's claims (1999) that the establishment of fully funded systems is more effective in developing countries than in developed countries. In addition, it might reflect the offsetting effect from fiscal policies by the reforming government as reviewed in Section 2.2.3.1.4. If the government borrowed a lot in order to finance the implicit pension debts, or simply reduced other forms of public saving, the overall effect is the decrease in the national savings. Empirical findings by Bosworth and Burtless (2004a) have confirmed this point by indicating that pension saving reduces non-retirement public saving.

Regarding other saving rate determinants, we find the dampening effect of young and old dependency ratio, i.e. POP15 and POP65 on savings, a result in line with other major work (Loayza 2000; Samwick 1999). In addition, there is evidence that higher inflation rates induce savings, which reflects the precautionary saving hypothesis (Banks et al 1995). For example, Table 14 indicates that one per cent increase in the inflation rate will increase gross national saving by 0.014 for OECD countries and 0.012 for EMEs.

3.2 Pension assets' impact on economic growth

Pension fund assets have increased noticeably during the past decades across both OECD countries and EMEs. As we mentioned earlier, Figures 4 until 7 clearly reveal the steady rising trend of pension assets across all countries (18 OECD countries and 11 EMEs) over the period 1981-2000[33] in terms of pension assets both in absolute values (Figures 4 and 5) and relative to GDP (Figures 6 and 7) where although we have few exceptions, e.g. Fiji, South Africa etc.

[33] In Figure 1 and 2, we average every 5 year observations over 1981-2000, so total together we have 4 observations for each country. We use 1901 to denote the 5 year average over 1981-1985, 1902 to denote 1986-1990, 1903 to denote 1991-1995 and 1904 to denote 1996-2000. Similar designation has been used by Beck et al (2000). These 5 year average data are also created for our econometric analysis in this section.

Table 15 shows that as of 2000, total pension fund assets across 18 advanced OECD countries were US$ 12 trillion, of which, the US as the biggest pension markets, accounted for just above half of the whole assets and Japan and the UK followed. In addition, in terms of pension assets relative to GDP, the Netherlands had the largest figure at the level of 149.09 per cent, while this figure for New Zealand was 0.69 per cent, the smallest across OECD countries in the table.

As regards 28 EMEs in Table 16, the biggest pension markets were Singapore and Malaysia. It is not surprised given that they are two countries which have adopted Provident pension systems since 1950s. Other countries with a significant size of pension assets include Brazil, Chile and Mexico. Total pension assets across our selected 28 EME countries were US$ 280 billion, while the average of pension assets of GDP was 12 per cent, much less than that of OECD countries – 42 per cent.

Given the rapid growth of pension funds and the arguments that pension fund assets might be able to induce economic growth as we reviewed in Section 2.2.3.1, in this section we aim to empirically examine the link between pension fund assets and economic growth.

3.2.1 Data and variable

In this study, we use macro-economic and financial data across up to dozens of countries, including both OECD countries and EMEs. As in previous section, all of these data are from World Development Indicators 2003 (WDI) database and Financial Structure and Economic Development database (Beck, Demirguc-Kunt and Levine 2003).

Pension fund assets data are collected from a number of sources. For OECD countries, OECD Institutional Investors (2003) and Davis and Steil (2001) are the main sources, but some are expanded and updated by checking financial statistical reports in individual countries, e.g. National Financial Statistics in the UK. For Latin American countries, the website of the International Federation of Pension Fund Administrations in Chile is very helpful in this case[34], where we obtained pension data up to the year end of 2003 on most Latin American countries and some reform countries in Central Asia and Eastern Europe, e.g. Hungary and Kazajstan. For South Asian countries and South Africa, pension data are largely compiled individually by searching e.g. local central banks' Financial Bulletin, although ASEAN Social Security Association's website was used to update recent pension data[35] on some Southeast Asian countries. Regarding the observation period, in general, for OECD countries, e.g. the UK, the US, we have data ranging from 1960s to 2001, while for many EMEs, e.g. Argentina, the data available are relatively limited. See Table 17 for detailed sources of pension data on South Asian countries and South Africa.

3.2.2 Econometric specification

[34] One of my friends' kindness in helping me to read this Spanish language website is greatly grateful.
[35] Special thank here is given to Mukul Asher who kindly provided me with relevant information on data collection regarding Southeast Asian countries. In addition, Gregorio Impavido's suggestion on data searching, particularly on South Africa is also appreciated.

In order to find the extent to which pension fund assets are correlated to economic growth, we utilise three specifications. The first two are borrowed from the economic growth literature, notably by King and Levine (1993) and Beck, Levine and Loayza (2000), while the last specification is a Granger-Causality test, aiming to test whether there is a causality relation between pension fund assets and economic growth.

3.2.2.1 Panel Contemporaneous regression on 5 year averages

The first regression is to look at the contemporaneous relation between pension fund assets and economic growth which is proxied by three indicators, i.e. total factor productivity growth (TFPGR), gross fixed capital formation growth rate (GFCFGR) and GDP per capital growth rate (GDPPCGR). Explanatory variables are pension fund assets as % of GDP (PFAGDP), liquid liabilities as % of GDP (LIQUID) to proxy financial development, ratio of government expenditure to GDP (GOVEXP), interest rate (INT) and inflation rate (INFL) as indicators of macroeconomic stability, export and Import as % of GDP (EXIMGDP) to capture an economy's openness and initial GDP per capita (I_GDPPC) to control for convergence (Beck and Levine 2004; Levine and Loayza 2000). In addition, we use a number of variables which appeared in our earlier study, but normally dismissed in many growth-finance literature e.g. work by Levine et al (2000, 2004). They are stock market capitalisation (STKCAP), stock market turnover (STKNV) to indicate stock market development, domestic credit provided by banking industry (CREDIT) to measure the banking system, and urbanisation to measure industrialisation. Therefore, the model we used is as follows:

$$\begin{aligned} LOG(EG)_{it} = \alpha + \beta_1 LOG(PFAGDP)_{it} + \beta_2 LOG(INFL)_{it} + \beta_3 LOG(INT)_{it} + \\ \beta_4 LOG(LIQUID)_{it} + \beta_5 LOG(CREDIT)_{it} + \beta_6 LOG(STKCAP)_{it} \\ + \beta_7 LOG(STKTNV)_{it} + \beta_8 LOG(GOVEXP)_{it} + \beta_9 LOG(URBAN)_{it} \\ + \beta_{10} LOG(EXIMGDP)_{it} + \beta_{11} LOG(I\_GDPPC)_{it} + \varepsilon_i + \upsilon_{it} \end{aligned} \tag{12}$$

EG: vector of economic growth indicators, including TFPGR, GFCFGR and GDPGR.

In order to seek the long run relation and remove the business cycle effects, we average every 5 year's observations over the period of 1981-2000, so at the end, we have 4 observations for each variable. Note, for some variables, particularly PFA, data are not complete for each 5 year interval, so in some cases, we average 3 or 4 year's observations, but we still have 4 observations for all variables regardless if each interval has full data. In fact, in view of this problem, we carefully selected countries from our sample, so we only use those countries which either have full data over 1981-2000, or have data straddling at least two intervals, i.e. two 5-year periods and in each interval at least two observations are available so as to make assure our averaging technique does not lose its meaning. Following these criteria, only 29 countries are available to use (See Table 18 for a country summary). In addition to this core regression, we also seek to control for other countries, i.e. countries without or having very few pension assets during the period 1981-2000. In other words, we run the same regressions, but include all other countries, e.g. France, China; in this

way, we hope to see whether the inclusion of countries with no pension assets can materially affect our previous results. For the latter methodology, we include all 72 countries (See Appendix 2 for country summary).

3.2.2.2 Cross country initial regression

The first regression, i.e. panel contemporaneous regression we have just discussed above, aims to find the extent to which growth is linked to pension fund assets after removing business cycle effects with the variables set in 5 year averages. The second regression, also from King and Levin (1993), seeks to look at the relationship between initial values of pension fund assets at the beginning of specified period and the subsequent period of economic growth. The underlying logic is, abstracting from the debate whether there is any long run relation between pension assets and growth, that one very interesting question is whether the former is a good predictor of the latter.

As regards this regression, we still use three growth indicators as in our first panel contemporaneous regressions. They are TFPGR, GFCFGR and GDPPCGR; 5 year averages of 1996-2000 and 10 year averages of 1991-2000 are used in two separate regressions, although the latter is considered as core regression, as in this case we have more reasonable length of observations. Among explanatory variables are pension assets (PFAGDP), domestic credit provided by banking sector (CREDIT), stock market capitalisation (STKCAP), government expenditure (GOVEXP), inflation (INFL), real interest rate (INT), ratio of export plus import to GDP (EMIMGDP). For all explanatory variables, initial values of 1991 and 1996 are used, again for two separate regressions. It is worth noting that due to limited dataset in this study of cross country initial regression, we are not able to use all potential explanatory variables, e.g. stock market turnover, which are argued to be linked to economic growth as used in our previous study. Regarding countries included, we use all 72 countries and assign zero to PFAGDP for those countries which have no or very few pension assets in 1991 and 1996. It should be, however, noted again that due to automatic endpoint adjustment in our package, the included countries are always less than 72.

3.2.2.3 Granger-causality test

Above, we followed the estimation procedures by King and Levine (1993) and Beck et al (2000) to examine the relationship between pension fund assets and economic growth. On balance we found a positive link between pensions and growth as presented in next section, but the estimation results at best imply that pensions and growth are positively correlated. The question of the causality relation, i.e. the causality direction between pensions and growth, however, are still unanswered. Therefore, in this section, as our last specification, we seek to complement our analysis above by using Granger causality and intend to find the temporal causality relation between pensions and growth.

The best known causality test is the Granger causality test (Granger 1969), but this test is commonly used with time series data. In this study we adapt it to a panel data context (cross section and time series). The general model specification for panel Granger causality is as follows:

$$Y_{i,t} = \sum_{k=1}^{p} \lambda^k Y_{i,t-k} + \sum_{k=0}^{p} \beta^k X_{i,t-k} + \varepsilon_i + \upsilon_{i,t} \tag{13}$$

$p \in \square$, and $\forall k \in [1, p]$. K indicates the lag of variables Y and X. i and t denote time and country respectively.

The introduction of both cross section and time series dimensions largely increases the observation, which is urgently needed in this study and reduces the collinearity among independent variables, thus improving the efficiency of Granger causality tests.

We use the testing procedure proposed by Hurlin and Venet (H-V) (2003) and Hurlin (2004) for panel Granger causality tests.

A. Homogeneity (HO) hypothesis test

The first step of the H-V (2003) approach is to test the homogeneity of the coefficients associated with X at all lags. We allow the coefficients of Y, i.e. λ^k in Equation 13 to vary across countries. The hypothesis is as follows:

$$H_0 : \beta_i^k = \beta_j^k \quad \forall k \in [1, p] \quad \forall (i, j) \tag{14}$$

$$H_1 : \beta_i^k \neq \beta_j^k \quad or \quad \beta_i^k \neq \beta_j^k \quad \exists k \in (1, p) \quad \exists (i, j) \in [1, N] \tag{15}$$

H_0 shows that coefficients associated with $X_{i,t-k}$ in Equation 13 are identical for each lag, while H_1 indicates that for some lag k, coefficients across countries are different. The relevant F statistics is:

$$F_{ho} = \frac{(RSS_0 - RSS_1)/[p(N-1)]}{RSS_1/[N(T-2p-1)]} \tag{16}$$

RSS_0 is the restricted residual sum of squared under H_0 , while RSS_1 is the unrestricted residual sum of squared under H_1, without any restriction.

If the hypothesis of homogeneity (HO) above is accepted, we need to move to the testing of the Homogeneous non-causality (HONC) hypothesis against the alternative of which there is a homogenous causality (HOC) across all N units. In contrast, if the HO hypothesis is rejected, H-V (2003) proposes to test the Homogeneous non causality (HONC) against the alternative of which only a subgroup of N units shows the Granger-causality relationship, i.e. a heterogeneous causality (HEC).

B. HONC VS HOC hypothesis test

Therefore, if the HO hypothesis is accepted, the next step is to test the Homogenous non causality (HONC) hypothesis against the hypothesis of HOC. Mathematically,

$$\forall i \in [1, N] \qquad E(Y_{i,t} / \bar{Y}_{i,t}, \alpha_i) = E(Y_{i,t} / \bar{Y}_{i,t}, \bar{X}_{i,t}, \alpha_i) \tag{17}$$

Equation 17 shows the presence of $\bar{X}_{i,t}$ does not have any explanatory power on $Y_{i,t}$, reflecting the hypothesis of HONC.

Given Equations 13 and 17, the corresponding test is proposed as follows:

$$H_0 : \beta_i^k = 0 \quad \forall i \in [1, N], \forall k \in [1, p] \tag{18}$$

$$H_1 : \beta_i^k \neq 0 \quad \exists \ (i, k) \tag{19}$$

What we need to do is to test if β_i^k is zero for all country i and at all lag k. The F statistics is defined as:

$$F_{honc} = \frac{(RSS_2 - RSS_0)/(p)}{RSS_0 / [NT - N(1+p) - p]} \tag{20}$$

RSS_2 is the restricted residual sum of squared under H_0 in Equation 18, while RSS_0 is the restricted residual sum of squared under H_0 in Equation 14.

If H_0 cannot be rejected, then it might imply that X does not Granger cause Y as shown in Equation 17, and the non-Granger causality process is homogenous. However, if H_0 is rejected, it implies that X Granger causes Y across all units, which in turn is homogeneous. This test is similar to the panel unit root test proposed by Levin et al (2002).

C. HONC VS HEC hypothesis test

As mentioned earlier, if the HO hypothesis is rejected, then we need to test the hypothesis of HONC against heterogeneous causality (HEC). Under the HEC hypothesis, it holds that there exists at least 1 and at most N individual causality relationships which are heterogeneous. Mathematically,

$$\exists \ i \in [1, N] \qquad E(Y_{i,t} / \bar{Y}_{i,t}, \alpha_i) \neq E(Y_{i,t} / \bar{Y}_{i,t}, \bar{X}_{i,t}, \alpha_i) \tag{21}$$

$$\exists \ (i, j) \in [1, N] \qquad E(Y_{i,t} / \bar{Y}_{i,t}, \alpha_i) \neq E(Y_{j,t} / \bar{Y}_{j,t}, \bar{X}_{j,t}, \alpha_j) \tag{22}$$

Therefore, the corresponding hypotheses are specified as follows:

$$H_0 : \beta_i^k = 0 \ \ \forall k = 1, ..., p \ \ \forall i = 1, ..., N \tag{23}$$

$$H_1 : \beta_i^k = 0 \ \ \forall k = 1, ..., p \ \ \forall i = 1, ..., N_1 \tag{24}$$

$$\beta_i^k \neq 0 \ \ \exists k = 1, ..., p \ \ \forall i = N_1 + 1, N_1 + 2, ..., N \tag{25}$$

Specially, in a subgroup of units, i.e. N_1, there is no Granger causality relationship as shown in Equation 24, while for the rest units, i.e. $N - N_1$, X Granger causes Y as in Equation 25.

Given that the structure of the hypothesis of HEC above is similar to the panel unit root test of Im et al (2003), Hurlin and Venet (2003), and Hurlin (2004) design a Wald statistic. The Wald statistic is a simple average of individual Wald statistics.

3.2.3 Empirical results

3.2.3.1 Panel Contemporaneous regression on 5 year averages 1981-2000

Tables 20 and 21 summarise the results of our contemporaneous regression between pension fund assets and economic growth indicators. Table 20 is for regressions on those countries having pension assets, while Table 21 presents results for all sample countries, i.e. controlling for those without pension assets. Estimations in Table 20 are again split into three groups, OECD countries, Emerging market economies (EMEs) and Sub-all which is defined as all countries (35) having pension assets in our dataset, in order to be differentiated from All countries (72) in Table 21.

It is revealed in Table 20 that pension assets are positively and significantly linked to growth, although we do have few opposite results. For example, in the LTFPGR regressions, pension funds (LPFAGDP) show a positive sign in EMES, indicating that pension growth induces higher productivity in emerging markets. Meanwhile, the positive effects of pension funds also are found in investment regressions (LGFCFGR) for sub-all and OECD countries, and GDP growth regressions (GDPGR) for EMEs. It worth noting that, when using GDP growth rate (GDPGR) as dependent variable, for OECD countries, LPFAGDP is negatively associated with LGDPGR at the level of –1.799; this result, however, should be taken with caution, as we have only 32 observations for the regression.

Regarding other explanatory variables, we find evidence of the detrimental effects of high inflation rate on growth. In row 5 of Table 20, 7 out of 9 coefficients of LINFL are negative. Specifically, one per cent increase in inflation can reduce GDP growth rate by 0.2 per cent for EMEs. Also, there is some evidence that higher interest dampens investments, which is revealed in the LGFGFGR regression for OECD. In terms of CREDIT, i.e. domestic credit provided by banking industry, our regressions favour a negative sign. It is intriguing, but same result has been found by Davis (2003a) who argues that large banking lending might contribute to macro-economic volatility, for example via commercial property cycles (Davis and Zhu 2004a). Consequently, economic growth is affected negatively. In addition, there is evidence that initial level of income is reversely linked to economic growth. As shown in Table 20, the variable of L(I_GDPPC) is frequently negative, implying poor countries grow faster than rich countries, consistent with our findings earlier in Section 3.1.3 and those of Beck and Levine (2004). Government expenditure in Table 20, i.e. LGOVEXP frequently shows the negative sign, which is consistent with the hypothesis that macro-economic instability move with economic growth in opposite directions. The magnitude is consistent with other studies. Most estimates of Beck et

al (2000) as concerns the contribution of government expenditure to the economic growth varies from –0.4 to –1.5, similar as what we found in Table 20. In passing, we also find the positive effect of higher openness to the economic growth in LGFCFGR regression for sub-all countries. In addition, we find that stock market turnover ratio has a positive and significant sign, in consistent with research results by Levine and Zervos (1998) and Beck et al (2000).

If pension assets in general can boost economic growth, to what extent this result would be changed if countries without assets are included? In addition, we mentioned earlier that the negative sign of PFAGDP in GDPGR regression for OECD countries in Table 20 might be due to small observation. Therefore, in view of these issues, we run the same regression again, but controlling for countries with no assets, as a variant to check our finding's robustness. Results are given in Table 21. Coefficients for PFAGDP are mixed, although two of three are positive. Some other results are significant. Our regressions favour a negative link between CREDIT, initial level of GDP per capital (I_GDPPC) and growth, in line with our previous findings. Meanwhile, government expenditure, i.e. GOVEXP shows a negative sign, indicating the damaging impact of government size on growth. The same relation is found by Beck et al (2000) who use a dataset covering 77 countries. In addition, the positive contribution from stock market liquidity, proxied by LSTKTNV, to the economic growth is also found. For example, one percent increase in LSTKTNV boosts productivity growth by 0.05 percent. Last, liquid liabilities can stimulate growth, as revealed by the positive signs of LLIQUID in Table 21.

3.2.3.2 Cross country initial regression

As noted, we ran two separate regressions based on two sets of data. For the first dataset, the values of dependent variables are averages of 1996-2000, while those of independent variables are corresponding initial values of 1996. For the second dataset, we use averages of 1991-2000 and initial values of 1991. It should be noted, however, that we believe the results from the second regression are less reliable given the small observation and only included here as a variant. Results are given in Tables 22 and 23.

Regarding the ratio of Pension fund assets/GDP, results are encouraging as revealed in Table 22. Pension assets are a good predicator of productivity, capital formation and GDP growth, a result statistically significant and economically meaningful. This complements our earlier results where there might not exist a strong relationship between pension assets and some growth indicators; pension assets growth is always followed by a faster growth in the subsequent years. In addition, there is evidence that urbanisation predicts economic growth, which is consistent with the argument of a positive link between industrialisation and growth.

Last, as a variant, we run regressions using data of averages of 1991 and 2000 and initial values of 19991. Pension assets are not strongly linked to economic growth, and signs are mixed with positive and negative. Some other variables, however, are significant. For example, initial values of stock market capitalisation are found to be a good predictor of subsequent economic growth, consistent with findings by Levine and Zervos (1998), and Beck et al (2000).

3.2.3.3 Panel Granger-causality test

Tables 24, 25 and 26 present results of panel Granger causality estimation based on pooled annual data across 38 countries[36] (see table 19 for country details). By pooling data in this way, our dataset is significantly enlarged. Normally, we have observations above 100 and up to 600. In order to check the robustness of our results, we use six growth indicators, which are total factor productivity growth rate (TFPGR), GDP growth rate (GDPGR), gross fixed capital formation growth rate (GFCFGR), private saving rate (PSR), gross national saving rate (GNSGDP), and gross domestic saving rate (GNSGDP). In addition, we specify 5 lags order[37]. As regards the hypothesis of homogeneity (HO), our F-test statistics results in Table 24 are satisfactory, as in most cases, they are well above the critical values at 1 per cent significance which are at the range of 1.50-2.00 depending on the lag levels. This suggests that the null hypothesis that the coefficients of X in Equation 13 are homogenous can not be rejected. Given the consideration that the data generating process (DGP) might be heterogonous across courtiers, we split our sample countries into two groups, OECD countries and EMEs. Despite separate estimations on different sub-groups, our results, however, are still robust. Results of these two regressions are given in Tables 25 and 26.

As the hypothesis of HO cannot be rejected, we then move on to test the hypothesis of homogenous non-causality (HONC) against the alternative of which there is a homogenous causality across all N countries by following the procedure of Hurlin and Venet (2003). The underlying rationale is that if the homogeneity of coefficients of X across all countries is valid, then the question of homogenous causality from pension assets to growth arises. Results are reported next to column HO in Tables 24, 25 and 26. Regardless of lags order and growth indicators, our results strongly favour a rejection of the HONC hypothesis, as all F statistics with few exceptions are significantly greater than critical values at both 1 per cent level. Therefore, there exists a homogenous causality relation between pension assets and all six growth indicators (TFPGR, GDPGR, GFCFGR, PSR, GDSGDP and GNSGDP). The results hold even if all countries are split into two sub-groups, OECD and EMEs. The findings from panel Granger causality tests are an encouraging complement to our previous work (Davis and Hu 2005b), in that pension assets are not only closely associated with economic growth, but also Granger cause growth in a positive way. Meanwhile, such a causality relationship is, on one hand, indirect through productivity, investment and savings, and on the other hand, direct as indicated by the significant results on GDP growth rate (GDPGR).

Table 27 gives results where we are curious about the reverse Granger causality, i.e. from GDP growth to pension fund assets. Similarly, the hypothesis of homogenous coefficients of the variable - GDP growth is not rejected for the All regression. But in all cases, the hypothesis of HONC is rejected. Therefore, we have to accept the alternative hypothesis, i.e. homogenous causality (HOC). But when separate

[36] It is noted that the maximum number of countries in this paper is 38. But for different estimations, observations from different number of countries are used, due to data limitation of particular variables.

[37] Choice of 5 lags order is a little bit arbitrary, but the same order of lag is used by Hurlin and Venet (2003) for their empirical work. In addition, 5-year lags are believed to be reasonable length to consider the dynamic structure of our panel data. It is to some extent in line with current growth and finance literature where 5-year averages of annual data are utilised to remove business-cycle effects (King and Levine 1993 and Beck et al 2000).

regressions for OECD and EMEs are estimated, different results emerge. As regards the hypothesis of HO, in 2 of 5 cases for OECD, and 4 of 5 cases for EMEs, HO is rejected. That means for OECD, we do not strongly accept the hypothesis of HO, while for EME, we have to reject that of HO. But as regards the hypothesis of HONC, in all cases of OECD, it should be rejected. In consequence, we conclude that compared to the Granger causality from pension asset to GDP growth, the reverse causality, i.e. from GDP growth to pension assets is not strong.

In sum, in this section based on three econometric specifications, i.e. panel contemporaneous regression, cross-country initial regression and panel Granger causality test, on balance we find a both positive linkage and strong causality relationship between pension assets and growth indicators. Such positive effect of pensions on growth might arise from improved corporate governance of targeted firms at the micro level (Clark and Hebb 2002) and the whole economy at macro level (Davis 2002c, 2003d). In addition, pension assets growth is followed by the increase in productivity due to the benefits of higher saving/investment (James 1996) and/or less labour market distortion (Disney 2003) as reviewed in Section 2.

3.3 Pension assets' impact on financial development

Compared with the study of the impact of pension assets on economic growth, the relationship between pension assets and financial markets has been investigated extensively (Davis 1995, 1998c, 2003c and Walker and Lefort 2002). In this section, we revisit this same issue, but with a dataset, covering both OECD countries and EMEs, in addition to more robust econometric specifications.

3.3.1 Data and variable

This section looks at pension fund assets' impact on financial development from four aspects, i.e. financial intermediaries, the banking industry, the stock market and the bond market. Regarding financial intermediaries, we use the ratio – private credit provided by deposit monetary bank and other financial institutions to GDP (PCDMBOFIGDP) as the dependent variable. It should be noted that other financial institutions include other banklike institutions, e.g. development banks, and nonbank financial institutions, e.g. provident and pension funds (Beck et al 2003)[38]. We concentrate here on private credit rather than credit issued to public enterprises so as to better investigate financial intermediaries' ability to channel saving between householders and investors. In addition, we exclude credit provided by the central bank from the numerator given that government credits are always granted to public sector. Same indicator has been used by Levine et al (1999) and Levine and Zevos (1998).

As for the banking industry, we have two indicators to proxy its development, a) the ratio of deposit monetary bank assets to total financial assets (DMBTFA), b) the ratio of deposit monetary bank assets to GDP (DMBGDP) and c) the ratio of domestic credit provided by banking industry to GDP (CREDIT). The underlying logic is to find out whether with pension fund assets' growth, the traditional commercial banking

[38] But, a check of the data (Beck et al 1999) found that pension assets are included in only very few countries across their dataset.

industry is declining relative to both other financial institutions and the whole economy, and whether the credit provided by the traditional biggest credit providers is under competition from other institutions.

Concerning the stock market, we employ stock market capitalisation to GDP (STKCAP), stock market total value traded to GDP (STKTRD) and stock market turnover (STKTNV), which are most commonly used stock market indicators (Levine and Zervos 1998). In this way, three different aspects of stock market, i.e. size, activity and efficiency are able to be examined.

Last, as regards bond market, public bond market capitalisation to GDP (PUBBND) and private bond market capitalisation to GDP (PRIBND) are employed. More attention should, however, be paid to estimated results on private bond market, in that the extent to which and whether private bond market develops with pension assets growth is our major research question. In contrast, public bond issuance will normally increase following pension reform towards funded systems as the government typically chooses debt financing to make up the implicit pension debt (Holzmann et al 2001).

Most of our macro financial data are from from Beck, Demirguc-Kunt and Levine (2003), and macro economic data are again from World Development Indicators (2003). Pensions data are collected from different sources as mentioned in the previous section (See Table 7 for details).

3.3.2 Econometric specification

In this pension funds study, we use two specifications, i.e. Panel error correction model (PECM) and Panel Granger causality tests.

The advantage of Panel error correction model is its ability to identify the short run and long run relationships simultaneously between economic variables (Banerjee, Hendry and Smith 1986) as well as testing the co-integration hypothesis with the presence of lag terms (Pesaran and Shin 1995). This technique has been widely used by researchers, and most recent applications are with e.g. Barrell and Davis (2004) and Davis and Zhu (2004).

The general formulation for our PECM is as follows:

$$DLOG(K) = \beta_1 DLOG(PFAGDP)_{it} + \beta_2 DLOG(X)_{it} + \beta_3 LOG(Y)_{it} + \beta_4 LOG(Z)_{it}$$
$$+\beta_5 ECM_{i,t-1} + \beta_6 LOG(PFAGDP)_{i,t-1} + \beta_7 LOG(X)_{i,t-1} + \beta_8 LOG(Y)_{i,t-1} + \beta_9 LOG(Z)_{i,t-1} + \varepsilon_i + \upsilon_{it}$$

$$ECM_{i,t-1} = \lambda_1 LOG(K_{i,t-1}) - \lambda_2 LOG(PFAGDP_{i,t-1}) - \lambda_3 LOG(X_{i,t-1}) - \lambda_4 LOG(Z_{i,t-1})$$

(26)

i. is the across country dimension and t is the time dimension. D represents first difference. K is a vector of dependent variables, including various financial indicators, as we have just discussed. PFAGDP is the ratio of pension fund assets/GDP, X is the economic growth indicator, i.e. constant GDP, US dollars in 1995. Y is a vector of

variables controlling macro-economic stability, i.e. inflation (INFL) and real interest rate (INT). Z is a vector of other variables which we believe can determine the dependent variables.

ECM is an error correction term for our panel error correction model, which measures the speed of convergence from short run to long run equilibrium. Coefficients on log level terms show the long run relationship. Note that INFL and INT are stationary, so we use the level terms of these two variables. In addition, they both are not included in the term ECM_{it}, as they are I(0) variables and should not affect the cointegration test (Demetriades and Luintel 1996). (see Table 8 for results of panel unit root tests)

In addition to the core regression as we have just described, we also use a two-stage least squares (TSLS) method as a variant. The underlying rationale is the potential problem of measurement errors as well as simultaneity (Baltagi 2001). In other words, our financial development indicators and pension assts might have a two-way causality relation. Same methodology has been used to eliminate the simultaneity bias in empirical work (Bailliu and Reisen 1997). For the TSLS, we first calculate the fitted values of variable – PFAGDP by running Autoregressive Integrated Moving Average (ARIMA) (p, t, q) model as below

$$u_t = \alpha_1 u_{t-1} + \alpha_2 u_{t-2} + ... + \alpha_p u_{t-p} + \varepsilon_t + \beta_1 \varepsilon_{t-1} + \beta_2 \varepsilon_{t-2} + ... + \beta_q \varepsilon_{t-q} \quad (27)$$

u_t, autoregressive term (AR) and ε_t, moving average (MA) term.

Then, by replacing the original data of PFAGDP with fitted values, we re-estimate the regression of Equation 26 again. As of ARIMA-, we normally use ARIMA (p,1,q) specification, in that PFAGDP is non-stationary but becomes stationary after first differencing (see Table 8 for panel unit root rests). Regarding the orders of p and q, we specify them at the levels of 1 or 2, depending on countries. The method we utilise to choose appropriate order of lags is Ljung-Box Q-statistics and their corresponding p-values (Greene 2003).

$$Q_{LB} = T(T+2)\sum_{j=1}^{k} \frac{\sigma_j^2}{T-J} \quad (28)$$

σ_j is the j-th autocorrelation, while T is the number of observations. Based on Ljung-Box (1979), if ARIMA is correctly modelled, the residuals should be nearly white noise.

We believe PECM is an improvement than those used by other pension researchers, e.g. Walker and Lefort (2002), in that our model enables the identification of the dynamics of pension funds growth, i.e. both a long run and short run effects. In addition, in Walker and Lefort's paper, we suspect their model suffers from spurious estimations, as some explanatory variables, e.g. bank_assets (the assets of deposit money banks to GDP) are non-stationary, but they are included in the regressions in levels.

In addition to Panel error correction model (PECM), Panel Granger causality tests same as in previous section are employed. This specification, complementing our PECM, seeks to identify the extent to which the Data generating process (DGP) reveals the underlying link between pension fund assets and corresponding financial indicators.

3.3.3 Empirical result

3.3.3.1 Panel error correction model

3.3.3.1.1 Panel unit root test

Before proceeding to formal panel regression analysis, the first step is to examine our data's stationarity.

There are a number of ways to test panel data's stationarity (Maddala and Wu 1999; Baltagi 2001). In this study, in order to check our results' robustness, we use two different but commonly quoted tests, i.e. one designed by Levin, Lin and Chu (2002) (hereafter LLC), and the other by Im, Pesaran and Shin (2003) (hereafter IPS).

Consider the following model

$$y_{i,t} = \rho_i y_{i,t-1} + X_{i,t}\delta_i + \varepsilon_{i,t} \quad i = 1,...N : t = 1,...T \tag{29}$$

where y is our variable of interest; X is vector of exogenous variables, including fixed effects and/or a time trend, or simply one or unity, based on the modelers' assumptions. $\varepsilon_{i,t}$ are i.i.d. $(0, \sigma_\varepsilon^2)$. As customary, t proxies time, while i proxies country.

The principal difference between LLC and IPS is the assumption made on ρ_i. LLC proposes that $\rho_i = \rho$, implying the coefficient of lagged dependent variable in Equation 29 is the same across countries, while under IPS, ρ_i is allowed to vary across countries. Given that in our sample, both OECD countries and EMEs are included, we put more emphasis on the latter test, i.e. IPS (2003), in that there might be heterogeneity across countries.

Both LLC and IPS tests are an extended version of time series' Augmented Dickey-Fuller test (ADF) into the context of panel data. The formulation is as follows:

$$\Delta y_{i,t} = \beta y_{i,t-1} + \sum_{j=1}^{p_i} \rho_{i,j} \Delta y_{i,t-j} + X_{i,t}\delta_i + \varepsilon_{i,t} \quad i = 1,...N : t = 1,...T \tag{30}$$

LLC tests the null hypothesis of β=0, while IPS is testing that of β_i=0 for all i. In addition, for the IPS test, t-bar statistics is used, which are formed as a simple average of the individual t statistics for testing β_i=0 in Equation 30, namely

$$t-bar_{NT} = N^{-1}\sum_{i=1}^{N} t_{iT} \quad (31)$$

Results for panel unit root tests are given in Table 8, where test results for all variables used in this paper are presented. In this study, however, we only used some of them, i.e. PFAGDP, INT, INFL, GDPCON, STKCAP, STKTNV, STKTRD, PCDMBOFIGDP, CREDIT, DMBTFA, PUBBND and PRIBND. As shown in Table 8, on balance, all variables, but INT and INFL, are non-stationary in levels, but become stationary after first-differencing, although there are some variations, e.g. CREDIT, and STKCAP.

3.3.3.1.2 Impact on financial intermediaries and banking industry

Results regarding how pension fund assets contribute to one of the financial system's function, i.e. channelling funds, i.e. private credit between investors and savers (Merton and Bodie 1995) are given in Table 28. All coefficients of ECM(-1) are negative and significant as expected, which implies that pension fund assets and the variable – private credit provided by deposit money banks and other financial institutions to GDP (PCDMBOFIGDP) are co-integrated. The coefficient of DLPFAGDP on our All countries regression in Column A Table 28 is 0.03708, positive and significant, suggesting that pensions induce financial development by facilitating saving transfer. This impact, however, is short run and the long run effect is not statistically significant. When we divided All countries into two sub-groups, the results as shown in two other Columns A in Table 28, indicate that there is a positive link in the short run and negative link in the long run, but all are not significant.

Results of Two-stage least squares (TSLS) regressions are given in Columns B Table 28. For OECD countries, we find a negative relationship between pension assets and PCDMBOFIGDP in both short and long terms, while for EMEs, such relation turns into positive. This result is interesting, and it might reflect the heterogeneous corporate financing across countries. Davis and Stone (2004) present results, showing that the equity accounts for a larger share of corporate liabilities in the firms of advanced countries than those of developing countries. For example, the median ratio of debt-equity was 0.59 in G-7 countries, while it was 0.73 in EMEs. Therefore, in OECD countries, crowding-out effect of pension assets on debt financing might be larger. In terms of other variables, we find the benefit of larger stock market (LSTKACAP) on the dependent variable, while the coefficients of LSTKTNV are positive, but not statistically significant.

Table 29 gives results of regressions of PFAGDP on CREDIT (private credit provided by banking industry to GDP). As revealed, the coefficients of DLPFAGDP and LPFAGDP(-1) are negative, implying that domestic credit provided by banking sector across our sample country is declining in both short run and long run. This result, consistent regardless of estimation methods (core or TSLS estimations) and sample grouping, reflects the strong competition from other financial institutions, e.g. mutual fund and large finance companies (AT&T, GE in the US) which have become very active in proving credit to consumers and enterprises (Allen and Santomero 2001). Table 30 clearly shows such trend in the US. For the commercial banking sector, its share of credit providing declined from 33.16 per cent in 1945 to 17.31 per cent in 2003, a 47.82 per cent decrease over this 60-year period. Life and other insurance

companies followed the same trend. Other financial intermediaries, however, had grown significantly during the same period, particularly Mutual funds which nearly increased by 150-fold!

As of other explanatory variables, inflation rate indicates its damaging effect on the credit leading aspect of financial development. This effect, however, is short-term. The long run impact is mixed across countries and estimations, and for most part, not statistically significant. The impacts of stock markets development on credit lending by banks also are mixed and not consistent across OECD countries and EMEs. We, however, find the positive impact of stock market capitalisation on credit lending in EMEs in the long run. This is in line with the "financial accelerator" hypothesis. In EMEs, people are getting richer, which leads to more capital available in the stock market. Consequently, such higher net wealth leads to more bank lending, which in turn stimulates the economic growth.

Table 31 presents the results of regressions of deposit money bank assets to total financial assets (DMBTFA) on pension fund assets. This ratio is designed to look at how traditional banking industry in terms of financial assets responded to pension assets growth. For OECD countries, such effect is negative at the beginning as shown by the negative sign of DLPFAGDP's coefficient, although such effect is not statistically significant based on TSLS estimator. The long run effect is positive, but again statistically insignificant. Abstracting from the insignificant long run term, this finding of negative link to some extent is in line with the statistics presented by Barth et al (1997) which show that during the period of 1950 - 1995, the share of commercial banking industry in the US relative to other intermediaries, such as pension funds and investment companies diminished.

However, for EMEs, the estimated results are different; both in the short run and long run, pension funds growth leads to a higher ratio of DMBTFA. This result is intriguing, but could be explained by the different circumstances between developing and developed countries. In other words, for developing countries, economic and financial environment, e.g. legal systems, accounting standards, is not good enough to significantly induce the development of other financial institutions, e.g. insurance companies, mutual funds. Typically, at the beginning stage, governments (for example, Chile and China) always restrict pension funds investment to a large share of bank deposits for the reason of security[39]. Correspondingly, in the short run following pension funds growth, traditional banking industry improves. On the contrary in the developed countries where markets are more mature, other financial institutions, e.g. life insurers and mutual funds have witnessed rapid growth following pension reform and pension funds. Although there is investment portfolio restriction in developed countries, the magnitude is much less, and also such restriction is more about the debate of international and alternative investments, e.g. hedge funds (Financial Times 2003), rather than whether to invest in equity or hold bank deposit as in many developing countries. In addition, there are some arguments that in EMEs, banking industry and financial institutions, e.g. pension funds are complementary. In other words, banks still serve as important information providers and transaction agents, which is much needed for EMEs (Vittas 200, Mitchell 2000, Davis 1998c).

[39] For Peru, even after 10 years' pension reform, i.e. in 2000, one third of pension funds portfolio is still bank deposit (Walker and Lefort 2002).

If the response of banking industry/total financial sector (DMBTFA) to pension funds growth is differential across countries at least in the short run, the ratio of deposit money bank asses/GDP, i.e. DMBGDP[40] is more consistent over time and across countries. As indicated in Figure 9, our time series descriptive statistics about 72 countries across the world give evidence that deposit money banking sector relative to the whole economy is not weakening. Only five countries, Algeria (DZA), Bulgaria (BGR), Czech Republic (CZE), Finland (FIN) and Romania (ROM) show obvious downward trend in recent years (1990-2001); for BGR, CZE and ROM, the declining trend might be due to the crisis which happened during the transition to market economy in the 1990s. All other countries in Figure 9 either maintained the same level or witnessed rising DMBGDP. Similar statistics have been presented by Scholtens and van Wensveen (1999), and Allen and Santomero (2001), but they only focus on the US.

In addition, Figure 10 shows that over the period of 1960-2001, the average (arithmetic mean) deposit money bank assets/GDP (DMBGDP) for each OECD country was around the line of 0.5 with some countries, e.g. Switzerland (CHE), Germany (DEU) having highest ratios. Compared with OECD countries, EMEs relatively had less developed banking industry, as Figure 11 reveals that most of these 48 EMEs had lower DMBGDP which was much below the 0.5 line, although Hong Kong (HKG) enjoyed the highest ratio. Moreover, the mean of the average DMBGDP for OECD countries was 0.68, while this figure was 0.37 for EMEs. These descriptive statistics are in line with Barth et al (2004) where they use statistics from 50 countries and conclude that more developed banking industry one country has, richer the country is. Therefore, there is a positive link between economic growth and banking sector. Under this rationale, it might be argued that pensions funds induce economic growth via positive impact on banking industry.

Taking into account all the empirical results presented and discussed above in this section, it could be concluded that given the growth of institutional investors, e.g. pension funds, there is evidence that relative to other financial intermediaries, commercial banking institutions are losing ground in traditional business, e.g. credit lending, but the role banking sector plays in the whole financial systems and economy is still very important (Allen and Santomero 2001); banking industry is in a state of evolution by developing and entering new businesses, e.g. securities underwriting, rather than outright decline (Davis 2002a, Davis 2003c).

3.3.3.1.3 Impact on stock market and bond markets

Results of pension fund assets' impact on stock market are given in Tables 32 through 34. Although large stock markets do not necessarily function efficiently, stock market capitalisation (STKCAP) is still the most frequently used indicator, measuring the overall size of markets. Our estimated results suggest that both in the long run and in the short run, pension funds growth leads to a larger stock market, which is both statistically significant and economically meaningful. When we estimated regressions on two separate groups, e.g. OECD and EMEs, the results remain. Again, in order to

[40] We also ran regressions on pension assets (PFAGDP) for DMBGDP, but results show that in both short run and long run, pension assets growth leads to a decrease in DMBGDP, which is inconsistent with our hypothesis. Thus, results are not reported.

check results' robustness as well as eliminating the simultaneity bias noted earlier, we run the estimation based on TSLS by using fitted values of PFAGDP. Results are given in Columns B Table 32. For most part, results do not change much; there is still evidence of a positive association between STKCAP and PFAGDP. Some other explanatory variables are significant. Error correction terms (ECM) are all negative, signalling the long run relationship between pension assets and market capitalisation. Interest rate shows negative sign, implying the opposite movement of interest rate and stock market; normally when interest goes down, stock market goes up.

In terms of stock market's liquidity indicator, i.e. total value traded (STKTRD), we in Table 33 find a positive link between pensions and stock market, although the positive long run effect is statistically insignificant for the All countries regression. Also, there is sign that such positive impact is stronger for OECD countries than EMEs. For example, all four coefficients (Columns A and B) of LPFAGDP(-1) and DLPFAGDP on OECD regressions are significant, while one out of four is significant on EME regressions. This might reflect the easiness of more developed markets to grow with pension assets, as in such markets, excellent telecommunications etc. are more ready to utilise and take advantage of pension growth. Meanwhile, more pension funds traded in the markets, more cheap the transaction costs, which in turn encourage infrastructure development.

As indicated by the sign of coefficients of LINFL(-1) across sample groupings and estimators, there is sign of the negative impact of macro-instability on stock market turnover. Also, four out of six coefficients of DGDPCON are positive and significant, which indicates a faster economic growth can boost the development of financial market (Levine and Zervos 1998; Beck, Levine and Loayza 2000).

The last indicator we use is stock market turnover ratio (STKTNV). Regression of this indicator as shown in Table 34 is less satisfactory, as most signs associated with DLPFAGDP and LPFAGDP are not statistically significant, although we still find a strong and positive short-term linkage between pension assets and STKTNV for OECD countries.

On balance, by using three indicators, we find a positive link between pension assets growth and stock market development, in line with arguments from World Bank (1994) and Davis (1998c). Such positive impact encompasses not only the creation and emergence of new financial instruments via financial engineering, but also secondary/qualitative effects (Davis and Hu 2005a), e.g. more efficient regulatory and accounting systems. The latter effects will be beneficial to the whole financial markets and not just the pension funds industry. In consequence, it will lead to faster economic growth in the long run as depicted as arrow e in Figure 3.

As for pensions' impact on the public bond market (PUBBND), results are given in Table 35. Our regressions, based on both two sub-groups and different estimators, favour a positive relationship in the short run, but negative in the long run. The positive short-run effect may be partly due to the willingness of government to use pension funds to finance implicit pension debts (Holzmann 2001). But in the long run, the impact turns into negative for OECD countries. It might be argued that most of OECD members are developed nations with more mature financial markets, therefore from the perspective of long run, governments are not able to force large proportion of

pension funds invested in government bonds, thus leading to diminishing public bond market. Or, it might be explained that if pension system is reformed in OECD countries, there is less need for deficit financing. And given that debt issuance is one important way of financing pension debts, public bond market will go down in the long run. Concerning other explanatory variables, the negative effects of inflation on bond market are discernible in Table 35, implying the importance of macro-stability in maintaining financial markets. In addition, we find a negative effect of stock value traded on public bond market. For example, one per cent increase in STKTRD can reduce public bond issuance by 0.02 and 0.08, depending estimation methods.

Regarding the private bond market (PRIBND), results in Table 36 are more consistent than those of estimations on PUBBND; all six separate regressions indicate a positive link between pensions and PRIBND, although some coefficients are not statistically significant. Specifically, in both long run and short run, pension assets growth boost private bond market in our core (A) and EMEs and All regressions, although not in OECD. Given that this indicator is more meaningful as we discussed in Section 2.2.3.2.1, we might expect a more developed private bond market following pension asset growth. Our separate regressions in this section on private and public bond markets improve findings by Impavido et al (2003), who use the aggregated data, i.e. public bond market development following pension reform at least in the short run does not crowd out private bond issuance.

3.3.3.2. Panel Granger causality test

3.3.3.2.1 Impact on financial intermediaries and banking industry

Results are given in Table 37. The hypothesis of homogeneity (HO) is unanimously accepted on three regressions - All, OECD and EMEs and for both indicators – PCDMBOFIGDP and CREDIT, as all calculated F statistics are below the corresponding critical values. The only exception is the 2.66 statistic obtained in CREDIT regression at lag 4. Then based on the testing procedures by Hurlin and Venet (2003), we tested the hypothesis of homogeneous non-causality (HOC) against the alternative of which there is a homogenous causality across all N countries. Regardless of the lag level, all F statistics, with are much greater than corresponding critical values. This implies that pension fund assets (PFA) Granger cause PCDMBOFIGDP and CREDIT, and this causality relationship is applicable to both OECD countries and EMEs. This result might be viewed as extra evidence to strengthen our conclusion from earlier Panel ECM model where we found relatively strong correlation for EMEs, but statistically insignificant correlation for OECD countries.

3.3.3.2.2 Impact on stock market and bond market

For the panel Granger causality estimation, we used three indicators, i.e. STKCAP, STKTRD and STKTNV, seeking to look at the causality of pensions on the size, liquidity and efficiency of stock market. Results are presented in Tables 38 through 40. Again, the hypothesis of HO cannot be rejected in all cases. The only exception is under the EME-STKTRD estimation and at lag 3. Then, for the HONC VS HOC hypotheses, our statistics strongly reject the former and accept the latter, as all F-statistics are greater than critical values. The results remain when sample is divided

into two sub-groups, OECD countries and EMEs. Therefore, our results from earlier panel ECM model in Section 3.3 are consolidated in that pension assets are not only positively linked to stock market's development, but also cause a larger, more liquid and more efficient market. This finding confirms the results of Granger causality tests by Catalan et al (2000) where they conclude a Granger causality relation between contractual saving and stock market. In our study, however, we have observations in most cases, ranging from 100 up to 500, a much larger dataset than that used by Catalan et al (2000).

Regarding pension funds' effect on public bond market, the estimate results are shown in Table 41. As for the All countries regression, the HO hypothesis cannot be rejected, but the HONC is frequently rejected. When we run separate regressions on OECD countries and EMEs. Results again favour an acceptance of the HO hypothesis at all lag orders, and the rejection of the HONC hypothesis. This implies that there is a strong positive causality between pension assets and public bond market across both OECD countries and EMEs, which deviates from our PECM estimation in Section 3.3.3.1 where we found a positive link for EMEs, but a negative link for OECD in the long run. It is due to the dynamic nature of the underlying effect. In this section, the strong positive causality between pension growth and public bond market is temporal and short run, while the negative relationship in OECD obtained from our PECM model is concerned with the long run.

Concerning private bond market (PRIBND), results from the All countries regression are given in Table 41. At all lag levels, the hypothesis of HO is not rejected, while that of HONC is rejected at all lags, but lag 5. When estimating separately, similar results are obtained. The HO is not rejected, and the HONC is frequently rejected, although at lags 4 and 5 under the estimation of OECD-PRIBND, the HONC could not be rejected.

It should be noted, however, that the findings in this section based on Granger causality test – our complementary technique only mean whether there is a *causality* correlation between indicators. Therefore, rejecting causality does not necessarily contradict our findings earlier from panel error correction model. For example, the non-existence of a Granger causality from pensions to private bond market for the OECD countries regression at lags 4 and 5 does not and should not deny a positive *correlation* between them as we found earlier from PECM model in Section 3.3.3.1.

4 Conclusion

4.1 Concluding remarks

In this part of the paper, we empirically analysed three relationships, a) that between pension reform towards World Bank model and economic growth, b) that between pension fund assets and economic growth and c) that between pension funds growth and financial development.

Regarding the first relationship, we used data from 59 countries which included both reforming and non-reforming countries. It was found that pension reform is negatively linked to such growth indicators as TFP, GFCGGDP and PSR, GDSGDP, GNSGDP in the short run and positively in the long run. This nonlinearity relationship is in line with Packard's findings (2003) and might be argued that people need time to get used to the dramatic change to the public pension systems. For example, it takes a few years to persuade people to convert to private systems, i.e. after they are confident about the new system. Then assets accumulation could be raised, therefore increasing both private and domestic savings. This finding, however, is less robust for OECD countries. In addition, we found evidence of a direct linkage between pension reform and economic growth per se by using the indicator of GDP growth rate.

The second empirical work was focused on the link between pension fund assets and economic growth. Our contemporaneous estimation favours a strong positive link between pensions and the TFP growth rate, the gross fixed capital formation growth rate and GDP growth rate, although results are less robust after controlling for countries without pension assets. This effect might be due to less labour market distortion following pension reform (Disney and Whitehouse 1999) and pension funds' increasing participation in corporate governance, thus improving corporate performance on the firm level and (Clark and Hebb 2002) economic productivity on the macro level (Davis 2002c, 2003d). In addition to the contemporaneous regressions, we employed a second specification, i.e. initial regression. It was revealed that pension fund assets in 1996 are a good predictor of economic growth in the subsequent years (1996-2002) in terms of all three indicators. But, regressions using pension data of 1991 was not very successful, which might be due to the small number of observations. This positive link is further strengthened by our panel Granger causality test where we found the hypothesis of Homogenous non-causality is rejected and that of Homogenous causality could not be rejected, which implies that pensions cause economic growth across both OECD countries and EMEs.

The last empirical work dealt with the relationship between pension fund assets and financial development. Our Panel error correction model, including a TSLS estimator, suggested a positive short run effect from pensions to private credit provided by banks and other financial institutions (PCDMBOFIGDP), while the long run is not significant. Regarding the banking industry, we found that pension funds growth leads to less credit provided by commercial banks in the economy in both short run and long run. This might imply the strong competition from other financial institutions, e.g. mutual funds, etc. (Allen and Santomero 2001). Also, banks assets relative to total financial assets (DMBTFA) declined in the short run for OECD courtiers. But for EMEs, both short run and long run effects were positive. It might reflect the heterogeneity across countries where in EMEs, deposit money banks are more

important at the beginning stage of pension reform than in OECD countries. In addition, even there is some evidence that banking sector is declining relative to other institutions, our statistics showed that the important role of banking plays in the economy is not diminishing and even increasing for many countries. Meanwhile, our statistics also suggests that a larger banking industry in the economy, the higher of the income level, implying the positive link between banking sector and economic performance.

When turning to the stock market, panel error correction model is in favour of a strong positive link between pension fund assets and three stock market indicators, i.e. market capitalisation, market value traded and market turnover. This impact is both short run and long run. This finding is consistent with results by Davis (1995, 2000a) Holzmann (1997) and Walker and Lefort (2002). Pension growth is indicated to reduce the cost of capital, and transaction costs, thus increasing market liquidity and efficiency.

As for the public bond market, impacts are heterogeneous across countries. In the short run, a positive link between pensions and public bond market is found, but in the long run, such effects are negative for OECD countries and positive for EMEs. This could be explained in that for both OECD countries and EMEs, in the short run, governments are willing to use pension funds to finance public projects or implicit pension debts, but the former countries are less able to do it for a relatively long period. Concerning the private bond market, positive impacts from pension funds are homogenous across countries. This is consistent with pension reform experiences in many countries, e.g. Chile where pension managers required and stimulated the growth of a more developed bond market to manage long term assets, e.g. by introducing zero-coupon bond (Bodie 1989).

As in the previous study, we used panel Granger causality to complement our panel error correction model. For two financial intermediary indicators, i.e. PCDMBOFIGDP and CREDIT1 and three stock market indicators, i.e. STKCAP, STKTRD and STKTNV, our Panel Granger causality specification strongly favours a homogenous causal relationship from pension funds assets to these financial indicators. Results we obtained in this study should be more robust than those by Catalan et al (2000) in that we have a much larger dataset. Regarding bond markets, we found little causality correlation from pensions to public bond market for both OECD countries and EMEs. For private bond market, our Panel Granger causality estimation suggests that the causality relation is not existent for OECD countries, but existent for EMEs. It should be noted, however, panel Granger causality is a different specification from PECM; estimated results from the former suggest the causal relationship, so the non-existence of the Granger causality relation does not and should not deny any pure *correlation* between variables as we found when using PECM.

4.2 Summary

The world is aging rapidly. It is anticipated that by 2050, one in four people will be aged above 65 at the world level. Mainly due to rising longevity and declining fertility rate as well as the unfunded nature of Pay-as-you-go (PAYG) systems, most governments in both OECD countries and Emerging market economies (EMEs) are

facing financial difficulties, which has led many countries to re-think their pension systems. Typically, they switch partially or wholly from unfunded systems, e.g. PAYG to funded systems, e.g. the three-pillar World Bank model (1994).

In this paper, we empirically analysed the linkage between pension reform, pension assets, economic growth and financial development. The dataset we used covers 72 countries, including 21 OECD countries and 51 EMEs. By utilising various econometric models, on balance, we found a positive impact of pension reform and assets on economic growth, not only indirectly via increasing productivity, investment and savings, but also directly leading to rising GDP growth rate. Regarding financial markets, we found a negative effect of pensions on credits provided by banking industry as well as the declining role of banking compared to other financial institutions, reflecting the strong competition from institutions investors (Davis and Steil 2001). Results remain when using Two-stage least squares (TSLS) estimator as a variant. Relative to the whole economy, however, there is no strong sign that banking sector has been diminishing; on the contrary, it is rising as shown by our statistics across 72 countries over 1960-2001. In addition, our models are in favour of a positive relationship between pension assets and stock market in terms of size, liquidity and efficiency (Walker and Lefort 1997; and Davis 1998).

In sum, the empirical results in this paper, in general, favour the positive effects of pension reform on growth and finance. Therefore, the benefit of the pension reform trend towards funded systems, typically the 3-pillar scheme supported by World Bank (1994) (Holzmann 1999a) is not a myth (Orszag and Stiglitz 1999; Barr 2000; Kotlikoff 1999), but a real benefit (Holzmann 1999b).

Given that EMEs are normally younger and social security coverage is not as wide as that in OECD countries, the sooner governments start implementing pension reform fully or partially towards funded systems, the less the transition debt incurred and the earlier the benefits of transition will be realised. In addition, pre-conditions are argued to be needed for the development of financial markets following pension reform (Vittas 2000; Blake 2003). Hence, before introducing private pension accounts, governments in EMEs should seek to maintain a healthy banking sector, and good accounting standards as well as a sound macro-economic policies etc. (Davis 1998).

Regarding OECD countries, the fiscal burden of transition is quite heavy compared with that in EMEs. In consequence, together with other reasons as we discussed in Part one, many OECD governments, e.g. Germany and France, are reluctant to implement structural pension reform towards fully funded systems. Parametric reform and/or Notional defined contribution (NDC) reform might be acceptable politically in the short run. It is, however, not financially sustainable in the long run, and has the risk of accumulating pension debts in a intolerable level in decades; not least to say to realise the positive externalities, e.g. less labour market distortion, etc. Therefore, OECD countries should start pension reform at least towards a partially funded systems immediately. In other words, a less radical reform, and not necessarily the reform like Chile in 1980s, might be politically reasonable and practically feasible. For example, a basic pillar could be maintained as a public pension scheme, while at least one private and funded pillar should be established. The problem as of the relative size of private/public pillar within the whole multi-pillar systems, however, is a country-by-country issue and should not and could not have a one-fit-all model.

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Table 1 Dependency ratios %, 1950-2050

	World			More developed regions			Less developed regions		
Year	Total	Child	Elderly	Total	Child	Elderly	Total	Child	Elderly
1950	65	57	9	54	42	12	71	64	7
1955	69	60	9	55	42	13	76	69	7
1960	73	64	9	58	44	13	80	73	7
1965	75	66	9	58	43	14	84	77	7
1970	75	65	10	56	41	15	83	76	7
1975	74	64	10	54	37	17	82	75	7
1980	70	60	10	52	34	18	76	69	7
1985	65	55	10	49	32	17	70	63	7
1990	63	53	10	49	31	19	67	60	7
1995	61	51	11	50	29	20	65	57	8
2000	59	48	11	48	27	21	62	53	8
2005	55	44	11	48	25	23	57	49	9
2010	53	41	12	47	24	23	54	45	9
2015	52	40	13	50	24	26	53	43	10
2020	53	39	14	54	24	29	53	41	11
2025	53	37	16	58	25	33	52	39	13
2030	54	36	18	62	25	37	52	37	15
2035	54	34	20	65	25	39	53	36	17
2040	55	33	22	67	26	42	53	34	19
2045	56	32	23	69	26	43	54	33	20
2050	56	31	25	71	27	44	54	32	22

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2002 Revision and World Urbanization Prospects.

Table 2 Summary of pension systems and reform across the world

Asia/Pacific				**Central & Eastern Europe**			
16	Year of reform	Pension model	Systemic/Parametric	11	Year of reform	Pension model	Systemic/Parametric
China	1997	WBM	Systemic	Bulgaria	2000	WBM	Systemic
Fiji	1966	PPF	N.A.	Czech Republic	1994	WBM	Systemic
Hong Kong	2000	WBM	Systemic	Croatia	2002	WBM	Systemic
India	1952	PPF	Parametric	Hungary	1997	WBM	Systemic
Indonesia	1992	PPF	Parametric	Latvia	1996	NDC	Systemic
Iseral	1995	WBM	Systemic	Poland	1999	NDC	Systemic
Jordan		PAYG	Parametric	Romania	2001	WBM	Systemic
Kazajstan	1998	WBM	Systemic	Russian Federation		PAYG	Parametric
Malaysia	1951	PPF	Parametric	Slovak Republic		PAYG	N.A.
Pakinstan	1976	PPF	N.A.	Turkey		PAYG	Parametric
Philippines	1957	PPF	Parametric	Ukraine		PAYG	N.A.
Singapore	1955	PPF	Parametric				
South Korea		PAYG	Parametric				
Sri Lanka	1958	PPF	N.A.				
Thailand	1990	PPF	Parametric				
Vietnam		PAYG	Parametric				
Latin America				**OECD**			
16				23			
Argentina	1994	WBM	Systemic	Australia	1992	WBM	Systemic
Bolivia	1997	WBM	Systemic	Austria		PAYG	Parametric
Brazil		PAYG	Parametric	Belgium		PAYG	Parametric

Chile	1981	WBM	Systemic	Canada	1997	WBM	Systemic
Colombia	1994	WBM	Systemic	Denmark	1991	WBM	Systemic
Costa Rica	2001	WBM	Systemic	Finland		PAYG	Parametric
Dominican Republic	2003	WBM	Systemic	France		PAYG	Parametric
El Savaldor	1998	WBM	Systemic	Germany		PAYG	Parametric
Ecuador		PAYG	N.A.	Greece		PAYG	Parametric
Honduras		PAYG	Parametric	Iceland		PAYG	Parametric
Mexico	1995	WBM	Systemic	Ireland		PAYG	Parametric
Panama		PAYG	N.A.	Italy	1995	NDC	Systemic
Paraguay		PAYG	Parametric	Japan		PAYG	Parametric
Peru	1993	WBM	Systemic	Luxembourg		PAYG	N.A.
Uruguay	1996	WBM	Systemic	Netherlands	1960	WBM	Systemic
Venezuela		PAYG	N.A.	New Zealand		PAYG	Parametric
Africa				Norway		PAYG	Parametric
6				Portugal		PAYG	N.A.
Algeria		PAYG	N.A.	Spain	1997	WBM	Systemic
Egypt		PAYG	Parametric	Sweden	1998	NDC	Systemic
Morocco		PAYG	N.A.	Switzerland	1985	WBM	Systemic
Nigeria		PAYG	N.A.	UK	1988	WBM	Systemic
South Africa		PAYG	Parametric	US	1981	WBM	Systemic
Tunisia		PAYG	N.A.				

1. PAYG, Pay as you go pension systems. PFF, Provident pension fund systems, WBM, World Bank model. Countries are defined as Reform countries towards World Bank model (WBM) if they introduced a new pension system with significant funding element, but not necessarily the specific three pillar model recommended by the World Bank
2. The Year of reform in most cases is cross checked by at least two sources. Two of those sources which are particularly helpful and comprehensive are regional survey papers from Vols. 54, 55 and 56, International Social Security Review (2001, 2002 and 2003) and one World Bank paper from Schwarz and Demirguc-Kunt (1999). For many countries with PAYG systems, we leave this entry blank as we did not find widely agreed information or simply not exist.

3. All reform countries are then classified into Systemic and Parametric countries (see main text in Section 2.2.2 for definitions). All WBM and NDC countries are by definition systemic countries.
4. N.A., Not available. For some countries, we did not find relevant literature regarding whether they have implemented parametric reform or not.

Table 3 Comparison of two papers on the link between demographics and bonds

	Davis and Li (2003)			Cannon (2003)		
Dependent variable	Real stock yields			Real return on bonds		
Explanatory variables						
Demographic variables	20+	40+	65+	20+	40+	65+
	0.125*	-0.311*	0.406*	0.759*	-0.031	0.405
Other control variables	Not available			Population growth, Standard deviation of bond, inflation		
No. of countries	7			16		
Observation period	1950-1999			1950-1999**		

* indicates statistically significance at 1%, 5% or 10% levels. ** in Cannon's study, an estimation based on a long observation period, i.e. 1900-1999 is also employed, but in order to make it comparable with Davis and Li's work, we only consider the estimation with observation period from 1950-1999.

Table 4 Comparison of two papers on the link between demographics and equities

	Davis and Li (2003)			Cannon (2003)		
Dependent variable	Real stock prices			Real return on equities		
Explanatory variables						
Demographic variables	20+	40+	65+	20+	40+	65+
	0.017*	0.016*	-0.008	0.101	-0.259	-1.358
Other control variables	GDP, lag of GDP, CPI, lag of CPI			Population growth, Standard deviations of equity and inflation, inflation		
No. of countries	7			16		
Observation period	1950-1999			1950-1999**		

* indicates statistically significance at 1%, 5% or 10% levels. ** in Cannon's study, an estimation based on a long observation period, i.e. 1900-1999 is also employed, but in order to make it comparable with Davis and Li's work, we only consider the estimation with observation period from 1950-1999.

Table 5 Comparison of charge ratios across 11 selected countries, in percentage

Bolivia	9.8
Australia	11.2
Kazakhstan	15
Colombia	13.5
Sweden	15
Uruguay	14.7
El Salvador	17.1
Poland	18
Chile	18
Peru	19.1
UK: stakeholder	23
UK: personal	25
Argentina	23.1
Mexico	26

Source: Whitehouse (2000). Charge ratio is defined as one minus the ratio of the accumulated pension assets net of charges to the accumulation assets without charges (Whitehouse 2000).

Table 6 Country summary for panel pension reform estimation, OECD countries and EMEs

EMEs								**OECD**	
Asia/Pacific		**Latin America**		**Central & Eastern Europe**		**Africa**			
7	Year of reform	**16**	Year of reform	**9**	Year of reform	**6**	Year of reform	**21**	Year of reform
China	1997	Argentina	1994	Bulgaria	2000	Algeria		Australia	1992
Hong Kong	2000	Bolivia	1997	Czech Republic	1994	Egypt		Austraia	
Israel	1995	Brazil		Croatia	2002	Morocco		Belgium	
Jordan		Chile	1981	Hungary	1997	Nigeria		Canada	1997
Kazajstan	1998	Columbia	1994	Romania	2001	South Africa		Denmark	1991
South Korea		Costa Rica	2001	Russian Federation		Tunisia		Finland	
Vietnam		Dominican Rep.	2003	Slovakia				France	
		El Savaldor	1998	Turkey				Germany	
		Ecuador		Ukraine				Greece	
		Honduras						Iceland	
		Mexico	1995					Ireland	
		Panama						Japan	
		Paraguay						Luxembourg	
		Peru	1993					Netherlands	1960
		Uruguay	1996					New Zealand	
		Venezuela						Norway	
								Portugal	
								Spain	
								Switzerland	1995
								UK	1988
								US	1981

Countries without year of reform are No Reform countries, while others are Reform countries as in the main text. Countries are defined as Reform countries toward World Bank model if they introduced a new pension system with significant funding element, but not necessarily the specific three pillar model recommended by the World Bank (1994). The Year of reform for each country is obtained from several pension papers and a range of relevant websites. The Year of reform in most cases is cross checked by at least two sources. Two of those sources which are particularly helpful and comprehensive are regional survey papers from Vols. 54, 55 and 56, International Social Security Review (2001, 2002 and 2003) and one World Bank paper from Schwarz and Demirguc-Kunt (1999).

Table 7 Variable summary, definition, sources and observation period

Group	Variable	Definition	Source	Observation period
Pension assets	PFA	Pension fund assets, in US$ millions	Various	Various
	PFAGDP	pension fund assets/GDP, %	Various	Various
Economics	GCFGDP	Gross capital formation (constant 1995 US$)	WDI(2003)	1960-2001
	GDPCON	GDP (constant 1995 US$)	WDI(2003)	1960-2001
	GDPGR	GDP growth rate	WDI(2003)	1960-2001
	GDPPC	GDP per capita	WDI(2003)	1960-2001
	GDPPCGR	GDP per capita growth rate	WDI(2003)	1960-2001
	GDSGDP	Gross national savings, including NCTR (% of GDP)	WDI(2003)	1960-2001
	GFCFGDP	Gross fixed capital formation	WDI(2003)	1960-2001
	GFCFGR	Gross fixed capital formation (annual % growth)	WDI(2003)	1960-2001
	GNSGDP	Gross domestic savings (% of GDP)	WDI(2003)	1960-2001
	TFPGR*	Total factor productivity growth rate	WDI(2003)	1960-2001
	CAPSTK	Capital stock	WDI(2003)	1960-2001
	PSR	Private saving/gross national disposable income, %	LLSS(1998)	1971-1994
Financial intermediary	LIQUID	Liquid liabilities (M3) as % of GDP	WDI(2003)	1960-2001
	CREDIT	Domestic credit provided by banking sector (% of GDP)	WDI(2003)	1960-2001
	DMBGDP	Deposit Money Bank Assets to GDP	BDL(2003)	1960-2001
	DMBTFA	Deposit Money Bank Assets to total financial assets	BDL(2003)	1960-2001
	I_CREDIT	Initial value of CREDIT in 1991 and 1996	WDI(2003)	1991, 1996
	PCDMBOFIGDP	Private credit by deposit money banks and other financial institutions to GDP	BDL(2003)	1960-2001
Stock market	STKCAP	Stock market capitalization to GDP	BDL(2003)	1960-2001
	I_STKCAP	Initial values of STKCAP in 1991 and 1996	BDL(2003)	1991, 1996
	STKTNV	Stock market turnover ratio	BDL(2003)	1960-2001
	STKTRD	Stock market total value traded to GDP	BDL(2003)	1960-2001
Bond market	PRIBND	Private domestic debt securities issued by financial institutions and corporations, % of GDP	BDL(2003)	1990-2001
	PUBBND	Public domestic debt securities issued by government, % of GDP	BDL(2003)	1990-2001

Labour & Demographics	LBTTL	Labour force, total	WDI(2003)	1960-2001
	POP15	Population ages 15-64 (% of total)	WDI(2003)	1960-2001
	POP65	Population ages 65 and above, total	WDI(2003)	1960-2001
Others	ECM	Error correction, i.e. residual term for our Panel Error Correction Model (PECM)		
	EXIMGDP	Export and import as % of GDP	WDI(2003)	1960-2001
	GONCONS	Gross government finanical consumption expenditure (% of GDP)	WDI(2003)	1960-2001
	I_EXIMGDP	Initial values of EXIMGDP in 1991 and 1996	WDI(2003)	1991, 1996
	I_GOVEXP	Initial values of GOVEXP in 1991 and 1996	WDI(2003)	1991, 1996
	I_INFL	Initial values of INFL in 1991 and 1996	WDI(2003)	1991, 1996
	INFL	Inflation, GDP deflator (annual %)	WDI(2003)	1960-2001
	INT	Real interest rate (%)	WDI(2003)	1960-2001
	I_INT	Initial values of INT in 1991 and 1996	WDI(2003)	1991, 1996
	URBAN	Urban population (% of total)	WDI(2003)	1960-2001
	YR	Year since pension reform, e.g. 1 for 1981 for Chile, 2 for 1982, etc.		
Memo	I	Variables prefixed with capital letter I are always referred to as initial value at a particular year, until otherwise		
	D	Variables prefixed with capital letter D are always referred to as first difference, until otherwise		
	L	Variables prefixed with capital letter L are always referred to as logarithm, until otherwise		

1. Various: various sources, including OECD Institutional Investors (2003), Davis and Steil (2001) and national sources. Various yearly data for our sample countries; some have longer observations, while others have shorter ones. See Section 3.2.1 for more information.
2. WDI: World Development Indicators database (2003);
3. LLSS: Loayza, Lopez, Serven and Schmidt-Hebbel (1998);
4. BDL: Financial Structure and Economic Development database (Beck, Demirguc-Kunt and Levine 2003);

*, derived based on methodology of OECD (1997) and Davis (2003), rather than directly obtained from WDI(2003) dataset.

Table 8 Panel unit root test

Variable	Level		First difference	
	IPS (2003)	LLC (2002)	IPS (2003)	LLC (2002)
CAPSTK	17.06	2.66	-2.50*	1.70
CREDIT	-1.38***	-1.50***	-29.92*	-30.78*
DMBTFA	3.10	0.28	-21.05*	-20.19*
GDPCON	20.39	16.09	-23.01*	-19.78*
GDPGR	-27.19*	-25.74*	N.A.	N.A.
GDSGDP	-6.36*	-6.72*	N.A.	N.A.
GFCFGDP	-6.41*	-5.72*	N.A.	N.A.
GNSGDP	-4.96*	-4.11*	N.A.	N.A.
INFL	-15.99*	-8.82*	N.A.	N.A.
INT	-10.11*	-8.95*	N.A.	N.A.
LIQUID	4.54	4.67	-29.27*	-32.21*
PCDMBOFIGDP	4.07	1.91	-15.83*	-15.84*
PFAGDP	6.56	5.60	-11.20*	-25.10*
PRIBND	5.82	5.66	-7.08*	-11.87*
PSR	-6.63*	-6.65*	N.A.	N.A.
PUBBND	1.04	-6.67*	N.A.	N.A.
STKCAP	-2.39*	-21.29*	N.A.	N.A.
STKTNV	-5.72*	-66.95*	N.A.	N.A.
STKTRD	5.48	5.71	-19.03*	-31.84*
TFPGR	-25.11*	-25.10*	N.A.	N.A.
UNEMPT	-2.40*	-6.21*	N.A.	N.A.
URBAN	-2.77*	-9.59*	N.A.	N.A.

See Table 7 for variable details. IPS, Im, Pesaran and Smith (2003). LLS, Levine, Lin and Chu (2002). Both methods are based on null hypothesis of unit root. *, rejection of null hypothesis at 1%; **, rejection of null hypothesis at 5%. If levels are stationary, we normally will not test first difference, which is in turned indicated as N.A.

Table 9 Panel estimation for log of total factor productivity growth rate (LTFPGR)

	All	OECD	EMEs
C	-1.5493*	10.4100*	-2.1273*
LINFL	0.0355	-0.1468	-0.0262
LINT	-0.0990*	-0.1015	-0.1234*
LLIQUID	0.0587	0.0044	0.0785
LCREDIT	-0.1984	-0.6473***	-0.1539
LSTKCAP	-0.0868*	-0.4921*	-0.1139*
LSTKTRD	0.0899*	0.7044*	0.0728*
L(I_GDPPC)	-0.4068*	-1.3605*	-0.3058*
L(GDPPC)	0.2360*	-0.0630	0.2191
YR	-0.1587	0.0879	-0.0776
YR^2	0.0120	-0.0036	0.0091
YR^3	-0.0002***	0.0000	-0.0002
RSQ-bar	0.9438	0.9226	0.9644
SE	0.8586	0.8232	0.7981
OBS	296	118	178

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%. *** indicates significance at 10%. See Table 7 for variable details.

Table 10 Panel estimation for log of GDP growth rate (LGDPGR)

	All	OECD	EMEs
C	-1.3904*	10.7566*	-2.3671*
LINFL	0.0315	-0.1286	-0.0400
LINT	-0.0973*	-0.2732	-0.1169*
LLIQUID	0.1186	0.0446	0.0805
LCREDIT	-0.2548*	-0.4774	-0.1285
LSTKCAP	-0.1039*	-0.5019**	-0.1198*
LSTKTRD	0.0920*	0.5475*	0.0700*
L(I_GDPPC)	-0.4210*	-1.1695*	-0.3106*
L(GDPPC)	0.2626*	-0.2717	0.2429*
YR	-0.1145	-0.3234	-0.0059
YR^2	0.0101***	0.0202	0.0051
YR^3	-0.0002	-0.0003	-0.0001
RSQ-bar	0.9534	0.5762	0.9841
SE	0.8657	0.8613	0.8001
OBS	318	122	196

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%. *** indicates significance at 10%. See Table 7 for variable details.

Table 11 Panel estimation for log of gross fixed capital formation (LGFCFGDP)

	All	OECD	EMEs
C	3.5805*	1.4818*	3.6632*
LINFL	-0.0212*	0.0610*	-0.0785*
LINT	-0.0460*	0.0870*	-0.0739*

LLIQUID	0.0759*	0.0426*	0.0977*
LCREDIT	-0.0227	0.0928*	-0.0425**
LSTKCAP	-0.0050*	-0.0073	-0.0282**
LSTKTRD	0.0302*	0.0179	0.0378*
L(I_GDPPC)	-0.1632*	-0.2478*	-0.1064*
L(GDPPC)	0.1192	0.3158*	0.0867*
YR	-0.0553	-0.0999*	-0.0746***
YR^2	0.0031	0.0050*	0.0051**
YR^3	0.0000	-0.0001*	-0.0001**
RSQ-bar	0.9980	0.9998	0.9936
SE	0.1793	0.1088	0.1817
OBS	351	134	217

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%. *** indicates significance at 10%. See Table 7 for variable details.

Table 12 Panel estimation for log of private saving rate (LPSR)

	All	OECD	EMEs
LINFL	0.0234**	0.0027	0.0527
LINT	-0.0244*	-0.0192*	-0.0221
LLIQUID	-0.1200*	-0.0143	-0.2315***
LCREDIT1	-0.0283	-0.1478*	0.1281
LPOP15	-0.2106	-0.4518*	0.6552
LPOP65	-0.1882***	-0.3294*	0.9638
LURBAN	1.1014*	0.2136	1.3363
YR	-0.0808***	-0.0089	-0.9223*
YR^2	0.0054***	0.0008	0.0623*
YR^3	-0.0001	0.0000	-0.0010*
RSQ-bar	1.0000	0.9905	1.0000
SE	0.2500	0.0928	0.6822
OBS	428	232	196

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%. *** indicates significance at 10%. See Table 7 for variable details.

Table 13 Panel estimation for log of gross domestic saving (LGDSGDP)

	All	OECD	EMEs
LINFL	0.013836**	0.013235***	0.007455
LINT	-0.03565*	-0.01639*	-0.05647*
LLIQUID	0.046695*	0.072638*	0.054025***
LCREDIT1	-0.08135*	-0.08163*	-0.09189*
LPOP15	-0.52673*	-0.43844*	-1.06961*
LPOP65	-0.50339*	-0.47062*	-0.72608*
LURBAN	0.492521*	0.077164	0.487889*
YR	-0.05086*	-0.00355	-0.15917*
YR^2	0.002938*	-0.00031	9.59E-03*
YR^3	-4.17E-05*	1.06E-05	-1.41E-04*
RSQ-bar	1	0.996275	1
SE	0.208809	0.090374	0.28329
OBS	725	320	405

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%. *** indicates significance at 10%. See Table 7 for variable details.

Table 14 Panel estimation for log of gross national saving (LGDSGDP)

	All	OECD	EMEs
LINFL	0.029936*	0.014424***	0.012364
LINT	-0.03039*	-0.02751*	-0.0462*
LLIQUID	0.045563***	0.010202	0.110412*
LCREDIT1	-0.2273*	-0.18594*	-0.25067*
LPOP15	-0.59457*	-0.76573*	-0.46169
LPOP65	-0.3421*	-0.54247*	-0.57995*
LURBAN	1.003399*	-0.04152	1.586602*
YR	-0.08837*	0.01552	-0.46014*
YR^2	0.004963*	-0.00159**	2.57E-02*
YR^3	-6.83E-05*	3.21E-05*	-0.00036*
RSQ-bar	1	0.99488	1
SE	0.29892	0.0916	0.375209
OBS	665	278	387

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%. *** indicates significance at 10%. See Table 7 for variable details.

Table 15 Total assets of pension funds within advanced OECD countries (as of 2000)

	Country Name	Total assets (US$ million)	As % of GDP	As % of Total
AUS	Australia	188892.83	48.63	1.54
AUT	Austria	7300.00	3.87	0.06
BEL	Belgium	14400.00	5.74	0.12
CAN	Canada	310500.00	43.94	2.54
CHE*	Switzerland	268600.00	124.25	2.19
DEU	Germany	62200.00	3.33	0.51
DNK	Denmark	40100	23.05	0.33
ESP**	Spain	32806.00	5.85	0.27
GBR**	UK	1141830.72	79.87	9.33
ISL	Iceland	6700.00	78.91	0.05
ITA	Italy	48100.00	4.48	0.39
JPN	Japan	2893319.29	60.72	23.63
NLD	Netherlands	550935.92	149.09	4.50
NOR**	Norway	11300.00	7.36	0.09
NZL***	New Zealand	615.00	0.69	0.01
PRT	Portugal	12400.00	11.70	0.10
SWE	Sweden	93922.37	41.01	0.77
USA	US	6559771.48	66.87	53.58
	Total assets within OECD countries	12243693.61	42.19****	100.00

Source: various sources, including OECD Institutional Investors (2003), Davis and Steil (2001) and national sources. See Section 3.2.1 for more information. All data are converted into and measured at US Dollars, for the convenience of across-country comparison.

* 1998 data, ** 1999 data and ***2002 data. **** average of pension assets of GDP within OECD countries.

Table 16 Total assets of pension funds within EMEs (as of 2002)

	Country Name	Total assets (US$ million)	As % of GDP	As % of Total
ARG	Argentina	11409.00	11.16	4.07
BGR	Bulgaria	41.94	0.27	0.01
BOL	Bolivia	1144.00	14.90	0.41
BRA	Brazil	47656.00	10.53	17.00
CHL	Chile	35500.00	55.34	12.66
COL	Colombia	5482.00	6.67	1.96
CRI	Costa Rica	136.00	0.81	0.05
DOM	Dominican Republic	184.49	0.87	0.07
ECU	Ecuador	14.27	0.06	0.01
FJI	Fiji	846.95	45.11	0.30
HND	Honduras	3.28	0.05	0.00
HUN	Hungary	1835.00	2.79	0.65
IDN	Indonesia	278.21	0.05	0.10
KAZ	Kazajstan	1432.00	5.92	0.51
KOR*	Korea	11500.00	2.49	4.10
LKA*	Sri Lanka	2697.99	16.55	0.96
MEX	Mexico	31748.00	4.98	11.33
MYS	Malaysia	53605.11	56.33	19.12
PAK	Pakistan	947.98	1.57	0.34
PAN	Panama	464.00	3.77	0.17
PER	Peru	4527.00	7.96	1.61
PHL	Philippines	3062.50	3.97	1.09
POL	Poland	6674.00	3.56	2.38
RUS	Russia	1612.70	0.47	0.58
SGP	Singapore	55526.98	63.85	19.81
SLV	Slovakia	1088.00	7.62	0.39
UKR	Ukraine	2.62	0.01	0.00
URG	Uruguay	893.00	7.25	0.32
	Total assets within EMEs	280313.00	11.96**	100.00

Source: various sources, including OECD Institutional Investors (2003), Davis and Steil (2001) and national sources. See Section 3.2.1 for more information. All data are converted into and measured at US Dollars, for the convenience of across-country comparison.
* 2000 data. ** average of pension assets of GDP within EMEs.

Table 17 Pension data sources for South Asian countries and South Africa

Country	Main source	Website and others
Fiji	National Provident Fund	www.fnpf.com.fj/
Hong Kong	Mandatory Provident Fund Authority	www.mpfahk.org/
India	Employees Provident Fund Organisation	www.epfindia.com/
Indonesia	ASEANN Social Security Association	www.asean-ssa.org
Malaysia	Bank Negara Malayisa	www.bnm.gov.my
Pakistan	Employees Old Benefit Institution	www.eobi.gov.pk
Philippines	Social Security System	www.sss.gov.ph/
Singapore	Central Provident Fund	www.cpf.gov.sg and Asher (1999)
Sri Lanka	Employees and Provident Fund	www.epf-cbsl.lk/
Thailand	ASEANN Social Security Association	www.asean-ssa.org

South Africa	South African Reserve Bank	www.resbank.co.za and Beck et al (1999)

Asher, M. G.; 1999; *The Pension System In Singapore*; Social Protection Discussion Paper No. 9919; The World Bank.
Beck, T, A. Demirguc-Kunt and R. Levine; 1999; *A New Database on Financial Development and Structure;* The World Bank.

Table 18 Country summary in panel contemporaneous regression on 5 year averages (countries with pension assets only), 1981-2000

OECD countries	EMEs
18	**11**
Australia	Brazil
Austria	Chile
Belgium	Fiji
Canada	Korea
Denmark	Malaysia
Germany	Pakistan
Iceland	Peru
Italy	Philippines
Japan	Singapore
Luxembourg	South Africa
Netherlands	Sri Lanka
Norway	
Portugal	
Spain	
Sweden	
Switzerland	
UK	
US	

Table 19 Country summary for panel Granger causality test

OECD countries	EMEs
18	21
Australia	Argentina
Austria	Bolivia
Belgium	Brazil
Canada	Chile
Denmark	Columbia
Germany	Ecuador
Iceland	Fiji
Italy	Hungary
Japan	Indonesia
Luxembourg	Korea
Netherlands	Malaysia
Norway	Mexico
Portugal	Pakistan
Spain	Panama
Sweden	Peru
Switzerland	Philippines
UK	Poland
US	Singapore
	South Africa
	Sri Lanka
	Uruguay

Table 20 Economic growth and contemporaneous pension fund assets. All countries with pension fund assets during the period of 1981-2000. 5 year averages 1981-2000

	LTFPGR			LGFCFGR			LGDPGR		
	Sub-all	OECD	EMEs	Sub-all	OECD	EMEs	Sub-all	OECD	EMEs
Constant	-0.5496	6.0868	-1.1053	0.9847	-6.7449	0.8236	0.8227	9.8850	1.2609
LPFAGDP	0.6866	-0.6881	2.1571**	1.9232*	2.5171**	0.0713	-0.1221	-1.7990***	2.7975*
LINFL	-0.0519	-0.0825	-0.2789*	-0.0771	0.0434	-0.2663	-0.0120	0.1162	-0.2198*
LINT	-0.0043	-0.1673	-0.0176	0.1046	-0.8156**	0.4462*	0.0506	-0.1682	-0.0220
LLIQUID	0.1518	-0.4580	0.0222	0.1986	0.3649	0.7874***	0.3073	-0.6144	0.2627
LCREDIT	-0.2827***	-0.0604	-0.2626	-0.3848**	-0.0664	-0.7317*	-0.1523	0.0183	-0.2606
LSTKCAP	-0.0543***	0.2765	-0.1857*	-0.0554	-0.1102	-0.0634	-0.0004	0.2086	-0.1345**
LSTKTNV	0.0976*	0.0292	0.1577*	0.2167*	0.1923	0.2694*	0.0581**	-0.0292	0.1067**
LGOVEXP	-0.6424*	-0.4370	-0.2736	-0.4472	0.9853***	-0.8656**	-0.7903*	-1.2305**	-0.4958*
LURBAN	0.0435	-0.5187	-0.0723	1.4736*	3.5034**	0.4419	-0.0287	-1.1216	-0.1156
LEXIMGDP	0.2454*	-0.0700	0.0503	0.4011**	-0.2700	0.4161	0.1271	-0.1396	-0.1064
L(I_GDPPC)	-0.1479***	-0.2787	0.0354	-0.5570*	-0.9689**	0.0428	-0.1117	0.0888	-0.0017
RSQ-bar	0.9920	0.9405	0.9481	0.9594	0.2207	0.9533	0.9989	0.6022	0.9986
SE	0.5496	0.5298	0.5225	0.7618	0.5520	0.8181	0.5713	0.5253	0.5029
OBS	88	42	46	71	33	38	72	32	40

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%.
*** indicates significance at 10%. See Table 7 for variable details.

Table 21 Economic growth and contemporaneous pension fund assets. All countries. 5 year averages 1981-2000

	LTFPGR	LGFCFGR	LGDPGR
Constant	-0.8975**	3.1407*	0.7568**
LPFAGDP	0.5334	1.3318**	-0.8311*
LINFL	-0.0923*	0.0641	0.0168
LINT	-0.0022	0.1525***	0.0495
LLIQUID	0.4570*	0.3858	0.4992*
LCREDIT	-0.5453*	-0.5309*	-0.3524*
LSTKCAP	-0.0163	-0.0071	0.0296
LSTKTNV	0.0564*	0.1052**	0.0470*
LGOVEXP	-0.2285**	-0.5228**	-0.5714*
LURBAN	-0.0308	0.0215	-0.3355*
LEXIMGDP	0.0264	0.4191*	0.0891***
L(I_GDPPC)	-0.1339*	-0.1440***	-0.0024
RSQ-bar	0.9966	0.8659	0.9795
SE	0.6274	0.9058	0.5165
OBS	125	105	105

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%.*** indicates significance at 10%. See Table 7 for variable details.

Table 22 Economic growth and initial pension fund assets 1996-2000

	LTFP	LGFCFGR	LGDPPCGR
Constant	-6.0099*	3.0211	-5.7010*
L(I_PFAGDP)	0.1753*	0.2608***	0.1443**
L(I_INFL)	0.1420	0.1322	0.1664
L(I_INT)	-0.1139	-0.4139	-0.1065
L(I_CREDIT)	-0.2302	-0.1136	-0.1982
L(I_STKCAP)	-0.0088	-0.1824	0.0629
L(I_EXIMGDP)	0.3141	-0.0120	0.2606
L(I_URBAN)	0.6160**	0.0323	0.5562**
RSQ-bar	0.4327	0.2615	0.3993
SE	0.4839	0.5177	0.4458
OBS	28	21	29

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%.*** indicates significance at 10%. See Table 7 for variable details.

Table 23 Economic growth and initial pension fund assets 1991-2000

	LTFP	LGFCFGR	LGDPPCGR
Constant	0.2672	5.1636	0.3644
L(I_PFAGDP)	-0.1079	0.0274	-0.1129
L(I_INFL)	0.1139	0.0256	0.1196
L(I_INT)	0.8623*	0.6614	0.8788*
L(I_CREDIT)	-0.4892**	-0.9842	-0.4910**
L(I_STKCAP)	0.9157*	0.5476	0.9356*
L(I_EXIMGDP)	0.0300	0.3136	0.0320
L(I_URBAN)	-0.6896**	-0.3954	-0.7144**
RSQ-bar	0.6310	0.1638	0.6332
SE	0.3165	0.8685	0.3215
OBS	21	21	21

RSQ: Adjusted R Squared. SE: Standard errors. OBS, Observation. * indicates significant at 1%. ** indicates significance at 5%.*** indicates significance at 10%. See Table 7 for variable details.

Table 24 F-Test results of panel Granger causality estimation for all countries (pension assets to growth indicators)

Lag	DLTFPGR		DLGDPGR		DLGFCFGR		DLPSR		DLGDSGDP		DLGNSGDP	
	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC
1	0.00	1430.90*	0.00	443.89*	0.00	1487.11*	0.00	3246.80*	0.00	11269.30*	0.00	3682.47*
2	-0.77	830.71*	8.16*	525.19*	0.01	471.29*	0.05	1236.21*	-6.83*	5841.49*	-0.08	1632.21*
3	6.52*	183.11*	9.28*	192.59*	0.25	312.74*	-0.16	795.18*	0.78	3423.16*	-0.11	1233.99*
4	0.19	389.92*	0.12	493.25*	1.34	176.05*	0.30	811.00*	-0.02	2454.97*	0.05	1231.43*
5	0.39	420.12*	0.39	479.08*	1.33	176.85*	0.44	473.21*	-1.05	1913.76*	1.48*	726.05*
	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS
1	37	430	38	460	32	263	26	389	38	633	38	560
2	34	353	35	379	26	195	26	363	38	595	37	520
3	31	288	32	310	25	142	26	337	36	557	35	481
4	27	235	28	254	24	100	25	311	33	521	32	445
5	25	179	25	208	20	66	23	286	32	488	31	412

DLTFPGR, first difference of log of total factor productivity growth rate, DLGDPGR, first difference of log of GDP growth rate, DLGFCFGR, first difference of log of Gross fixed capital formation growth rate, DLPSR, first difference of log of private saving rate, DLGDSGDP, first difference of log of gross domestic saving/GDP, DLNSGDP, first difference of log of national saving/GDP. HO is homogeneity hypothesis, and HONC is homogeneous non-causality hypothesis and. * indicates rejection at 1%. No: number of countries, and OBS: observation.

Table 25 F-Test results of panel Granger causality estimation for OECD countries (pension assets to growth indicators)

Lag	DLTFPGR		DLGDPGR		DLGFCFGR		DLPSR		DLGDSGDP		DLGNSGDP	
	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC
1	0.00	303.50*	0.00	469.20*	0.00	208.06*	0.00	259.41*	0.00	1105.26*	0.00	148.87*
2	0.02	179.06*	0.04	275.52*	0.05	75.52*	0.09	124.88*	0.07	562.14*	0.09	74.91*
3	0.23	115.85*	0.30	185.86*	0.24	76.02*	0.15	73.83*	0.07	340.12*	0.04	44.60*
4	0.37	117.03*	0.45	167.99*	0.96	35.18*	0.20	60.14*	0.09	222.56*	0.11	33.44*
5	0.66	153.95*	0.79	200.39*	1.04	37.75*	0.25	35.32*	0.09	163.46*	0.15	24.38*
	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS
1	18	270	18	312	18	185	17	287	18	420	18	351
2	18	241	18	262	17	139	17	270	18	402	17	331
3	18	198	18	217	17	101	17	253	18	384	17	312
4	18	160	18	177	17	71	16	236	18	366	17	294
5	18	127	18	142	15	46	15	220	18	348	17	276

DLTFPGR, first difference of log of total factor productivity growth rate, DLGDPGR, first difference of log of GDP growth rate, DLGFCFGR, first difference of log of Gross fixed capital formation growth rate, DLPSR, first difference of log of private saving rate, DLGDSGDP, first difference of log of gross domestic saving/GDP, DLNSGDP, first difference of log of national saving/GDP. HO is homogeneity hypothesis, and HONC is homogeneous non-causality hypothesis and. * indicates rejection at 1%. No: number of countries, and OBS: observation.

Table 26 F-Test results of panel Granger causality estimation for EMEs (pension assets to growth indicators)

Lag	DLTFPGR		DLGDPGR		DLGFCFGR		DLPSR		DLGDSGDP		DLGNSGDP	
	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC
1	0.00	1363.46*	0.00	1546.26*	0.00	204.59*	0.00	1256.71*	0.00	5769.55*	0.00	2005.40*
2	2.82*	555.01*	0.05	1077.20*	-0.88	435.48*	0.07	456.33*	-2.11*	3028.71*	-0.86	1008.93*
3	0.08	582.21*	9.97*	271.90*	19.13*	32.27*	0.27	307.41*	-0.70	1624.50*	3.99*	425.29*
4	0.42	388.35*	-3.75*	397.33*	0.60	142.64*	0.31	379.77*	0.06	1071.24*	0.00	716.69*
5	0.10	390.18*	0.25	408.12*	0.60	162.80*	0.30	208.22*	-0.36	799.83*	-0.75	666.10*
	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS
1	19	139	20	148	14	78	9	102	20	213	20	209
2	16	112	17	117	9	56	9	93	20	193	20	189
3	13	90	14	93	8	41	9	84	18	173	18	169
4	9	75	10	77	7	29	9	75	15	155	15	151
5	7	65	7	66	5	20	8	66	14	140	14	136

DLTFPGR, first difference of log of total factor productivity growth rate, DLGDPGR, first difference of log of GDP growth rate, DLGFCFGR, first difference of log of Gross fixed capital formation growth rate, DLPSR, first difference of log of private saving rate, DLGDSGDP, first difference of log of gross domestic saving/GDP, DLNSGDP, first difference of log of national saving/GDP. HO is homogeneity hypothesis, and HONC is homogeneous non-causality hypothesis and. * indicates rejection at 1%. No: number of countries, and OBS: observation.

Table 27 F-Test results of panel Granger causality estimation (GDP growth rate: GDPGR to pension assets)

Lag	All countries		OECD countries		EMEs	
	HO	HONC	HO	HONC	HO	HONC
1	0.00	2223.27*	0.000	176.63*	0.00	N.A.
2	0.58	1359.97*	7.847*	21.90*	-9.50*	N.A.
3	1.19	897.62*	0.036	196.49*	-2.89*	N.A.
4	-0.24	776.73*	0.079	223.77*	1.26**	N.A.
5	-1.55*	482.01*	1.955*	134.98*	2.27*	N.A.
	No	OBS	No	OBS	No	No
1	38	512	18	336	20	N.A.
2	38	426	18	285	20	N.A.
3	35	346	18	235	17	N.A.
4	30	278	18	190	12	N.A.
5	27	224	18	150	9	N.A.

HO is homogeneity hypothesis, and HONC is homogeneous non-causality hypothesis and. * indicates rejection at 1%. * *indicates rejection at 5%. No: number of countries, and OBS: observation.

Table 28 Panel error correction model estimation for difference of log of private credit (DLPCDMBOFIGDP)

	All		OECD		EMEs	
	A	B	A	B	A	B
DLPFAGDP	0.03708*	0.04012	0.01454	-0.13214**	0.02993	0.12856**
LINFL	-0.00278	-0.00063	0.00047	-0.00162	0.01716	0.01187
LINT	0.02600*	0.02193*	0.01263***	0.01342***	0.04467*	0.03500*
DLGDPCON	-0.69357*	-0.62407*	-0.15968	-0.24263	-0.68349*	-0.92704*
DLSTKCAP	-0.01064	0.00042	0.01621	0.01446	-0.07219*	-0.03320
DLSTKTNV	0.00576	0.00125*	0.00568	0.00766	0.00929	0.01919
ECM(-1)	-0.14151*	-0.13509*	-0.08354*	-0.07772*	-0.25557*	-0.20408*
LPFAGDP(-1)	-0.00151	0.00847	-0.00127	-0.03987**	-0.01238	0.03830***
LINFL(-1)	0.00867	0.00803	0.00982	0.00703	0.00074	0.00352
LINT(-1)	-0.00057	0.00011	0.00202	0.00278	0.00532	0.00755
LGDPCON(-1)	-0.06850*	-0.03387*	0.02776	0.05717	-0.15706*	-0.18130*
LSTKCAP(-1)	0.04314*	0.02209	0.00743	-0.00236	0.07437*	0.08817*
LSTKTNV(-1)	0.00036	0.00062	0.00124	0.00826	0.02193	0.02140
RSQ-bar	0.88764	0.33829	0.11571	0.13922	0.90797	0.56792
SE	0.08614	0.09655	0.06797	0.08435	0.10430	0.10713
OBS	407	376	267	279	140	97

D first difference and L log; See Table 7 for variable details. Column A presents the results of regressions on all countries, while Column B presents those of regressions, using fitted values of PFAGDP. See Appendix 2 for country details.

Table 29 Panel error correction model estimation for difference of log of domestic credit provided by banking industry (DLCREDIT)

	All		OECD		EMEs	
	A	B	A	B	A	B
DLPFAGDP	-0.04291**	-0.13198*	0.00210	-0.17661*	-0.15416*	0.04061
LINFL	-0.01798*	-0.00964**	-0.00622	-0.00325	-0.06006*	-0.04273***
LINT	0.02333*	0.01272**	0.00740	0.00829	0.02097	0.00951
DLGDPCON	-0.46139*	-0.26690***	0.04831	0.04239	-1.02899*	-0.69044**
DLSTKCAP	-0.01326	0.01092	0.03019	0.03812**	0.01147	-0.03174
DLSTKTNV	0.00802	0.00331	0.00637	0.00564	0.00324	0.00128
ECM(-1)	-0.12614*	-0.10775*	-0.09320*	-0.09930*	-0.19251*	-0.19015*
LPFAGDP(-1)	-0.02833*	-0.04192*	0.00210	-0.05252*	-0.09363*	-0.06626**
LINFL(-1)	0.00078	0.00361	0.00939***	0.00725	-0.00682	-0.00082
LINT(-1)	0.00333	0.00382	0.00372	0.00592	-0.00227	0.00800
LGDPCON(-1)	-0.02484	0.07274*	0.01379	0.12069*	-0.13417*	-0.06192
LSTKCAP(-1)	0.01295	-0.00550	-0.01128	-0.01465	0.04314**	0.04003***
LSTKTNV(-1)	0.00298	0.00798***	0.00276	0.00617	0.00106	-0.00240
RSQ-bar	0.41077	0.28219	0.11852	0.19315	0.84844	0.40350
SE	0.09131	0.08945	0.07209	0.07727	0.11354	0.10367
OBS	409	378	268	280	141	98

D first difference and L log; See Table 7 for variable details. Column A presents the results of regressions on all countries, while Column B presents those of regressions, using fitted values of PFAGDP. See Appendix 2 for country details.

Table 30 Share of credit provided by selected financial intermediaries in the US, 1945-2003, %

									Change
	1945	1950	1960	1970	1980	1990	2000	2003	1945-2003
Commercial banking	33.16	29.54	25.60	28.42	27.25	20.17	18.28	17.31	-47.82
Life and other insurance companies	17.30	15.31	15.53	12.83	10.75	10.76	8.96	9.05	-47.68
Private and public pension funds	1.80	2.35	4.95	5.38	6.31	6.77	5.38	4.40	144.16
Mutual funds	0.06	0.09	0.26	0.36	1.25	5.32	8.72	8.43	14862.81
Finance companies	1.01	1.83	3.12	3.41	3.80	3.43	3.11	2.74	169.94

Source: Board of Governors of the Federal Reserve System, "Flow of Funds Accounts of the United States". Various years.

Table 31 Panel error correction model estimation for difference of log of bank assets to total financial assets (DLDMBTFA)

	All		OECD		EMEs	
	A	B	A	B	A	B
DLPFAGDP	0.02473***	0.00101	-0.09833***	-0.04429	0.05691**	0.11320
LINFL	0.01090*	-0.00727	0.01135*	0.00900**	-0.02417	-0.02986
LINT	0.00356	0.01788*	0.01372	0.01396	-0.00254	-0.00428
DLGDP	0.31803*	-0.65363*	0.00205	-0.06025	0.42086**	-0.00137
DLSTKCAP	-0.00345	-0.02657**	0.02473	0.00407	-0.06241***	-0.04623
DLSTKTNV	0.00549	0.00812	0.00681	0.00149	0.01357	0.00018
ECM(-1)	-0.07614*	-0.13740*	0.00020	0.00952	-0.16926*	-0.28263*
LPFAGDP(-1)	0.02377*	-0.01349***	0.04004	0.02718	0.03284***	0.14327*
LINFL(-1)	0.00020	-0.00083	-0.00485	-0.01058**	-0.01144	-0.03401
LINT(-1)	-0.01408**	-0.00189	-0.02221***	-0.01951	-0.00958	-0.02338**
LGDPCON(-1)	-0.03411	-0.03737***	-0.13970**	-0.14516*	-0.10296**	-0.22646*
LSTKCAP(-1)	0.00094	0.01223	0.01306	0.02588***	0.00451	0.00075
LSTKTNV(-1)	0.01277***	0.00883***	0.00759	0.01102	0.07242*	0.06938*
RSQ-bar	0.34671	0.30808	0.33243	0.25157	0.30903	0.44371

SE	0.05869	0.08106	0.05090	0.04921	0.06119	0.05698
OBS	206	375	111	127	95	66

D first difference and L log; See Table 7 for variable details. Column A presents the results of regressions on all countries, while Column B presents those of regressions, using fitted values of PFAGDP. See Appendix 2 for country details.

Table 32 Panel error correction model estimation for difference of log of stock market capitalisation (DLSTKCAP)

	All		OECD		EMEs	
	A	B	A	B	A	B
DLPFAGDP	0.30419*	0.34786***	0.63711*	0.89834*	0.19722*	-0.38154
LINFL	0.00612	-0.02128	-0.01258	-0.02186	0.02901	0.04974
LINT	-0.02419***	-0.02393	-0.04006*	-0.02530***	-0.00656	0.01258
DLGDPCON	2.04066*	1.61678*	1.53185*	1.06558**	2.05248*	2.28440*
DLCREDIT	0.02774	0.01604	0.14187	0.23408	-0.07988	-0.29923
DLLIQUID	0.17267	0.07486	0.08340	0.08847	0.18450	0.14111
ECM(-1)	-0.15895*	-0.15025*	-0.14861*	-0.14197*	-0.15574*	-0.14985**
LPFAGDP(-1)	0.13411*	0.09992**	0.13324**	0.10420	0.10004*	-0.01734
LINFL(-1)	-0.01273	-0.00287	0.00226	-0.01748	0.00084	0.09608
LINT(-1)	0.00288	-0.00061	-0.00039	-0.01069	0.01238	0.07020***
LGDPCON(-1)	-0.18152*	-0.21952**	-0.31265**	-0.34854**	-0.14806***	-0.02885
LCREDIT(-1)	-0.04830	0.04190	0.14426	0.15582	-0.15333	-0.11291
LLIQUID(-1)	-0.10667	-0.15830	-0.15841	-0.17173	-0.00867	-0.09696
RSQ-bar	0.65863	1.00000	0.54992	1.00000	0.65129	0.26314
SE	0.15721	0.18607	0.12523	0.13258	0.19030	0.20558
OBS	344	298	204	200	147	98

D first difference and L log; See Table 7 for variable details. Column A presents the results of regressions on all countries, while Column B presents those of regressions, using fitted values of PFAGDP. See Appendix 2 for country details.

Table 33 Panel error correction model estimation for difference of log of stock market traded (DLSTKTRD)

	All		OECD		EMEs	
	A	B	A	B	A	B
DLPFAGDP	0.33685**	0.81232***	1.39857*	3.12497*	0.04871	-0.63489
LINFL	0.03707	0.01320	-0.00515	0.00277	0.31681*	0.02262
LINT	-0.10609**	-0.11889*	-0.19165*	-0.15016*	0.04636	-0.02440
DLGDPCON	4.74242*	2.29475**	0.14705	-1.26503	6.81132*	3.92205**
DLCREDIT	-0.06590	-0.26179	1.23954**	1.43219**	0.05383	-0.94439***
DLLIQUID	0.84915***	1.09791**	0.21994	0.26399	1.10693***	1.55594**
ECM(-1)	-0.20966*	-0.18351*	-0.10379*	-0.12091*	-0.48488*	-0.45379*
LPFAGDP(-1)	0.10399	-0.00047	0.47207*	0.64437*	0.23459***	-0.24607
LINFL(-1)	-0.10064**	-0.13657*	-0.13225**	-0.18131*	0.07110	0.26423***
LINT(-1)	0.06481**	0.03551	0.04474	0.01654	0.09914	0.15492***
LGDPCON(-1)	-0.20497	-0.26270	-1.82962*	-2.01564*	0.29765	0.43411
LCREDIT(-1)	0.10999	0.26140	1.06159*	0.70064***	0.64701*	0.46024
LLIQUID(-1)	-0.40254***	-0.42346***	-0.97202*	-0.81216**	-0.99316**	-0.77994
RSQ-bar	0.23599	1.00000	0.24662	1.00000	0.37333	0.31133
SE	0.46957	0.44350	0.38384	0.38512	0.50697	0.50634
OBS	355	294	200	195	142	99

D first difference and L log; See Table 7 for variable details. Column A presents the results of regressions on all countries, while Column B presents those of regressions, using fitted values of PFAGDP. See Appendix 2 for country details.

Table 34 Panel error correction model estimation for difference of log of stock market turnover (DLSTKTNV)

	All		OECD		EMEs	
	A	B	A	B	A	B
DLPFAGDP	0.01546	0.95407***	0.76833*	2.64679*	-0.11897	0.15174
LINFL	0.03825	0.02751	0.03029	0.02573	0.21044**	-0.02887
LINT	-0.07581**	-0.08461**	-0.14675*	-0.11530*	0.08346	0.02127

DLGDPCON	2.87018*	1.30430	-0.28215	-1.31332	3.36328*	1.65769
DLCREDIT	-0.11849	-0.29984	0.79759	1.00158***	-0.43195	-1.20720**
DLLIQUID	0.71984***	1.15122*	0.28481	0.22371	0.63142	1.36893**
ECM(-1)	-0.27829*	-0.25631*	-0.16854*	-0.20185*	-0.67452*	-0.67318*
LPFAGDP(-1)	-0.02118	-0.03833	0.19866	0.51356*	0.04247	-0.15179
LINFL(-1)	-0.09112**	-0.13024*	-0.14089*	-0.17929*	0.07474	0.11214
LINT(-1)	0.04497***	0.01657	0.04348	0.02228	0.06726	0.06939
LGDPCON(-1)	-0.01301	-0.09410	-0.91707**	-1.69504*	0.04446	0.34190
LCREDIT(-1)	0.21939	0.12853	0.67283**	0.50475	0.17674	0.46317***
LLIQUID(-1)	-0.29615	-0.13924	-0.54515	-0.61706***	-0.52105	-0.63325***
RSQ-bar	0.17600	1.00000	0.19099	1.00000	0.29756	0.35189
SE	0.40951	0.37664	0.35944	0.33025	0.41267	0.39164
OBS	330	290	189	192	141	98

D first difference and L log; See Table 7 for variable details. Column A presents the results of regressions on all countries, while Column B presents those of regressions, using fitted values of PFAGDP. See Appendix 2 for country details.

Table 35 Panel error correction model estimation for difference of log of public bond market (DLPUBBND)

	All		OECD		EMEs	
	A	B	A	B	A	B
DLPFAGDP	0.21266*	0.23950*	0.01877	0.04614	0.29412*	0.23943
LINFL	-0.02066	-0.02109***	-0.02059	-0.01771	-0.07224**	-0.1181*9
LINT	0.04451*	0.03879*	-0.07017	-0.05265	0.06861**	0.04890*
DLGDPCON	-0.70188**	-0.87720*	0.40042	0.29171	-1.11110*	-2.51974*
DLCREDIT	0.10442	0.09497	0.17951***	0.15899***	0.29557*	0.15797***
DLLIQUID	-0.22269**	-0.08119	0.03471	0.03613	-0.81841*	-0.48914*
DLSTKCAP	0.09827*	0.14327*	0.11457*	0.11808*	0.09145**	0.19065*
DLSTKTRD	-0.04096*	-0.05206*	-0.02366	-0.02327	-0.02692	-0.03858*
ECM(-1)	-0.22693*	-0.25720*	-0.29388*	-0.26966*	-0.36877*	-0.54178*

LPFAGDP(-1)	0.08060**	-0.03846	-0.27031*	-0.24126*	0.11001**	-0.24614*
LINFL(-1)	-0.01425	-0.02131	-0.01793	-0.01776	-0.05643**	-0.10975*
LINT(-1)	-0.01258	-0.02998**	-0.04896	-0.04968	-0.00277	-0.02007
LGDPCON(-1)	-0.27890*	-0.27684*	0.19222	0.16535	-0.60991*	-0.92222*
LCREDIT	0.02527	0.01071	0.36437*	0.32668*	0.01891	-0.35636*
LLIQUID	0.10200	0.15393**	-0.28390**	-0.24470***	0.18346	0.82560*
LSTKCAP(-1)	-0.06394***	-0.02572	-0.00829	0.00486	-0.04970	0.13874**
LSTKTRD(-1)	-0.02492	-0.03034***	-0.07691*	-0.08316*	-0.02416	-0.08344*
RSQ-bar	0.78488	1.00000	0.75538	1.00000	0.88409	0.92344
SE	0.07883	0.06124	0.05001	0.04945	0.08678	0.05812
OBS	156	135	85	84	71	51

D first difference and L log; See Table 7 for variable details. Column A presents the results of regressions on all countries, while Column B presents those of regressions, using fitted values of PFAGDP. See Appendix 2 for country details.

Table 36 Panel error correction model estimation for difference of log of private bond market (DLPRIBND)

	All		OECD		EMEs	
	A	B	A	B	A	B
DLPFAGDP	0.27914*	0.20547	0.11086	0.12460	0.41275*	0.04577
LINFL	-0.00598	-0.01096	0.00965	0.00498	-0.03764	-0.07078
LINT	-0.01138	-0.00096	-0.00799	0.00827	-0.02313	-0.00342
DLGDPON	-0.12844	-0.87539***	0.16952	-0.02094	-0.10032	-1.08554
DLCREDIT	0.13903	0.23041**	0.17718	0.17181	0.28434	0.96246**
DLLIQUID	0.01282	0.01438	0.18264	0.21614	-0.40279***	-1.04657**
DLSTKCAP	0.00911	0.11348*	0.10259**	0.11681*	-0.12353**	0.10752***
DLSTKTRD	0.01428	-0.02942	-0.01131	-0.02014	0.07041**	-0.02860
ECM(-1)	-0.32432*	-0.23647*	-0.14493***	-0.13985***	-0.47616*	-0.27731
LPFAGDP(-1)	0.07651*	0.01312	0.10422	0.08581	0.15088**	0.03620
LINFL(-1)	0.02932**	0.01792	0.02197	0.01252	0.02322	-0.00134

LINT(-1)	-0.00527	-0.01973	-0.02542	-0.02851	-0.00184	0.03176
LGDPCON(-1)	-0.10151	-0.13542	0.15533	0.16621	-0.35578**	-0.45626**
LCREDIT	-0.02070	0.10071	0.03325	-0.01396	-0.16817	0.58518**
LLIQUID	0.03412	0.07749	0.17224	0.24225	0.15588	-0.46832
LSTKCAP(-1)	-0.09363**	0.01585	-0.06299	-0.03165	-0.27882*	-0.00792
LSTKTRD(-1)	0.08960*	0.03689	0.01339	0.00041	0.18538*	0.09784
RSQ-bar	1.00000	1.00000	0.61304	1.00000	1.00000	1.00000
SE	0.08291	0.10476	0.06422	0.06286	0.09082	0.09342
OBS	144	125	85	84	59	41

D first difference and L log; See Table 7 for variable details. Column A presents the results of regressions on all countries, while Column B presents those of regressions, using fitted values of PFAGDP. See Appendix 2 for country details.

Table 37 F-Test results of panel Granger causality estimation (pension assets to financial intermediaries indicators)

	All countries				OECD				EMEs			
Lag	DLPCDMBOFIGDP		DLCREDIT		DLPCDMBOFIGDP		DLCREDIT		DLPCDMBOFIGDP		DLCREDIT	
	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC
1	0.00	4011.45*	0.00	3629.04*	0.00	215.35*	0.00	274.12*	0.00	2523.62*	0.00	2143.90*
2	0.04	2112.26*	0.16	1844.79*	0.02	121.38*	0.00	128.08*	1.42	944.11*	0.32	1136.91*
3	0.19	1166.60*	1.64*	1035.22*	0.34	72.84*	1.12	57.49*	1.20	653.40*	0.70	718.74*
4	0.34	740.24*	0.42	871.81*	0.33	46.77*	0.46	48.47*	0.11	519.45*	2.66*	302.71*
5	0.07	566.96*	1.20	546.45*	0.30	35.29*	1.31	36.42*	0.03	407.58*	0.38	340.33*
	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS
1	38	614	38	638	18	412	18	417	20	202	20	221
2	37	574	38	596	18	393	18	396	19	181	20	200
3	35	536	37	555	18	375	18	376	17	161	19	179
4	32	500	34	517	17	357	17	358	15	143	17	159
5	30	467	32	482	17	340	17	341	13	127	15	141

DLPCDMBOFIGDP, first difference of log of private credit provided by deposit money bank and other financial institutions to GDP, DLCREDIT, domestic credit provided by banking industry to GDP. HO is homogeneity hypothesis, and HONC is homogeneous non-causality hypothesis and. * indicates rejection at 1%. No: number of countries, and OBS: observation.

Table 38 F-Test results of panel Granger causality estimation. All countries (pension assets to stock market indicators)

Lag	DLSTKCAP		DLSTKTRD		DLSTKTNV	
	HO	HONC	HO	HONC	HO	HONC
1	0.00	1043.65*	0.00	1059.42*	0.00	769.47*
2	0.14	430.80*	1.25	383.83*	0.22	355.11*
3	0.06	239.56*	0.20	280.10*	0.85	173.84*
4	0.08	153.54*	0.02	210.60*	0.02	161.70*
5	0.00	124.97*	0.08	149.81*	0.02	119.95*
	No	OBS	No	OBS	No	OBS
1	38	527	38	518	38	504
2	37	489	35	478	35	464
3	35	452	32	442	32	428
4	32	417	31	409	31	395
5	31	385	31	378	30	364

DLSTKCAP, first difference of log of stock market capitalisation to GDP, DLSTKTRD, first difference of log of stock market total traded value, DLSTKTNV, first difference of log of stock market turnover ratio. HO is homogeneity hypothesis, and HONC is homogeneous non-causality hypothesis and. * indicates rejection at 1%. No: number of countries, and OBS: observation.

Table 39 F-Test results of panel Granger causality estimation. OECD countries (pension assets DLPFA to stock market indicators)

Lag	DLSTKCAP		DLSTKTRD		DLSTKTNV	
	HO	HONC	HO	HONC	HO	HONC
1	0.00	323.42*	0.00	305.66*	0.00	184.19*
2	0.03	144.32*	0.03	138.08*	0.01	93.96*
3	0.04	95.27*	0.02	89.98*	0.01	62.24*
4	0.05	64.92*	0.10	66.67*	0.21	34.49*
5	0.09	65.87*	0.08	52.00*	0.76	16.23*
	No	OBS	No	OBS	No	OBS
1	18	325	18	327	18	315
2	18	307	18	307	18	295
3	18	289	18	288	18	276
4	18	271	18	269	18	257
5	18	253	18	251	17	239

DLSTKCAP, first difference of log of stock market capitalisation to GDP, DLSTKTRD, first difference of log of stock market total traded value, DLSTKTNV, first difference of log of stock market turnover ratio. HO is homogeneity hypothesis, and HONC is homogeneous non-causality hypothesis and. * indicates rejection at 1%. No: number of countries, and OBS: observation

Table 40 F-Test results of panel Granger causality estimation. EMEs (pension assets DLPFA to stock market indicators)

Lag	DLSTKCAP		DLSTKTRD		DLSTKTNV	
	HO	HONC	HO	HONC	HO	HONC
1	0.00	638.69*	0.00	827.24*	0.00	520.56*
2	-0.16	277.78*	0.16	351.18*	0.84	231.89*
3	-0.55	154.61*	1.71*	129.51*	0.15	139.94*
4	0.19	83.37*	0.08	132.03*	0.07	101.59*
5	0.05	55.01*	0.16	93.48*	0.09	77.62*
	No	OBS	No	OBS	No	OBS
1	20	202	20	191	20	189
2	19	182	17	171	17	169
3	17	163	14	154	14	152
4	14	146	13	140	13	138
5	13	132	13	127	13	125

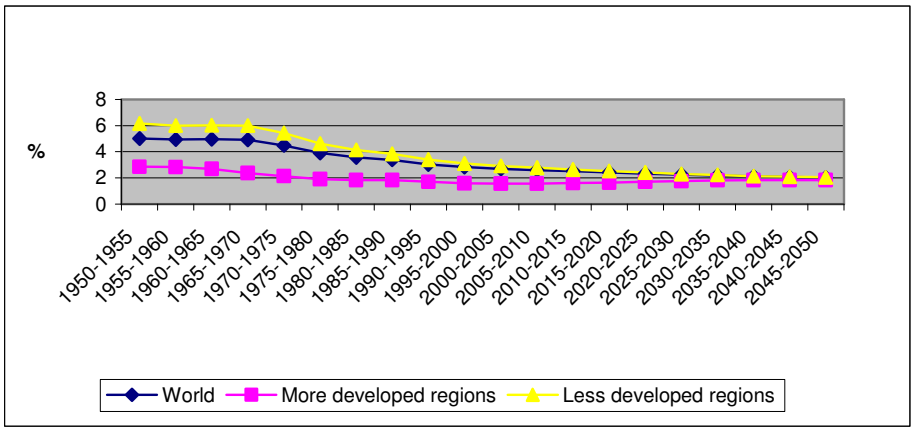
DLSTKCAP, first difference of log of stock market capitalisation to GDP, DLSTKTRD, first difference of log of stock market total traded value, DLSTKTNV, first difference of log of stock market turnover ratio. HO is homogeneity hypothesis, and HONC is homogeneous non-causality hypothesis and. * indicates rejection at 1%. No: number of countries, and OBS: observation

Table 41 F-Test results of panel Granger causality estimation (pension assets to bond market indicators)

	All countries				OECD				EMEs			
Lag	DLPUBBDN		DLPRIBND		DLPUBBDN		DLPRIBND		DLPUBBDN		DLPRIBND	
	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC	HO	HONC
1	0.00	195.90*	0.00	271.26*	0.00	15.81*	0.00	4.10*	0.00	99.83*	0.00	194.12*
2	0.03	48.21*	0.04	91.80*	0.09	2.49*	0.02	4.50*	0.33	22.18*	0.24	55.43*
3	0.03	16.02*	0.01	25.67*	0.02	1.53*	0.02	2.22*	0.03	8.89*	-0.10	14.16*
4	-0.01	5.42*	-0.06	7.17*	-0.04	0.62	-0.14	0.74	-0.11	1.87*	-0.18	3.68*
5	-0.08	-0.66	-0.32	-0.64	-0.09	-0.09	-0.23	-0.13	-0.41	-1.54	-1.06	-1.24
	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS	No	OBS
1	28	235	26	224	17	158	17	158	11	84	9	66
2	27	207	26	198	17	141	17	141	10	66	9	57
3	26	180	25	172	17	124	17	124	9	56	8	48
4	25	154	24	147	17	107	17	107	8	47	7	40
5	24	129	23	123	16	90	16	90	8	39	7	33

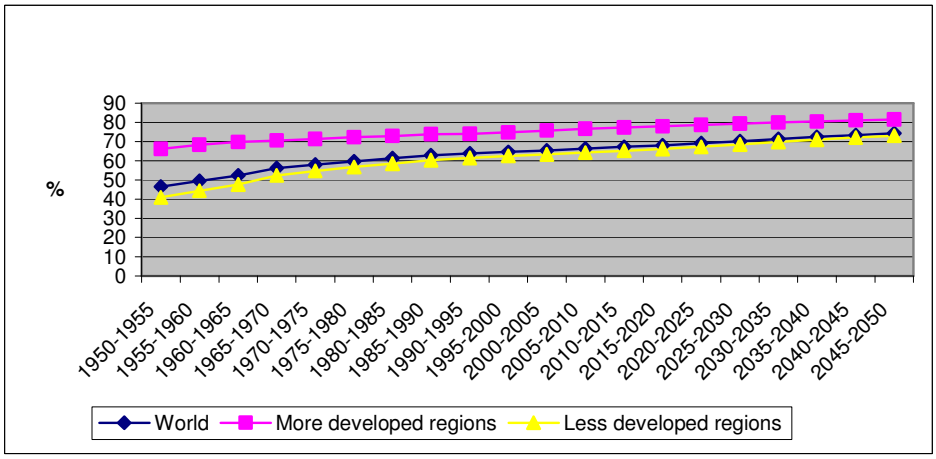
DLPUBBND, first difference of log of public bond market capitalisation to GDP, DLPRIBND, first difference of log of private bond market capitalisation to GDP. HO is homogeneity hypothesis, and HONC is homogeneous non-causality hypothesis and. * indicates rejection at 1%. No: number of countries, and OBS: observation

Figure 1 Fertility rate 1950-2050



Source Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2002 Revision and World Urbanization Prospects.

Figure 2 Life expectancy at birth, 1950-2050



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2002 Revision and World Urbanization Prospects.

Figure 3 Links between pension reform, pension funds, economic growth and financial development

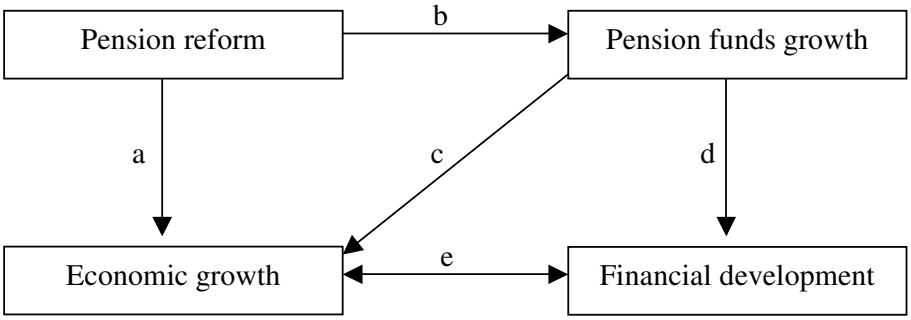
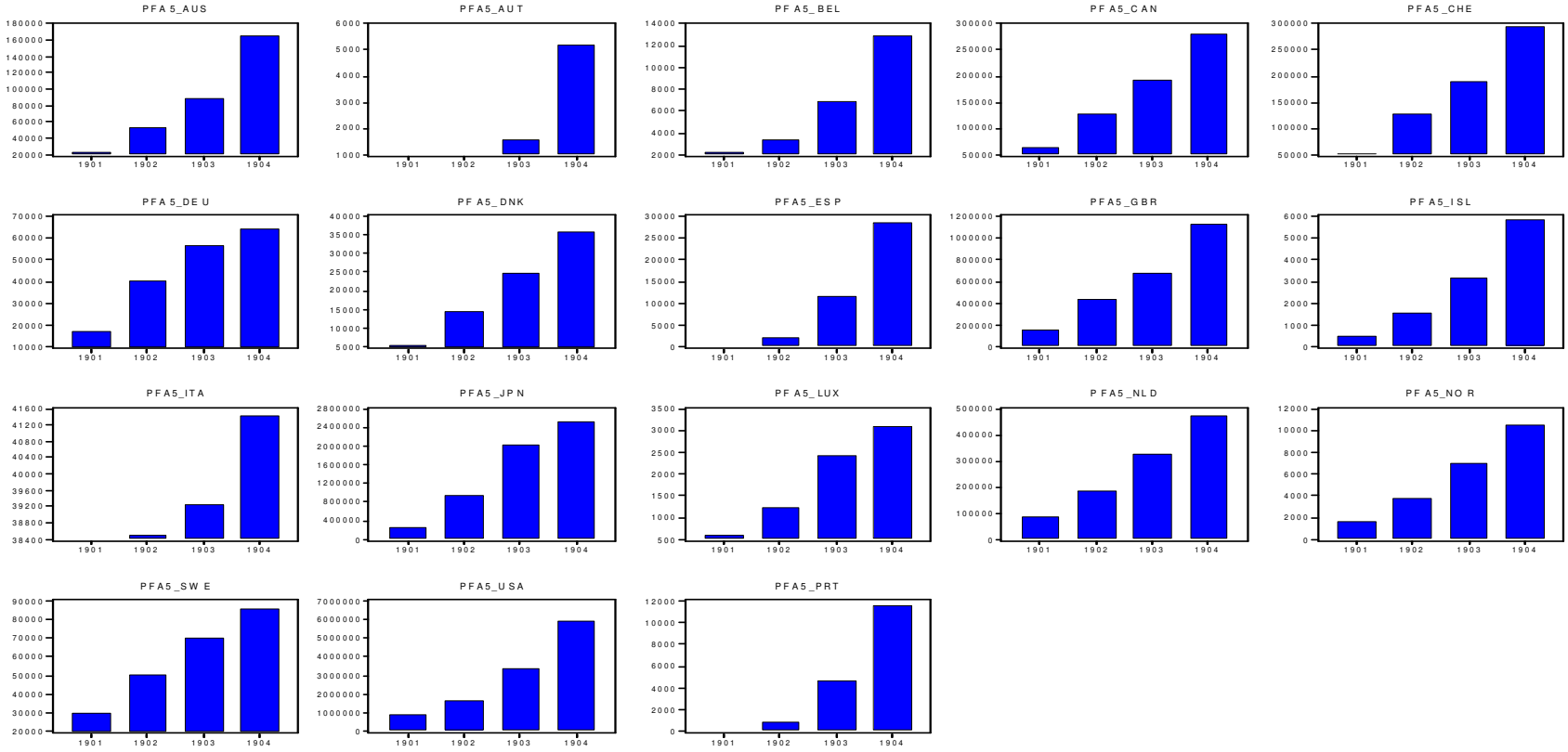


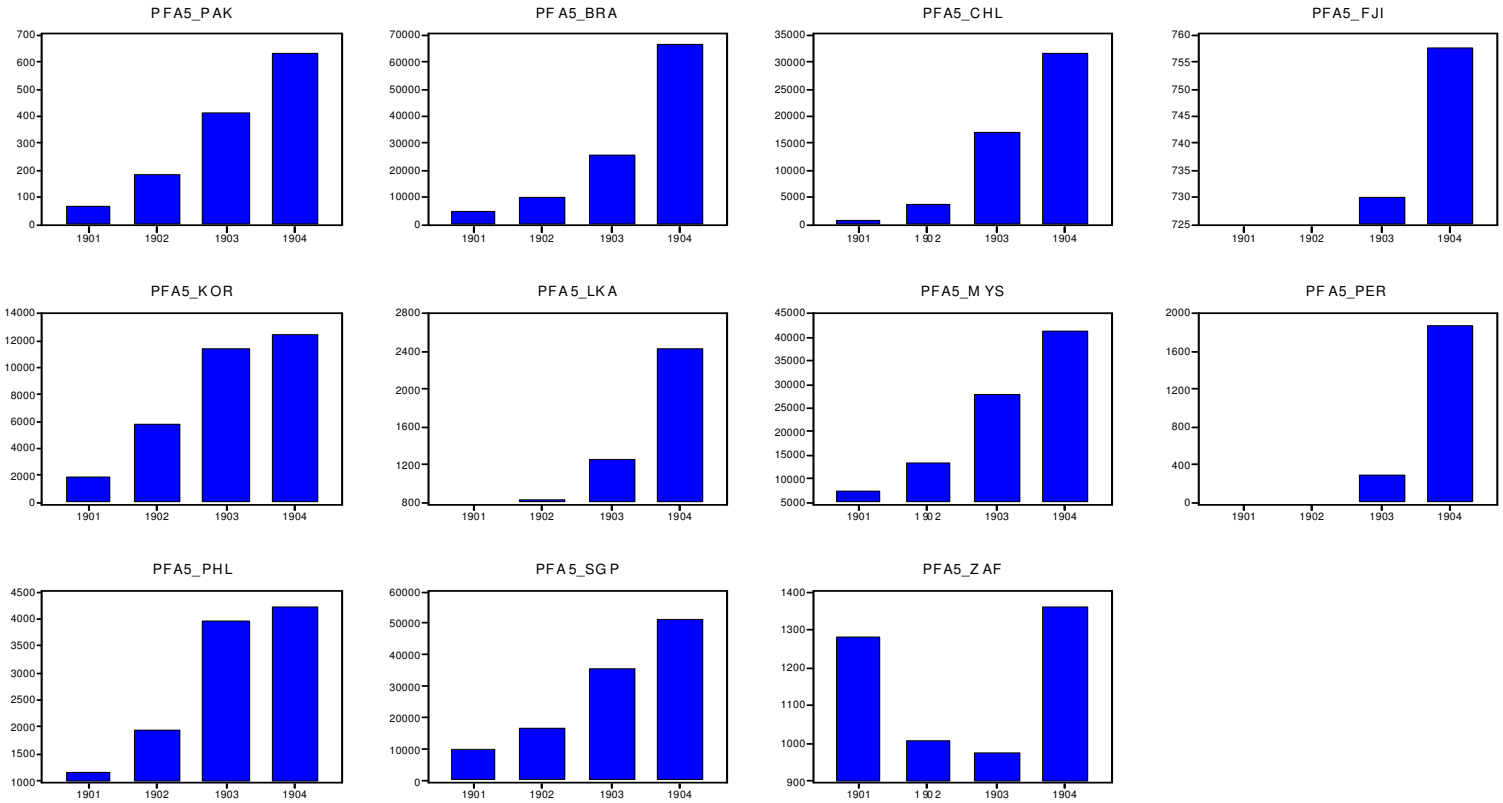
Figure 4 Pension fund assets (US$ million) across 18 OECD countries, 5 year average 1981-2000



Source: various sources, including OECD Institutional Investors (2003), Davis and Steil (2001) and national sources. See Section 3.2.1 for more information. All data are converted into and measured at US Dollars, for the convenience of across-country comparison.

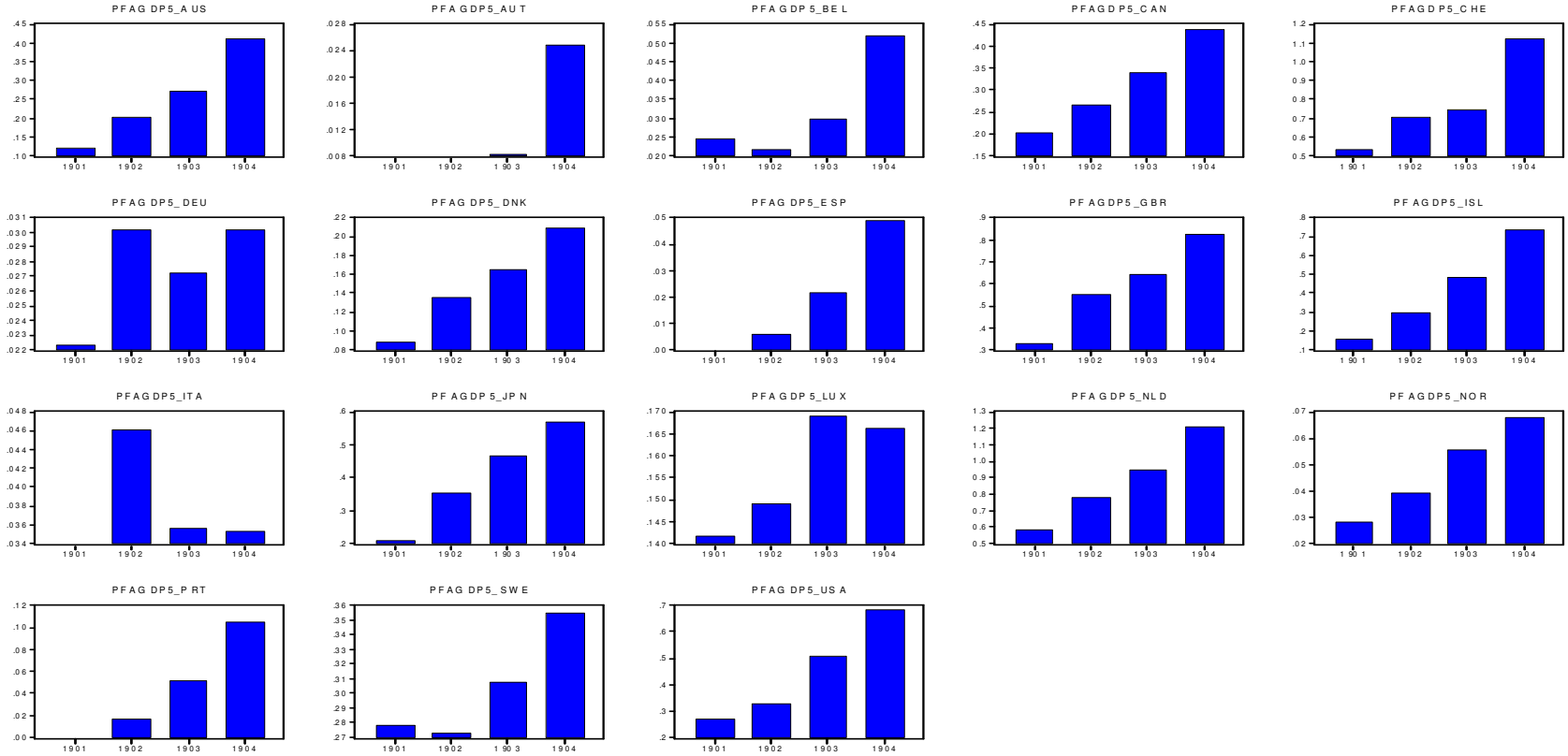
Notes: we average every 5 year observations over 1981-2000, so total together we have 4 observations for each country. We use 1901 to denote the 5 year average over 1981-1985, 1902 to denote 1986-1990, 1903 to denote 1991-1995 and 1904 to denote 1996-2000. Similar designation has been used by Beck et al (2000).

Figure 5 Pension fund assets (US$ million) across 11 Emerging market economies. 5 year average 1981-2000



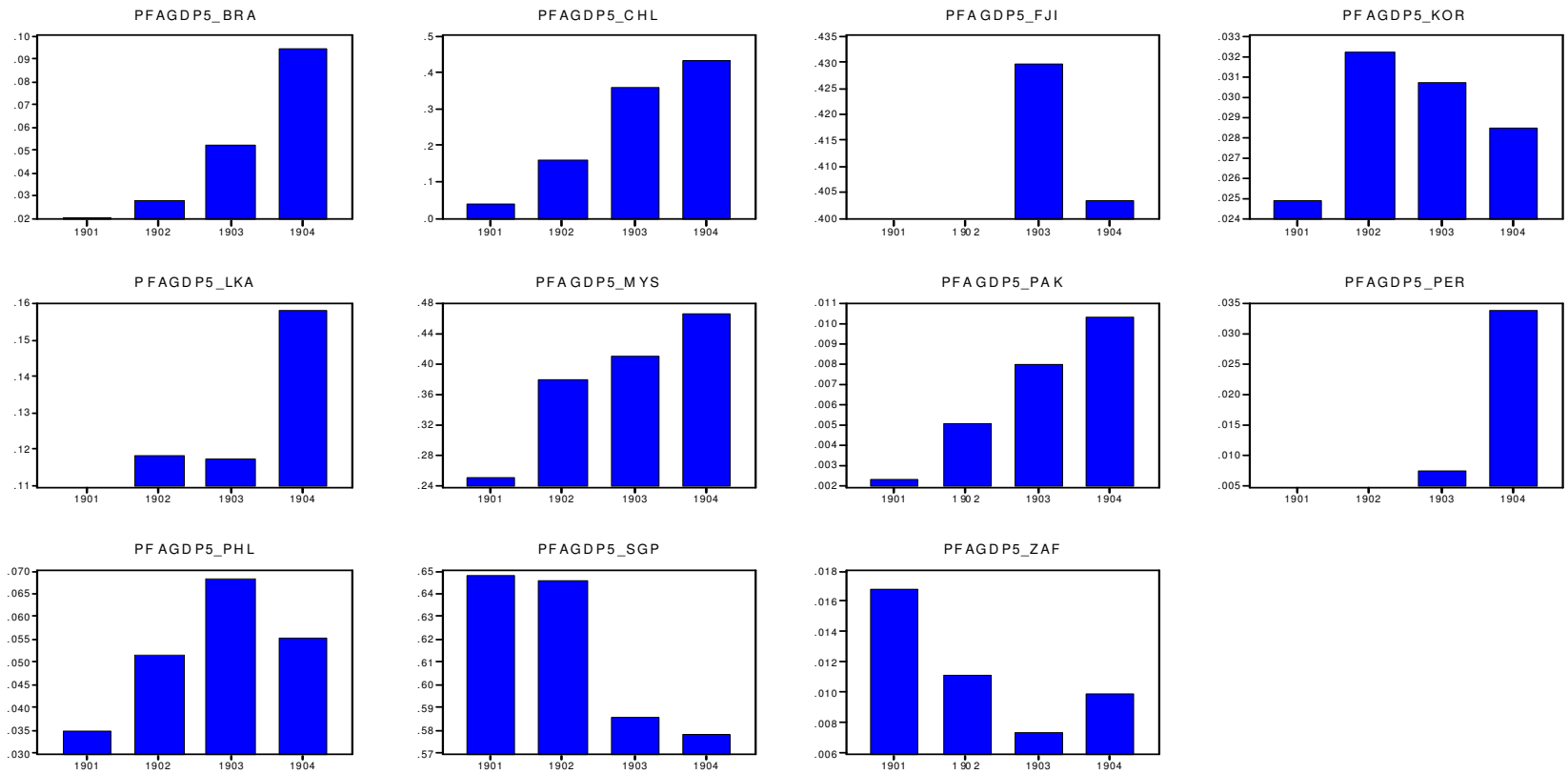
Source: various sources, including OECD Institutional Investors (2003), Davis and Steil (2001) and national sources. See Section 3.2.1 for more information. All data are converted into and measured at US Dollars, for the convenience of across-country comparison.
Note: we average every 5 year observations over 1981-2000, so total together we have 4 observations for each country. We use 1901 to denote the 5 year average over 1981-1985, 1902 to denote 1986-1990, 1903 to denote 1991-1995 and 1904 to denote 1996-2000. Similar designation has been used by Beck et al (2000).

Figure 6 Pension fund assets to GDP across 18 OECD countries. 5 year average 1981-2000



Source: various sources, including OECD Institutional Investors (2003), Davis and Steil (2001) and national sources. See Section 3.2.1 for more information. All data are converted into and measured at US Dollars, for the convenience of across-country comparison.
Note: we average every 5 year observations over 1981-2000, so total together we have 4 observations for each country. We use 1901 to denote the 5 year average over 1981-1985, 1902 to denote 1986-1990, 1903 to denote 1991-1995 and 1904 to denote 1996-2000. Similar designation has been used by Beck et al (2000).

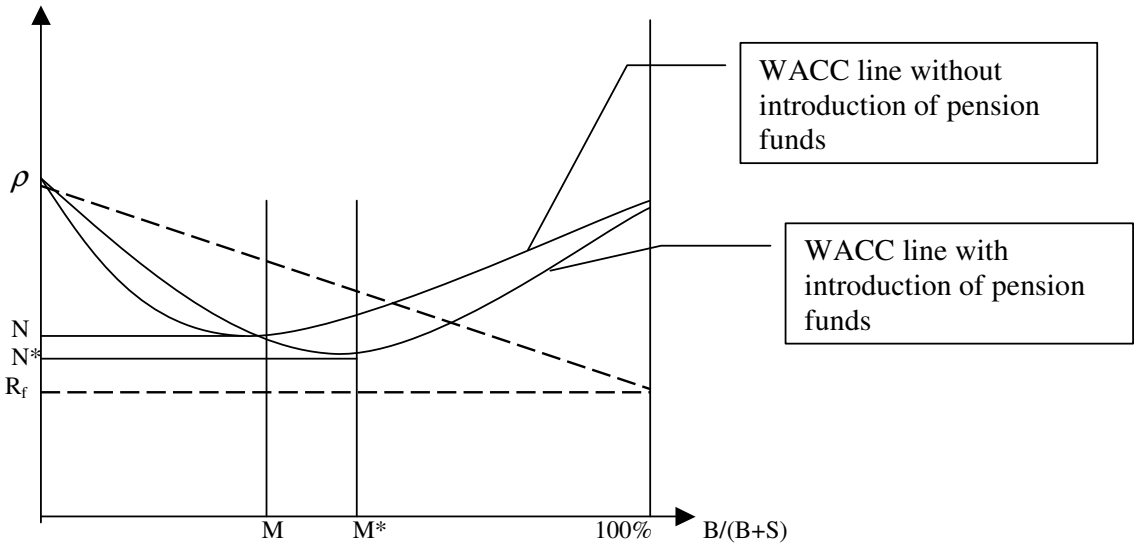
Figure 7 Pension fund assets to GDP across 11 EMEs. 5 year average 1981-2000



Source: various sources, including OECD Institutional Investors (2003), Davis and Steil (2001) and national sources. See Section 3.2.1 for more information. All data are converted into and measured at US Dollars, for the convenience of across-country comparison.

Note: we average every 5 year observations over 1981-2000, so total together we have 4 observations for each country. We use 1901 to denote the 5 year average over 1981-1985, 1902 to denote 1986-1990, 1903 to denote 1991-1995 and 1904 to denote 1996-2000. Similar designation has been used by Beck et al (2000).

Figure 8 Costs of capital, optimal capital structures and WACC lines with and without pension fund



WACC: Weighted average cost of capital. ρ : Discounted rate for an all-equity firm. R_f : Risk free rate of return. B: Proportio of bonds. S: proportion of shares. M and M*: optimal capital structure without and with introdcutio of pension funds. N and N*: cost of capital without and with introduction of pension funds.

Figure 9 Deposit money bank assets to GDP (DMBGDP) across 72 countries 1960-2001

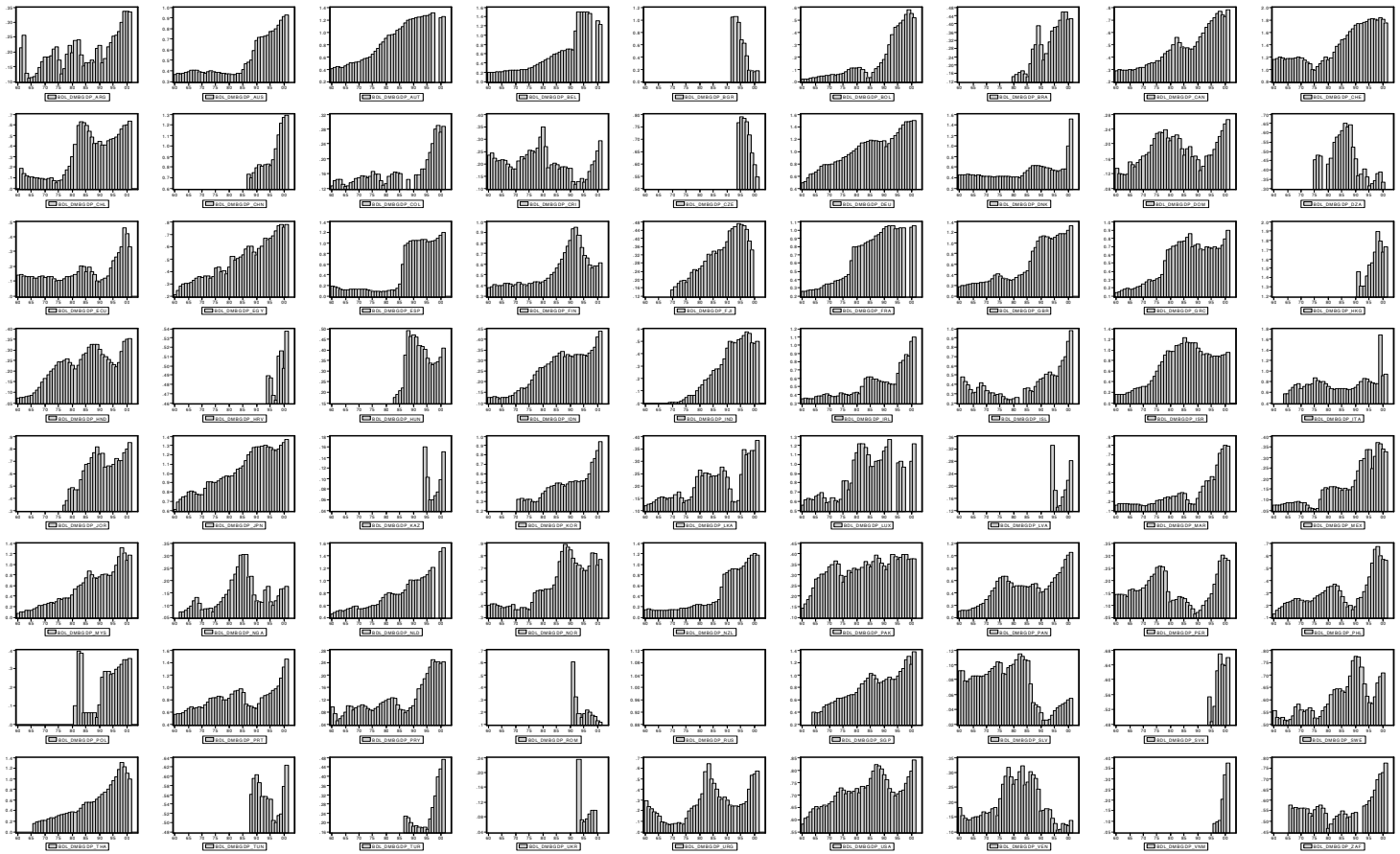


Figure 10 Deposit money bank assets/GDP, average over 1960-2001 OECD countries

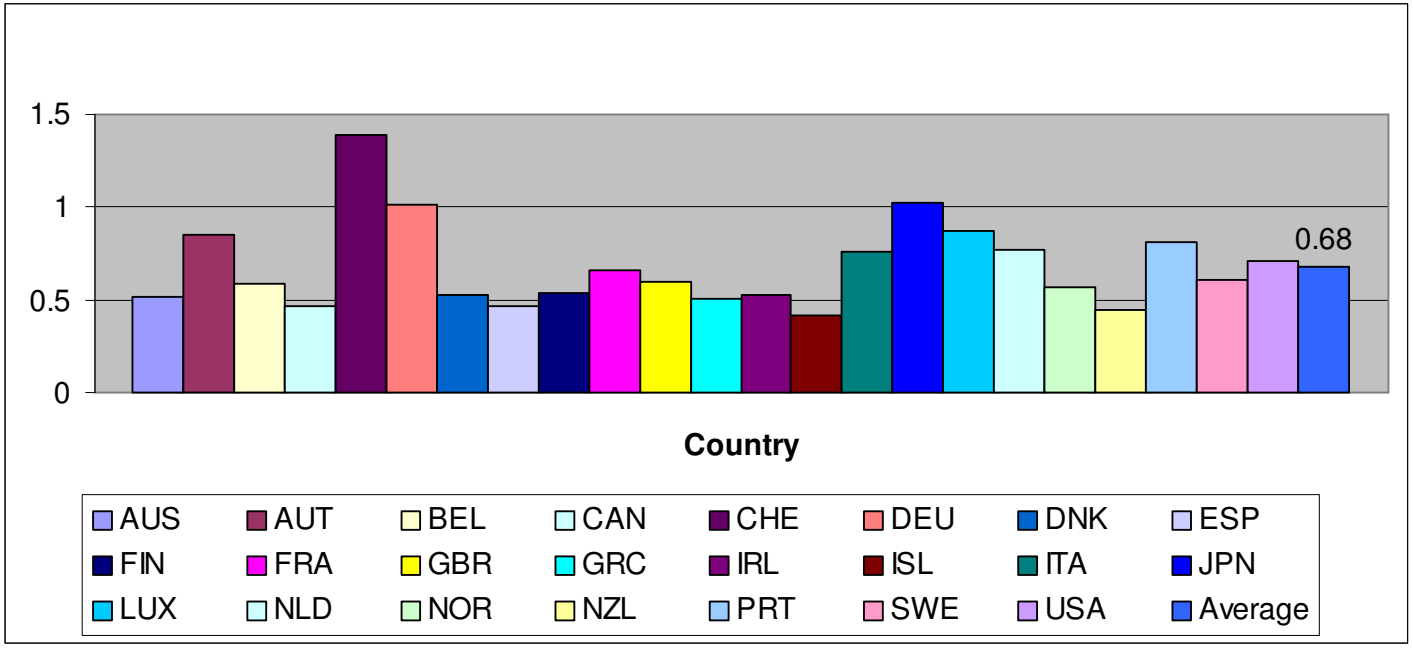
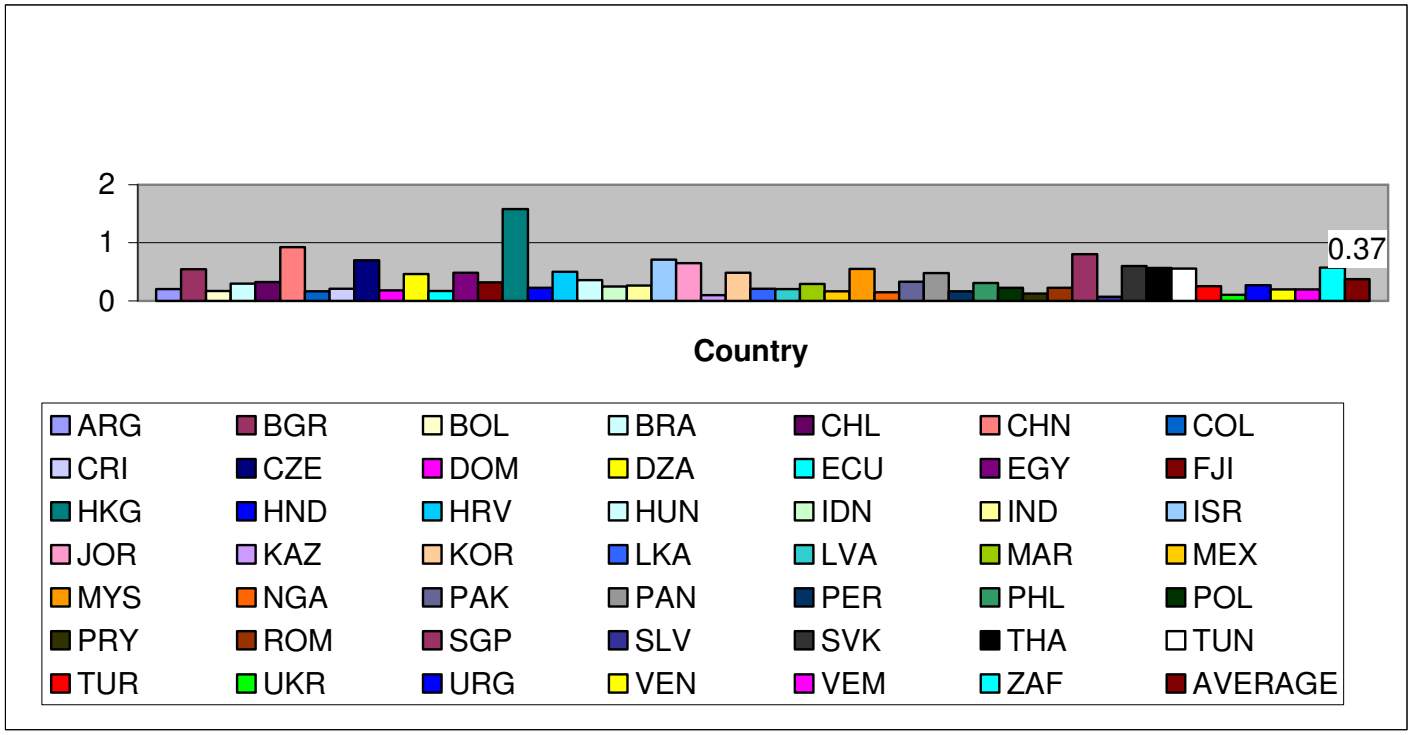


Figure 11 Deposit money bank assets/GDP average 1960-2001, EMEs



Appendix 1 Economics of funding and unfunding pension systems

The leading economist, Paul Samuelson (1958) published one paper, trying to identify the rationale underlying PAYG scheme. In that paper, an overlapping generation model involving two periods is designed to help academia to under the basic economics of PAYG retirement programme. People are assumed to work in Year t and retire in Year t+1 with constant tax rate θ. There is no capital in this economy, and people must consume all the goods in the current year. In addition, Labour (L) and wages (W) increase rates are n and g respectively.

Then Samuelson shows that PAYG arrangement implies a rate of return 1+r, equal to (1+n)(1+g) as follows;

$$
\begin{aligned}
1+r &= B_{t+1} / T_t = \theta W_{t+1} L_{t+1} / \theta W_t L_t \\
&= \theta W_t (1+g)(1+n) L_t / \theta W_t L_t \qquad \text{Equation 1} \\
&= (1+g)(1+n)
\end{aligned}
$$

B_{t+1}: benefits paid out to current retirees at time t+1

T_t: taxes collected by government at time t, equal wages W_t times tax rate θ, then times numbers of Labour L, i.e. $\theta W_t L_t$.

As for the above equation, a special case is considered, i.e. there is no wage increase over this two periods, then g equals to 0. Then equation 1 is reduced to R=1+n; or in words, implicit rate of return is 1 plus the labour increase rate, n which is assumed to be same as population growth rate p, a rate labelled by Samuelson as the *biological rate of interest*.

In addition to this positive implicit rate of return, the initial generation participants get one-off windfall from PAYG, since they did not contribute to this scheme by paying tax during their working period, therefore implying the Pareto improvement.

Following Samuelson's demonstration on social security systems as shown above, Aaron (1966) extends that paper and outlines condition which can be used to justify unfunded or funding systems, well known as "Aaron condition/rule".

Besides expressions, W_t and L_t which are used in the way as that in equation 1, Aaron introduces two extra terms, i.e. M, replacement rate – proportion of final salary earned when individuals are young as pensions when retired, and N, contribution rate – proportion of salaries used to contribute to pension systems. Then if assuming the budget is balanced, the following equation is obtained:

$$W_t L_t m = W_{t+1} L_{t+1} n = W_t (1+g) L_t (1+n) n \qquad \text{Equation 2}$$

The left hand side of equation 2 is the pension liabilities, calculated by multiplying total wages in aggregate - $W_t L_t$ during period t by replacement rate, while the right hand side of equation 2 is the pension contributions, which is equal to the product of W_{t+1} and L_{t+1} during period t+1then multiplied by n, contribution rate. If equation is rewritten as follows:

$$m / n = W_{t+1} L_{t+1} / W_t L_t = (1+g)(1+n) \qquad \text{Equation 3}$$

we get the rate of return implied by a PAYG system, i.e. $(1+g)(1+n)$, which is the same as that in equation 1, but in this case, we do not assume away g as Samuelson did. Moreover, it is noted that the rate of return under a funded systems is 1+r, then Aaron condition is given as:

$$1 + r \leq or \geq (1+g)(1+n) \qquad \text{Equation 4}$$

But when r, g and n are only slightly different from 1, then equation 4 is reduced to

$$r \leq or \geq g + n \qquad \text{Equation 5}$$

In words, if the market return, i.e. r is less than the sum of growth rates of wages and labour population – $g + n$, then funded systems are less advantageous than unfunded systems, e.g. PAYG. In contrast, if the market return is greater than the sum, funded systems are more beneficial.

But it should be noted that the standard Aaron condition as we have just outlined does not allow for the heterogeneity across individuals, e.g. in terms of wage rate and labour participation rate. Steurer (2003) extends the Aaron condition by relaxing this assumption and consider four scenarios based on two dimensions, i.e. PAYG/Funded and Earning-related/Flat[41].

The current trend has been increasingly favouring the funded systems, in that g – growth of wages and particularly the n – population growth rate have dropped during the past decades across OECD countries and are expected to continue such trend in the following years in both advanced and many developing countries. Davis (1995) examines this issue across OECD countries while Steurer (2003) conducts a detailed study using historic data from the US and both confirm the benefit of transferring from unfunded systems to funded systems given the ageing population and higher rate of return of market investment.

[41] The first dimension is referred to whether the pension system is funded or not funded, i.e. PAYG. The other one concerns the situation where for some pension systems pensions are closely linked to salaries, e.g. the occupational final salary schemes in the UK, while for some pension systems whereby pension payments are flat, regardless of final salary or years of service.

Appendix 2 Summary of countries used in different estimation studies

EMEs								**OECD**	
Asia/Pacific		**Latin America**		**Central & Eastern Europe**		**Africa**			
16		16		11		6		**23**	**72**
China	a, b2	Argentina	a, b2, c1, d, e	Bulgaria	a, b2	Algeria	a, b2	Australia	a, b1, b2, c1, c2, d, e
Fiji	b1, b2, c1, d, e	Bolivia	a, b2, d	Czech Republic	a, b2	Egypt	a, b2	Austria	a, b1,b2, c1, d, e
Hong Kong	a, b2	Brazil	a, b1, b2, c1, c2, d, e	Croatia	a, b2	Morocco	a, b2	Belgium	a, b1, b2, c1, c2, d, e
India		Chile	a, b1, b2, c1, c2, d, e	Hungary	a, b2, d, e	Nigeria	a, b2	Canada	a, b1, b2, c1, d, e
Indonesia	b2, c1, d, e	Columbia	a, b2, c1, d, e	Latvia	b2,	South Africa	a, b1, b2, c1, c2, d, e	Denmark	a, b1, b2, c1, c2, d, e
Israel	a, b2	Costa Rica	a, b2	Poland	b2,	Tunisia	a, b2	Finland	a, b2
Jordan	a,b2	Dominican Republic	a, b2	Romania	a, b2			France	a, b2
Kazajstan	a,b2	El Salvador	a, b2	Russian Federation	a, b2			Germany	a, b1, b2, c1, c2, d, e
Malaysia	b1, b2, c1, c2, d, e	Ecuador	a, b2, c1, d, e	Slovakia	a,b2			Greece	a, b2
Pakistan	b1, b2, c1, c2, d, e	Honduras	a, b2	Turkey	a, b2			Iceland	a, b1, b2, c1, c2, d, e
Philippines	b1, b2, c1, c2	Mexic1o	a, b2, d, e	Ukraine	a,b2			Ireland	a, b2
Singapore	b1, b2, c1, c2, d, e	Panama	a, b2, d, e					Italy	b1, b2, c1, c2, d, e
South Korea	a b1, b2, c1, c2, d, e	Paraguay	A, b2					Japan	a, b1, b2, c1, c2, d, e
Sri Lanka	b1, b2, c1, c2	Peru	a, b1, b2, c1, d, e					Luxembourg	a, b1, b2, c1,c2, d, e
Thailand	b2, c1	Uruguay	a, b2, c1					Netherlands	a, b1, b2, c1, c2, d, e
Vietnam	a, b2	Venezuela	a, b2					New Zealand	A, b2
								Norway	a, b1, b2, c1, c2, d, e
								Portugal	a, b1, b2, c1, c2, d, e
								Spain	a, b1, b2, c1,c2, d, e

								Sweden	b1, b2, c1, c2, d, e
								Switzerland	a, b1, b2, c1, c2, d, e
								UK	a, b1, b2, c1, c2, d, e
								US	a, b1, b2, c1, c2, d, e

a. Pension reform estimation. 59 countries. EMEs (38), of which are no reform countries; OECD (21), 13 of which are no reform countries
b1. Panel contemporaneous estimation 1981-2000 5 Yr average. 29 countries. EME(11), OECD (18)
b2. Panel contemporaneous estimation 1981-2000 5 Yr average. All 72 countries, controlling for countries without pension assets. EME(49), OECD (23)
c1. Cross country initial estimation 1996-2002. 35 countries. EME(49), OECD (23)
c2. Cross country initial estimation 1996-2002. 26 countries, using fitted values of PFAGDP. EME(9), OECD (17)
d. Panel granger causality tests. Total 39 countries. EME(21), OECD(18)
e. Panel ECM. Total 39 countries. EMEs (21), OECD (18).