Funding of pensions and economic growth: Are they really related?

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Abstract

We show empirically that there is no relation between funding of pensions and economic growth in a sample of OECD- as well as non-OECD countries over the period 2001-2008. This finding contradicts findings of earlier studies, which do not control for capital market returns of pension funds. Our estimation procedure consists of two steps: In the first step we explain the change in the pension assets/GDP ratio by capital market returns of pension funds and demographic developments. In the second step we estimate a dynamic growth regression with the residual from the first step-regression as a proxy for funding.

JEL classifications: C23, J26

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1 Introduction

In a lot of countries pay-as-you-go (PAYG) pension systems are being replaced by (partly) funded pension systems. These shifts are mainly motivated by population aging. One of the accompanying arguments put forward by proponents of such a shift is that it might lead to higher economic growth. If this would already be the case during the transition, it would partly alleviate the transition burden that comes with a shift from PAYG to funding (Borsch-Supan et al., 2005). Given the changes. Once we control for these factors, there is no relationship between funding of pensions and economic growth. Our dataset consists of 58 countries, of which 29 are OECD countries, for the years 2001-2008. We use a two-step procedure. First, we regress the change in pension assets on the rate of return of pension funds and the change in the inverse old dependency ratio. There is a clear positive relationship between the change in pension assets and the rate of return of pension funds, which is hardly surprising. Furthermore, an increase in the number of people in the labor force relative to the number of retirees has a positive effect on the change in pension assets as well. We are able to explain about 25% of the variation in the change in pension assets. We then use the residual from this regression as a proxy for changes in the degree of funding and estimate a dynamic growth model with country- and time-fixed effects. We employ a bias-corrected LSDV-estimator with bootstrap standard errors. The proxy for funding is mostly insignificant, except in the sample with OECD countries only, where it becomes marginally positively significant.

The paper that comes closest to our study is Davis and Hu (2008). They examine empirically whether the level of pension assets, scaled by GDP, is related to economic growth. Their empirical specification builds upon a standard Cobb-Douglas production function, which is augmented by a term that measures the level of pension assets of a country. The main conclusion is that pension fund growth is positively related to economic growth and that this effect is larger for emerging market economies than for OECD countries. However, there are several reasons why examining the effect of funding on growth by estimating an aggregate production function is questionable. To begin with, it is doubtful whether a causal relationship can be inferred from the estimation of an aggregate production function, as the factors of production and output have the same time index. Besides that, the amount of pension assets is the product of (implicit) saving decisions by consumers and is as such already represented by the capital stock. Therefore, pension assets and the capital stock will tend to be correlated, which complicates a correct interpretation of the regression results. A last issue concerns the data they use. Davis and Hu

(2008) use data on the amount of pension assets of autonomous pension funds from the OECD Statistics as a measure of pension funding. However, we believe that it is better to use total pension assets as it does not matter for the analysis whether a pension fund or some other institute invests the money.

A few other studies have examined this issue as well. Holzmann (1997a,b) finds a positive relationship between pension reform and total factor productivity for Chile. Davis (2002, 2004) examines the link between institutionalization, which is the proportion of equity held by institutional investors, and GDP growth but finds no effect. These studies do not exactly test the hypothesis that pension funding increases economic growth, as insurance companies and mutual funds are also part of institutional investors in his dataset. What all the above studies have in common is that they do not control for capital market returns of pension funds when examining the effect of pension assets on economic growth. Failing to do this might bias the result towards a positive effect between funding and growth, as capital market returns are positively related to both the change in pension assets and economic growth.

One of the main objections that might be raised against us is that our results are driven by the construction of the investment portfolios of the pension funds. To examine whether this is a valid criticism we perform two robustness checks. Firstly, we decrease the fraction of stocks in the investment portfolios by 20% and recalculate the rates of return for all country-years. Secondly, we increase the fraction of stocks by 20% and similarly recalculate the rates of return. With both alternative measures of the rate of return on pension assets we find exactly the same results as in the original situation. We thus conclude that our main result, namely that funding of pensions does not increase economic growth, is not driven by the way in which we construct the investment portfolios and the assumptions we make in that process.

The rest of the paper is organized as follows: Section II presents the theory, section III describes the data and section IV gives the empirical strategy, results and robustness checks. Finally, section V concludes.

2 Theory

In this section we will describe the possible channels through which funding might impact upon economic growth. We divide these into the effect through the aggregate saving rate, which has received most attention in the literature, and other channels.

Pension systems can be either funded, unfunded or partly funded. An unfunded pension system is called a PAYG system. In such a system the currently young are paying taxes that are used to pay pensions to the currently old in the same sions

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2.1 Aggregate Saving Rate

The contribution of workers to a PAYG system should be viewed as a pure tax, because these contributions are immediately used to pay pension benefits to retirees. In contrast, the pension premiums in a funded system are part of saving as these are invested in the capital market. Therefore, a shift towards more funding could increase the aggregate saving rate and as such economic growth. For this effect to be operative in practice, three conditions have to be fulfilled (Barr, 2000). Funding must lead to a higher rate of saving than PAYG, these additional savings have to be translated into more investment and finally, additional investments must lead to a higher economic growth rate.

Although the effect of funding on saving could be permanently, it might be highest during the transition from the PAYG system to the funded system. During the transition the build-up of funds takes place, which is reflected in a net increase in pension fund assets. At some point in time, the pension fund is matured and the net inflow of funds will be much lower or even negative, as the outflow of funds to pension beneficiaries leads to dissaving. Besides this, a few other issues play a role as well here. Remember that the transition must be financed by either the government or the workers. If it is the government and it does so by issuing government debt, it might fully undo the possible effect on the aggregate saving rate of the transition. Also, as Blanchard and Fischer (1989) have pointed out, a funded pension system will only increase the aggregate saving rate if the pension fund forces people to save more than they used to save voluntarily beforehand. If saving is already high, people will simply replace part of their voluntary saving by mandatory pension saving and the aggregate saving rate might stay the same.

Davis and Hu (2006) explain that financial liberalization might impact upon the relationship between funding and saving as well. Households living in countries with a relatively repressed financial sector might face liquidity constraints. Forced saving through pension funds will have a larger effect on the national saving rate in these countries than in countries with a more liberalized financial system, although it could play a role there as well for low-income households.

Whether funding leads to more saving has been examined extensively in the empirical literature. Reisen and Bailliu (1997) perform a comprehensive international study to the link between pension fund assets and saving rates. They use data from 11 countries that include OECD as well as non-OECD countries. Their conclusion is that the accumulation of pension fund assets has a positive and significant impact on private saving, although the effect is 8 times larger for non-OECD countries than for OECD countries. Lopez-Murphy and Musalem (2004) test whether the accumulation of pension funds' financial assets has an effect on national saving. The main conclusion is that it increases national saving when these funds are the result of a mandatory pension program and it decreases national saving when pension funds are the result of a public program to foster voluntary pension saving. Bosworth and Burtless (2004) provide evidence that pension saving substitutes for other forms of private saving in OECD countries. Samwick (2000) argues that the effect of funding on saving depends primarily on the way the government chooses to finance the transition from a PAYG system to a (partly) funded system. Remember that there is a cohort that has paid pension premiums in a PAYG system, but will not be able to collect benefits from this system as the cohort immediately after it is paying pension premiums in a funded system (so their contributions are invested in the capital market, instead of being paid out immediately as pension benefits to the old). Therefore, the government has to finance this 'gap'. It can do so by increasing taxes or by issuing government debt. The empirical analysis of Samwick (2000) consists of two parts. In the first part he analyzes the time-series behavior of several countries that experienced a pension reform. His results show that none of the countries, except Chile, experienced a significant increase in national saving after the reform had been carried out. In the second part he analyzes saving rates in a cross-sectional dataset and finds that countries with PAYG systems tend to have lower saving rates than countries with funded pension systems. All in all, the evidence on the link between funding and saving is mixed.

Whether higher saving automatically translates into more investment is not clear a priori. On the one hand, pension funds invest the contributions of their members in a portfolio of worldwide securities. For example, in 2003 Dutch pension funds invested 57% of their funds abroad (Kakes, 2006). In this case, a higher saving rate might only have a limited influence on domestic investment. On the other hand, the literature on the 'Feldstein-Horioka puzzle'[1] (Feldstein and Horioka, 1980) shows that domestic investment is still strongly related to domestic saving (Davis and Hu, 2008). Finally, whether higher investment increases growth depends on the quality of investment as well. An extreme example is provided by the latter days of communism when investment rates in the Soviet Union were extremely high, yet economic growth rates were close to zero (Barr, 2000). Also, when pension funds use part of their funds to finance government debt, it is questionable whether this will lead to productive investments.

2.2 Other Channels

The development of capital markets is a second channel through which funding might impact upon economic growth. The literature has established a clear positive link between funding of pensions and financial development (Catalan et al., 2000; Impavido et al., 2003; Hu, 2005). Furthermore, financial development is positively associated with economic growth (Levine and Zervos, 1998; Beck and Levine, 2004). So, funding might lead to better developed capital markets which in turn are growth-enhancing. On the other hand, Barr and Diamond (2006) argue that capital market development can hardly be a relevant argument for advanced countries as their capital markets are usually very well-developed already.

A shift from a PAYG system to a funded pension system decreases the amount of distorting taxes that the government has to collect (Disney et al., 2004). In

[1] The 'Feldstein-Horioka puzzle' is the problem that, although capital can freely flow across the world in search of the highest possible return, saving and investment within a single country are still strongly related.

addition, due to the weak link between pension contributions and benefits under PAYG systems, workers tend to retire earlier and job mobility is lower (Disney, 2002). Both these effects might increase economic efficiency and lead thereby to higher growth. However, simulation studies show that these effects are rather small (Raffelhuschen, 1993; Kotlikoff, 1996).

Finally, there is another argument put forward in the literature. Funding of pensions could increase growth by improving corporate governance (Barr and Diamond, 2006; Davis and Hu, 2008). This might be through the demand of pension funds for more transparency and accountability at the firm level and the pressure on pension funds to undertake socially responsible investments (Clark and Hebb, 2003). Although there is clear evidence of a positive impact at the firm level in the U.S. (Woidtke, 2002; Coronado et al., 2003), only Davis (2002) argues that these effects may be economy-wide.

3 Data Description

In order to examine the possible effect of funding on growth we use data on the amount of pension assets on a country-level. The data come from the OECD Statistics and consist of the total amount of pension assets for a maximum of 58 countries over the period 2001-2008. Exactly half of the countries are OECD countries. For 24 countries there is data for all these years, but for the other 34 countries the time series is incomplete. We have a total of 414 observations on the amount of pension assets.

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nies, banks' managed funds, investment companies' managed funds and all kinds of other funds. For most countries, these are just a small part of total pension assets, but especially in the United States, Denmark, Sweden, France and South Korea they make up around or even more than 50% of total pension assets.

Davis and Hu (2008) take the ratio of pension fund assets over GDP as a proxy for funding of pensions. If you start to think about how the amount of pension assets evolves over time it becomes clear that, besides the degree of funding, there are two other important drivers of pension assets, namely capital market returns and demographic developments. The amount of pension assets for country i in year t can be described as follows:

$$PA_{it} = (1 + r_{it})PA_{i,t-1} + C_{it} - B_{it}, \tag{1}$$

where r is the rate of return on pension assets, C is the amount of contributions that is made to pension funds by workers and B is the amount of benefits that is paid out to retirees. Slightly rewriting (1) gives:

$$\Delta PA_{it} = r_{it}PA_{i,t-1} + C_{it} - B_{it}, \tag{2}$$

which shows that the change in pension assets can be decomposed in two parts: $r_{it}PA_{i,t-1}$, capital market returns, and $C_{it} - B_{it}$, which is mainly driven by demographic developments. In an aging population, for example, the number of people that contribute to a pension fund decreases relative to the number of people that receive a pension benefit. If these two drivers, capital market returns and demographic developments, have explained their share of the variation in the change in pension assets we think that the remainder is a good measure of changes in the degree of funding of pensions. Therefore, we will use this as explanatory variable in a growth regression to see whether there is an effect on economic growth.

Data on GDP and on the age decomposition of the population come from the World Development Indicators 2009. We divide the number of people in the age category 15-65 by the number of people that are 65 and older to arrive at the inverse old dependency ratio. To calculate rates of return on pension assets we use several data sources. The OECD Statistics provide (incomplete) data on the shares of their investment portfolios that pension funds allocate to stocks, bonds, loans, cash, etc. We use the MSCI World Gross Return Index, which includes reinvested gross dividends, as a measure of rates of return on stocks. Furthermore, we take returns on the Barclays Capital Global Aggregate Bond Index as a measure for bond returns. Finally, we use the interest rate on 3-month Treasury bills as a measure for the return that pension funds get on their cash.

(3) shows how we calculate the rate of return of the pension sector of country i in year t:

$$r_{it} = (MSCI_t * \omega_{it} + BondReturn_t * \alpha_{it} + T\text{-}bill_t * \pi_{it})/(\omega_{it} + \alpha_{it} + \pi_{it}). \qquad (3)$$

ω, α and π are the shares of the investment portfolio that are allocated to stocks, bonds (which we define to include loans as well) and cash respectively.

We make three important assumptions in this calculation. The first one is that all pension funds (or other institutions that invest money for future retirees) invest in a worldwide portfolio of securities. The second assumption we make is that all other investments (land and buildings, unallocated insurance contracts, private investment funds and other investments) earn the average rate of return (of stocks, bonds and cash combined). ω, α and π thus do not necessarily sum to one. Finally, because we do not have data on the shares of the different investment categories for all country-year observations, we have to make some strong assumptions there as well. For countries where we have data for only a few years, we simply take the average of these available years and use that as shares for the missing years. For countries where we do not have data at all, we take the average over all available countries of the particular year. Later on in the paper we will show that these assumptions do not influence our results.

If we plot the change in pension assets/GDP against economic growth, there seems to be a slightly positive relationship between the two:

–figure 1 here–

This is indeed what other studies have found as well. However, we will show that this positive effect is mainly driven by the fact that the amount of pension assets is largely determined by capital market returns and that these capital market returns tend to be positively correlated with economic growth. So, years with high economic growth rates go together with high capital market returns, which means that large increases in the amount of pension assets tend to be associated with high economic growth. We can illustrate this with two simple graphs. Plotting rates of return against the change in the amount of pension assets shows a clear positive relationship, which is not surprising in light of (2).

–figure 2 here–

Furthermore, there is a positive relationship between rates of return and economic growth as well in our dataset, as figure 3 shows:

–figure 3 here–

–table 1 here–

We will analyze these relationships further in the empirical section, where we explicitly show that the positive effect of pension assets on growth is a spurious correlation.

Table 1 provides descriptive statistics of our data. 'Growth' is real GDP per capita growth and is denoted in percentages. Pension assets as a fraction of nominal GDP and the rate of return on pension assets are also denoted in percentages. Furthermore, an average inverse old dependency ratio of about 7 means that on average there are 7 times as many people in the ages between 15 and 65 than there are people who are older than 65. We also show the first difference of pension assets and the inverse old dependency ratio as we will use these, instead of the levels, in our empirical analysis. The table shows for each variable the number of observations, the mean, the standard deviation, the minimum and the maximum. Besides that, it also shows the between- and within-group standard deviations and the number of cross-sectional units and time periods. A few remarks can be made with respect to these summary statistics. Firstly, the amount of pension assets as a fraction of GDP varies between 0% and about 150%. This shows that there are countries with completely PAYG as well as countries with almost fully funded pension systems present in the data. Secondly, for the rate of return on pension assets as well the change in pension assets the variation is almost completely made up of within-group variation. This reinforces our belief that the former drives the latter.

Appendix A presents plots of the development of pension assets as a percentage of GDP over time. In most countries the ratio of pension assets over GDP is growing over time with a remarkable drop in 2008, which is caused by massive capital market losses during the worldwide financial crisis. Especially in Australia, Denmark, Iceland and The Netherlands pension assets have increased considerably, about 40% between 2001 and 2007. On the other hand, there are countries where the amount of pension assets has hardly increased or even decreased (Belgium, New Zealand, Suriname and Zambia).

4 Empirical Results

In this section we present our empirical strategy and show the regression results. Subsequently, we perform robustness checks on our main results by relaxing some of the assumptions that we have made with respect to the calculation of the rates of return on pension assets.

4.1 Empirical Strategy

To test whether there still is an effect of funding on growth after controlling for capital market returns and demographic developments, we use a two-step approach. We first regress the change in the amount of pension assets on the rate of return on pension assets and the change in the inverse old dependency ratio. Then, we use the estimated residuals from this regression as a proxy for funding in a dynamic growth regression. The first step is thus to estimate the following regression:

$$\Delta(PA/GDP)_{it} = \beta_1 \, r_{it} \; + \; \beta_2 \, \Delta(\textit{Old Dependency Ratio})^{-1}{}_{it} \; + \; \epsilon_{it}, \tag{4}$$

where PA/GDP is pension assets divided by nominal GDP (and subsequently multiplied by 100), r is the rate of return on pension assets and the *inverse old dependency ratio* is the number of people between 15 and 65 divided by the number of people over 65. Finally, ϵ is the error term. We estimate (4) by OLS and calculate robust standard errors.

The second step is to use the residual from (4) as a proxy for changes in the degree of funding in a dynamic growth regression:

$$\log(y_{it}/y_{i,t-1}) = \; \mu_i \; + \; \delta_t \; + \; \gamma_1 \; \log(y_{i,t-1}/y_{i,t-2}) \; + \; \gamma_2 \; \hat{\epsilon}_{i,t-1} \; + \; u_{it}, \tag{5}$$

where y is real GDP per capita, $\hat{\epsilon}$ is the residual that results from estimating (4), μ_i is a country fixed effect, δ_t is a time fixed effect and u is the error term. With this approach we focus on a possible effect of funding on growth during the transition from a PAYG to a (partly) funded system.

The estimated residual that we use in (5) as explanatory variable is lagged because pension assets are measured on the last day of the year, and the possible channels through which the amount of pension assets influences economic growth all operate with a short delay. For example, higher saving needs to be translated into more investment which should lead to higher growth. Therefore, it seems reasonable to assume that the amount of pension assets at the end of period $t-1$ influences economic growth in period t.

We are aware of the fact that most studies that estimate growth regressions use five- or ten-year averages for economic growth and usually take for the explanatory variables the value at the beginning of these periods. The main argument is to filter out business cycle effects with this strategy and to be able to focus purely on long term economic growth. Due to data limitations it is not possible for us to use five- or ten-year averages. Therefore, we choose to work with yearly data. However, we believe that we can partly undo possible business cycle effects in the data by adding time dummies to our regressions. Assuming that business cycles are, to some extent, correlated from country to country it should be possible to control for this.

Widely used estimators for dynamic panel models are the Arellano-Bond and Blundell-Bond estimators (Arrelano and Bond, 1991; Blundell and Bond, 1998). However, these estimators are developed for small T, large n panels, where T refers to the time dimension and n to the cross-sectional dimension of the data. With 58 cross-sections our n is too small relative to our T (8), to use these estimators.

An alternative to these GMM estimators is the within (or least-squares dummy variable (LSDV)) estimator. Nickell (1981) shows that this estimator is not consistent for finite T in dynamic panel data models, where the inconsistency for $n \to \infty$ is $O(T^{-1})$. In other words, the inconsistency is inversely proportional to T and disappears when T becomes very large. Our T, however, is 8. The bias in our estimates will thus be considerable when we use the within estimator for our dynamic panel model.

Therefore, we use a bias-corrected LSDV estimator to estimate (5). Bun and Kiviet (2003) provide LSDV bias approximations, which are extended to unbalanced panels by Bruno (2005). The analytical approximation of the bias that we use has order $O(T^{-1})$, which is the simplest bias approximation that Bun and Kiviet (2003) consider. However, they show that this bias approximation term already accounts for most of the bias in the LSDV estimator when $nT \geq 400$ and $n \geq 10$. We initialize the bias correction procedure by a standard Blundell-Bond estimator with no intercept.

In addition, we use a non-parametric bootstrap procedure to estimate the asymptotic variance-covariance matrix of the bias-corrected LSDV estimates. Kiviet and Bun (2001) show that this variance estimator is superior to the standard analytical variance estimator. To calculate the variance-covariance matrix we draw bootstrap errors from the empirical distribution of the ϵ's in (4). We use these bootstrap errors to generate 1000 bootstrap samples. We then calculate the bias-corrected LSDV estimate for each bootstrap sample, and infer the standard errors from the distribution of these 1000 estimates. We cluster over cross-sections when drawing bootstrap errors. By doing this we assume that the residuals are serially uncorrelated but that heteroskedasticity may be present.

To test for the presence of serial correlation in the residuals we regress $\hat{u}_{it}$ on $\hat{u}_{i,t-1}$, as suggested by Wooldridge (2002), calculate robust standard errors (to allow for possible heteroskedasticity) and use the t statistic to test the null of no serial correlation. We are never able to reject the null hypothesis of no serial correlation and thus conclude that in none of the regressions the residuals are serially correlated.

4.2 Results

Table 2 presents the estimates of (4). We show results for the full sample, for OECD countries and for non-OECD countries. As can be seen in table 2, using the full dataset we are able to explain 25% of the variation in the change in pension assets with capital market returns and demographic developments only. In the sample with OECD countries it is even 40%. Both the rate of return and the change in the inverse old dependency ratio are highly significant with the expected positive coefficient. This confirms our prior beliefs that a higher rate of return leads to faster growth in pension assets and that more people in the working age relative to the number of retirees has a positive effect as well. Only in the sample with non-OECD countries the change in the inverse old dependency ratio is insignificant.

–table 2 here–

If we then plot the estimated residual from (4) against economic growth in figure 4, there seems to be no effect of funding on growth anymore:

–figure 4 here–

Table 3 shows the results from estimating (5). The estimated residual of the first-stage regression, the proxy for changes in the degree of funding, is insignificant when the full sample is used. Only in the sample with OECD countries it becomes marginally significant, at a 10% level. This is a striking result, as Davis and Hu (2008) report a larger effect for non-OECD countries than for OECD countries, which is completely opposite to our findings.

–table 3 here–

The lagged level of economic growth is significant in all three regressions, with an autoregressive parameter that varies from 0.5 to 0.8. We report the estimates of the time dummies as well, because this shows that these dummies (partly) control for business cycle effects. The dummy for 2008, for example, is significantly negative in all regressions with an estimate of around -0.025 which means that, all other things equal, economic growth was 2.5% lower in 2008.

The table also shows the p-value of a test with null hypothesis of no serial correlation in the residuals. For none of the three regressions we are able to reject the null of serial correlation in the residuals, and thus conclude that serial correlation is not present anymore.

4.3 Robustness Checks

In order to calculate the rates of return on pension assets we make a lot of (necessary) assumptions. One potential objection that might be raised against us is that these assumptions drive our results. In other words, that the absence of any effect of funding on growth is caused by the assumptions. For example, making slightly different assumptions in the calculation process might increase or decrease the share of stocks in the investment portfolio. Therefore, we change the portfolio composition of pension funds in two ways: First, we decrease the portfolio share of stocks by 20%. To prevent short shelling the minimum share of stocks is 0%. Second, we increase the portfolio share of stocks by 20%. We then estimate the two regressions, (4) and (5), again. Tables 4 and 5 show the results of the decrease in the share of stocks, and tables 6 and 7 show the results of the increase in the share of stocks.

–table 4 here–

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–table 7 here–

The results for our funding proxy ($\hat{\epsilon}_{i,t-1}$) are almost exactly the same as in the benchmark regressions. It is only marginally significant in the OECD sample, but for the rest it is insignificant. The only difference between these results and the results from the benchmark regressions is a lower R^2 in the first-stage regressions and a lower coefficient estimate for the rate of return. However, this estimate is still significantly positive. Also, the p-values of the serial correlation test show that serial correlation is not a problem in any of these regressions. Therefore we conclude that the particular assumptions we make do not drive our results, and that there really is no effect of funding on growth once we control for capital market returns.

5 Conclusions

The most important conclusion of our study is that, once we control for capital market returns, the positive effect of funding on growth largely disappears. Only in the sample with OECD countries we find a marginally significant positive effect. In the full sample and the sample with non-OECD countries we are not able to find any effect of funding on growth. We believe that the positive effect that other studies find is caused by spurious correlation between the amount of pension assets and economic growth.

Our findings can not be used to explain why there does not seem to be a link between funding of pensions and economic growth. The only thing we are able to claim is that we can not find such an effect. This might be due to a weaker link between funding and saving than commonly is found, which could be caused by the fact that pension funds invest a significant amount of their assets abroad. It also could be that additional saving is not translated into a higher economic growth rate, it might be that capital market development and reduced labor market distortions are less important than we think, or it might be something else. Future research should be directed towards finding satisfactory explanations for our results. Data on the fraction of assets that pension funds invest abroad would be of considerable help to find explanations for the absence of an effect of funding on growth.

Implications of our results are that the costs from a transition toward a funded system can not be born partly by higher economic growth rates during the transition. All in all, we think that there might be good reasons to switch from a PAYG to a funded pension system. However, in this study we can not find evidence that higher economic growth rates is one of them.

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Table 1: Summary statistics data

Variable		Numb. of Obs.	Mean	Standard Deviation	Min.	Max.
Growth	Overall	N=406	3.190	2.891	-12.517	12.088
	Between	n=58		1.871		
	Within	T=7		2.216		
Pension Assets	Overall	N=414	29.678	39.036	0.000	151.550
	Between	n=58		37.493		
	Within	T=3-8		6.599		
Δ Pension Assets	Overall	N=356	0.603	6.057	-37.300	33.440
	Between	n=58		1.757		
	Within	T=2-7		5.794		
Rate of Return	Overall	N=464	5.326	8.866	-29.987	27.656
	Between	n=58		0.970		
	Within	T=8		8.813		
Inv. Old Dep. Ratio	Overall	N=464	7.303	4.086	2.997	21.083
	Between	n=58		71.700		
	Within	T=8		11.318		
Δ Inv. Old Dep. Ratio	Overall	N=406	-0.085	0.098	-0.447	0.155
	Between	n=58		0.090		
	Within	T=7		0.041		

Table 2: Estimates of (2)

	Full Sample	OECD	non-OECD
r_{it}	0.265	0.361	0.107
	(0.04)***	(0.06)***	(0.03)***
$\Delta(\textit{Old Dependency Ratio})^{-1}{}_{it}$	0.076	0.113	0.024
	(0.03)***	(0.04)***	(0.02)
Observations	356	190	166
R^2	0.25	0.40	0.05

[a] Estimated by OLS.

[b] Numbers in parentheses are robust standard errors.

[c] *,**,*** denote significance at the 10%, 5% and 1% respectively.

Table 3: Estimates of (3)

	Full Sample	OECD	non-OECD
$\log(y_{i,t-1}/y_{i,t-2})$	0.658	0.783	0.487
	(0.00)***	(0.01)***	(0.00)***
$\hat{\epsilon}_{i,t-1}$	0.024	0.043	-0.014
	(0.02)	(0.02)*	(0.06)
$year2004$	0.011	0.015	0.006
	(0.00)***	(0.00)***	(0.00)***
$year2005$	-0.000	-0.003	0.002
	(0.00)	(0.00)***	(0.00)***
$year2006$	0.004	0.004	0.004
	(0.00)***	(0.00)***	(0.00)***
$year2007$	-0.001	-0.001	-0.002
	(0.00)***	(0.00)	(0.00)***
$year2008$	-0.024	-0.023	-0.025
	(0.00)***	(0.00)***	(0.00)***
Observations	298	161	137
Autocorrelation test (p-value)	0.913	0.896	0.766

[a] Estimated by the bias-corrected LSDV estimator.

[b] Numbers in parentheses are bootstrap standard errors.

[c] *,**,*** denote significance at the 10%, 5% and 1% respectively.

Table 4: Estimates of (2) with the share of stocks minus 20%

	Full Sample	OECD	non-OECD
r_{it}	0.241	0.319	0.086
	(0.04)***	(0.06)***	(0.04)**
$\Delta(\textit{Old Dependency Ratio})^{-1}{}_{it}$	0.072	0.112	0.018
	(0.03)**	(0.05)**	(0.03)
Observations	356	190	166
R^2	0.11	0.16	0.02

[a] Estimated by OLS.

[b] Numbers in parentheses are robust standard errors.

[c] *,**,*** denote significance at the 10%, 5% and 1% respectively.

Table 5: Estimates of (3) with the share of stocks minus 20%

	Full Sample	OECD	non-OECD
$\log(y_{i,t-1}/y_{i,t-2})$	0.658	0.788	0.487
	(0.00)***	(0.01)***	(0.00)***
$\hat{\epsilon}_{i,t-1}$	0.023	0.044	-0.016
	(0.02)	(0.03)*	(0.06)
$year2004$	0.010	0.014	0.006
	(0.00)***	(0.00)***	(0.00)***
$year2005$	-0.001	-0.004	0.002
	(0.00)	(0.00)***	(0.00)***
$year2006$	0.003	0.003	0.004
	(0.00)***	(0.00)***	(0.00)***
$year2007$	-0.002	-0.002	-0.002
	(0.00)***	(0.00)**	(0.00)**
$year2008$	-0.024	-0.024	-0.025
	(0.00)***	(0.00)***	(0.00)***
Observations	298	161	137
Autocorrelation test (p-value)	0.443	0.479	0.792

[a] Estimated by the bias-corrected LSDV estimator.

[b] Numbers in parentheses are bootstrap standard errors.

[c] *,**,*** denote significance at the 10%, 5% and 1% respectively.

Table 6: Estimates of (2) with the share of stocks plus 20%

	Full Sample	OECD	non-OECD
r_{it}	0.222	0.314	0.086
	(0.03)***	(0.05)***	(0.03)***
$\Delta(\textit{Old Dependency Ratio})^{-1}{}_{it}$	0.059	0.088	0.017
	(0.02)**	(0.04)**	(0.02)
Observations	356	190	166
R^2	0.19	0.30	0.05

[a] Estimated by OLS.

[b] Numbers in parentheses are robust standard errors.

[c] *,**,*** denote significance at the 10%, 5% and 1% respectively.

Table 7: Estimates of (3) with the share of stocks plus 20%

	Full Sample	OECD	non-OECD
$\log(y_{i,t-1}/y_{i,t-2})$	0.657	0.783	0.487
	(0.00)***	(0.01)***	(0.00)***
$\hat{\epsilon}_{i,t-1}$	0.023	0.040	-0.014
	(0.02)	(0.03)	(0.06)
$year2004$	0.011	0.016	0.006
	(0.00)***	(0.00)***	(0.00)***
$year2005$	-0.000	-0.002	0.002
	(0.00)	(0.00)***	(0.00)***
$year2006$	0.004	0.005	0.004
	(0.00)***	(0.00)***	(0.00)***
$year2007$	-0.000	-0.000	-0.002
	(0.00)***	(0.00)	(0.00)***
$year2008$	-0.024	-0.022	-0.025
	(0.00)***	(0.00)***	(0.00)***
Observations	298	161	137
Autocorrelation test (p-value)	0.630	0.852	0.700

[a] Estimated by the bias-corrected LSDV estimator.

[b] Numbers in parentheses are bootstrap standard errors.

[c] *,**,*** denote significance at the 10%, 5% and 1% respectively.

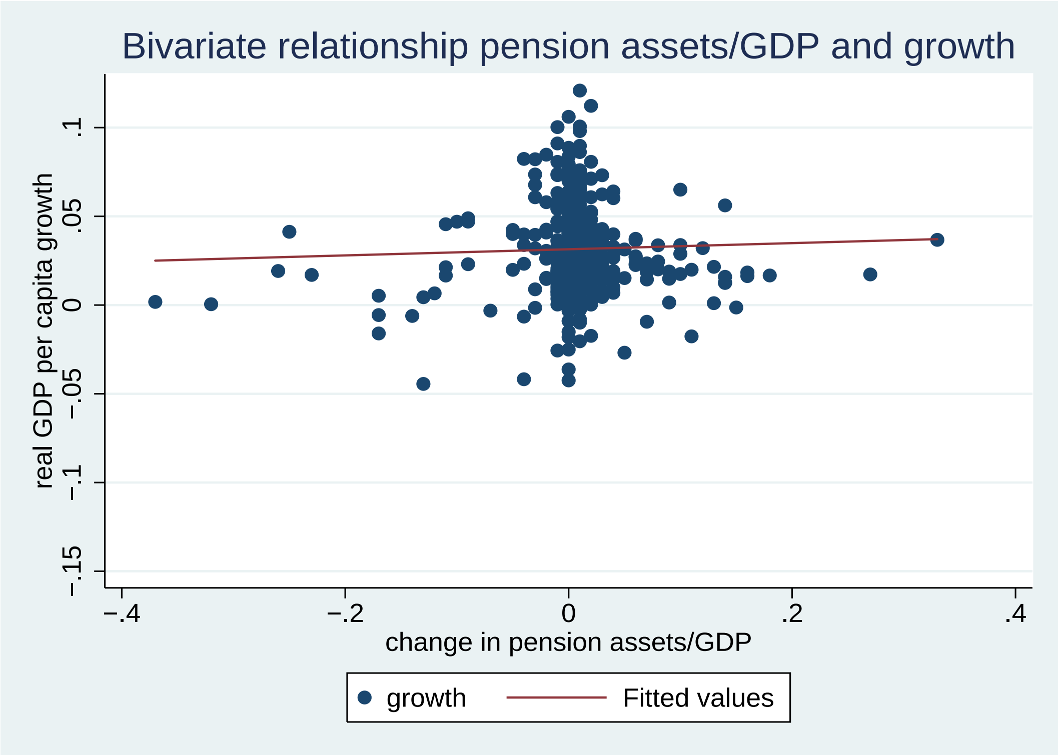


Figure 1: ΔPension assets/GDP plotted against economic growth

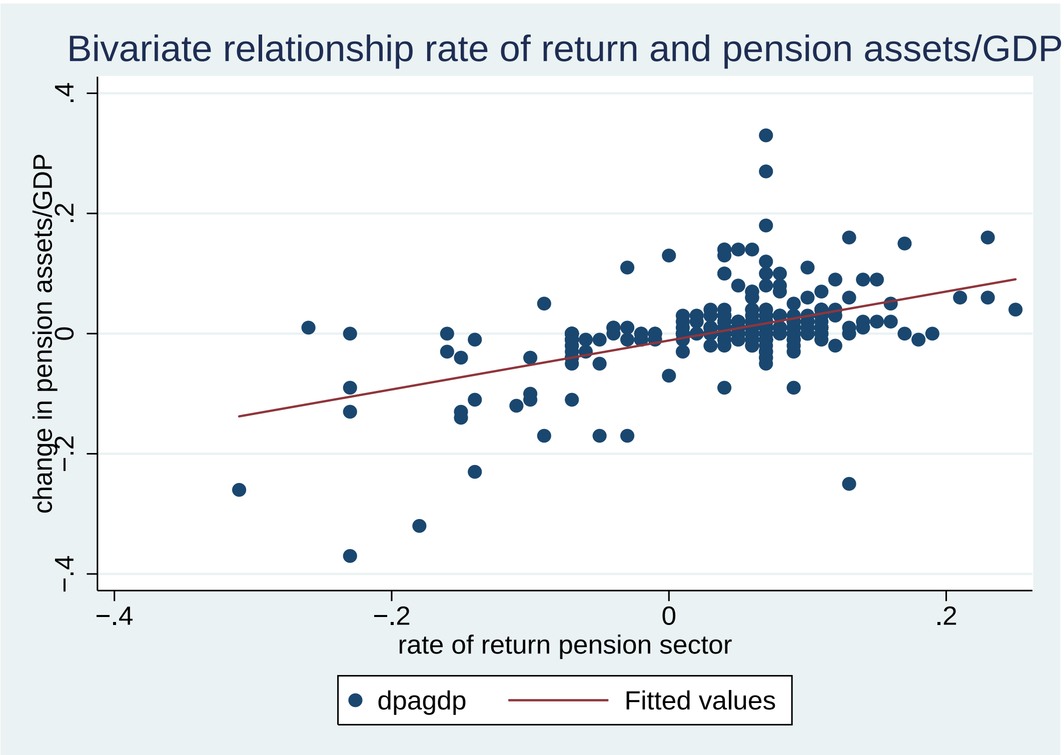


Figure 2: The rate of return plotted against Δpension assets/GDP

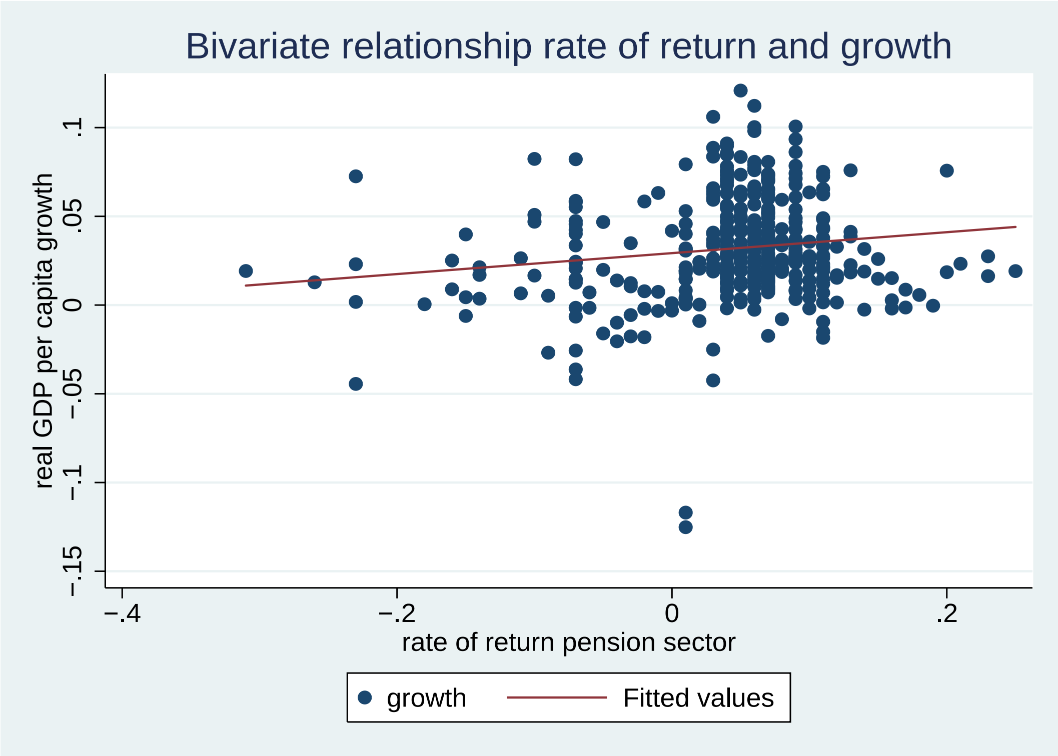


Figure 3: The rate of return plotted against economic growth

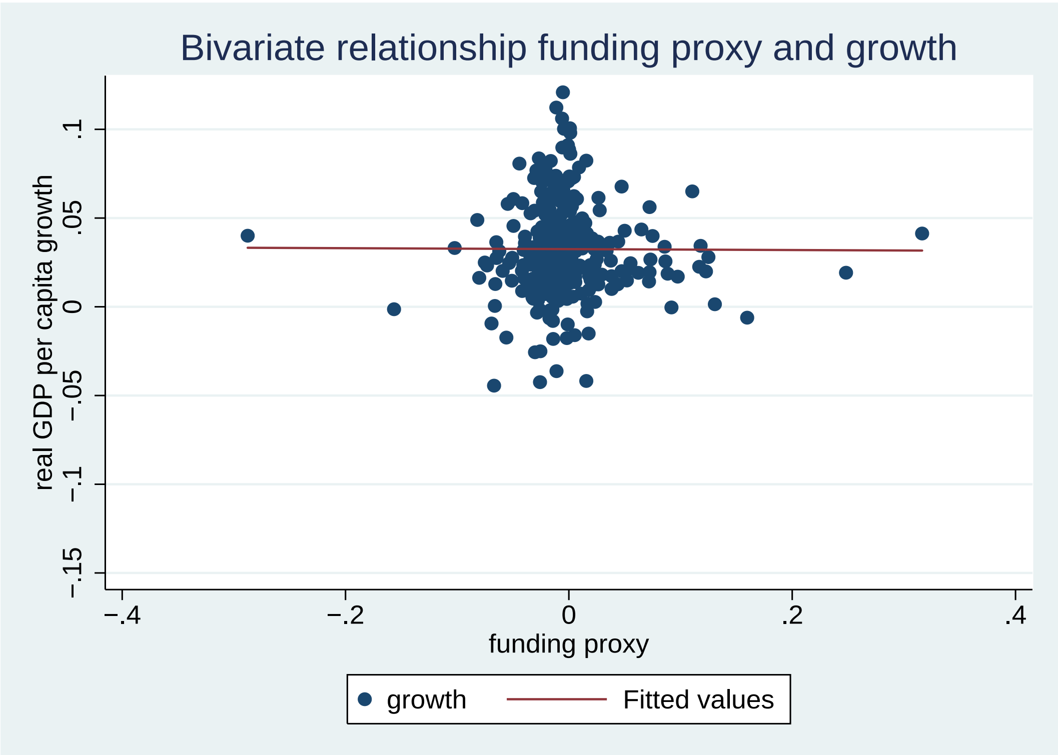
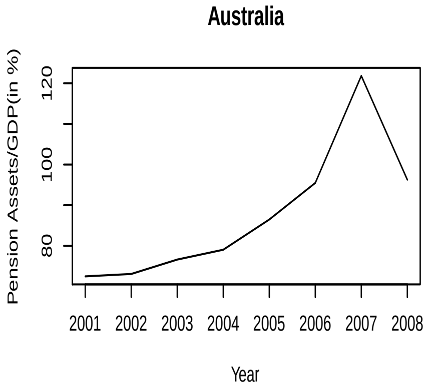
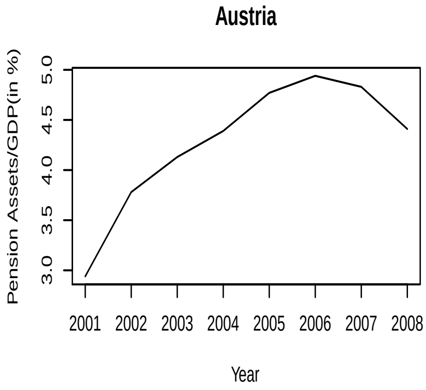
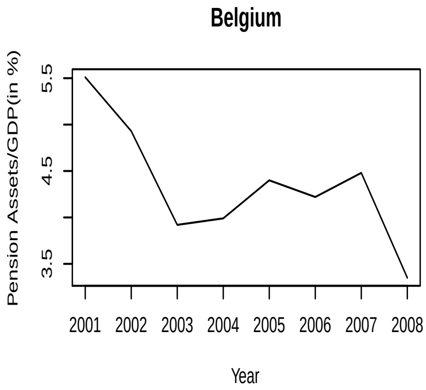


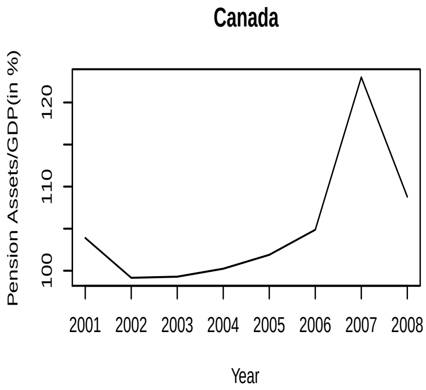
Figure 4: The funding proxy plotted against economic growth

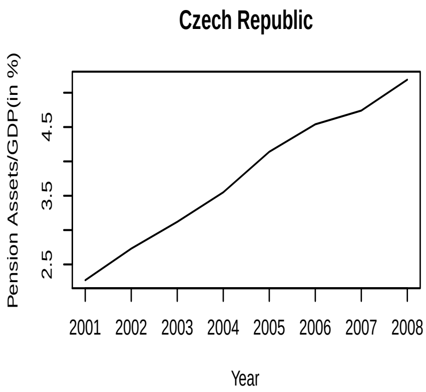
Appendix A Plots Pension Assets

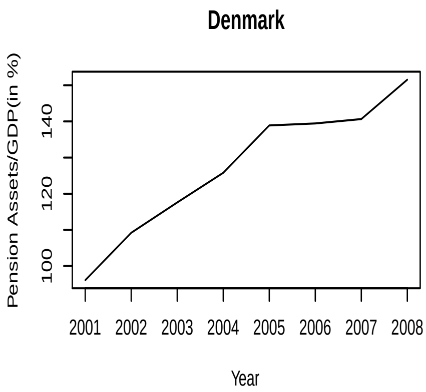


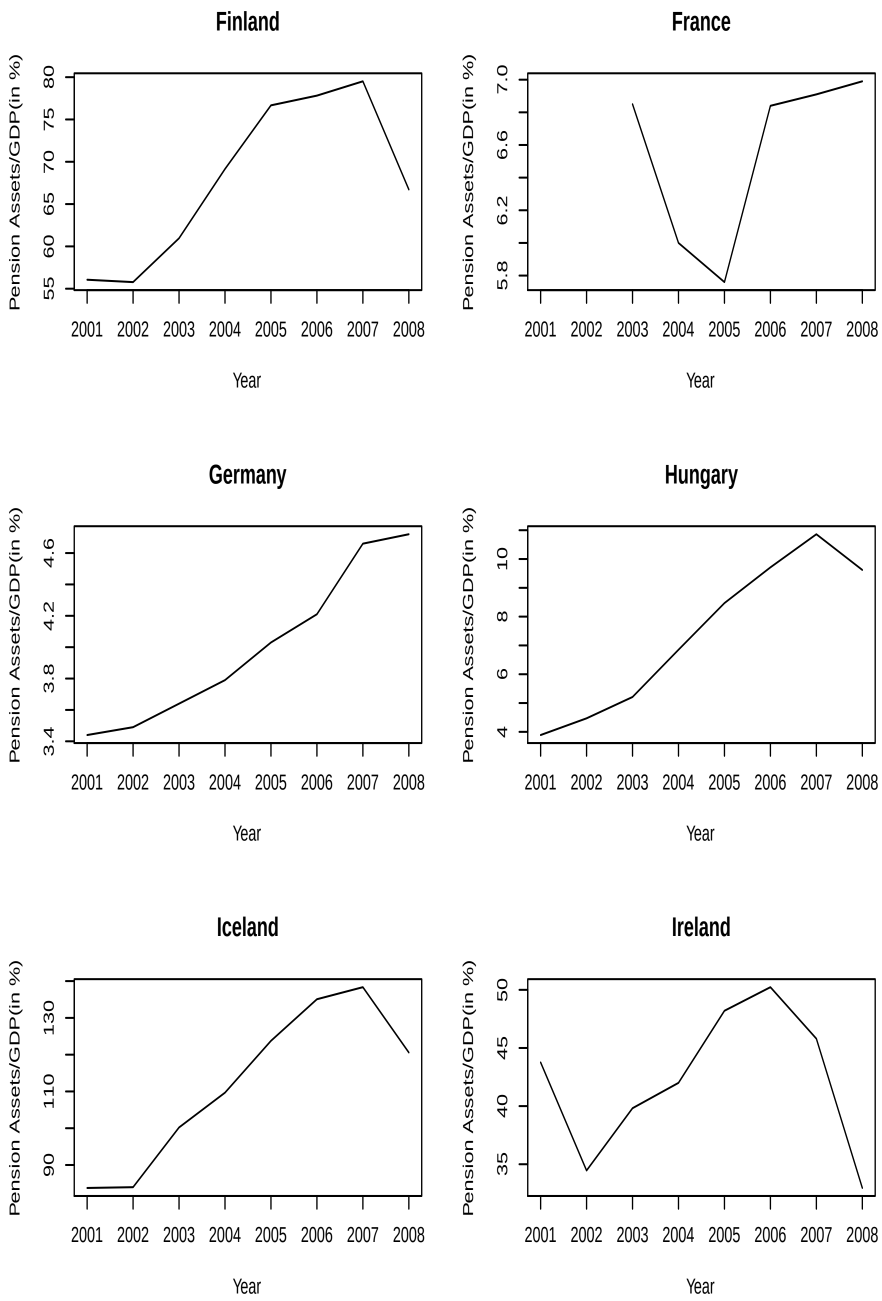


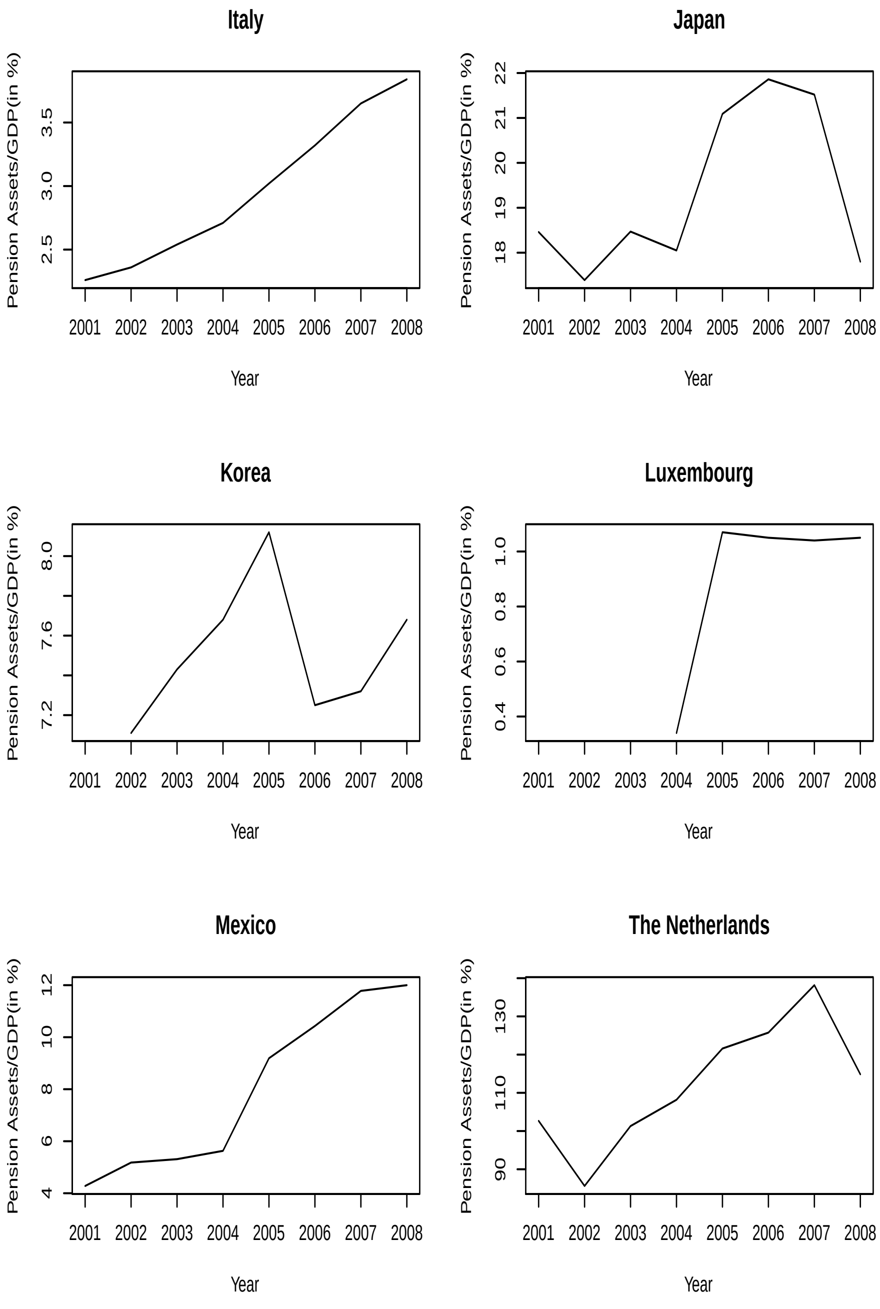


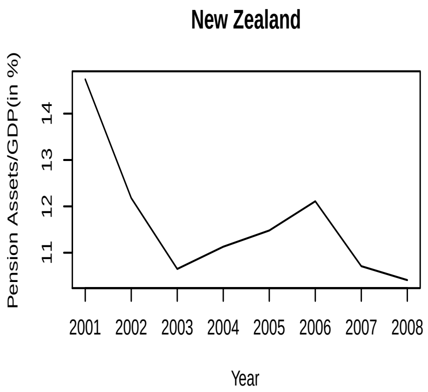


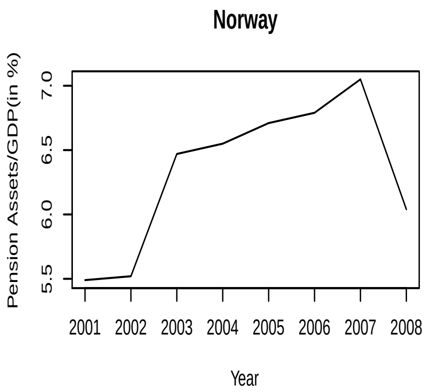


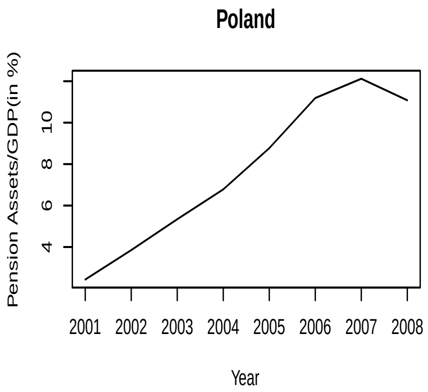


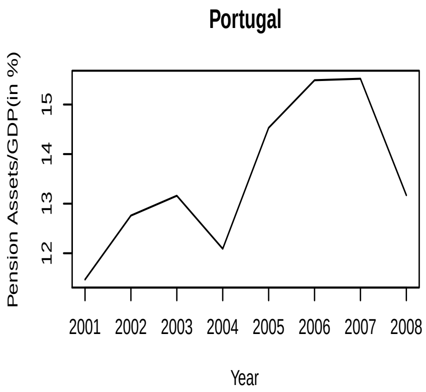

Finland
Pension Assets/GDP(in %)
55 60 65 70 75 80
2001 2002 2003 2004 2005 2006 2007 2008
Year
France
Pension Assets/GDP(in %)
5.8 6.2 6.6 7.0
2001 2002 2003 2004 2005 2006 2007 2008
Year
Germany
Pension Assets/GDP(in %)
3.4 3.8 4.2 4.6
2001 2002 2003 2004 2005 2006 2007 2008
Year
Hungary
Pension Assets/GDP(in %)
4 6 8 10
2001 2002 2003 2004 2005 2006 2007 2008
Year
Iceland
Pension Assets/GDP(in %)
90 110 130
2001 2002 2003 2004 2005 2006 2007 2008
Year
Ireland
Pension Assets/GDP(in %)
35 40 45 50
2001 2002 2003 2004 2005 2006 2007 2008
Year

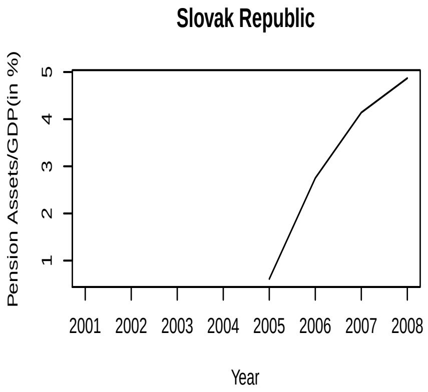

Italy
Japan
Korea
Luxembourg
Mexico
The Netherlands
Pension Assets/GDP(in %)
Year
2001
2002
2003
2004
2005
2006
2007
2008

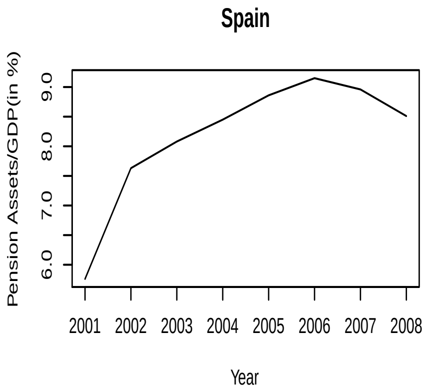

New Zealand
Pension Assets/GDP(in %)
11
12
13
14
2001 2002 2003 2004 2005 2006 2007 2008
Year

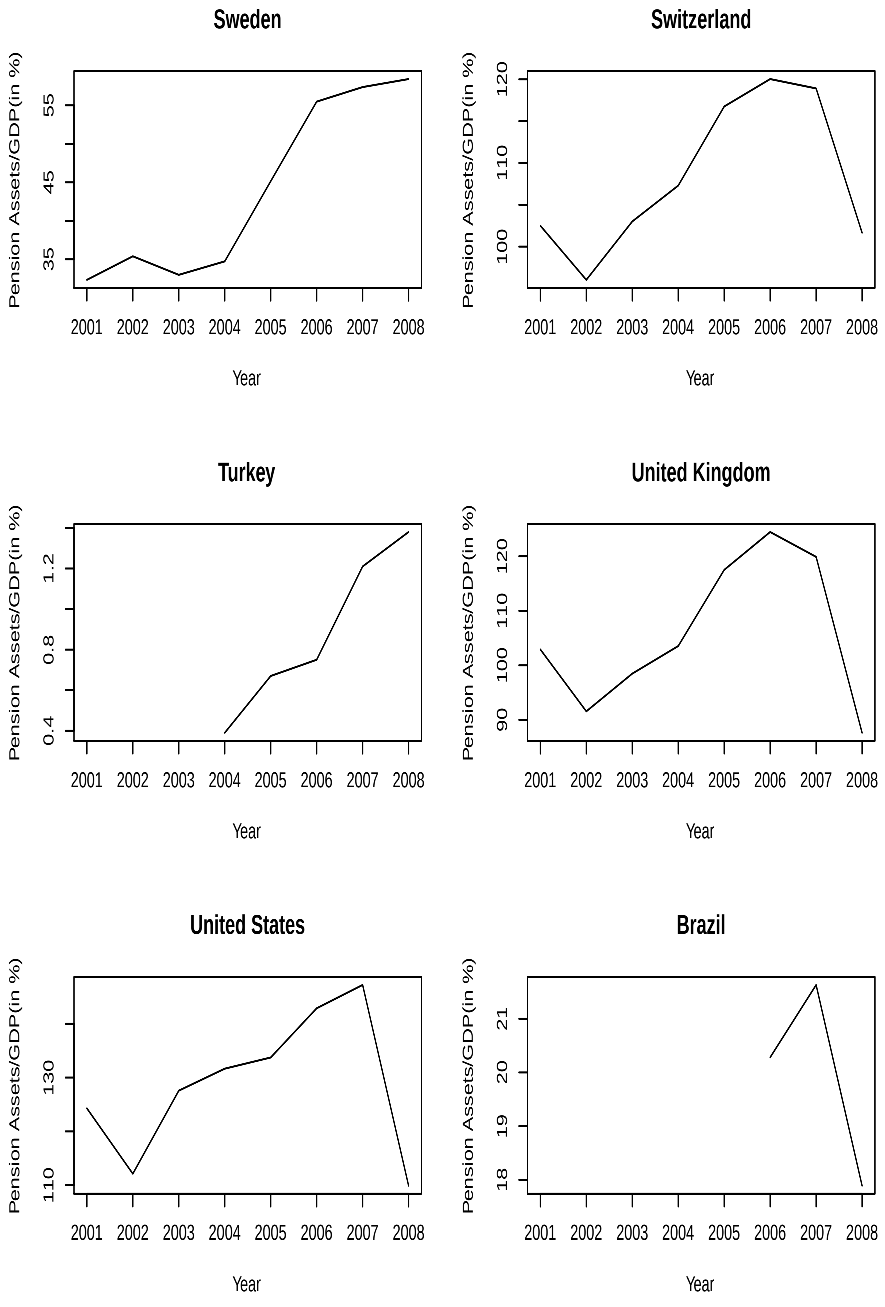

Norway
Pension Assets/GDP(in %)
5.5
6.0
6.5
7.0
2001 2002 2003 2004 2005 2006 2007 2008
Year

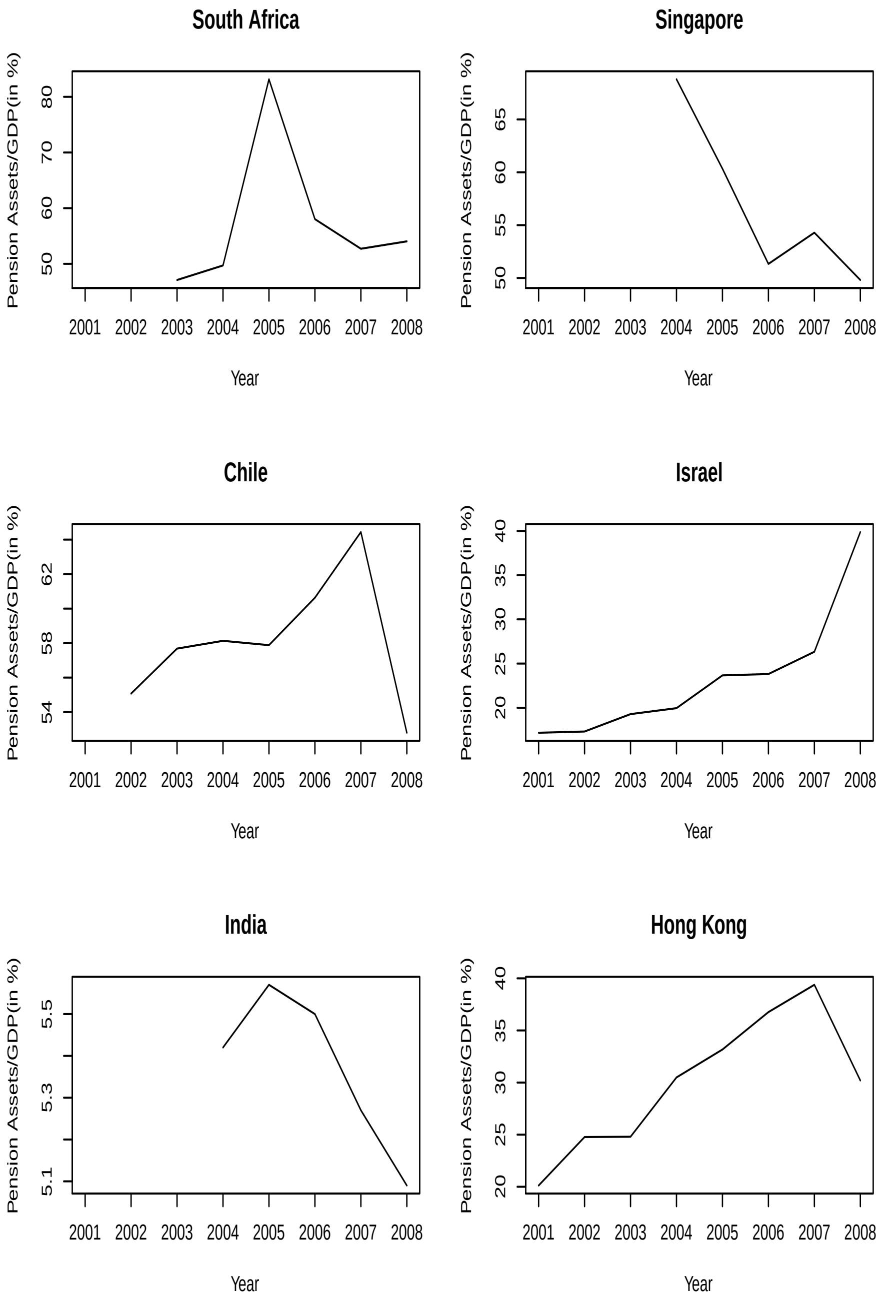

Poland
Pension Assets/GDP(in %)
4
6
8
10
2001 2002 2003 2004 2005 2006 2007 2008
Year

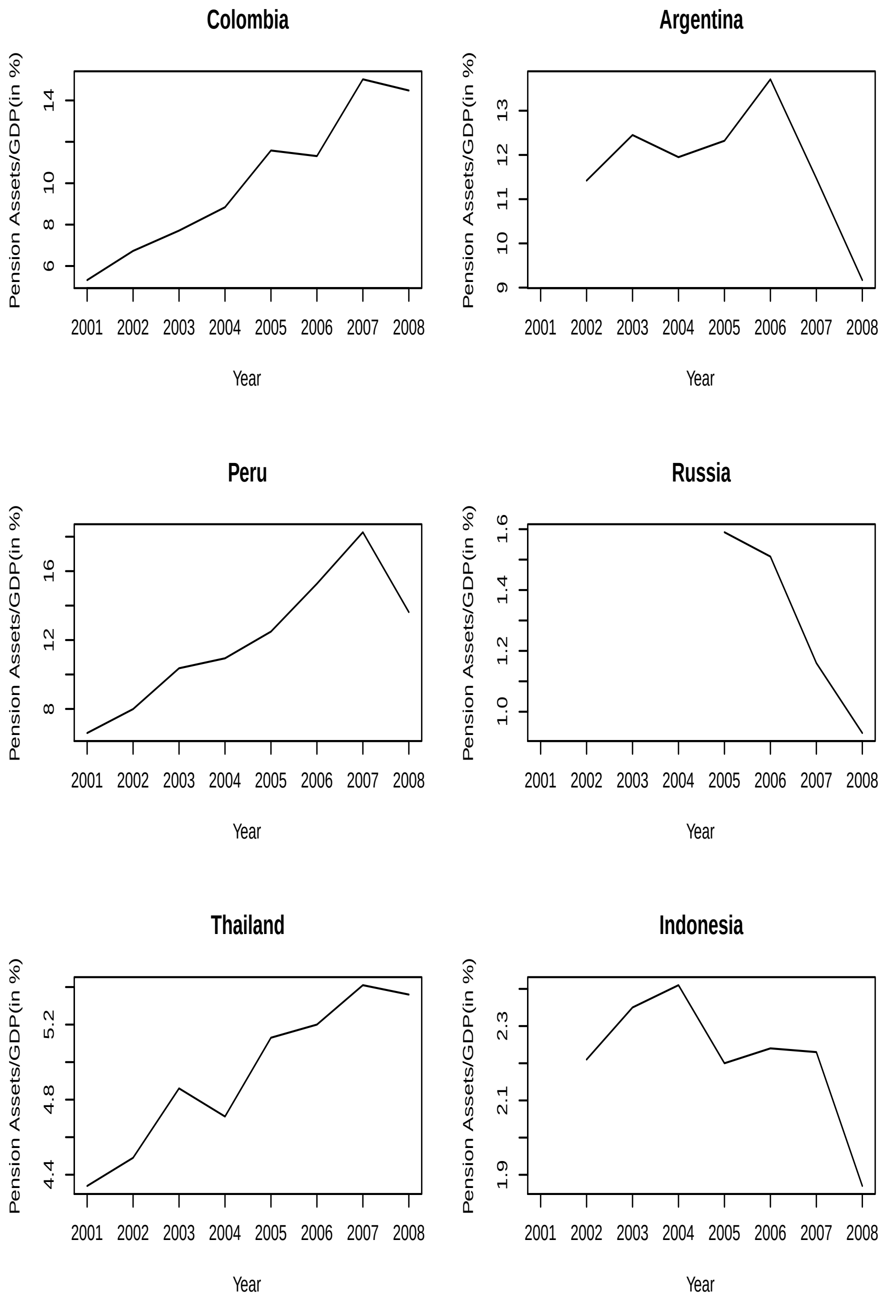

Portugal
Pension Assets/GDP(in %)
12
13
14
15
2001 2002 2003 2004 2005 2006 2007 2008
Year

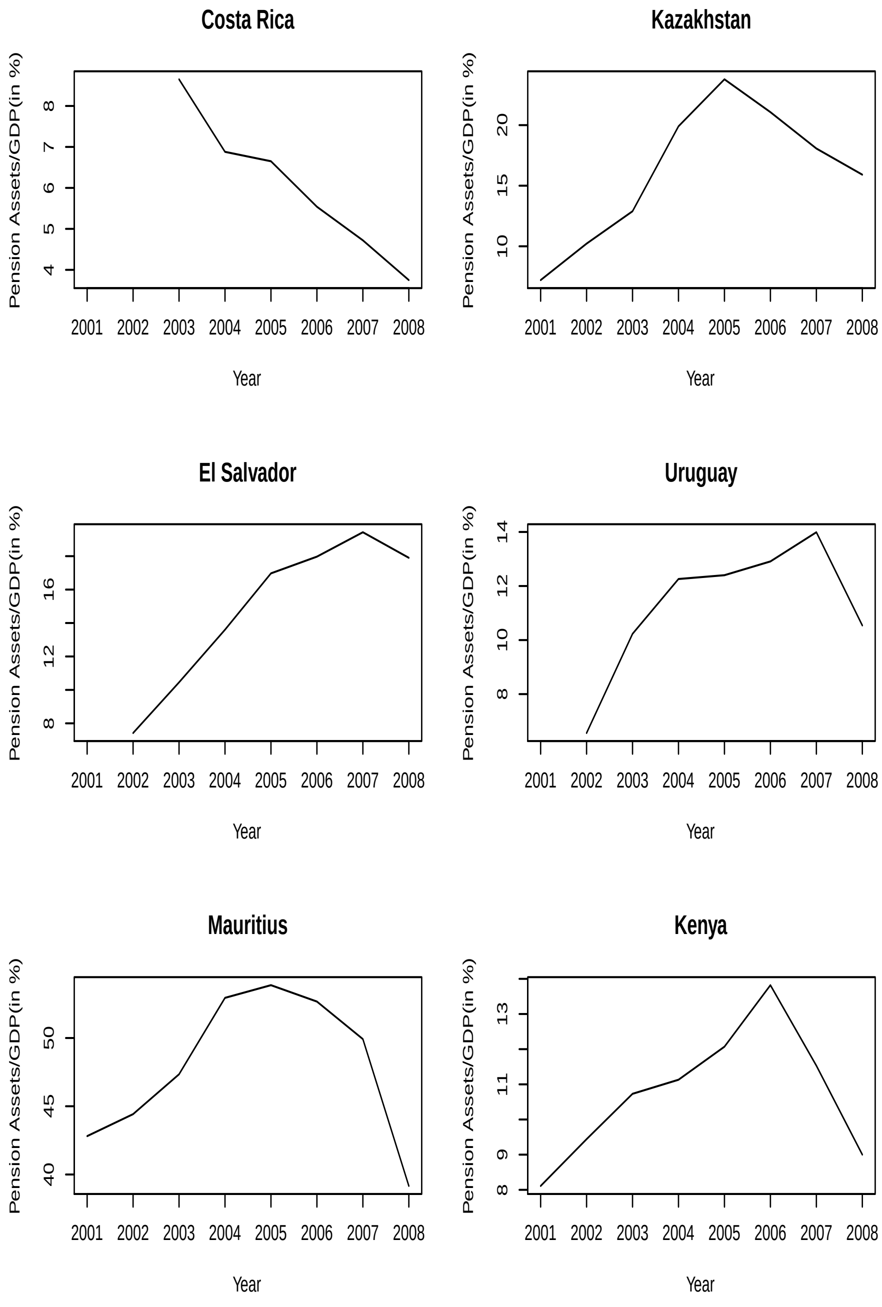

Slovak Republic
Pension Assets/GDP(in %)
1
2
3
4
5
2001 2002 2003 2004 2005 2006 2007 2008
Year

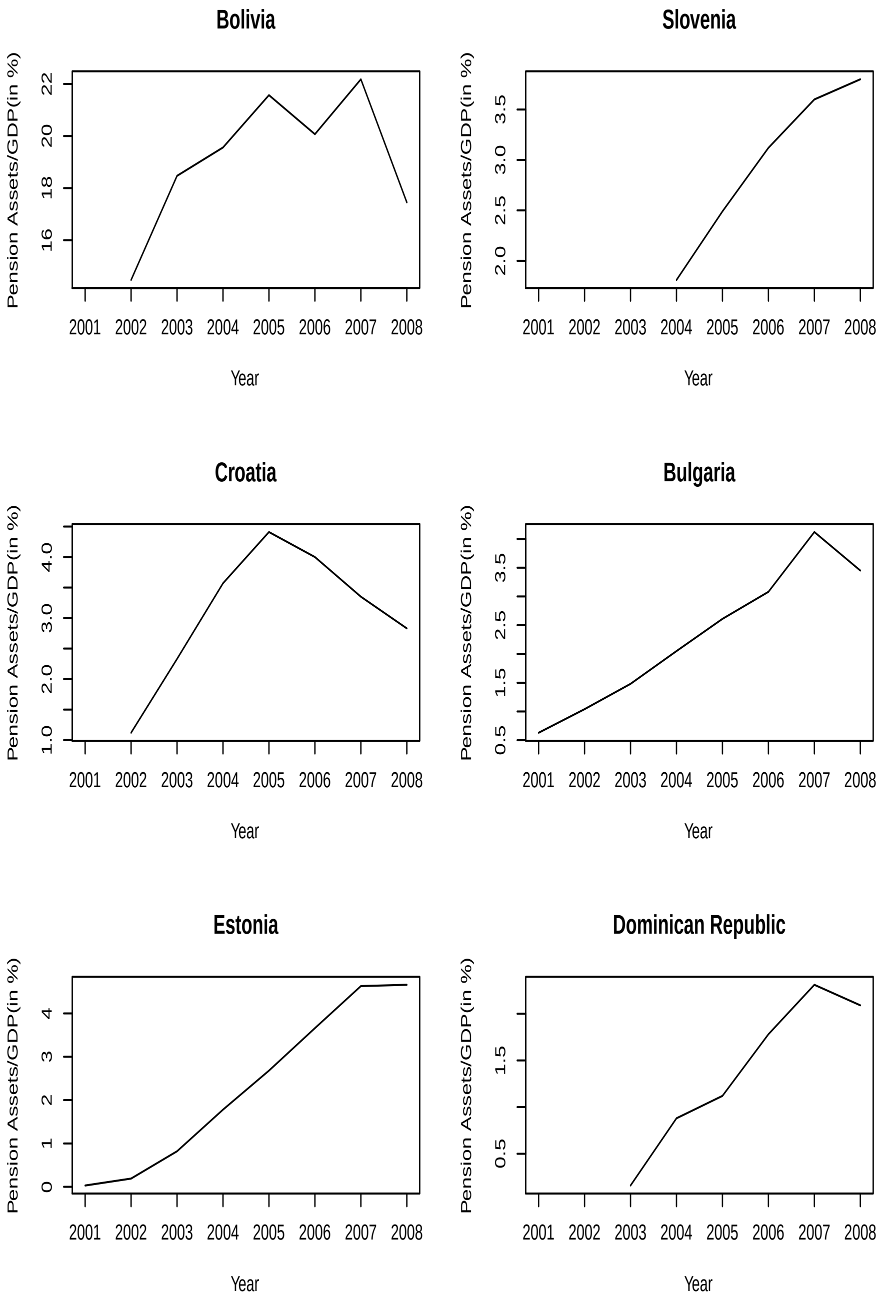

Spain
Pension Assets/GDP(in %)
6.0
7.0
8.0
9.0
2001 2002 2003 2004 2005 2006 2007 2008
Year

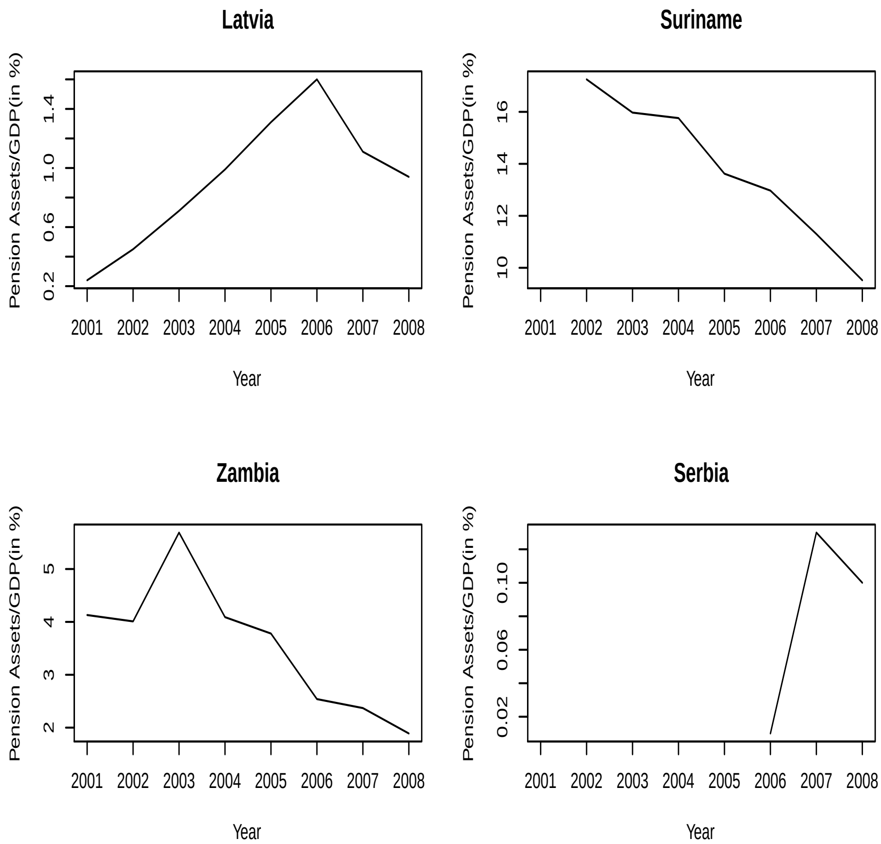

Sweden
Switzerland
Turkey
United Kingdom
United States
Brazil
Pension Assets/GDP(in %)
Year
2001 2002 2003 2004 2005 2006 2007 2008
35 45 55
100 110 120
0.4 0.8 1.2
90 100 110 120
110 130
18 19 20 21


South Africa
Singapore
Chile
Israel
India
Hong Kong
Pension Assets/GDP(in %)
Year
2001
2002
2003
2004
2005
2006
2007
2008


Colombia
Argentina
Peru
Russia
Thailand
Indonesia
Pension Assets/GDP(in %)
Year
2001 2002 2003 2004 2005 2006 2007 2008


Costa Rica
Kazakhstan
El Salvador
Uruguay
Mauritius
Kenya
Pension Assets/GDP(in %)
Year
2001
2002
2003
2004
2005
2006
2007
2008


Bolivia
Pension Assets/GDP(in %)
16
18
20
22
2001
2002
2003
2004
2005
2006
2007
2008
Year
Slovenia
Pension Assets/GDP(in %)
2.0
2.5
3.0
3.5
2001
2002
2003
2004
2005
2006
2007
2008
Year
Croatia
Pension Assets/GDP(in %)
1.0
2.0
3.0
4.0
2001
2002
2003
2004
2005
2006
2007
2008
Year
Bulgaria
Pension Assets/GDP(in %)
0.5
1.5
2.5
3.5
2001
2002
2003
2004
2005
2006
2007
2008
Year
Estonia
Pension Assets/GDP(in %)
0
1
2
3
4
2001
2002
2003
2004
2005
2006
2007
2008
Year
Dominican Republic
Pension Assets/GDP(in %)
0.5
1.5
2001
2002
2003
2004
2005
2006
2007
2008
Year


Latvia
Suriname
Zambia
Serbia
Pension Assets/GDP(in %)
Year
2001 2002 2003 2004 2005 2006 2007 2008
0.2 0.6 1.0 1.4
10 12 14 16
2 3 4 5
0.02 0.06 0.10