

Private Pension Systems Cross-Country Investment Performance

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ABSTRACT¹

This study investigates the performance of private pensions systems across countries – a topic which has yet to be adequately addressed in the literature. Specifically, this study examines the relationship between pension fund performance (as captured by gross real rates of return and the three year standard deviation of those returns) and the structure of a country's private pension industry and the design of its pension schemes. A database covering 27 countries over the period 1990-2007 was created for this research. The study's key findings include (i) higher returns are associated with *size* (systems with more assets under management tend to generate higher returns), *type* (occupational schemes tend to generate higher returns than do personal pension schemes and closed schemes tend to generate higher returns than do open schemes), and *number* (systems with multiple funds tend to generate higher returns than those with a single fund) and (ii) lower volatility in pension system returns is associated with older systems, voluntary (rather than mandatory) systems, systems with restrictions on foreign investing, and systems with minimum return guarantees.

RESUMEN

Este documento provee evidencia sobre el desempeño de los sistemas privados de pensión, en base a la comparación de los mismos entre 27 países. En particular, se examina si existe una relación entre dos medidas de desempeño (retorno y varianza), y las características de la estructura de la industria y del diseño de los planes de pensiones. Se utiliza una base de datos de panel, compilada para esta investigación, que cubre el período 1990-2007. El estudio usa como fundamentos la literatura existente sobre fondos de pensiones privados y la teoría de finanzas para establecer un marco metodológico para el subsiguiente trabajo econométrico. Encontramos que sistemas con mayor tamaño, ocupacionales (en oposición a los personales), cerrados (en oposición a los abiertos) y multifondos (en oposición a los de fondos únicos) muestran, en promedio, niveles superiores de retornos. Los sistemas con mayor edad, voluntarios (en oposición a los obligatorios), con límites a las inversiones en el exterior, y con garantías mínimas se encuentran, en promedio, relacionados con menor volatilidad en los retornos del sistema.

JEL Classification: G2, G23, O1, O16

Keywords: Private Pension Funds, Investment Performance

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I. INTRODUCTION

Privately managed pension funds have been growing in importance in an increasing number of countries, both in the developed and developing world. According to data assembled by the Organisation for Economic Co-operation and Development (OECD) and the World Bank covering the period 1990 to 2007, the financial assets of privately managed pension funds expressed as a percentage of GDP increased, on average, from 40% to 62% for developed countries and from 2% to 14% for developing countries between the first and last years of observations available.²

Surprisingly little is known about the comparative performance of private pension fund investments across countries. This study draws on both the existing literature and on financial theory and then examines the observed relationship between two measures of investment performance – the real gross rates of return earned on a country’s pension system investments and the volatility of those returns as measured by their three year standard deviation – and (i) the key design attributes of the country’s pension system and (ii) the characteristics of the country’s pension fund industry while controlling for cross-country differences in key macroeconomic, financial sector, and institutional variables.

Key design attributes include whether (i) the system is mandatory or voluntary, (ii) schemes are sponsored by employers (i.e., occupational funds) or marketed directly to individuals, (iii) benefits are determined using a defined benefit (DB) or a defined contribution (DC) methodology, (iv) schemes are open versus closed, (v) a minimum return guarantee exists, (vi) management fees are based on the value of assets managed or on the flow of new contributions, (vii) supervision is risk-based or governed by a prudent person standard, (viii) there exist multiple funds or only one, and (ix) quantitative limits are established to limit foreign investments. Macroeconomic, financial market, and institutional variables are used as controls. The most important characteristics that define the structure of a country’s pension industry include (i) the age of the pension system, (ii) the value of assets under management, (iii) the number of pension funds in operation, and (iv) the degree to which the market is dominated by a few large funds.

For pension fund participants, investment returns directly influence the premiums they pay for a given level of benefits or the level of benefits they receive for a given stream of contributions. Previous studies have either been industry-specific, fund-specific, or have been limited to a particular country. Most have aimed to identify issues related to industry structure or system design or to improve the ability of trustees to select capable investment managers. This study is based on panel data (i.e., the aggregation of pension fund portfolios at the national level) rather than on data for any given pension fund or collection of funds. Its purpose is more ambitious: this study aims to identify policy issues – including issues related to the

² Throughout this study, *developed countries* refers to the countries of the OECD while *developing countries* include Argentina, Bolivia, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, the Dominican Republic, El Salvador, Estonia, India, Indonesia, Israel, Jamaica, Kazakhstan, Kenya, Lithuania, Mauritius, Peru, the Russian Federation, Serbia, Singapore, Slovenia, South Africa, Thailand, Uruguay, and Zambia. The first and last years of observations vary by country due to the availability of data (see Tables 11 and 12 in Appendix 1).

macroeconomy, financial sector, institutional and industrial structure of the pension system, and pension system design – that can be changed by policy makers in order to improve the investment climate or improve investment performance on the part of pension schemes within the national pension system.

The remainder of this study is organized as follows. Section II discusses the methodology employed. Section III provides descriptive statistics and summarizes the econometric results. Section IV provides conclusions, discusses the limits of the study, and offers suggestions for further research. Appendix 1 provides detailed econometric output. Appendix 2 provides a list of references employed by this study. Appendix 3 summarizes the prior research consulted during the preparation of this study.

II. METHODOLOGY

This section explains the methodology used to measure pension system investment performance and is divided into four subsections covering the data used for the study, the two dependent variables (gross real rates of return and the volatility of those returns), the explanatory variables, and various econometric issues.

Sample

This study relies on a database created using annual observations for 26 countries including Argentina, Australia, Bolivia, Canada, Chile, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, El Salvador, Estonia, Hungary, Israel, Japan, Kazakhstan, Latvia, Mexico, Netherlands, Peru, Poland, Sweden, Switzerland, United Kingdom, United States, and Uruguay, as well as for the special administrative region of Hong Kong. The data generally covers the period from 1990 to 2007 although its availability varies by country.³

Dependent Variables

Decisions by pension portfolio managers – and, thus, patterns of pension fund returns – are influenced by several factors including the set of available investment opportunities, regulatory constraints, preferences regarding risk, and the time horizon of investment decisions. Given these situation-specific factors, defining “success” is methodologically problematic. This makes it difficult to establish uniform criteria for comparing the performance of pension funds across countries. Nevertheless, by taking a simplified approach, this study attempts to do just that. In this study, pension fund performance is defined solely by rates of return on invested assets and the volatility of those returns. The authors recognize the limits of such an approach but believe those limits are outweighed by the usefulness of the approach in providing insight into pension fund performance as a function of the structure of a country’s pension fund industry and the design of its pension system.

³ See Tables 11 and 12 in Appendix 1.

- Gross Real Return: this study measures investment returns using gross real pension system returns based on annual data from the OECD, the Association of Latin American Pension Supervisors (AIOS), and Federación Internacional de Administradoras de Fondos de Pensiones (FIAP). In cases where national pension systems include more than one fund, the returns have been weighted according to the relative size of each fund in the system. For the purposes of cross-country comparison, returns are measured in real terms (e.g., nominal rates of gross returns are adjusted for inflation).⁴
- Volatility of Gross Real Return: this study measures investment risk using a three year standard deviations of gross real pension system return based on annual data. This measure of risk was chosen for simplicity and for reasons of data availability. Such a measure is clearly limited in scope as it does not capture other sources of risk often present in emerging markets such as exchange rate-related risks, jurisdictional risks, and default risks. Using a more robust measure of risk represents a fruitful opportunity for further study. Such a measure also does not comport with a typical investment horizon because pension funds are generally long term investors. However, extending this period would have resulted in lost observations in the data, thereby reducing the statistical confidence of the findings and limiting the range of the sample.

Explanatory Variables

The database also includes annual observations for the explanatory variables which are grouped into four categories including (i) pension system variables, (ii) macroeconomic variables, (iii) financial sector variables, and (iv) institutional variables. A summary of these variables, their definitions, and their sources is contained in Table 6 in Appendix 1.

- Pension System Variables include both descriptive time-series variables relating to market structure and dummy variables that capture the major characteristics of a pension system's design.
 - Market Structure Variables include (i) the number of years a pension system has been in existence (*years since inception*), (ii) the total value of assets under management expressed relative to GDP (*assets under management*), (iii) the number of pension funds in the pension system (*number of funds*), and (iv) the market share of the largest three funds as a measure of market concentration (*market concentration*).
 - System Design Variables are specified as dummy variables (i.e., their values are either 0 or 1) and capture (i) whether a pension system is mandatory or voluntary (*mandatory vs. voluntary*), (ii) whether a pension system is based on occupational or individual schemes (*occupational vs. personal*), (iii) whether benefits are determined using a DC or DB benefit structure (*DC vs. DB*), (iv)

⁴ Since no data was available to calculate net rates of return (i.e., returns net of administrative costs), the ratio of gross returns to net returns could not be used as another measure of pension fund performance.

whether a system is open to everyone (for the purpose of this study, this is interpreted to mean that at least one pension fund exists which has no restrictions on membership) or only to select persons or employees (*open vs. closed*), (v) whether a pension system offers a minimum rate of return or benefit guarantee (*minimum guarantee*), (vi) whether fees are levied based on the amount of annual contributions or on the assets under management (*contribution-based vs. asset-based*), (vii) whether supervision is risk-based or based on a prudent person standard (*risk-based supervision*), and (viii) whether a pension system has multiple funds or a single fund (*multiple funds*). In addition, the impact of restrictions on portfolio composition is examined using a foreign investments limit variable (foreign investment limit) with values ranging in percentages from zero (i.e., a complete prohibition on foreign investing) to 100 (i.e., no restrictions).

- Macroeconomic Variables include the (i) real rate of GDP growth (*real GDP growth*), (ii) per capita GDP expressed on purchasing power parity basis (*per capita GDP*), (iii) the rate of inflation (*inflation*), (iv) the government's fiscal surplus or deficit expressed as a percent of GDP (*fiscal surplus*), (v) the annual percent change in the exchange rate (*exchange rate growth*),⁵ (vi) the real annual rate of interest for deposits of up to 90 days (*real interest rate*), and (vii) a measure of the openness of a country's capital account (*capital account openness*).⁶
- Financial Sector Variables include the (i) the capitalization of a country's stock market expressed relative to its GDP (*stock market capitalization*), (ii) the capitalization of a country's corporate bond market expressed relative to its GDP (*corporate bond market capitalization*), (iii) the stock of a country's debt expressed relative to its GDP (*stock of public debt*), and (iv) the amount of credit extended to a country's private sector relative to its GDP (*credit to private sector*).
- Institutional Variables include three indices. The first is the *rule of law index*, extracted from Kaufmann, Kraay, and Mastruzzi (2008), which measures confidence in the rules of society (to include contract enforcement, property rights, the police and courts, as well as the incidence of crime and violence). The second is the *anti self-dealing index*, extracted from Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2005) which measures the strength with which minority shareholders are protected against self dealing by controlling shareholders. The third is the *creditor rights index*, extracted from Djankov, McLiesh, and Shleifer (2007) which measures the legal rights of creditors to recover losses against defaulting debtors in different jurisdictions.

⁵ Exchange rates are defined as a country's national currency against the United States dollar (\$US). Thus, for \$US-based economies (i.e., the United States and El Salvador), the exchange rate variable will be equal to 1.0 for all years. Although, the authors recognize the merits of using use multilateral (i.e., weighted) exchange rates, they were not used to avoid excessive complication.

⁶ *Capital account openness* is defined as the sum of the absolute value of *Portfolio Investment Assets* (IFS line 78bfd) plus *Portfolio Investment Liabilities* (IFS line 78bgd) divided by GDP. All variables are defined in Appendix 1.

As discussed in the review of the literature, other characteristics merit consideration and evaluation, but insufficient data was available to generate robust statistical results for these characteristics so they are not addressed herein.

Econometric Approach

The relationship between performance measures (i.e., *gross real return* and the *volatility of gross real return*) and explanatory variables is examined using the specifications shown in the two equations below. Each block of explanatory variables is sequentially incorporated. For use with the second equation, macroeconomic and financial sector variables are transformed into their respective three year standard deviations. This required the authors to first test the volatility of these variables as determinants.

(1)

$$\text{return}_{t,i} = \beta_j * \text{designdummy}_{t,i} + \sum_{k_1} \beta_{k1} * \text{macrovar}1_{t,i} + \sum_{k_2} \beta_{k2} * \text{financialsystemvar}2_{t,i} + \sum_{k_3} \beta_{k3} * \text{institutional}3_{t,i} + \sum_{k_4} \beta_{k4} * \text{pensionindustry}4_{t,i} + \varepsilon_{t,i}$$

(2)

$$\text{stdev}(\text{return})_{t,i} = \beta_j * \text{designdummy}_{t,i} + \sum_{k_1} \beta_{k1} * \text{stdev}(\text{macrovar}1)_{t,i} + \sum_{k_2} \beta_{k2} * \text{stdev}(\text{financialsystemvar}2)_{t,i} + \sum_{k_3} \beta_{k3} * \text{institutional}3_{t,i} + \sum_{k_4} \beta_{k4} * \text{pensionindustry}4_{t,i} + \varepsilon_{t,i}$$

Where k_1 , k_2 , k_3 and k_4 stand for the number of the macroeconomic, financial system, institutional, and pension industry variables, respectively. The error term $\varepsilon_{t,i}$ is separated into a country-specific component and a remaining error ($\varepsilon_{t,i} = v_i + u_{t,i}$). The country-specific component is modeled as a random term.⁷ The objective of this specification is to eliminate bias in the estimation due to (i) unobserved components (and also to “non observable effects” and “non observable heterogeneity”) and (ii) country-specific characteristics impacting performance that are not captured by the explanatory variables. This methodological approach also reduces problems related to errors in the measurement of

⁷ A fixed-effects model could not be used for the purpose of testing pension system design variables (which are almost constant over time) because the estimation would not enable the effects of policy variables from other country-level constant effects.

variables and related problems.⁸ Specification tests have been performed to test key assumptions.⁹

III. RESULTS

Performance Measures

Table 7 in Appendix 1 provides the main statistics for *gross real return*, and for *volatility of gross real return*. Figures reflect all available (country and period) observations. The mean of the *gross real return* is 6.4%. The mean of the *volatility of gross real return* is 5.8%; its median is a bit lower at 4.2% which may reflect the existence of abnormally high observations, possible outliers in the underlying distribution. In fact, the country that displays the highest *volatility of gross real return* is Argentina as a consequence of the crises the country experienced between 2001 and 2002, which caused gross real returns to plummet to -45.2% in 2002.

Table 8 in Appendix 1 reports the same statistics by country. The countries with the highest mean *gross real return* are Uruguay (14.7%), Colombia (10.4%), Peru (10.9%), and Australia (9.4%). The countries with the lowest mean *gross real return* are Denmark (2.2%), the Czech Republic (1.1%), Hungary (0.9%), and Latvia (-1.8%). The countries with the highest *volatility of gross real return* are Argentina (17.2%), Kazakhstan (12.7%), United Kingdom (12.2%) and Uruguay (12.1%) while the lowest are Canada (3.2%), Croatia (2.7%), Czech Republic (1.6%), and Denmark (1.1%).

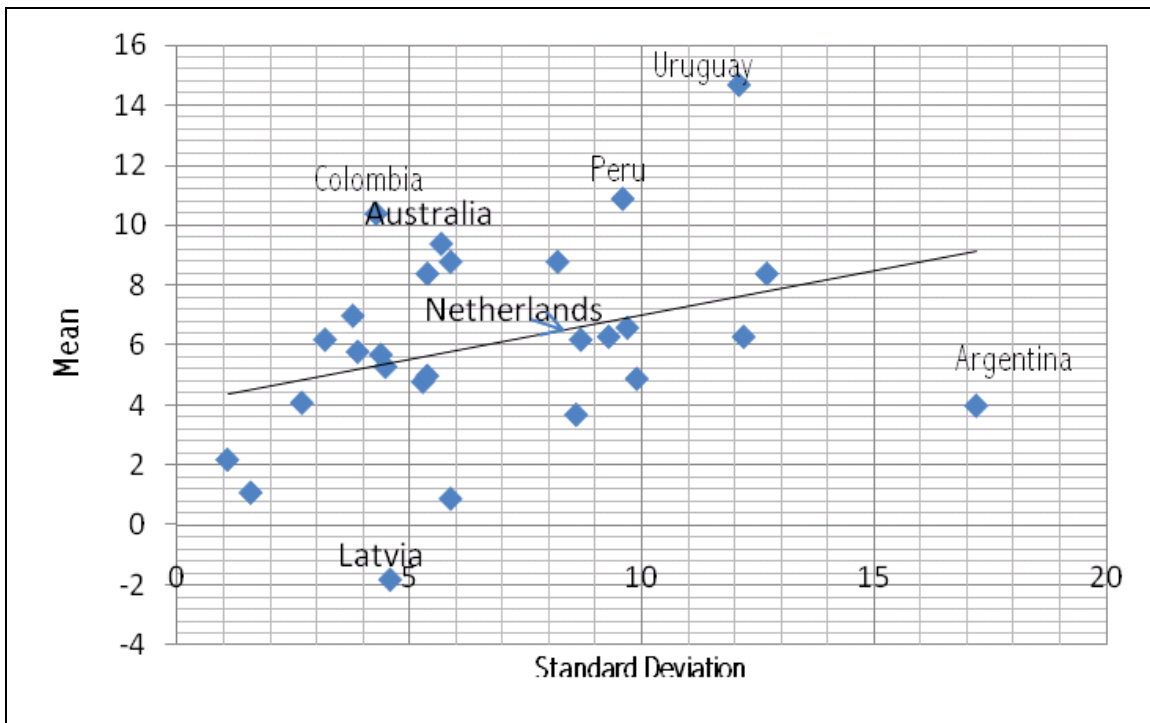
⁸ One of the key assumptions underlying this specification is that shocks to pension returns (and also to the volatility of those returns) that are not already explained by the explanatory variables – or by unobserved heterogeneity – are uncorrelated with present or future changes in the explanatory variables (i.e., an assumption of strict exogeneity). This assumption may prove unfounded if unexpected shocks (i.e., shocks not captured by an explanatory variable) drive changes in pension system design. An additional assumption is that the unobserved heterogeneity component is not correlated with any of the explanatory variables (i.e., a *random effects* modeling assumption).

⁹ Tables 35 and 36 in Appendix 1 provide the results for two specification tests. Table 35 shows the Breusch & Pagan (1980) statistic which tests for the presence of unobserved heterogeneity. For the pension system return model, and assuming no unobserved heterogeneity, the null hypothesis cannot be rejected when incorporating all of the blocks of control variables. This suggests that the control variables account for much of the heterogeneity between countries. Note how the progressive incorporation of controls implies the impossibility of rejecting the null. This suggests that the incorporation of these variables properly captures the heterogeneity between countries. In the case of the pension system return model, this implies that a pooled ordinary least squares model specification would also report efficient estimators. In fact, when incorporating control variable blocks, the results of ordinary least squares and random effects estimations are nearly identical since the estimated unobserved variability is close to zero. However, in the case of the pension system return volatility model, the nulls are rejected at a 5% confidence threshold. This prevents us from assuming a lack of unobserved heterogeneity and requires us to explicitly model it. Table 36 shows the results of Hausman (1978) tests in order to check for the lack of correlation between the unobserved heterogeneity component and the explanatory variables. (In actual practice, if correlation were found, it would not be possible, of course, to rely on an alternative specification.) We did not run the Hausman test for those specifications where all control blocks were incorporated because, as previously explained, no significant presence of unobserved heterogeneity was found. Finally, no autocorrelation or heteroscedasticity were found by any related residuals tests although the results are not shown.

Cross-Country Mean and Volatility

Figure 1 shows the relationship between mean *gross real return* (y-axis) and the *volatility of gross real return* (x-axis), as measured by the three year standard deviation of the *gross real return* for all countries in the sample. Clearly, the observation for Argentina should be considered as an outlier, exhibiting excessive volatility relative to its mean real rate of return. The general pattern of observations seems to suggest that, as one might expect, risk and return exhibit positive correlation.

Figure 1: Volatility of Gross Real Return Versus Mean of Gross Real Return (All Years)



Note: whole sample, 1990-2007, using data for which each country reports its available period statistic.

In order to check the consistency of these cross-country patterns over time, Figures 4 to 6 in Appendix 1 shown the same data disaggregated into three time periods (1990 to 1995, 1996 to 2001, and 2002 to 2007). To avoid differences in mean returns due to economic cycles, only countries with complete data for the full periods have been included. While it may not be apparent in some periods (particularly the period 1996 to 2001), a positive pattern does appear in all of the graphs.

Correlations

The question of whether performance measures are correlated among pensions systems over time – an outcome which would seem reasonable given economic integration and globalization – is examined next. Pairwise correlations of *gross real returns* are shown in Table 9 in Appendix

1 (which displays all 351 correlations coefficients that result from the combination of the 27 countries in the sample). Table 1 below summarizes these results.

Table 1: Correlation Statistics

Correlation Statistics		
Number of correlations calculated among the 27 countries	351	
Number of pairwise correlations with (abs) coefficient >0.5	146	42%

Forty two percent of the correlations coefficients are found to be higher than 0.5 which suggests that the presence of correlation between cross-country pension returns over time is important.

Econometric Results

This subsection summarizes the results of the estimations generated by the two investment performance models with the primary objective of identifying differences in performance that are related to the pension fund characteristics. As was explained in Section II, the models correspond to the two dependent variables used herein to capture pension system performance (i.e., *gross real return* and the *volatility of gross real return*). Tables 2, 3, and 4 provide a summary of the results. For each model, alternative specifications were run that sequentially incorporate the selected blocks of control variables (i.e., macroeconomic variables, financial sector variables, institutional variables, and pension system variables).¹⁰ The results are presented below, starting first with pension system variables followed by control variables.

Pension System Variables

Market Structure Variables

Key findings include the following: bigger systems (in terms of assets under management and the number of funds operating) exhibit higher levels of gross real returns; older systems exhibit lower levels of volatility in their returns. An interesting question is whether the impact of system size on returns is the result of lower transactions costs due to economies of scale, riskier investment strategies, greater financial innovation (possibly engendered by the existence of a large private pension industry), more efficient investment opportunities, or some combination of these factors. The following observations might provide an answer. There is a positive relationship between *assets under management* and the *volatility of gross real return* which suggests that higher returns in bigger systems may be the consequence of riskier investment strategies. Volatility may also be related to the degree of market concentration in the pension industry and the resulting level of competition. Our results suggest that an increase in *market*

¹⁰ Full econometric results tables are not provided to save space but can be found in Appendix 1. When creating summary tables, results are not reports for model specifications that yielded too few observations or that did not pass specification tests. The problem of too few observations prevented us from analyzing models incorporating multiple funds, numbers of pension funds, and market concentration variables.

concentration (as measured by the market share of the three largest funds) is positively correlated with an increase in the volatility of pension system returns.

Pension System Age: *years since inception* displays no relationship with *gross real return* but is negatively related to *volatility of gross real return*. The estimated coefficient suggests that a one year increase in *years since inception* is associated with a decrease in *volatility of gross real return* of about 0.05 points. This could suggest that pension fund managers in older systems have learned from their experience or the regulatory system has been strengthened over time.

Table 2: Results for Market Structure Variables

Performance Measure	Gross Real Return	Volatility of Gross Real Return
<i>Years since inception</i>	Not significant.	The coefficient displays a value of -0.05. Statistically significant in specifications incorporating macroeconomic, financial sector, and institutional controls.
<i>Assets under management</i>	Coefficients range from 0.08 to 0.13. Statistically significant in most specifications.	The coefficient displays a value of 0.04. Statistically significant in specifications incorporating macroeconomic, financial sector and institutional controls.
<i>Number of funds</i>	Coefficients range from 0.06 to 0.07. Statistically significant in most specifications.	Not significant.
<i>Market concentration</i>	Not significant.	Coefficients range from 0.117 to 0.209. Statistically significant in specifications incorporating macroeconomic and financial sector controls and those incorporating institutional controls.

Note: macroeconomic and financial system variables were transformed to their respective three year standard deviations when used with estimations for the volatility of pension returns. For methodological details see Section II.

Industry Size: *assets under management* exhibits a positive relationship with *gross real return*. A ten percentage point increase in the value of *assets under management* is associated with an increase of 0.8 to 1.3 percentage points in *gross real return*. As discussed previously, this measure of industry size is also positively related to *volatility of gross real return*.

Number of Funds: another proxy for market size (but perhaps more related to the level of competition in the market) is *number of funds* which is positively associated with *gross real return*. Each additional fund is associated with an increase of 0.06 to 0.07 percentage points in *gross real return*. This might suggest that an increase in the size of – and the amount of competition in – the pension industry is associated with improved efficiency of the allocation of capital, thereby increasing rates of return.

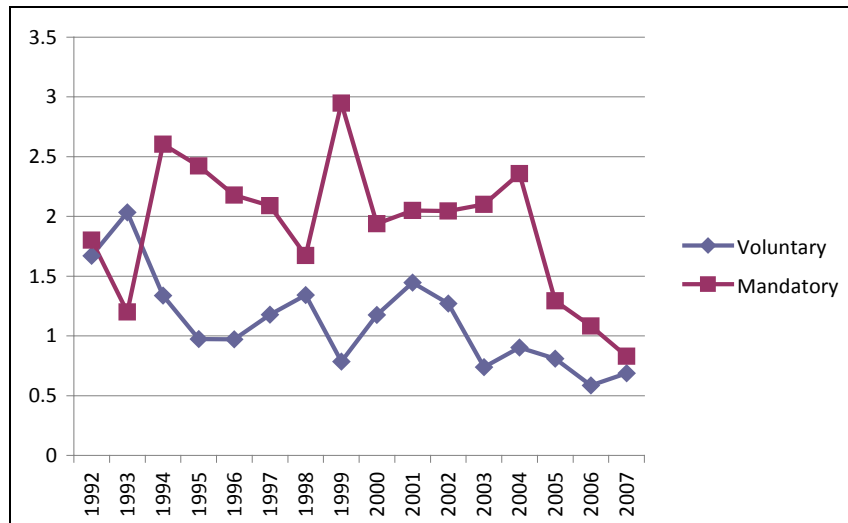
Market Concentration: the degree of market concentration is positively associated with an increase in *volatility of gross real return* although no relationship was found with the returns themselves. A 10% increase in the market share of the three largest pension funds is associated with an increase of 1 to 2 percentage points in the three year standard deviation of pension system returns.

Pension System Design Variables

The characteristics of pension system design play a meaningful role in explaining pension fund performance. Higher gross real returns are associated with *occupational* (rather than *personal*) pension schemes, *closed* (rather than *open*) schemes, and pension systems with *multiple* (rather than one) fund. Higher levels of volatility in pension system returns are associated with *mandatory* (rather than *voluntary*) systems, systems without *minimum guarantees*, and systems which permit higher levels of foreign investment. Differences between systems generally emerge when incorporating the macroeconomic variables, financial sector variables, and institutional variables as controls.

Mandatory Versus Voluntary: whether systems are mandatory or voluntary is unrelated to *gross real return* but positively related to *volatility of gross real return* (with mandatory systems experiencing greater volatility). The coefficients suggest that mandatory systems have 2.0 to 3.4 percentage points greater three year standard deviations in gross real returns. It might be tempting to try to explain this by observing that mandatory systems are predominantly found in emerging economies which exhibit greater macroeconomic volatility – hence, this variable is really a proxy for macroeconomic volatility (see Figure 2). However, this cannot be the case because the model specification already accounts for the volatility of macroeconomic variables. Moreover, we cannot say that rate of returns of mandatory pension systems are, in general, more volatile than in voluntary systems (see Figure 3). Mandatory systems do seem to induce higher volatility in returns once macroeconomic variables, financial sector variables, institutional variables, and institutional variables are taken into account. Thus, a more likely explanation is that fund managers take greater risks, on average, when participation in pension schemes is mandated than they do when participation is voluntary.

Figure 2: Three Year Standard Deviation of GDP Growth by Type of Scheme



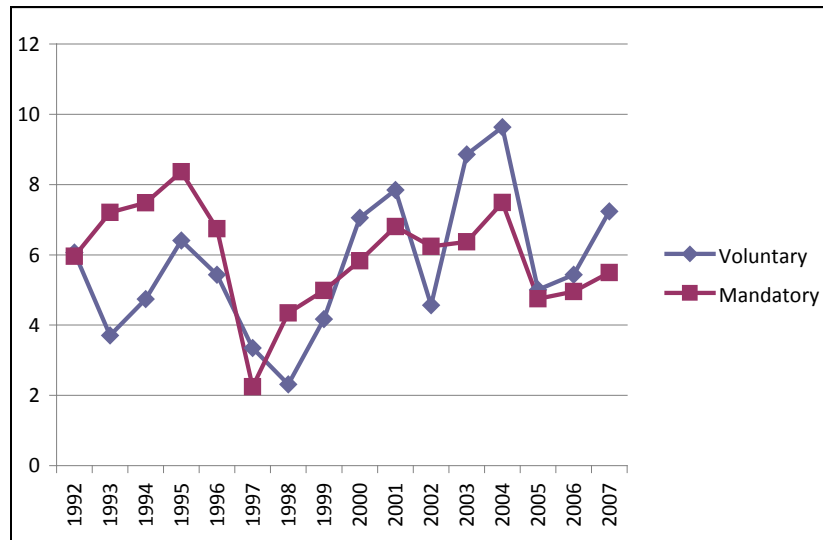
Note: fewer observations were available for the last two years of the sample.

Occupational Versus Personal: occupational schemes generally earn higher returns on their investments. Occupational schemes earned 6.53 percentage points more, on average, on their investments than did pension systems with personal pension schemes.

DC Versus DB: whether pension benefits are determined by a DC or DB benefit structure was unrelated with either *gross real return* or *volatility of gross real return*. However, it must be noted that while the DC schemes found in the data could be open or closed or occupational or personal, the DB schemes are most often occupational and closed. This fact may explain the lack of statistical significance for benefit structure.

Open Versus Closed: the results for this dummy variable are identical to those for occupational systems because closed systems are typically occupational systems (and vice versa). Thus, closed systems generally earn higher returns although no statistically valid relationship emerged for the volatility of those returns. As suggested in Appendix 3 (which reviews the literature), investment strategies for closed and occupational systems are guided by asset-liability (ALM) models which are more efficient than the models used by mutual funds (which are a typical characteristic of open and personal system).

Figure 3: Volatility of Gross Real Return by Type of Scheme



Note: fewer observations were available for the last two years of the sample.

Minimum Guarantee: pension systems with minimum guarantees exhibit lower levels of volatility although no relationship was observed with the returns themselves. The estimated effect suggests that systems with minimum guarantees have, on average, three year standard deviations that are 1.88 to 2.66 points lower. This can be explained either by more conservative fund management or herding behavior.

Multiple Funds: pension systems with multiple funds generate, on average, returns 7.2 percentage points higher than do systems with a single fund although no relationship was observed with the volatility of those returns. As is discussed in Appendix 3, however, this finding may be a consequence of the sampling period used in this study.

Foreign Investment Limit: the foreign investment limit variable displays a negative relationship with *gross real return* when it is the only explanatory variable. However, this relationship ceases to be statistically significant when control variables are included. The foreign investment limit variable is not significant by itself when explaining the volatility of pension system returns. However, the relationship becomes significant when macroeconomic and financial sector control variables are included (see Table 34).¹¹ For systems with no limits to foreign investments (i.e., when *foreign investment limit* is equal to 100) *volatility of gross real return* is 2.1 percentage points higher it is for systems that prohibit all foreign investment when all macroeconomic variables and financial sector variables are incorporated. As discussed in Appendix 3, there is considerable debate on the impact of foreign investment on pension system performance. Some studies have suggested that foreign investment does not affect returns but does reduce the volatility of those returns (see Davis, 2002), but not all of the

¹¹ It is important to note that quantitative limits on international investments are policy instruments which impact the degree of capital account openness. Thus, an indirect effect may exist between restrictions on international investment and the performance variables captured by the degree of capital account openness (as is discussed further).

previous work in this field has controlled for macroeconomic, financial sector, and institutional variables. Furthermore, since this study relies on the most current data available, differences in findings could be due to the time periods selected. This suggests that, more broadly, the findings of this study should be treated as preliminary and not conclusive.

Table 3: Results for Scheme Parameters

Performance Measures	Gross Real Return	Volatility of Gross Real Return
<i>Mandatory vs. voluntary</i>	Not significant.	Coefficients range from 2.052 to 3.449. Statistically significant in specifications incorporating macroeconomic, financial sector and institutional controls.
<i>Occupational vs. personal</i>	The coefficient displays a value of 6.3. Statistically significant in specifications incorporating macroeconomic, financial sector and institutional controls.	Not significant.
<i>Defined contribution vs. defined benefit</i>	Not significant.	Not significant.
<i>Open vs. closed</i>	The coefficient displays a value of -6.3. Statistically significant in specifications incorporating macroeconomic, financial sector and institutional controls.	Not significant.
<i>Minimum guarantee</i>	Not significant.	The coefficient takes a value of -2.439. Statistically significant in the specification incorporating macroeconomic, financial sector and institutional controls.
<i>Multiple funds</i>	The coefficient displays a value of 7.2. Statistically significant in specifications incorporating macroeconomic, financial sector and institutional controls.	Not significant.
<i>Foreign investment limit</i>	Not significant when incorporating controls.	Coefficients range from 0.021 to 0.036. Statistically significant in specifications incorporating macroeconomic, and financial sector controls.

Note: macroeconomic and financial system variables were transformed to their respective three year standard deviations when used with estimations for the volatility of pension returns. For methodological details see Section II.

Control Variables

Macroeconomic Variables

In general, many of the macroeconomic control variables are statistically related to both performance measures. In the case of the pension system *gross real return*, positive coefficients emerged for *real GDP growth* and *capital account openness* while negative coefficients emerged for *per capita GDP* and *inflation*. In the case of *volatility of gross real returns*, these same variables, as well as *fiscal surplus*, are determinant. Positive coefficients were found for *real GDP growth*, *per capita GDP*, and *inflation* while negative coefficients were found for *capital account openness* and *fiscal surplus*.

Real GDP Growth: *real GDP growth* exhibits a positive relationship both with pension system *gross real return* and with the three year standard deviation of those returns, but the relationships are only statistically significant when macroeconomic variables, financial sector variables, and institutional variables are incorporated into the specification as controls. A one percentage point increase in the annual rate of real GDP growth is associated with an average increase of 0.67 to 0.78 percentage points in *gross real return*. As is discussed in Appendix 3, an increase in the growth rate of the economy can reasonably be expected to increase corporate profits and, consequently, the return on equity. The fact that the standard deviation of the real GDP growth rate is positively related to the standard deviation of the pension system return once the macroeconomic variables have been incorporated as controls suggests that the volatility of returns is, in part, explained by macroeconomic volatility as measured by the standard deviation of real GDP growth.

Per Capita GDP: *per capita GDP* exhibits a negative relationship with *gross real return*. A \$US1,000 increase in per capita GDP is associated with a reduction of -0.01 to -0.04 percentage points in *gross real return*. The effect emerges in most specifications of the model. The higher per capita GDP, the lower the real rate of return on capital. A positive relationship also emerged with *volatility of gross real return* which, not surprisingly, suggests that countries with greater macroeconomic instability also experience greater return volatility in the investment returns earned by their pension systems.

Inflation: the annual rate of inflation also displays a significant negative relationship with *gross real return* while the three-year standard deviation of the inflation rate is positively associated with *volatility of gross real return*. There are several possible explanations. Higher inflation may (i) induce investors to hold more real assets thus reducing real rates of return; (ii) create incentives to change production techniques to conserve cash which increases the capital-to-labor ratio and depresses real rates of return on capital; and (iii) shorten the maturity of available credit which pushes more borrowers into shorter term instruments that generally provide lower rates of return. The positive relationship with *volatility of gross real return* suggests (as observed earlier) that countries with greater macroeconomic instability also experience greater return volatility in the investment returns earned by their pension systems. The observed relationship, both with gross returns and the volatility of those returns emerges in most of the specifications of the models (i.e., in both the raw data and when incorporating

controls). An increase in inflation of one percentage point is associated with a reduction in real returns of -0.4 to -0.5 percentage points; an increase of one point in the three year standard deviation of inflation increases the *volatility of gross real return* by 0.4 to 0.5 points.

Fiscal Surplus: the degree to which countries run a fiscal account surplus has no statistical relationship with the gross returns earned by the country’s pension system. However, higher volatility of the fiscal surplus expressed as a percent of GDP does reduce the volatility of returns. This may seem counterintuitive. However, if higher volatility reflects countercyclical fiscal policies, then the findings are quite reasonable (pro-cyclical fiscal policies, on the other hand, reduce the volatility of the fiscal balance but then contribute to increased volatility of GDP).

Exchange Rate Growth and Real Interest Rate: neither *exchange rate growth* nor the *real interest rate* is statistically related to either performance measure. As discussed in Appendix 3, this may be due to hedging in the futures and derivatives markets by pension fund investment managers.

Capital Account Openness: the degree to which a country’s capital account is open is positively related with *gross real return* and negatively related with *volatility of gross real return*. A one percentage point increase in *capital account openness* is associated with an increase of 0.04 to 0.27 percentage points in the pension system gross real return and a reduction of 0.5 to 1.1 percentage points in the three year standard deviation of gross real returns. A possible explanation is that the degree to which the capital account is open may expand the universe of investment opportunities, thereby improving the efficiency of capital allocation in the economy. Higher openness would also improve liquidity, thereby enabling portfolio managers to adjust portfolio composition more efficiently, thereby, improving rates of returns. On the other hand, the negative relationship between the variability of *capital account openness* and the volatility of pension fund returns may be because greater openness in the account helps to dampen price movements.

Table 4: Results for Macroeconomic Variables

Performance Measures	Gross Real Return	Volatility of Gross Real Return
<i>Real GDP growth</i>	Coefficients range from 0.67 to 0.78. Statistically significant in specifications incorporating macroeconomic, financial sector and institutional controls.	Coefficients range from 0.58 to 0.69. Statistically significant in specifications incorporating macroeconomic controls.
<i>Per capita GDP</i>	Coefficients range from -0.00043 to -0.00016. Statistically significant in most specifications.	Coefficients range from 0.0016 to 0.002. Statistically significant in specifications incorporating macroeconomic controls.
<i>Inflation</i>	Coefficients range from -0.49 to -0.41. Statistically significant.	coefficients range from 0.40 to 0.55. Statistically significant in nearly all specifications incorporating macroeconomic and financial sector

		controls.
<i>Fiscal surplus</i>	Not significant in most specifications.	Coefficients range from -0.93 to -0.22. Statistically significant only in specifications incorporating macroeconomic and financial sector variables as controls.
<i>Exchange rate growth</i>	Not significant.	Not significant.
<i>Real interest rate</i>	Not significant.	Not significant.
<i>Capital account openness</i>	Coefficients range from 4.372 to 27.35. Significant when incorporating all macroeconomic, financial sector, and institutional variables controls.	Coefficients range from -110 to -49.5. Statistically significant in most specifications.

Note: macroeconomic and financial system variables were transformed to their respective three year standard deviations when used with estimations for the volatility of pension returns. For methodological details see Section II.

Financial Sector Variables

The financial sector variables generally exhibited less statistical relation to the two performance measures than did the macroeconomic variables. Gross real returns were statistically positively related to *credit to the private sector* and negatively related to *stock of public debt*. The *volatility of gross real return* was statistically positively related both to *credit to the private sector* and to *stock market capitalization*. This seems reasonable given that greater variability in the amount of credit extended in the private sector and in the aggregate value of securities traded should lead to greater variability in the returns earned by pension funds.

Stock Market Capitalization: the size of the stock market relative to GDP is not statistically related to pension system returns but is positively related to the volatility of those returns. The relationship observed between the volatility of *stock market capitalization* and the *volatility of gross real return* is not surprising given that pension funds often invest in equities.

Corporate Bond Market Capitalization: the size of the corporate bond market relative to GDP is not statistically related to either performance measure.

Stock of Public Debt: the stock of a country's public debt relative to its GDP is statistically negative related to pension system returns but unrelated to the volatility of those returns. The relationship is weak (the estimated coefficient is only -0.03) which suggests that large increases in the amount of public debt are required to dampen investment returns. This seems reasonable given that substantial increases in public debt create the expectation of higher taxes and increase the cost of capital (by increasing the risk of default).

Credit to the Private Sector: the amount of credit extended in the private sector as a percentage of GDP (a measure of the depth of the financial economy) is statistically positively related to both pension system returns and the volatility of those returns. A one percentage

point increase in *credit to the private sector* is associated with an increase of 2.4 to 3.3 percentage points in *gross real return*. This relationship is significant when macroeconomic variables are incorporated into the regression as controls. This implies that, for countries with comparable macroeconomic circumstances, greater depth in the financial economy is associated with higher returns on pension investments. This suggests that policy measures aimed at deepening the financial economy could improve the landscape for pension fund investment. The relationship between *credit to the private sector* and *volatility of gross real returns* is unsurprising given that variability in the amount of credit extended in the private sector points toward macroeconomic instability that can reasonably be expected to lead to higher variability in asset prices.

Institutional Variables

In general, the three indexes were only weakly related to the two performance measures. For *real gross returns*, only the *anti self-dealing index* was statistically significant; its relationship was positive. For the volatility of those returns, none of the indexes were statistically significant. A 0.1 increase in the index (index can take on values between zero and one) is associated with a 0.8 to 1.5 percentage point increase in pension system returns. This suggests that for countries which are comparable in terms of their macroeconomic and financial sector characteristics, improving investor protection for minority shareholders – either by strengthening the law or its enforcement – is associated with higher pension system returns.

Table 5: Results for Financial Sector Variables

Performance Measures	(i) Pension System Return	(ii) Pension System 3 year Standard Deviation
B. Financial Sector Variables		
<i>Stock market capitalization</i>	Not significant	Positive and statistically significant in most specifications incorporating macroeconomic, financial sector and institutional controls. Coefficients range from 13.25 to 18.26.
<i>Corporate bond market capitalization</i>	Not significant	Not significant in most specifications.
<i>Stock of public debt</i>	While not significant in most specifications, when significant the coefficient is negative with a value of -0.03.	Not Significant.
<i>Credit to the private sector</i>	Positive and statistically significant in specifications incorporating macroeconomic, financial sector and institutional controls. Coefficients range from 2.41 to 3.314.	Positive and statistically significant in most specifications incorporating macroeconomic and financial sector controls. In these specifications coefficients range from 4.202 to 4.536.
<i>Real interest rate</i>	Not significant	Not significant
C. Institutional Variables		
<i>Rule of law index</i>	Not significant	Not significant
<i>Anti self-dealing index</i>	Positive and significant. Coefficients range from 8.788 to 15.19.	Not significant
<i>Creditor rights index</i>	Negative and significant in some specifications.	Not significant
Note The macroeconomic and financial system variables were transformed to the respective 3-year standard deviations when incorporating them for Column ii regressions. For further details see the Methodological Section.		

IV. CONCLUSIONS, LIMITATIONS, AND SUGGESTIONS FOR FUTURE WORK

This study has examined the relationship between two dependent variables (the real gross rates of return earned on a country's pension system investments and the volatility of those returns as measured by their three year standard deviation) and (i) the key design attributes of the country's pension system and (ii) the characteristics of the country's pension fund industry. To account for differences among countries not related to the design of their pension systems or characteristics of their pension industry, the study has controlled for cross-country differences in macroeconomic, financial sector, and institutional variables.

To the extent that this topic has yet to be fully covered in the literature, this study breaks new ground, most likely because of prior limitations regarding the availability of data. Considerable work, however, remains to be done. Data is not yet available to explore other relationships that might exist between the two performance measures and other aspects of pension system design or characteristics of the structure of a country's pension fund industry (two examples include different approaches to market supervision than those addressed herein and the levying of commissions by investment managers). In addition, it would be interesting to compare pension system returns against a country-specific benchmark by representing returns in excess of the rate earned on government bills (i.e., the least risky asset available) in each country.

Several methodological issues must be also be improved. The two performance measures of investment performance could be made more nuanced (e.g., by considering investment maturities and the structure of beneficiaries). The efficiency of investments also merits consideration. As more data becomes available, the time period covered by the study can – and should – be extended. Finally, the conclusions presented herein rely on stated asset valuations. In the case of funds that invest only in listed securities in markets with reasonable liquidity, valuation is not problematic. However, pension funds often invest in nonmarket securities (including private equity and real estate, for example), many emerging markets lack enough liquidity for price formation to be efficient, and valuation methodologies may differ substantially across the countries in our sample.

All findings presented herein should be treated as preliminary, of course, given that they rely on a relatively short time horizon, a limited number of countries, and a limited number of observations regarding pension fund characteristics. These limitations notwithstanding, this study offers the following insights:

- Larger pension systems (i.e., those with more assets relative to GDP) tend to earn higher gross real rates of returns.
- More mature pension systems (i.e., those that have been in existence longer) tend to experience less volatility in rates of return.
- Pension systems with greater competition (i.e., those with larger numbers of funds and those where the largest funds hold relatively small market shares) tend to experience less volatility in rates of return.
- Higher gross real rates of return are associated with occupational (rather than personal) pension schemes, closed (rather than open) schemes, and pension systems with multiple (rather than one) fund.¹²

¹² Pension system real returns may indirectly benefit from relaxing foreign investments limits as a result of its impact on the openness of the capital account.

- Lower levels of volatility in rates of return are associated with voluntary (rather than mandatory) systems, systems with minimum guarantees, and systems which permit lower levels of foreign investment.¹³

In general, differences in performance measures still arise when macroeconomic variables, financial sector variables, and institutional variables are introduced into the regression as controls. When comparing countries with comparable macroeconomic variables (i.e., incorporating all variables simultaneously as controls), higher returns are associated with higher rates of GDP growth, greater openness in the capital account, lower inflation, and lower GDP per capita. Moreover (and as expected), greater volatility in these macroeconomic variables (with the exception of *capital account openness*) is also associated with greater volatility in pension system returns. Weaker relationships were observed between the two performance measures and both financial system variables and institutional variables. Still, it is worth noting (i) the positive relationship between pension system returns and the amount of credit extended in the private sector, (ii) the positive relationship between the volatility of returns and the volatility of the amount of credit extended in the private sector, and (iii) the positive relationship between rates of return and the anti self-dealing index.

Finally, the authors wish to encourage international donor organizations to devote more resources to the collection and publishing of data on private pension funds in a more systematic and regular way. Such investment would enable richer and more nuanced analysis of pension fund performance and may reasonably be expected to identify public policy measures that might improve pension fund investment management in ways that ultimately enable national pension systems to generate higher levels of benefits for the same level of contributions at lower risk to participants.

¹³ Restrictive investment limits also reduce *capital account openness*, indirectly – as is explained below – increasing the volatility of pension system gross real returns. Thus, its net effect is ambiguous.

APPENDIX 1: ECONOMETRIC OUTPUT

Table 6: Variables, Definitions and Sources

Category and Variables	Definition	Source	Website
Macroeconomic Variables			
<i>Real GDP growth</i>	Annual growth rate of real GDP	IMF (IFS)	http://www.imfstatistics.org
<i>Inflation rate</i>	Rate of growth in the annual consumer price index	IMF (IFS)	http://www.imfstatistics.org
<i>Fiscal surplus</i>	General government balance as a percent of GDP	IMF, EBRD	www.imf.org ; www.ebrd.com
<i>Exchange rate growth</i>	Annual percentage change in the nominal exchange rate defined as national currency against the U.S. dollar.	World Economic Outlook Database, April 2008 (IMF) and IFS	http://www.imfstatistics.org www.imf.org
<i>Per capita GDP</i>	Per capita GDP measured on a purchasing-power parity (PPP) basis	World Economic Outlook Database, April 2008 (IMF)	www.imf.org
<i>Real interest rate</i>	Nominal annual deposit interest rate for deposits of term less than 90 days, net of inflation	National central banks	
<i>Capital account openness</i>	The absolute value of portfolio investment assets (IFS line 78bfd) plus portfolio investment liabilities (IFS line 78bgd) divided by GDP	IMF (IFS)	http://www.imfstatistics.org/imf/
Financial Sector Variables			
<i>Stock market capitalization</i>	Number of issued shares of domestic companies multiplied by their prices at year end divided by GDP	World Federation of Exchanges	www.world-exchanges.org
<i>Corporate bond market capitalization</i>	Number of listed bonds multiplied by their prices at year end divided by GDP	World Federation of Exchanges	www.world-exchanges.org
<i>Stock of public debt</i>	General government net debt divided by GDP	World Economic Outlook Database, April 2008 (IMF) and EBRD	www.imf.org
<i>Credit to private sector</i>	Ratio of credit from deposit taking financial institutions to the private sector divided by GDP	IMF (IFS)	http://www.imfstatistics.org/imf/
Institutional Variables			
<i>Rule of law index</i>	An index measuring confidence in the rules of society to include contract enforcement, property rights, the police and courts, as well as the incidence of crime and violence	Kaufmann, Kraay, and Mastruzzi (2008)	www.worldbank.org/wbi/governance/govdata/
<i>Anti self-dealing index</i>	Measures the strength with which minority shareholders are protected against self dealing by controlling	Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2005)	http://www.nber.org/papers/w11883

Category and Variables	Definition	Source	Website
	shareholders. Ranges from zero to one.		
<i>Creditor rights index</i>	Measures the legal rights of creditors to recover losses against defaulting debtors. First proposed by La Porta et al. (1997, 1998) Ranges from zero (weak rights) to one (strong rights).	Djankov, McLiesh, and Shleifer (2007)	http://www.nber.org/papers/w11078
Pension Fund System: Time Series Variables			
<i>Years since inception</i>	Number of years since a pension system was started	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
<i>Assets under management</i>	Total assets in the pension system divided by GDP	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
<i>Number of funds</i>	Number of pension funds in the private pension system	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
<i>Market concentration</i>	The percentage of pension system assets held by the largest three pension funds	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
Pension Fund System: Dummy Variables			
<i>Mandatory vs. voluntary</i>	Equals one if the pension system is mandatory and zero if voluntary	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
<i>Occupational vs. personal</i>	Equals one if the pension system is occupational based and zero if personal	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
<i>DC vs. DB</i>	Equals one if benefits are determined using as a defined contribution (DC) methodology and zero if defined benefit (DB)	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
<i>Open vs. closed</i>	Equals one if the pension system supports at least one pension plan with no restrictions on membership and zero otherwise	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
<i>Minimum guarantee</i>	Equals one if the pension system guarantees minimum payments and zero	OECD, FIAP, AIOS and national sources	http://stats.oecd.org -

Category and Variables	Definition	Source	Website
	otherwise		www.fiap.cl - www.aiosfp.org
<i>Contribution-based vs. asset-based</i>	Equals one if the pension system charges commissions based on contributions and zero if commissions are based on assets under management	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
<i>Risk-based supervision</i>	Equals one if their supervision is risk-based and zero otherwise	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org
<i>Multiple funds</i>	Equals one if multiple pension funds exist within the pension scheme and zero otherwise	OECD, FIAP, AIOS and national sources	http://stats.oecd.org - www.fiap.cl - www.aiosfp.org

Table 7: Dependent Variables Descriptive Statistics (1990-2007)

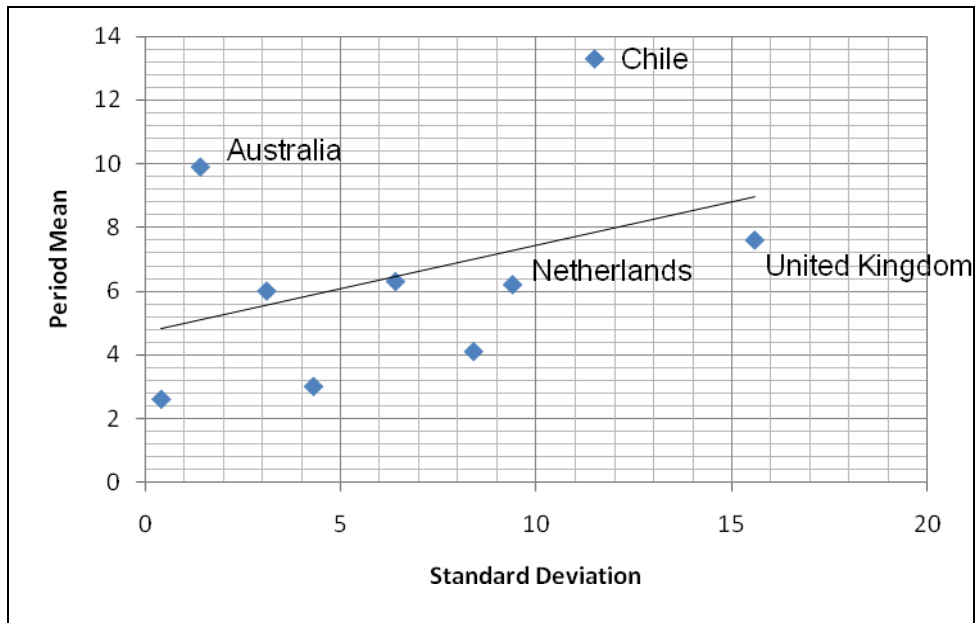
Variable	Observations	Mean	Median	Std. Dev.	Min	Max
<i>Gross real return</i>	302	6.416	6.259	8.528	-45.23	40.6
<i>Volatility of gross real return</i>	247	5.829	4.146	4.963	0.112	30.755

Table 8: Real Return Statistics by Country (1990-2007)

Country	Observations	Mean	Median	Std. Dev.	Mean/Std. Dev.	Min	Max	Period
Argentina	13	4	4.6	17.2	0.23	-45.2	19.8	1995-2007
Australia	17	9.4	10.5	5.7	1.65	-4.9	18.9	1990-2006
Bolivia	10	8.8	9.3	5.9	1.49	-2.9	16	1998-2007
Canada	16	6.2	6.7	3.2	1.94	1.9	10.5	1990-2005
Chile	18	8.8	5.6	8.2	1.07	-2.6	29.6	1990-2007
Colombia	13	10.4	11.3	4.3	2.42	0.9	16.4	1995-2007
Costa Rica	7	5.8	6.1	3.9	1.49	-0.7	10.3	2001-2007
Croatia	6	4.1	3.5	2.7	1.52	0.9	9	2002-2007
Czech Republic	11	1.1	0.9	1.6	0.69	-1.2	3.9	1995-2005
Denmark	15	2.2	2.5	1.1	2.00	0	3.8	1990-2004
El Salvador	9	5.7	4.8	4.4	1.30	1.2	14.1	1999-2007
Estonia	4	5.3	6.7	4.5	1.18	-1.3	8.9	2002-2005
Hong Kong	6	4.9	5.4	9.9	0.49	-9.5	19.7	2002-2007
Hungary	10	0.9	-1.3	5.9	0.15	-7.7	10	1998-2007
Israel	6	4.8	5.3	5.3	0.91	-4.7	11.8	1999-2004
Japan	17	3.7	3.7	8.6	0.43	-12.2	21.6	1990-2006
Kazakhstan	6	8.4	6	12.7	0.66	-2.9	32.9	1999-2004
Latvia	5	-1.8	-1.8	4.6	-0.39	-9.2	2.4	2003-2007
Mexico	10	7	6.7	3.8	1.84	1.6	13.1	1998-2007
Netherlands	17	6.2	8.5	8.7	0.71	-10.9	18.6	1990-2006
Peru	14	10.9	11.1	9.6	1.14	-6.7	26.8	1994-2007
Poland	8	8.4	9.3	5.4	1.56	-0.2	14.6	1999-2006
Sweden	16	6.6	7	9.7	0.68	-12.8	19.3	1990-2005
Switzerland	4	5	4.5	5.4	0.93	-0.9	11.9	2004-2007
UK	18	6.3	9	12.2	0.52	-16.4	26.1	1990-2007
United States	15	6.3	7	9.3	0.68	-11.6	17.6	1990-2004
Uruguay	11	14.7	12	12.1	1.21	0.5	40.6	1997-2007
Total	302	6.4	6.3	8.5	0.75	-45.2	40.6	1990-2007

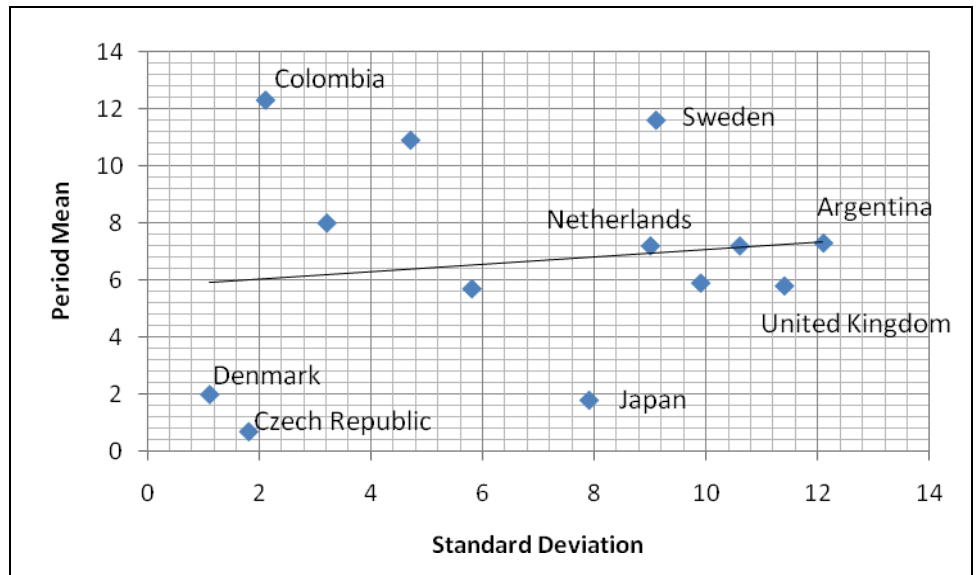
Note: the period covered was selected based on the availability of data.

Figure 4: Volatility of Gross Real Return Versus Mean of Gross Real Return (1990-1995)



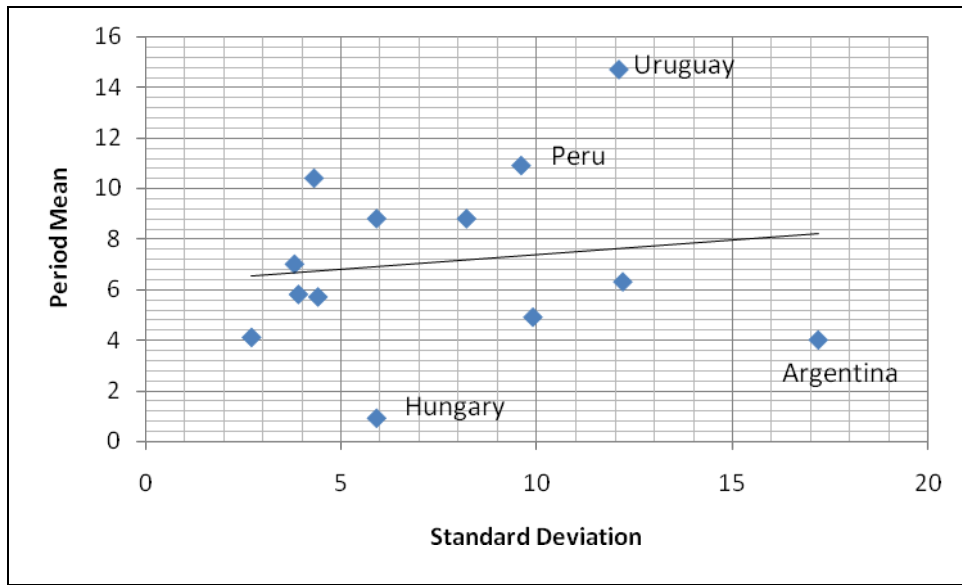
Note: data includes only countries with complete data for the whole period.

Figure 5: Volatility of Gross Real Return Versus Mean of Gross Real Return (1996-2001)



Note: data includes only countries with complete data for the whole period.

Figure 6: Volatility of Gross Real Return Versus Mean of Gross Real Return (2002-2007)



Note: data includes only countries with complete data for the whole period.

Table 9: Pairwise Correlations

	Argentina	Australia	Bolivia	Canada	Chile	Colombia	Costa Rica	Croatia	Czech Republic	Denmark	El Salvador	Estonia	Hong Kong
Argentina	1												
Australia	0.6128*	1											
Bolivia	-0.4577	-0.5556	1										
Canada	0.5722	0.6174*	-0.4067	1									
Chile	0.2456	0.0814	-0.0922	-0.4071	1								
Colombia	0.147	-0.0006	0.8129*	0.4822	-0.3765	1							
Costa Rica	0.052	-0.2632	0.4012	-0.6643	0.6006	0.2154	1						
Croatia	-0.8400*	-0.6242	0.8581*	-0.5383	-0.2966	0.4825	0.3522	1					
Czech Republic	0.0829	-0.2219	0.0015	-0.2997	0.7790*	-0.1206	0.6525	-0.2805	1				
Denmark	0.6852*	0.7105*	-0.6049	0.5574*	0.1932	0.4353	-0.7042	-0.4567	0.0649	1			
El Salvador	0.314	0.1306	0.578	0.417	0.2597	0.7090*	0.1527	-0.0889	0.3511	0.2532	1		
Estonia	0.9514*	0.7605	-0.8174	0.7155	0.5146	0.4788	-0.1845	-	0.0969	0.6499	0.6335	1	
Hong Kong	0.2104	0.7613	-0.4441	0.8125	0.032	-0.2018	-0.5338	-0.1569	-0.9478	0.9054	-0.3662	0.2249	1
Hungary	0.0988	0.2273	0.321	0.0353	0.1185	0.6485*	0.018	0.3336	0.4699	0.7706*	0.4192	0.496	0.3204
Israel	0.8743*	0.2689	-0.5156	0.1439	0.5955	-0.0018	0.2512	-0.974	0.2066	0.2216	0.3483	0.8953	-0.1915
Japan	0.6194*	0.1411	-0.3614	0.0542	-0.0201	0.1414	0.1556	-	0.4521	0.3754	0.3793	0.9249	-0.1738
Kazakhstan	0.2667	0.0772	0.4869	0.2196	0.7409	0.7741	0.2367	0.8544	0.5092	0.2311	0.8929*	-0.9513	-0.5498
Latvia	0.47	-0.7327	0.9638*	-0.7451	0.2072	0.7975	0.7539	0.7232	0.9813	-1	0.6644	0.2447	-0.4483
Mexico	0.2437	0.0612	0.5663	-0.1013	0.5351	0.3578	0.5381	0.0053	0.1841	-0.1872	0.7444*	0.2224	-0.4389
Netherlands	0.8397*	0.4323	-0.5664	0.5296*	-0.0721	0.3034	0.0454	-	0.1838	0.5866*	0.3746	0.9971*	0.1908
Peru	0.1215	-0.1137	-0.3182	-0.5741	0.5465*	-0.4996	0.424	-0.5122	0.7659*	-0.1682	-0.1393	0.311	-0.3919
Poland	-0.2467	0.0036	-0.4873	-0.3559	-0.2202	-0.4769	0.3632	0.065	0.0594	-0.3087	-0.6996	-0.1389	0.0556
Sweden	0.8507*	0.4051	-0.4361	0.6435*	-0.1988	0.5492	0.1677	-	0.0866	0.4499	0.7539	0.9415	-0.1041
Switzerland	0.3042	-0.4768	0.8848	-1	0.0849	0.6835	0.6874	0.4738	1.0000*	.*	0.8298	1	-0.4865
UK	0.7881*	0.3092	-0.3403	0.4537	-0.0034	0.1991	0.1108	-0.7121	0.2864	0.5126	0.3579	0.9819*	0.0367
United States	0.7624*	0.2893	-0.7019	0.3801	-0.0708	0.2568	0.2507	-0.9879	0.0602	0.409	0.1978	0.9253	-0.1198
Uruguay	-0.6083*	-0.8826*	0.5652	-	0.0812	0.1467	0.6993	0.7331	0.3016	-0.8086*	-0.1036	-0.7585	-0.751
				0.7707*									

* Significant Correlation at 5%

	Hungary	Israel	Japan	Kazakhstan	Latvia	Mexico	Netherlands	Peru	Poland	Sweden	Switzerland	United Kingdom	United States	Uruguay
Hungary	1													
Israel	-0.0786	1												
Japan	0.5074	0.7902	1											
Kazakhstan	0.2447	0.0155	0.2826	1										
Latvia	0.576	1.0000*	0.9351	1.0000*	1									
Mexico	0.0613	0.2625	0.1833	0.7788	0.5619	1								
Netherlands	0.4842	0.693	0.6755*	0.3132	0.6928	0.0048	1							
Peru	-0.0022	0.3065	0.5228	0.3426	-0.0167	0.2042	0.1027	1						
Poland	0.0432	-0.433	0.0994	-0.7395	-0.168	-0.0251	0.382	0.3191	1					
Sweden	0.2293	0.7451	0.6170*	0.5544	0.8709	0.2826	0.8821*	0.0016	-0.3191	1				
Switzerland	0.5658	.*	0.9254	.*	0.9054	0.7729	0.6891	0.1909	0.74	1	1			
United Kingdom	0.4424	0.7178	0.7072*	0.3424	0.9109*	0.0885	0.9436*	0.2321	0.0144	0.7889*	0.9436	1		
United States	0.2259	0.8038	0.7871*	0.095	1.0000*	-0.1007	0.8372*	0.1455	-0.1512	0.7656*	.*	0.7829*	1	
Uruguay	-0.0782	-0.3509	-0.247	-0.1711	0.737	0.1562	-0.6448*	0.1891	0.2703	-0.6221	0.7611	-0.4536	-0.4426	1

* Significant Correlation at 5%

Table 10: Descriptive Statistics for Explanatory Variables (1990-2007)

	Observations	Mean	Median	Min	Max	Std. Dev.
A. Macroeconomic Variables						
<i>Real GDP growth</i>	302	3.504	3.338	-	13.500	3.135151
				11.032		
<i>Per capita GDP</i>	302	17401.2	17161.3	3035.0	41994.1	9884.065
<i>Inflation</i>	302	4.414	2.795	-1.886	40.953	4.862625
<i>Fiscal surplus</i>	300	-1.906	-1.702	-	8.700	3.164032
				11.201		
<i>Exchange rate growth</i>	302	.0393363	.014371	-	2.1983	.1654297
				.16891		
<i>Capital account openness</i>	301	0.050	0.029	0.000	0.650	0.074885
B. Financial Sector Variables						
<i>Stock market capitalization</i>	291	0.724	0.494	0.008	12.841	1.085878
<i>Corporate bond market capitalization</i>	219	0.309	0.182	0.002	1.309	0.313511
<i>Stock of public debt</i>	300	54.064	47.984	1.000	194.670	33.68421
<i>Credit to the private sector</i>	295	0.781	0.622	0.061	3.451	0.573515
C. Institutional Variables						
<i>Rule of law Index</i>	302	0.675	0.736	0.302	0.896	0.193529
<i>Anti self-dealing index</i>	291	0.472	0.460	0.140	0.960	0.231662
<i>Creditor rights index</i>	298	0.495	0.500	0.000	1.000	0.301469
D. Pension Fund System Variables						
Industry Variables						
<i>Years since inception</i>	293	13.294	8.000	0.000	62.000	13.75853
<i>Assets under management (% of GDP)</i>	288	30.726	16.503	0.195	145.000	32.16827
<i>Assets under management (in \$US millions)</i>	288	459225.800	27510.260	14.229	8599308.000	1266177
<i>Number of funds</i>	158	19.962	8.000	2.000	376.000	48.94503
<i>Market concentration</i>	124	73.700	70.935	45.070	100.000	16.07881
System Design Variables						
<i>Mandatory vs. voluntary (dummy)</i>	296	0.682	1	0	1	0.466319
<i>Occupational vs. personal (dummy)</i>	290	0.486	0	0	1	0.500674
<i>DC vs. DB (dummy)</i>	296	0.689	1	0	1	0.463609
<i>Open vs. closed (dummy)</i>	296	0.524	1	0	1	0.500286
<i>Minimum guarantee (dummy)</i>	302	0.57	1	0	1	0.495963
<i>Contribution-based vs. asset-based (dummy)</i>	263	0.928	1	0	1	0.259384
<i>Risk-based supervision (dummy)</i>	51	0.078	0	0	1	0.271524
<i>Multiple funds (dummy)</i>	125	0.152	0	0	1	0.360466
<i>Foreign investment limit</i>	213	41.997	30	0	100	39.30449

Table 11: Macro Financial Variables: Emerging Countries

Country	First and Last Available Year	Assets Under Management (% of GDP)	Per Capita GDP (PPP)	Private Credit (% of GDP)	Stock Market Capitalization (% of GDP)	Old Age Dependency Ratio
Argentina	1995	1.0	7,882	20.2	14.5	0.15
	2007	11.5	13,308	12.7	22.0	0.17
Bolivia	1998	3.9	3,051	58.4	5.3	0.07
	2007	22.0	4,013	35.2	22.3	0.09
Chile	1990	18.3	4,806	46.9	36.8	0.10
	2007	64.4	13,936	83.3	130.0	0.13
Colombia	1995	0.3	4,543	30.7	17.3	0.07
	2007	14.7	6,724	32.5	59.4	0.09
Costa Rica	2001	0.7	7,186	25.0	18.4	0.09
	2007	5.1	10,300	37.9	7.3	0.09
Croatia	2002	1.3	10,748	44.3	15.9	0.28
	2007	8.5	15,549	67.2	49.4	0.31
Czech Republic	1995	0.4	12,690	66.5	19.5	0.19
	2005	4.1	20,290	32.9	28.0	0.20
El Salvador	1999	1.7	4,455	42.0	14.4	0.08
	2007	21.2	5,842	40.7	18.5	0.11
Estonia	2002	0.2	12,047	24.0	26.9	0.22
	2005	2.7	16,660	45.9	35.7	0.24
Hungary	1998	1.3	10,551	22.9	30.9	0.21
	2007	11.5	19,027	54.0	33.4	0.24
Kazakhstan	1999	2.7	4,279	6.1	12.2	0.11
	2004	8.6	7,735	21.6	7.4	0.12
Latvia	2003	0.4	10,262	29.0	8.3	0.26
	2007	1.2	17,416	62.7	13.1	0.26
Mexico	1998	1.4	8,732	22.9	29.6	0.07
	2007	8.5	12,775	18.1	44.5	0.11
Peru	1994	0.6	4,074	11.4	14.8	0.07
	2007	18.5	7,803	21.6	63.6	0.11
Poland	1999	0.3	9,599	22.9	14.9	0.17
	2006	11.1	14,884	26.2	36.1	0.20
Uruguay	1997	0.9	7,643	25.2	1.1	0.20
	2007	15.7	11,621	25.0	2.1	0.25
<i>Simple Average</i>	<i>First Year</i>	<i>2.2</i>	<i>7,659</i>	<i>31.2</i>	<i>17.5</i>	<i>0.15</i>
	<i>Last Year</i>	<i>14.3</i>	<i>12,368</i>	<i>38.6</i>	<i>35.8</i>	<i>0.17</i>

Source: Bebczuk and. Musalem (2008c), based on data assembled for this project by the OECD and World Bank.

Table 12: Macro Financial Variables: Developed Countries

	First and Last Available Year	Assets Under Management (% of GDP)	Per Capita GDP (PPP)	Private Credit (% of GDP)	Stock Market Capitalization (% of GDP)	Old Age Dependency Ratio
Australia	1990	53.7	17,519	57.2	39.5	0.17
	2006	90.9	34,375	107.5	145.0	0.20
Canada	1990	29.1	19,615	87.8	46.8	0.16
	2005	50.2	35,111	170.3	119.9	0.19
Denmark	1990	14.3	18,564	50.2	29.4	0.23
	2004	30.7	31,764	152.9	56.1	0.22
Hong Kong	2002	16.8	27,855	151.4	298.0	
	2007	27.7	41,994	138.7	1284.1	
Israel	1999	24.0	18,348	72.5	49.7	0.16
	2004	26.7	21,368	85.6	73.7	0.17
Japan	1990	12.4	18,712	168.6	122.6	0.17
	2006	23.4	32,032	97.5	105.4	0.31
Netherlands	1990	78.3	19,068	126.4	45.7	0.19
	2006	130.0	36,833	168.6	108.7	0.21
Sweden	1990	8.2	18,080	123.4	45.2	0.28
	2005	9.3	32,706	106.3	109.8	0.26
Switzerland	2004	108.2	34,856	156.8	218.2	0.22
	2007	145.0	41,128	168.1	299.8	0.25
UK	1990	49.9	16,656	111.6	85.2	0.24
	2007	77.1	35,134	163.9	138.9	0.23
US	1990	42.0	23,208	116.8	57.5	0.19
	2004	73.8	39,812	182.1	132.0	0.18
<i>Simple Average</i>	<i>First Year</i>	<i>39.7</i>	<i>21,135</i>	<i>111.1</i>	<i>94.3</i>	<i>0.18</i>
	<i>Last Year</i>	<i>62.3</i>	<i>34,751</i>	<i>140.1</i>	<i>233.9</i>	<i>0.20</i>

Source: Bebczuk and Musalem (2008c), based on data assembled for this project by OECD and World Bank.

Table 13: Pension System Return: Mandatory vs. Voluntary Dummy Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Mandatory vs. voluntary</i>	0.977 (1.477)	-1.136 (1.702)	-0.355 (2.228)	3.014 (2.359)
<i>Real GDP growth</i>		0.0794 (0.179)	0.818*** (0.255)	0.695*** (0.250)
<i>Per capita GDP</i>		-0.000246*** (0.0000862)	-0.000294 (0.000196)	-0.000164 (0.000189)
<i>Inflation</i>		-0.263** (0.119)	-0.483*** (0.149)	-0.494*** (0.143)
<i>Fiscal surplus</i>		-0.0682 (0.188)	-0.0307 (0.257)	-0.0834 (0.238)
<i>Exchange rate growth</i>		-1.084 (3.110)	-2.699 (3.412)	-3.032 (3.395)
<i>Capital account openness</i>		12.04 (9.223)	10.47 (14.55)	19.12 (13.84)
<i>Stock market capitalization</i>			-0.786 (2.244)	-3.300 (2.137)
<i>Corporate bond market capitalization</i>			-0.605 (3.617)	-2.832 (2.985)
<i>Stock of public debt</i>			-0.00670 (0.0248)	-0.0167 (0.0215)
<i>Credit to the private sector</i>			2.140 (1.586)	3.314** (1.463)
<i>Real interest rate</i>			0.0344 (0.207)	-0.0950 (0.203)
<i>Rule of law index</i>				3.125 (6.500)
<i>Anti self-dealing index</i>				15.19*** (4.401)
<i>Creditor rights index</i>				-7.158** (2.868)
Constant	5.647*** (1.251)	11.68*** (2.636)	10.22*** (3.797)	1.393 (4.972)
Observations	296	293	210	210
Number of countries	26	26	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>mandatory vs. voluntary</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 14: Pension System Return: Occupational vs. Personal Dummy Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Occupational vs. personal</i>	-1.130 (1.382)	3.331 (2.339)	4.592 (2.998)	6.306* (3.316)
<i>Real GDP growth</i>		0.149 (0.185)	0.835*** (0.253)	0.780*** (0.250)
<i>Per capita GDP</i>		-0.000353*** (0.000119)	-0.000399** (0.000184)	-0.000439*** (0.000160)
<i>Inflation</i>		-0.249** (0.120)	-0.476*** (0.148)	-0.487*** (0.143)
<i>Fiscal surplus</i>		-0.0777 (0.190)	-0.0305 (0.256)	-0.103 (0.237)
<i>Exchange rate growth</i>		-1.682 (3.154)	-2.578 (3.390)	-2.915 (3.374)
<i>Capital account openness</i>		10.99 (8.265)	12.23 (12.65)	25.37** (12.31)
<i>Stock market capitalization</i>			-0.824 (2.240)	-1.563 (2.060)
<i>Corporate bond market capitalization</i>			-1.869 (3.476)	-1.621 (2.607)
<i>Stock of public debt</i>			-0.0168 (0.0256)	-0.0377 (0.0239)
<i>Credit to the private sector</i>			1.454 (1.648)	2.520* (1.501)
<i>Real interest rate</i>			-0.0140 (0.208)	-0.136 (0.204)
<i>Rule of law index</i>				-1.603 (7.090)
<i>Anti self-dealing index</i>				8.788** (3.968)
<i>Creditor rights index</i>				-7.826*** (2.822)
Constant	6.909*** (0.921)	11.03*** (1.950)	10.85*** (3.147)	11.32** (4.778)
Observations	290	287	210	210
Number of countries	25	25	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>occupational vs. personal</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 15: Pension System Return: Defined Contribution vs. Defined Benefit Dummy Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>DC vs. DB</i>	0.112 (1.462)	-1.297 (1.530)	-1.194 (2.205)	-0.684 (1.998)
<i>Real GDP growth</i>		0.0886 (0.179)	0.823*** (0.254)	0.734*** (0.253)
<i>Per capita GDP</i>		-0.000244*** (0.0000789)	-0.000287* (0.000170)	-0.000311** (0.000148)
<i>Inflation</i>		-0.260** (0.119)	-0.480*** (0.149)	-0.484*** (0.144)
<i>Fiscal surplus</i>		-0.0547 (0.189)	-0.0363 (0.258)	-0.0520 (0.238)
<i>Exchange rate growth</i>		-1.113 (3.109)	-2.663 (3.409)	-2.807 (3.404)
<i>Capital account openness</i>		10.24 (8.232)	9.971 (12.71)	27.00** (12.39)
<i>Stock market capitalization</i>			-0.886 (2.274)	-2.397 (2.030)
<i>Corporate bond market capitalization</i>			-0.351 (3.615)	-0.599 (2.798)
<i>Stock of public debt</i>			-0.0121 (0.0276)	-0.0211 (0.0245)
<i>Credit to the private sector</i>			1.755 (1.760)	2.979* (1.638)
<i>Real interest rate</i>			0.0235 (0.207)	-0.0646 (0.203)
<i>Rule of law index</i>				3.407 (6.799)
<i>Anti self-dealing index</i>				11.77*** (3.679)
<i>Creditor rights index</i>				-7.589*** (2.867)
Constant	6.265*** (1.261)	11.84*** (2.497)	11.25*** (3.991)	6.763 (5.060)
Observations	296	293	210	210
Number of countries	26	26	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) DC vs. DB dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 16: Pension System Return: Open vs. Closed Dummy Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Open vs. closed</i>	1.041 (1.333)	-2.759 (2.029)	-4.592 (2.998)	-6.306* (3.316)
<i>Real GDP growth</i>		0.152 (0.182)	0.835*** (0.253)	0.780*** (0.250)
<i>Per capita GDP</i>		-0.000331*** (0.000108)	-0.000399** (0.000184)	-0.000439*** (0.000160)
<i>Inflation</i>		-0.257** (0.119)	-0.476*** (0.148)	-0.487*** (0.143)
<i>Fiscal surplus</i>		-0.0821 (0.187)	-0.0305 (0.256)	-0.103 (0.237)
<i>Exchange rate growth</i>		-1.686 (3.128)	-2.578 (3.390)	-2.915 (3.374)
<i>Capital account openness</i>		13.51 (8.684)	12.23 (12.65)	25.37** (12.31)
<i>Stock market capitalization</i>			-0.824 (2.240)	-1.563 (2.060)
<i>Corporate bond market capitalization</i>			-1.869 (3.476)	-1.621 (2.607)
<i>Stock of public debt</i>			-0.0168 (0.0256)	-0.0377 (0.0239)
<i>Credit to the private sector</i>			1.454 (1.648)	2.520* (1.501)
<i>Real interest rate</i>			-0.0140 (0.208)	-0.136 (0.204)
<i>Rule of law index</i>				-1.603 (7.090)
<i>Anti self-dealing index</i>				8.788** (3.968)
<i>Creditor rights index</i>				-7.826*** (2.822)
Constant	5.781*** (1.003)	13.55*** (2.901)	15.44*** (4.761)	17.63** (7.334)
Observations	296	293	210	210
Number of countries	26	26	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>open vs. closed</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 17: Pension System Return: Minimum Guarantee Dummy Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Minimum guarantee</i>	1.288 (1.270)	0.289 (1.359)	-1.495 (2.542)	-0.353 (2.141)
<i>Real GDP growth</i>		0.0745 (0.175)	0.819*** (0.254)	0.726*** (0.251)
<i>Per capita GDP</i>		-0.000207*** (0.0000768)	-0.000294* (0.000171)	-0.000316** (0.000147)
<i>Inflation</i>		-0.273** (0.118)	-0.483*** (0.149)	-0.488*** (0.144)
<i>Fiscal surplus</i>		-0.0764 (0.187)	-0.0264 (0.259)	-0.0496 (0.240)
<i>Exchange rate growth</i>		-0.978 (3.090)	-2.727 (3.403)	-2.830 (3.405)
<i>Capital account openness</i>		8.863 (8.005)	11.28 (12.92)	27.35** (12.46)
<i>Stock market capitalization</i>			-1.006 (2.275)	-2.432 (2.033)
<i>Corporate bond market capitalization</i>			-0.639 (3.517)	-0.865 (2.655)
<i>Stock of public debt</i>			-0.0118 (0.0271)	-0.0186 (0.0233)
<i>Credit to the private sector</i>			1.664 (1.803)	3.083* (1.713)
<i>Real interest rate</i>			0.0207 (0.207)	-0.0668 (0.203)
<i>Rule of law index</i>				3.878 (6.634)
<i>Anti self-dealing index</i>				11.87*** (3.696)
<i>Creditor rights index</i>				-7.603*** (2.916)
Constant	5.570*** (0.971)	10.24*** (2.354)	11.75*** (4.428)	6.173 (5.118)
Observations	302	299	210	210
Number of countries	27	27	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>minimum guarantee</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 18: Pension System Return: Multiple Funds Dummy Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Multiple funds</i>	-0.279 (2.371)	2.632 (2.705)	3.271 (3.054)	7.201** (3.412)
<i>Real GDP growth</i>		0.122 (0.230)	0.517* (0.297)	0.424 (0.320)
<i>Per capita GDP</i>		-0.00113*** (0.000277)	-0.000977*** (0.000352)	-0.00230** (0.000999)
<i>Inflation</i>		-0.205 (0.137)	-0.220 (0.165)	-0.253 (0.178)
<i>Fiscal surplus</i>		-0.105 (0.313)	1.188** (0.508)	1.446** (0.614)
<i>Exchange rate growth</i>		-1.647 (3.676)	-4.350 (3.785)	-5.174 (3.729)
<i>Capital account openness</i>		55.69*** (19.80)	118.5*** (45.21)	151.1*** (48.61)
<i>Stock market capitalization</i>			-22.30*** (7.020)	-25.25*** (7.055)
<i>Corporate bond market capitalization</i>			-10.78 (29.26)	-40.00 (36.65)
<i>Stock of public debt</i>			-0.0674 (0.0608)	-0.0780 (0.0703)
<i>Credit to the private sector</i>			12.28 (9.873)	19.96 (27.17)
<i>Real interest rate</i>			-0.111 (0.241)	-0.205 (0.270)
<i>Rule of law index</i>				-2.271 (34.86)
<i>Anti self-dealing index</i>				-28.78 (28.11)
<i>Creditor rights index</i>				21.51 (25.70)
Constant	7.284*** (1.129)	15.94*** (2.377)	22.12*** (4.426)	43.54* (25.71)
Observations	125	122	74	74
Number of countries	13	13	6	6
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>multiple funds</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 19: Pension System Return: System Age Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Years since inception</i>	-0.0736 (0.0466)	-0.0379 (0.0496)	-0.0705 (0.0738)	-0.0997 (0.0619)
<i>Real GDP growth</i>		0.0542 (0.178)	0.785*** (0.261)	0.699*** (0.257)
<i>Per capita GDP</i>		-0.000191** (0.0000763)	-0.000231 (0.000165)	-0.000280* (0.000152)
<i>Inflation</i>		-0.263** (0.119)	-0.483*** (0.155)	-0.521*** (0.150)
<i>Fiscal surplus</i>		-0.0284 (0.194)	0.138 (0.288)	0.175 (0.266)
<i>Exchange rate growth</i>		-1.257 (3.105)	-3.258 (3.483)	-4.438 (3.471)
<i>Capital account openness</i>		7.107 (8.252)	6.536 (12.31)	26.54** (12.31)
<i>Stock market capitalization</i>			-1.841 (2.252)	-3.836* (2.071)
<i>Corporate bond market capitalization</i>			-0.928 (3.439)	-0.442 (2.707)
<i>Stock of public debt</i>			0.00252 (0.0291)	0.0113 (0.0280)
<i>Credit to the private sector</i>			2.608 (1.610)	3.860*** (1.479)
<i>Real interest rate</i>			0.0286 (0.210)	-0.114 (0.208)
<i>Rule of law index</i>				0.103 (6.789)
<i>Anti self-dealing index</i>				14.43*** (3.756)
<i>Creditor rights index</i>				-6.081** (2.884)
Constant	7.157*** (0.855)	10.75*** (1.935)	10.34*** (3.155)	6.746* (3.750)
Observations	293	290	201	201
Number of countries	27	27	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>years since inception</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 20: Pension System Return: Assets Management of Pension Funds Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Assets under management</i>	0.0123 (0.0192)	0.0767*** (0.0211)	0.134*** (0.0373)	0.120*** (0.0360)
<i>Real GDP growth</i>		0.145 (0.175)	0.724*** (0.252)	0.666*** (0.251)
<i>Per capita GDP</i>		-0.000350*** (0.0000745)	-0.000342** (0.000158)	-0.000299** (0.000149)
<i>Inflation</i>		-0.193* (0.116)	-0.376*** (0.144)	-0.419*** (0.140)
<i>Fiscal surplus</i>		-0.143 (0.188)	0.143 (0.266)	0.0649 (0.250)
<i>Exchange rate growth</i>		-1.239 (3.078)	-3.266 (3.349)	-4.209 (3.332)
<i>Capital account openness</i>		1.149 (8.217)	-10.10 (12.25)	4.372 (13.58)
<i>Stock market capitalization</i>			-5.939** (2.426)	-6.720*** (2.215)
<i>Corporate bond market capitalization</i>			0.312 (3.086)	0.624 (2.636)
<i>Stock of public debt</i>			0.00313 (0.0233)	-0.00134 (0.0216)
<i>Credit to the private sector</i>			1.234 (1.553)	2.410 (1.489)
<i>Real interest rate</i>			0.0579 (0.200)	-0.0615 (0.199)
<i>Rule of law index</i>				-4.852 (6.825)
<i>Anti self-dealing index</i>				9.926*** (3.752)
<i>Creditor rights index</i>				-5.522* (2.832)
Constant	5.919*** (0.835)	10.17*** (1.788)	10.42*** (2.926)	10.51*** (3.851)
Observations	288	285	199	199
Number of countries	27	27	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>assets under management</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 21: Pension System Return: Number of Pension Funds Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Number of funds</i>	0.00983 (0.0150)	0.0627*** (0.0193)	0.0747*** (0.0207)	0.0631** (0.0298)
<i>Real GDP growth</i>		0.0147 (0.197)	0.526** (0.257)	0.338 (0.282)
<i>Per capita GDP</i>		-0.000822*** (0.000179)	-0.00113*** (0.000275)	-0.000960* (0.000500)
<i>Inflation</i>		-0.220* (0.124)	-0.342** (0.140)	-0.321** (0.142)
<i>Fiscal surplus</i>		-0.100 (0.247)	0.918** (0.408)	1.241*** (0.458)
<i>Exchange rate growth</i>		-1.545 (3.318)	-4.006 (3.315)	-3.811 (3.370)
<i>Capital account openness</i>		39.12 (26.50)	90.51*** (32.94)	94.85*** (34.79)
<i>Stock market capitalization</i>			-17.27*** (4.005)	-21.15*** (4.797)
<i>Corporate bond market capitalization</i>			-1.520 (6.813)	-4.699 (7.225)
<i>Stock of public debt</i>			-0.0802* (0.0422)	-0.0600 (0.0441)
<i>Credit to the private sector</i>			6.547 (5.991)	1.505 (7.425)
<i>Real interest rate</i>			-0.185 (0.201)	-0.162 (0.204)
<i>Rule of law index</i>				20.25 (12.97)
<i>Anti self-dealing index</i>				6.317 (10.46)
<i>Creditor rights index</i>				-6.776 (8.251)
Constant	6.863*** (0.893)	14.39*** (2.174)	24.17*** (3.606)	14.79 (9.328)
Observations	158	155	88	88
Number of countries	19	19	9	9
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>number of funds</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 22: Pension System Return: Market Concentration Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Market concentration</i>	0.0182 (0.0541)	-0.0416 (0.0602)	-0.104 (0.100)	-0.0765 (0.114)
<i>Real GDP growth</i>		0.224 (0.247)	0.529 (0.342)	0.412 (0.371)
<i>Per capita GDP</i>		-0.000621** (0.000248)	-0.00102** (0.000478)	-0.00153 (0.00109)
<i>Inflation</i>		-0.190 (0.143)	-0.310* (0.182)	-0.313 (0.201)
<i>Fiscal surplus</i>		-0.590* (0.347)	0.856 (0.641)	1.243 (0.763)
<i>Exchange rate growth</i>		-1.919 (3.905)	-3.983 (4.165)	-4.139 (4.254)
<i>Capital account openness</i>		12.64 (37.79)	109.3** (54.32)	136.6** (59.52)
<i>Stock market capitalization</i>			-21.04*** (8.114)	-22.65*** (8.364)
<i>Corporate bond market capitalization</i>			-11.16 (33.87)	-16.00 (42.09)
<i>Stock of public debt</i>			-0.0581 (0.0684)	-0.0546 (0.0838)
<i>Credit to the private sector</i>			17.54 (12.26)	13.33 (31.69)
<i>Real interest rate</i>			-0.218 (0.265)	-0.213 (0.299)
<i>Rule of law index</i>				17.15 (40.58)
<i>Anti self-dealing index</i>				-8.668 (31.70)
<i>Creditor rights index</i>				-1.422 (30.21)
Constant	7.033* (4.088)	16.03*** (5.887)	28.12*** (9.155)	28.29 (28.50)
Observations	124	122	66	66
Number of countries	14	14	6	6
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>market concentration</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 23: Pension System Return: Foreign Investments Limit Test

Dependent Variable: Pension System Real Gross Return	(1)	(2)	(3)	(4)
<i>Foreign investment limit</i>	-0.0385** (0.0150)	-0.0261 (0.0214)	-0.0324 (0.0279)	-0.0190 (0.0339)
<i>Real GDP growth</i>		0.0679 (0.205)	0.838*** (0.292)	0.843*** (0.297)
<i>Per capita GDP</i>		-0.000182** (0.0000888)	-0.0000692 (0.000192)	-0.0000537 (0.000217)
<i>Inflation</i>		-0.318** (0.133)	-0.459*** (0.166)	-0.471*** (0.164)
<i>Fiscal surplus</i>		-0.00480 (0.220)	0.242 (0.329)	0.0869 (0.341)
<i>Exchange rate growth</i>		-1.824 (3.409)	-2.523 (3.777)	-3.179 (3.733)
<i>Capital account openness</i>		13.04 (9.526)	11.49 (11.86)	28.62** (13.83)
<i>Stock market capitalization</i>			-3.368 (2.412)	-4.052* (2.448)
<i>Corporate bond market capitalization</i>			-3.203 (3.712)	-3.358 (3.669)
<i>Stock of public debt</i>			-0.0214 (0.0267)	-0.0234 (0.0266)
<i>Credit to the private sector</i>			2.531 (1.645)	3.982** (1.737)
<i>Real interest rate</i>			0.0362 (0.225)	-0.0727 (0.225)
<i>Rule of law index</i>				-7.155 (9.297)
<i>Anti self-dealing index</i>				10.34** (4.629)
<i>Creditor rights index</i>				-5.117 (4.534)
Constant	7.733*** (0.862)	10.90*** (1.999)	9.590*** (3.110)	9.311** (4.607)
Observations	213	210	145	145
Number of countries	26	26	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>foreign investment limit</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 24: Std. Deviation of Pension System Return: Mandatory vs. Voluntary Dummy Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Mandatory vs. voluntary</i>	0.116 (1.442)	-0.169 (1.195)	2.052** (0.884)	3.449*** (1.063)
<i>Std deviation of real GDP growth</i>		0.678*** (0.215)	0.439 (0.335)	0.476 (0.334)
<i>Std deviation of per capita GDP</i>		0.00189*** (0.000619)	0.00143 (0.00114)	0.00143 (0.00119)
<i>Std deviation of inflation</i>		0.651*** (0.115)	0.477** (0.238)	0.503** (0.241)
<i>Std deviation of fiscal surplus</i>		-0.186 (0.304)	-0.229 (0.396)	-0.226 (0.428)
<i>Std deviation of exchange rate growth</i>		-1.576 (1.696)	-2.878 (2.347)	-2.886 (2.380)
<i>Std deviation of capital account openness</i>		-32.44*** (12.44)	-102.4*** (25.26)	-110.7*** (26.29)
<i>Std deviation of stock market capitalization</i>			18.41*** (4.942)	17.16*** (4.960)
<i>Std deviation of corporate bond market capitalization</i>			-33.96** (16.91)	-34.66** (17.31)
<i>Std deviation of stock of public debt</i>			0.0685 (0.0779)	0.0797 (0.0772)
<i>Std deviation of credit to the private sector</i>			4.392* (2.613)	4.859* (2.687)
<i>Std deviation of real interest rate</i>			-0.252 (0.287)	-0.254 (0.288)
<i>Rule of law index</i>				0.653 (3.393)
<i>Anti self-dealing index</i>				3.210 (2.040)
<i>Creditor rights index</i>				1.625 (1.461)
Constant	5.425*** (1.243)	2.639** (1.271)	3.039** (1.380)	-0.517 (2.460)
Observations	244	241	176	176
Number of countries	26	26	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>mandatory vs. voluntary</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 25: Std. Deviation of Pension System Return: Occupational vs. Personal Dummy Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Occupational vs. personal</i>	0.720 (1.271)	1.753 (1.093)	0.859 (1.733)	-0.762 (1.416)
<i>Std deviation of real GDP growth</i>		0.669*** (0.215)	0.305 (0.307)	0.513 (0.345)
<i>Std deviation of per capita GDP</i>		0.00158** (0.000647)	0.000623 (0.00110)	0.000528 (0.00120)
<i>Std deviation of inflation</i>		0.671*** (0.116)	0.805*** (0.225)	0.412* (0.248)
<i>Std deviation of fiscal surplus</i>		-0.256 (0.308)	-0.805** (0.409)	-0.157 (0.441)
<i>Std deviation of exchange rate growth</i>		-1.305 (1.707)	-2.574 (2.057)	-1.661 (2.424)
<i>Std deviation of capital account openness</i>		-32.84*** (12.24)	-48.03* (24.95)	-73.50*** (24.44)
<i>Std deviation of stock market capitalization</i>			4.775 (4.766)	18.17*** (5.154)
<i>Std deviation of corporate bond market capitalization</i>			-8.074 (17.79)	-20.55 (17.57)
<i>Std deviation of stock of public debt</i>			-0.0224 (0.0786)	0.0582 (0.0820)
<i>Std deviation of credit to the private sector</i>			4.458* (2.413)	5.250* (2.839)
<i>Std deviation of real interest rate</i>			-0.124 (0.256)	-0.107 (0.296)
<i>Rule of law index</i>				-0.394 (4.502)
<i>Anti self-dealing index</i>				0.965 (2.002)
<i>Creditor rights index</i>				1.287 (1.541)
Constant	5.351*** (0.822)	2.215** (0.921)	4.693*** (1.678)	3.442 (2.454)
Observations	240	237	176	176
Number of countries	25	25	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>occupational vs. personal</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 26: Std. Deviation of Pension System Return: DC vs. DB Dummy Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>DC vs. DB</i>	-0.132 (1.245)	-1.208 (0.980)	-0.479 (1.167)	-1.369 (0.943)
<i>Std deviation of real GDP growth</i>		0.692*** (0.215)	0.343 (0.311)	0.516 (0.342)
<i>Std deviation of per capita GDP</i>		0.00190*** (0.000599)	0.000720 (0.00109)	0.000710 (0.00120)
<i>Std deviation of inflation</i>		0.657*** (0.116)	0.747*** (0.226)	0.495** (0.251)
<i>Std deviation of fiscal surplus</i>		-0.174 (0.302)	-0.711* (0.407)	-0.229 (0.442)
<i>Std deviation of exchange rate growth</i>		-1.477 (1.698)	-2.546 (2.081)	-1.510 (2.412)
<i>Std deviation of capital account openness</i>		-32.30*** (12.21)	-51.77** (24.68)	-62.75** (24.54)
<i>Std deviation of stock market capitalization</i>			6.543 (4.787)	15.45*** (5.339)
<i>Std deviation of corporate bond market capitalization</i>			-8.277 (17.06)	-13.74 (18.18)
<i>Std deviation of stock of public debt</i>			-0.00529 (0.0787)	0.0172 (0.0810)
<i>Std deviation of credit to the private sector</i>			4.536* (2.440)	4.280 (2.791)
<i>Std deviation of real interest rate</i>			-0.137 (0.259)	-0.0460 (0.292)
<i>Rule of law index</i>				-4.329 (3.746)
<i>Anti self-dealing index</i>				0.895 (1.943)
<i>Creditor rights index</i>				1.846 (1.521)
Constant	5.616*** (1.132)	3.389*** (1.160)	5.172*** (1.636)	6.326** (2.530)
Observations	244	241	176	176
Number of countries	26	26	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) DC vs. DB dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls. DC refers to defined contribution; DB refers to defined benefit.				

Table 27: Std. Deviation of Pension System Return: Open vs. Closed Dummy Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Open vs. closed</i>	-0.0875 (1.240)	-1.039 (1.044)	-0.859 (1.733)	0.762 (1.416)
<i>Std deviation of real GDP growth</i>		0.583*** (0.209)	0.305 (0.307)	0.513 (0.345)
<i>Std deviation of per capita GDP</i>		0.00178*** (0.000615)	0.000623 (0.00110)	0.000528 (0.00120)
<i>Std deviation of inflation</i>		0.698*** (0.114)	0.805*** (0.225)	0.412* (0.248)
<i>Std deviation of fiscal surplus</i>		-0.218 (0.305)	-0.805** (0.409)	-0.157 (0.441)
<i>Std deviation of exchange rate growth</i>		-1.451 (1.699)	-2.574 (2.057)	-1.661 (2.424)
<i>Std deviation of capital account openness</i>		-33.53*** (12.24)	-48.03* (24.95)	-73.50*** (24.44)
<i>Std deviation of stock market capitalization</i>			4.775 (4.766)	18.17*** (5.154)
<i>Std deviation of corporate bond market capitalization</i>			-8.074 (17.79)	-20.55 (17.57)
<i>Std deviation of stock of public debt</i>			-0.0224 (0.0786)	0.0582 (0.0820)
<i>Std deviation of credit to the private sector</i>			4.458* (2.413)	5.250* (2.839)
<i>Std deviation of real interest rate</i>			-0.124 (0.256)	-0.107 (0.296)
<i>Rule of law index</i>				-0.394 (4.502)
<i>Anti self-dealing index</i>				0.965 (2.002)
<i>Creditor rights index</i>				1.287 (1.541)
Constant	5.711*** (0.957)	3.417*** (1.141)	5.553*** (1.826)	2.680 (3.438)
Observations	244	241	176	176
Number of countries	26	26	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>open vs. closed</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 28: Std. Deviation of Pension System Return: Minimum Guarantee Dummy Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Minimum guarantee</i>	-1.188 (1.214)	-1.670 (1.062)	-2.370 (1.487)	-2.429** (1.051)
<i>Std deviation of real GDP growth</i>		0.587*** (0.207)	0.320 (0.307)	0.521 (0.339)
<i>Std deviation of per capita GDP</i>		0.00157** (0.000628)	0.000475 (0.00109)	0.000598 (0.00118)
<i>Std deviation of inflation</i>		0.699*** (0.113)	0.805*** (0.225)	0.549** (0.249)
<i>Std deviation of fiscal surplus</i>		-0.286 (0.308)	-0.848** (0.409)	-0.316 (0.440)
<i>Std deviation of exchange rate growth</i>		-1.221 (1.693)	-2.200 (2.065)	-1.224 (2.394)
<i>Std deviation of capital account openness</i>		-32.37*** (12.16)	-45.92* (24.78)	-49.58* (25.39)
<i>Std deviation of stock market capitalization</i>			4.730 (4.790)	13.25** (5.407)
<i>Std deviation of corporate bond market capitalization</i>			-4.294 (17.15)	-9.582 (17.93)
<i>Std deviation of stock of public debt</i>			-0.0244 (0.0784)	-0.00253 (0.0805)
<i>Std deviation of credit to the private sector</i>			4.212* (2.414)	3.633 (2.785)
<i>Std deviation of real interest rate</i>			-0.0971 (0.256)	-0.0158 (0.289)
<i>Rule of law index</i>				-6.439* (3.861)
<i>Anti self-dealing index</i>				0.770 (1.921)
<i>Creditor rights index</i>				2.667* (1.572)
Constant	6.234*** (0.936)	3.901*** (1.212)	6.588*** (1.786)	8.155*** (2.661)
Observations	248	245	176	176
Number of countries	27	27	16	16
R-squared
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Note: (1) *minimum guarantee* dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.

Table 29: Std. Deviation of Pension System Return: Multiple Funds Dummy Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Multiple funds</i>	-1.736 (1.322)	-0.488 (1.056)	-0.398 (1.628)	0.991 (1.704)
<i>Std deviation of real GDP growth</i>		0.610** (0.241)	0.632 (0.431)	0.0371 (0.502)
<i>Std deviation of per capita GDP</i>		0.000991 (0.00103)	0.00142 (0.00234)	-0.00295 (0.00309)
<i>Std deviation of inflation</i>		0.711*** (0.122)	0.161 (0.354)	0.608 (0.408)
<i>Std deviation of fiscal surplus</i>		-0.130 (0.450)	-0.424 (0.825)	-0.346 (0.843)
<i>Std deviation of exchange rate growth</i>		-1.049 (1.719)	-3.173 (2.569)	-3.979 (2.690)
<i>Std deviation of capital account openness</i>		-12.62 (20.22)	-8.023 (51.67)	-60.43 (57.38)
<i>Std deviation of stock market capitalization</i>			30.28*** (9.533)	18.76* (11.03)
<i>Std deviation of corporate bond market capitalization</i>			-22.45 (74.58)	-132.9 (88.73)
<i>Std deviation of stock of public debt</i>			0.0258 (0.0975)	-0.0526 (0.118)
<i>Std deviation of credit to the private sector</i>			5.602 (43.57)	45.72 (49.00)
<i>Std deviation of real interest rate</i>			-0.0643 (0.326)	-0.157 (0.324)
<i>Rule of law index</i>				-26.66 (17.57)
<i>Anti self-dealing index</i>				-10.82** (5.366)
<i>Creditor rights index</i>				30.84* (15.86)
Constant	6.109*** (0.912)	2.703*** (0.906)	3.153* (1.875)	19.80** (8.868)
Observations	101	98	62	62
Number of countries	13	13	6	6
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>multiple funds</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 30: Std. Deviation of Pension System Return: Years Since Creation Variable Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Years since inception</i>	0.0162 (0.0422)	0.0551 (0.0379)	0.0616 (0.0517)	-0.0482* (0.0263)
<i>Std deviation of real GDP growth</i>		0.598*** (0.212)	0.300 (0.312)	0.532 (0.349)
<i>Std deviation of per capita GDP</i>		0.00160** (0.000644)	0.000544 (0.00112)	0.000308 (0.00123)
<i>Std deviation of inflation</i>		0.699*** (0.113)	0.820*** (0.224)	0.361 (0.250)
<i>Std deviation of fiscal surplus</i>		-0.120 (0.351)	-0.936* (0.493)	-0.667 (0.559)
<i>Std deviation of exchange rate growth</i>		-1.774 (1.689)	-2.861 (2.048)	-2.435 (2.430)
<i>Std deviation of capital account openness</i>		-36.16*** (12.22)	-58.83** (26.11)	-79.51*** (24.26)
<i>Std deviation of stock market capitalization</i>			5.885 (5.003)	20.67*** (5.259)
<i>Std deviation of corporate bond market capitalization</i>			-13.20 (18.35)	-25.45 (17.72)
<i>Std deviation of stock of public debt</i>			-0.0375 (0.0789)	0.105 (0.0849)
<i>Std deviation of credit to the private sector</i>			4.321* (2.392)	5.053* (2.750)
<i>Std deviation of real interest rate</i>			-0.125 (0.255)	-0.264 (0.297)
<i>Rule of law index</i>				-0.777 (3.642)
<i>Anti self-dealing index</i>				0.704 (1.959)
<i>Creditor rights index</i>				1.258 (1.523)
Constant	5.342*** (0.805)	2.111** (0.989)	4.696*** (1.664)	5.029** (2.092)
Observations	241	238	169	169
Number of countries	27	27	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>years since inception</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 31: Std. Deviation of Pension System Return: Pension System Assets Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Assets under management</i>	0.00515 (0.0177)	0.0240 (0.0159)	0.0161 (0.0251)	0.0351** (0.0168)
<i>Std deviation of real GDP growth</i>		0.599*** (0.214)	0.309 (0.317)	0.603* (0.354)
<i>Std deviation of per capita GDP</i>		0.00165** (0.000665)	0.000760 (0.00114)	0.000349 (0.00123)
<i>Std deviation of inflation</i>		0.701*** (0.115)	0.801*** (0.225)	0.403 (0.247)
<i>Std deviation of fiscal surplus</i>		-0.169 (0.356)	-0.930* (0.498)	-0.510 (0.561)
<i>Std deviation of exchange rate growth</i>		-1.541 (1.703)	-2.853 (2.064)	-2.529 (2.437)
<i>Std deviation of capital account openness</i>		-39.57** (15.45)	-57.37** (26.35)	-80.51*** (24.55)
<i>Std deviation of stock market capitalization</i>			6.063 (5.054)	18.26*** (5.356)
<i>Std deviation of corporate bond market capitalization</i>			-16.43 (19.64)	-35.27* (18.08)
<i>Std deviation of stock of public debt</i>			-0.0215 (0.0791)	0.0771 (0.0805)
<i>Std deviation of credit to the private sector</i>			4.202* (2.415)	3.882 (2.798)
<i>Std deviation of real interest rate</i>			-0.144 (0.256)	-0.187 (0.293)
<i>Rule of law index</i>				-4.292 (3.552)
<i>Anti self-dealing index</i>				-1.024 (2.169)
<i>Creditor rights index</i>				1.477 (1.534)
Constant	5.473*** (0.821)	2.226** (0.940)	4.977*** (1.622)	6.283*** (2.171)
Observations	236	233	167	167
Number of countries	27	27	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>assets under management</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 32: Std. Deviation of Pension System Return: Number of Pension Funds Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Number of funds</i>	0.00393 (0.0107)	0.0105 (0.00686)	0.0112 (0.00935)	0.0113 (0.0102)
<i>Std deviation of real GDP growth</i>		0.645*** (0.220)	0.535 (0.369)	0.544 (0.377)
<i>Std deviation of per capita GDP</i>		0.0000833 (0.000932)	-0.000218 (0.00169)	-0.00110 (0.00228)
<i>Std deviation of inflation</i>		0.727*** (0.114)	0.232 (0.303)	0.257 (0.313)
<i>Std deviation of fiscal surplus</i>		-0.0273 (0.403)	-0.517 (0.732)	-0.679 (0.744)
<i>Std deviation of exchange rate growth</i>		-0.285 (1.626)	-2.828 (2.266)	-2.226 (2.313)
<i>Std deviation of capital account openness</i>		-32.73 (25.22)	-24.48 (41.35)	-37.15 (45.21)
<i>Std deviation of stock market capitalization</i>			31.53*** (8.369)	31.30*** (8.594)
<i>Std deviation of corporate bond market capitalization</i>			-46.33 (40.72)	-56.05 (41.41)
<i>Std deviation of stock of public debt</i>			0.0432 (0.0892)	0.0941 (0.0942)
<i>Std deviation of credit to the private sector</i>			-8.103 (7.314)	-8.109 (7.379)
<i>Std deviation of real interest rate</i>			-0.111 (0.296)	-0.161 (0.299)
<i>Rule of law index</i>				10.51* (6.220)
<i>Anti self-dealing index</i>				-1.539 (3.420)
<i>Creditor rights index</i>				-4.581 (4.064)
Constant	4.943*** (0.819)	2.587*** (0.927)	4.268*** (1.552)	1.191 (3.276)
Observations	128	125	75	75
Number of countries	19	19	9	9
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>number of funds</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

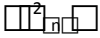
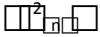
Table 33: Std. Deviation of Pension System Return: Market Concentration Test

Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Market concentration</i>	-0.0429 (0.0512)	0.00375 (0.0395)	0.117* (0.0624)	0.209*** (0.0605)
<i>Std deviation of real GDP growth</i>		0.565** (0.231)	0.782* (0.471)	-0.0239 (0.481)
<i>Std deviation of per capita GDP</i>		0.00150 (0.00141)	0.00336 (0.00297)	-0.00258 (0.00304)
<i>Std deviation of inflation</i>		0.741*** (0.114)	0.105 (0.364)	0.806** (0.379)
<i>Std deviation of fiscal surplus</i>		0.125 (0.486)	-0.736 (1.074)	-0.310 (0.990)
<i>Std deviation of exchange rate growth</i>		-1.959 (1.728)	-3.065 (2.647)	-4.037 (2.503)
<i>Std deviation of capital account openness</i>		-28.35 (37.81)	-44.03 (51.94)	-108.2** (52.52)
<i>Std deviation of stock market capitalization</i>			30.89*** (9.683)	12.87 (10.10)
<i>Std deviation of corporate bond market capitalization</i>			-9.174 (79.91)	-161.3** (81.59)
<i>Std deviation of stock of public debt</i>			0.0181 (0.0984)	-0.0953 (0.107)
<i>Std deviation of credit to the private sector</i>			1.389 (44.73)	38.98 (43.90)
<i>Std deviation of real interest rate</i>			0.0259 (0.328)	-0.0984 (0.291)
<i>Rule of law index</i>				-31.81** (15.35)
<i>Anti self-dealing index</i>				-19.97*** (5.477)
<i>Creditor rights index</i>				42.42*** (14.12)
Constant	8.908** (3.911)	1.942 (3.184)	-5.088 (4.971)	11.91 (8.306)
Observations	101	99	56	56
Number of countries	14	14	6	6
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>market concentration</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 34: Std. Deviation of Pension System Return: Foreign Investments Limit Test



Dependent Variable: Pension System Return Standard Deviation	(1)	(2)	(3)	(4)
<i>Foreign investment limit</i>	0.0153 (0.0134)	0.0210* (0.0119)	0.0359** (0.0168)	0.0154 (0.0152)
<i>Std deviation of real GDP growth</i>		0.630*** (0.233)	0.318 (0.341)	0.703* (0.385)
<i>Std deviation of per capita GDP</i>		0.00198** (0.000792)	0.000573 (0.00131)	0.000557 (0.00148)
<i>Std deviation of inflation</i>		0.679*** (0.120)	0.765*** (0.254)	0.348 (0.280)
<i>Std deviation of fiscal surplus</i>		-0.511 (0.463)	-0.789 (0.578)	-0.708 (0.651)
<i>Std deviation of exchange rate growth</i>		-1.766 (1.720)	-2.772 (2.056)	-1.872 (2.524)
<i>Std deviation of capital account openness</i>		-48.89*** (16.33)	-87.13*** (30.02)	-84.68*** (26.60)
<i>Std deviation of stock market capitalization</i>			5.420 (5.961)	17.14*** (6.273)
<i>Std deviation of corporate bond market capitalization</i>			-12.04 (20.53)	-18.15 (19.67)
<i>Std deviation of stock of public debt</i>			-0.0181 (0.0840)	0.0854 (0.0840)
<i>Std deviation of credit to the private sector</i>			3.622 (2.490)	3.462 (2.887)
<i>Std deviation of real interest rate</i>			-0.0827 (0.268)	-0.0729 (0.313)
<i>Rule of law index</i>				1.388 (4.271)
<i>Anti self-dealing index</i>				0.0676 (2.249)
<i>Creditor rights index</i>				-1.203 (2.265)
Constant	4.915*** (0.913)	2.286** (1.022)	4.259** (1.907)	3.239 (2.387)
Observations	186	183	131	131
Number of countries	26	26	16	16
Random Effects Estimator				
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
Note: (1) <i>foreign investment limit</i> dummy; (2) macroeconomic variables incorporated as controls; (3) financial sector variables incorporated as controls; (4) institutional variables incorporated as controls.				

Table 35: Test for Presence of Unobserved Effect

		Breusch & Pagan (1980) Statistic		
		(1)	(2)	(3)
Pension System Return Model		4,67	0,35	1,61
	p -value	0,0307	0,5561	0,2051
Pension System Return Standard		186,16	57,26	22,59
Deviation Model	p -value	0,0000	0,0000	0,0000

Note: the table reports the Breusch and Pagan (1980) statistic for the two performance models (in rows) and the different specifications (in columns) representing the sequential incorporation of control variables: (1) only macroeconomic variables as independent variables (n=1); (2) financial sector variables additionally incorporated as controls (n=1); (3) institutional variables additionally incorporated as controls (n=1).

Table 36: Test for Consistency of Random Effects Assumption

		Hausman (1978) Statistic		
		(1)	(2)	(3)
Pension System Return Model		14,38	25,54	25,62
	p -value	0,0134	0,0044	0,0122
Pension System Return Standard		8,18	9,84	42,08
Deviation Model	p -value	0,1464	0,4543	0,0000

Note: the table reports the Hausman (1978) statistic for the two performance models (in rows) and the different specifications (in columns) representing the sequential incorporation of control variables: (1) only macroeconomic variables as independent variables (n=5); (2) financial sector variables additionally incorporated as controls (n=10); (3) institutional variables additionally incorporated as controls (n=12).

APPENDIX 2: REFERENCES

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APPENDIX 3: SUMMARY OF PRIOR RESEARCH

This study represents an initial effort to analyze the investment performance of national private pension systems. The work began with a review of the relevant literature. A summary of that literature, organized by variable, is presented below. The purpose of this discussion is to provide additional background for the empirical work conducted in the main body of this report. It should be noted, however, that studies of pension fund performance at the level of individual countries are relatively scarce.

Matters of Size

In the United States, the pioneering work is Ippolito and Turner (1987) which studies 1526 pension plans in the United States. The authors use both the S&P 500 and a stock-bond mix index as benchmarks to study returns net of fees. They find that larger pension plans substantially outperformed smaller ones. In the United Kingdom, the studies by Blake, Lehmann and Timmermann (1999 and 2002) evaluates the returns of over 300 pension plans. Both studies find underperformance with respect to external indices as benchmarks. Pension funds in the Netherlands are analyzed, inter alia, by Van Riel et al. (2003) and Kakes (2006). The first shows that at least a third of the shift in the 1990s in the investment portfolio of pension funds towards foreign equity is attributable to a change in investment strategy on the part of the largest pension fund. The second examines 77 pension funds and finds that large institutions invest more assets in equities and tend to hold more foreign assets than do smaller ones. Gerber (2005) used disaggregated data to analyze the behavior of the private pension funds in Switzerland.

Risk Mitigation

A frequently used procedure for quantifying risk consists of determining the amount of money that would be lost if a return is negative by a certain number of standard deviations (i.e., *value at risk* or VaR) under the assumption that returns are normally distributed. However, this approach underestimates risk since extreme outcomes are more frequently observed in financial markets than would be expected if returns were distributed normally. Moreover, extremely negative returns are more frequent than are extremely positive returns, which implies that the distribution is not symmetrical about the mean. Furthermore, there are also alternative investments to equity and bonds – such as real estate, private equity, venture capital, commodities, derivatives, and hedge funds –which differ in terms of historical returns, volatility, and interdependence (see Kakes and Broeders, 2006). Finally, risk reduction by means of diversification is simple and can be achieved at very low cost in well-developed markets. It may be more difficult to accomplish in less developed markets.

Sophisticated pension funds and insurance companies assess overall risk in terms of the characteristics and coherence of assets and liabilities on its balance sheet, a technique known as *asset and liability management* (ALM) which has been used for some time. Under ALM, liabilities constitute an integral element of an institution's financial structure. In recent years, changes in disclosure and regulation have increasingly highlighted the significance of a pension

fund's overall risk profile, underscoring the need for and merits of ALM.¹⁴ At the beginning of this century, defined benefit pensions funds were hit by a double blow when both equity prices and interest rates declined at the same time. This prompted declines in asset values and increases in liabilities, thereby causing a sharp decline in the funding ratios of many defined benefit pension plans (Boeri *et al.* 2006). As a consequence, many companies around the world have shifted from defined benefit to defined contribution pension schemes, both to avoid the IFRS reporting requirement and to reduce their risks.¹⁵ This trend may be accelerated under the current ongoing financial crisis given that it is deeper and expected to last longer. In the case of the Dutch mandatory private pension pillar, both the switch from using final wages to career-average wages in existing defined benefit plans and the introduction of defined contribution elements to the scheme represent a shifting of risk from plan sponsors to participants (Ponds and van Riel, 2007). With regard to single fund mandatory pension systems in Latin America, Martínez and Murcia (2007) finds that risk based investment strategies to better match pension assets with liabilities are lacking; accordingly, investment portfolios are not efficiently matched to future liabilities or to the risk profile of many participants.

The performance of pension fund investments are also vulnerable to interest rate risks. The impact of real interest rates changes on investment performance is ambiguous. For example, if the portfolio of a defined contribution plan is dominated by short term debt instruments, an increase in real interest rates will improve performance. However, if portfolio composition is dominated by long term debt instruments, performance will worsen. Finally, if the portfolio is dominated by equities, an increase in real interest rates will worsen performance because stocks prices typically fall when the cost of capital rises. In the case of a defined benefit pension plan, a mismatch between the duration of assets and liabilities will make the plan vulnerable to changes in the interest rate. Typically, pension funds adopt hedging strategies to mitigate against such risks, but the securities are not available in many medium and smaller developing countries.

Controversies on Investing in Equity as Opposed to Bonds

There has been an intense debate over the merits of investing in equities by pension funds (see Siegel, 1998, and Campbell and Viceira, 2002, among others). Advocates of investing in equities cite two advantages: equities can be expected, on average, to generate higher expected returns (a consequence of the *equity risk premium*) and the fact that the risk of loss for an equity portfolio falls as the investment horizon increases (the *time diversification* effect). Others argue that equity returns are mean-reverting (meaning that periods of disappointing returns are followed by periods of above-average returns and vice versa). Another argument focuses on

¹⁴ According to IAS 19, implemented in 2005, under the International Financial Reporting Standards (IFRS), listed firms have to report unfunded liabilities associated with defined benefit pension schemes in their financial statements. The emergence of fair value principles for pension fund accounting has forced pension funds to redefine their risk management strategies (Kortleve *et al.* 2006).

¹⁵ This bolstered the trend from defined benefit to defined contribution pension schemes in the United States and United Kingdom (Munnell, 2006). In 2004, defined contribution pension assets amounted to 22% of total occupational plan assets in the United Kingdom, 35% in the United States, and 9% in the Netherlands (OECD, 2006).

economic reasoning. In theory, the value of equities should be driven by a company's discounted future dividends. Dividends, in turn, depend on profits. On average, corporate profits are fairly stable component of gross national product (GNP). In the long run, therefore, profits (and, consequently, equity prices) should grow with the economy. A defined benefit pension fund's real liabilities are determined by movements in wages and inflation. If equity prices move in line with nominal economic developments, then they are an admittedly imperfect hedge against both inflation and productivity growth which may trigger wage increases (Kakes and Broeders, 2006).

Critics of this investment strategy typically admit that the expected return on equities is higher than that of bonds – otherwise investors would not be prepared to accept the risk – but they point to the fact that there have been prolonged periods of sustained economic depression during which time equities generated lower returns, on average, than did bonds. In addition, economic theory suggests that the risk-adjusted return should be equal for all investments. Thus, investing in equities should not in itself create value for a pension fund, but it will impose different risks on stakeholders (see Siegelaer, 2003): higher expected returns result in a higher probability of future increases in contribution rates (for defined benefit plans) and lower final benefits (for defined contribution plans). See Kakes and Broeders (2006). Finally, the longer the investment horizon, the greater the possibility of sharply negative outliers (see Kakes and Broeders, 2006).

No consensus exists in the literature about the mean reversion property of equity returns. Some studies find significant negative autocorrelation over a horizon of several years. In some cases, however, this may be due to the period chosen for the study and to measurement errors resulting from small samples. Even if it exists, mean reversion is not a valid argument according to Bodie (1995) which brings option valuation theory to bear on the question. If it is assumed that in the longer run equities are less risky, then the premium for insurance against underfunding should decrease with time. Bodie shows that the opposite is true: the longer the term to maturity, the higher the value of the put option needed to provide protection from underfunding. Because no market exists for options contracts with very long maturities, however, the validity of this theoretical analysis cannot be assessed in practice (see Kakes and Broeders, 2006).

Finally, there is an alleged interrelationship between equity returns and inflation, but the relationship is, by no means, beyond dispute. Notably, the 1970s – a period of marked inflation – was also one of the worst decades in terms of equity returns (Kakes and Broeders, 2006).

Pension Funds and Asset Prices

No hard evidence exists to support the assertion that asset prices behaved differently before and after the introduction of funded pension systems (see Bebczuk and Musalem, 2008a). Although little research has thus far been published, at least two studies are consistent with this view. Walker and Lefort (2002) shows that pension funds had a stabilizing effect on security prices across a sample of 33 emerging countries – a finding at odds with the price pressure presumably introduced by funded pension schemes. Voronkova and Bohl (2003) demonstrates

that securities prices in Poland were not significantly influenced by the trading of securities by pension funds.

Investment Regulations and Performance

Regulatory provisions and other features of the pension scheme design also impact performance, particular in the case of mandatory defined contribution schemes (see Bebczuk and Musalem, 2008a). First, pension funds are typically restricted to buying securities that are listed, liquid, and rated. While this is sensible from the perspective of containing risk, it has had the pervasive effect of perpetuating a historical concentration of trading in a few securities and discouraging new firms from coming to market. Second, strict investment guidelines on portfolio composition may have outright prevented (or created incentives to discourage) investment managers from constructing portfolios that efficiently balance return and risk. Third, pension funds are in many cases parts of financial conglomerates; this may partly explain their bias toward bank deposits. Finally, features of some pension systems – such as guaranteed minimum returns, the use of relative benchmarks based on the performance of the overall industry, and salary-based commissions – may discourage pension fund managers from searching for new issuers and instruments.

The establishment of a minimum return relative to the industry-wide return creates an asymmetry of incentives (fund managers are penalized for underperforming the market but not as rewarded for over performing). This encourages herding behavior whereby all managers buy a similar portfolio, an apparent lack of shareholder activism, and a narrower offering of securities. See Jara, 2006, Laserna, 2007, Reveiz and Leon, 2007, Reveiz et al., 2007, and Bebczuk and Musalem, 2008a). Voronkova and Bohl (2003) provides evidence of herding among Polish pension funds; Srinivas, Whitehouse, and Yermo (2000) observes the same pattern in Latin American countries. One might conclude that competition among pension funds for new clients should substitute for the absence of other performance incentives; yet, workers in many countries that have introduced multipillar pension reforms continue, for the most part, to view contributions as taxes and do not choose their fund in a way that exerts any meaningful market discipline (see CEF, 2008).

Several studies have been published on the impact of investment restrictions on the investment performance of pension funds. See Berstein and Chumacero (2005) for Chile, Pereda (2007) for Peru, and Carriedo (2007) for Mexico, respectively. Berstein and Chumacero (2005) quantifies – using a counterfactual exercise – the cost of investment limits on portfolio returns for the period 1981 to 2002, prior to the implementation of multifunds. Three investment strategies were considered: (i) a minimum variance portfolio, (ii) portfolio management based on quadratic preferences, and (iii) an efficient portfolio based on VaR. The results suggest that the costs of imposing investment limits can be considerable. In the absence of limits, the total assets managed by the pension system could have been at least 10% larger. On the other hand, Pereda (2007) estimates the impact of investment limits on the efficient frontier of pension funds in Peru for the period 1995-2004 and concludes that returns were lower than optimal by 2.5% annually, of which 1.9 percentage points are attributable to investment limits and 0.6

percentage points are attributable to the fact that fund managers were not, on average, investing portfolios efficiently.¹⁶ Finally, Carriedo (2007) estimates that the flexible investment regulations in Mexico, introduced since the start of the system until 2007, have increased annual average returns by 127 basis points since 1997 and 301 basis points in the last 12 months.

Other studies have shown that the portfolios of many mandatory pension funds are financially inefficient within the regulatory framework under which they operate. Put simply: for same level of risk, funds could increase their expected returns, see Jara, Gómez and Pardo (2005) which estimates that financial regulations in Colombia have reduced returns by one percentage point, while portfolio managers themselves have adopted inefficient strategies that have reduced returns by another percentage point. Reveiz and Leon (2007) and Reveiz et al. (2007) show for Colombia that the length of efficient frontiers without investment restrictions is significantly larger than frontiers with investment restrictions. This suggests that regulatory limits on investments significantly constrain the efficient set of portfolios available to pension funds (i.e., they reduce access to superior levels of Sharpe ratios and higher diversification).

Single Versus Multiple Funds

There are several approaches to investment regulation. On one extreme are systems based on regulations that specify quantitative limits to investment; on the other are systems where regulation only imposes a prudent person standard for portfolio management. In between are other approaches. One way to make the investment regime flexible is to open the market to multiple funds. This allows funds to cater to the risk preferences and investment horizons of certain groups of plan members while permitting more efficient portfolio management in relation to the life cycle and restoring regulatory consistency between instruments and objectives. The economy as a whole benefits from such an approach as resources are allocated more efficiently. According to Cheyre (2006), the introduction of multiple funds in Chile increased the average annual rate of return of all funds by 2.4 percentage points over the period September 2002 to December 2006. Cumulative real returns since the inception of multifunds in Chile (September 2002 to June 2007) comport with financial theory: higher returns have been earned by more diversified funds (including those with both domestic and international assets). The risk profile of different funds since year 2002 has also been consistent with theory: greater volatility has been observed for funds with higher exposure to variable income instruments while the least volatile fund had no exposure to variable income instruments (see Conrads, 2007).

International Diversification

Despite the existence of general consensus that international diversification should generally be beneficial, it is not entirely free of controversy (see Bebczuk and Musalem, 2008b). Burtless

¹⁶ The impact of investment limits on the performance of pension funds in Peru is investigated further in Rivas-Llosa and Camargo (2002). It uses daily data between April and September 2002 and finds a lower real risk adjusted return relative to the optimum portfolio (0.323 vs. 0.463).

(2007) is rigorous and compelling study in support of foreign investment by developed countries in emerging countries – and vice versa – using financial return data from large countries over an extended period from 1927 to 2005. Relying on more conventional portfolio outcomes, Roldos (2004) and Chan-Lau (2004) both advocate for increased foreign investments by pension funds in Latin America. Alegría (2005) shows that the returns generated by internationally diversified pension portfolios in Chile dominated those generated by domestically focused portfolios between 1990 and 2004. Using a similar approach, Jara, Gómez and Pardo (2005) shows that restrictions to foreign investment significantly reduce the potential efficiency of pension portfolios in Colombia. Consequently, portfolios are concentrated in domestic assets with highly correlated returns – but this risk is not reflected in a higher expected return (Martínez and Murcia, 2007).

Some empirical studies, however, are less enthusiastic about the efficiency gains that accrue from holding more foreign assets. Davis (2002) studies 10 OECD countries and three emerging economies between 1970 and 1995 and compares actual pension fund returns (and the volatility associated with those returns) with the returns that would have been earned by four hypothetical portfolios holding (i) domestic bonds and equities in equal shares, (ii) 20% foreign assets, (iii) 40% foreign assets, and (iv) a global portfolio comprising all markets weighted by their corresponding capitalizations. Although the hypothetical portfolios all delivered higher returns than were actually earned, the internationally diversified portfolios generated similar returns to a portfolio of domestic equities and bonds in equal shares – and were only slightly less risky.

These studies capture the dilemma facing portfolio managers: higher returns (which could be attained by increasing the share of foreign assets in investment portfolios) necessarily entail higher risks (see Bebczuk and Musalem, 2008b). Moving further along the efficient frontier (that is, seeking higher returns without incurring any more risk than is necessary from the perspective of efficiency) forces asset managers to significantly increase their holdings of foreign assets. The overall conclusion is that international investment may help pension fund managers create more efficient portfolios – that is, attain the same expected returns with less risk – in some, but not all, cases. However, there are cases where such a move will only enhance returns if managers are willing to accept more risk (see Reveiz and Leon 2007). Finally, Reveiz et al. (2007) points out that effective diversification helps to reduce risk for the same level of expected return.

Although foreign investment, on the whole, appears to be a viable strategy for boosting returns, the conclusions is necessarily based ex post on market performance. Past performance may not always prove to be a good predictor of future performance. Finding, thus, depend on the time periods and countries sampled (see Bebczuk and Musalem, 2008b). Moreover, Solnik, Bourcelle, and Le Fur (1996) identifies another problem: correlations in asset returns across countries increase strongly when markets are turbulent, a situation which is only likely to grow more significant over time as financial markets become increasingly integrated.

Management Fees

Jara (2006) shows that when fund managers are not allowed to levy commissions based on the returns they earn on behalf of participants, they may not face adequate incentives to pick efficient portfolios.¹⁷

Investor Rights, Transparency and Corporate Governance

Bebczuk and Musalem (2008b) argues that the legal enforcement of investor rights and transparency with respect to reporting and enterprise behavior are essential to the efficient functioning of financial markets. This is particularly true for emerging markets when it comes to attracting foreign investment because the informational asymmetries associated with investing in such markets are often severe. The lack of such safeguards in some emerging markets can reasonably be expected to discourage investment in those markets by foreign pension funds. It is worth noting that the existence of a good legal and regulatory framework does not necessarily imply effective compliance and enforcement. A related issue is the absence of proper standards for corporate governance (or the ineffectiveness of mechanisms for enforcing those standards) and the presence of controlling shareholders (see Bebczuk and Musalem, 2008b). These conditions can foster the development of agency problems and the expropriation of value by insiders at the expense of minority shareholders. Bebczuk (2007) and Klapper and Love (2002), among others, discusses such conflicts of interest and provides evidence to demonstrate the existence of poor corporate governance in some emerging markets. Such an environment tends to discourage flows of investment capital into those markets. McKinsey & Company (2002) surveyed 200 major international institutional investors and found that 84% of them considered the existence of a good corporate governance framework to be at least as important as the financial condition and prospects of emerging market companies.

¹⁷ Moreover, the management fees paid to the managers of mandatory pension funds of Latin America and Eastern and Central Europe are calculated on the basis of monthly contributions from pension participants and their employers. Hence, commissions are paid once per unit of contribution regardless of how long those contributions are ultimately invested.

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Abstract

This study investigates the performance of private pensions systems across countries — a topic which has yet to be adequately addressed in the literature. Specifically, this study examines the relationship between pension fund performance (as captured by gross real rates of return and the three year standard deviation of those returns) and the structure of a country's private pension industry and the design of its pension schemes. A database covering 27 countries over the period 1990-2007 was created for this research. The study's key findings include (i) higher returns are associated with size (systems with more assets under management tend to generate higher returns), type (occupational schemes tend to generate higher returns than do personal pension schemes and closed schemes tend to generate higher returns than do open schemes), and number (systems with multiple funds tend to generate higher returns than those with a single fund) and (ii) lower volatility in pension system returns is associated with older systems, voluntary (rather than mandatory) systems, systems with restrictions on foreign investing, and systems with minimum return guarantees.

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