

HOW LONG IS LONG TERM IN EMERGING ECONOMIES?

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Abstract

This paper studies to what extent emerging market investments are long term. We use unique monthly and daily asset-level portfolios of Chilean pension funds between 1995 and 2005, and compare them to Chilean and US mutual funds. This comparison provides a useful case study because pension funds are thought to be long-term investors and Chile has been a pioneer among emerging markets in pension fund and capital market reform. The paper shows that pension funds have large amounts of short-term holdings: bank deposits (including cash), government paper, and corporate debt. This is especially the case when compared to US mutual funds. Moreover, pension funds are not longer than Chilean mutual funds (which are subject to significant redemptions). Short-termism is not driven by liquidity needs, tactical behavior, or lack of instruments. Instead, it seems to be partly explained by the desire to hedge inflation and currency risks and by agency factors that tilt managers' incentives.

JEL Classification Codes: G11, G12, G23, G28, O16

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1. Introduction

The behavior of investors and, in particular, the maturity structure of their investments continues to receive much attention. This interest experienced a boost with the emerging market crises of the 1990s, but the need of understanding what investors do becomes even more relevant as crises engulf developing and developed countries and the subprime crisis undermines the basic tenets of modern capital markets.

Having access to long-term financing allows government and firms to finance large projects and investments over time, reducing rollover risk and the potential for crises. In fact, several of the well-known crises in emerging economies have been linked to maturity mismatches.¹ As a consequence, many developing countries have actively tried to develop markets for long-term lending through various measures that tackle different parts of the financial system, such as the promotion of institutional investors, the extension of the maturity structure of sovereign debt, the reform of domestic capital markets, and the liberalization of international capital flows.

Given all the benefits of long-term debt and the efforts to encourage it, what explains then short-term borrowing? Are maturities being lengthened? Different explanations to the maturity structure have emerged. On the demand side, emerging countries (borrowers or firms) might borrow short term to signal markets that they are committed to sound policies and economic management (Calvo 1988; Blanchard and Missale, 1994; Rodrik and Velasco, 1999; and Jeanne, 2004). By having to rollover debt, investors can monitor borrowers frequently and punish them if they deviate from what is considered optimal, thus reducing the cost of borrowing. On the supply side, investor risk aversion might prompt countries to borrow short term. As argued in Broner et al. (2007),

¹ See The Economist (1999).

by lending long term, investors incur the price risk of long-term bonds, since they might need to sell those bonds before they mature. Therefore, the risk premium charged on long-term debt induces the demand side to borrow short term. In fact, Broner et al. (2007) show that emerging countries need to pay, on average, an extra 4 percentage points annually to borrow long term relative to short term (3% for a 3-year bond vs. 7% for a 12-year bond), on top of what Germany and the US pay for similar bonds. As the cost of borrowing increases, countries reduce the maturity structure of issuance. A related supply explanation for the prevalence of short-term debt contracts that is based on market discipline has been proposed by Stein (2005) to account for the prevalence of open mutual funds with short-term investments in the US. When investors can discipline fund managers by withdrawing money after poor performance, as in the case of open funds, managers may not be able to take advantage of arbitrage opportunities in long-term assets that take time to return to fundamentals (Shleifer and Vishny, 1990) and rely excessively on short-term investments.² From a different perspective, de la Torre and Schmukler (2004) argue that short-term debt might be a tool to cope with systemic risk prevalent in emerging economies. As systemic risk rises, short-term debt increases as a way to reduce price risk, at the expense of increasing credit risk.

Although the literature has emphasized in a number of ways that investor behavior is important to understand debt maturity structure, little evidence exists on what investors actually do and how they manage their portfolios.³ In particular, many

² Although this implies that under some conditions an open fund structure can be socially inefficient, Stein (2005) shows that a closed-fund equilibrium may not be sustainable if good managers can signal their type by offering an open structure.

³ This need has become more urgent as the US subprime crisis shows that incentives for institutional investors to invest in a socially optimal manner can be distorted. See Calomiris (2008) and Malevergne and Sornette (2008).

questions arise regarding portfolio maturity. For example, what decisions do investors make in terms of the investment horizon of their investments? How long are their investments? How do they vary by type of investors and with shocks, such as regulatory changes and crises? How do investors manage risk? Does the maturity of their investments vary by instrument? Is it affected by liquidity needs? Are their decisions constrained by the supply side of instruments (the demand side of funds)? Are there agency problems that prevent investors from following an optimal portfolio?

This paper sheds new light on the debate over debt maturity by analyzing unique data on the portfolios of institutional investors, looking at a benchmark emerging market case in which the conditions are set in order to foster long-term investments. In particular, we study detailed asset-level holdings over time of Chilean pension funds and compare them to those held by Chilean and US mutual funds. This analysis presents great advantages in order to fully understand how investors manage long-term investments and how long these maturities can be extended in emerging markets.

First, institutional investors are expected to invest long term and have become big players in financial markets across countries, managing professionally a large pool of assets. This is especially the case for pension funds, since pensioners save for retirement and contribute a steady flow of funds for many years.^{4,5}

⁴ Davis (1995) argues that increases in the holdings of pension funds (through a pension reform, for example) improve the depth of capital markets since they invest in long-term and riskier assets. Impavido and Musalem (2000) argue that pension funds also increase innovation, competition, and efficiency of capital markets. Impavido et al. (2003) find that the institutionalization of savings increases the depth of stock and bond markets and in some cases improves stock market liquidity.

⁵ Importantly, since pensioners are required to hold their investments in at least 1 pension fund until retirement, this gives stability to the system as a whole. That is, pension funds are supposed to receive net inflows, at least during their initial (accumulation) phase and as long as there is a relatively young contributing population.

Second, among emerging markets, Chile has a relatively developed capital market with many types of large institutional investors, and the government has made a conscious effort to try to extend their portfolio maturity structures. On the supply side, Chile was a pioneer in pension fund reform, by replacing the publicly administered, pay-as-you-go, defined-benefit public pension system with a mandatory privately administered, defined-contribution (DC) pension fund system in May 1981.⁶ Many developed and developing countries have followed suit.⁷ As a result of the reforms, the assets managed by Chilean pension funds have become substantial, reaching 59% of GDP at the end of 2005.⁸ In addition to pension funds, Chile has a broad institutional investor base where insurance companies and mutual funds are the other major players, managing assets corresponding to 20% and 11% of GDP, respectively. On the demand side, Chile has also made reforms to foster capital market development, with corporations and the government issuing a wide range of securities including a threefold extension of the maximum maturity of local currency bonds issued by the central bank from 200 to 700 days.⁹ Moreover, Chile's stable macroeconomic situation since the early 1990s and its long history of supplying inflation-linked instruments to protect investors from inflation risk also reduce the risk of long-term lending.

⁶ The proposal for the new system was presented in 1980 and was actually implemented during 1981. For more details on Chile's pension reform, see De Mesa and Mesa-Lago (2006).

⁷ They include Argentina, Bolivia, Colombia, Costa Rica, the Dominican Republic, El Salvador, Hungary, Kazakhstan, Lithuania, Mexico, Peru, Poland, Slovakia, Sweden, the UK, and Uruguay. Also in the US, proposals to reform the social security system have also been recurrently considered. See Disney and Emmerson (2005), Palmer (2000), for more details on pension system reform in the UK and Sweden, respectively. Also, Queisser (1998), De Ferranti et al. (2002), Gill et al. (2005), Rutkowski (1998, 2002) and Holzmann and Hinz (2005) provide a detailed description of the pension reforms in developing countries by region, covering Central Asia, Central and Eastern Europe, Latin America and the Caribbean, Sub-Saharan Africa, and South Asia.

⁸ See De Mesa and Mesa-Lago (2006).

⁹ For the link between capital market development and institutional investors, see Raddatz and Schmukler (2008), and references therein.

Third, the comparison between Chilean pension funds and US mutual funds sheds light on how far emerging markets' institutional investors can extend the maturity of their fixed-income assets relative to investors that operate in a developed capital market. On the other hand, the comparison between Chilean pension funds and Chilean mutual funds isolates factors that are specific to Chile and shows whether the differences with US investors are particular to pension funds or apply more generally to fund managers.

Last but not least, by working with Chile we were able to obtain unique data on detailed portfolio holdings of sovereign bonds, corporate bonds, and bank deposits (including cash) at daily and monthly frequencies. In total, we analyze the universe of 57 pension funds maintained by the 24 pension fund administrators that have operated in Chile between 1996 and 2005, and 79 Chilean mutual funds operating between 2002 and 2005, with assets under management of 75 billion US dollars, and 3 billion US dollars, respectively, as of December 2005.¹⁰ We also count with information on the maturity structure of approximately 500 multi-sector and short-term US mutual funds operating between 2003 and 2005.

The main stylized facts of the paper can be summarized as follows. Pension funds tend to hold a large amount of short-term instruments (bank deposits including cash, government paper, and corporate debt), which can be easily liquidated.¹¹ For example, over the entire sample period, pension funds hold 25% of their assets (excluding equity) up to 1 year, 46% up to 3 years, and 75% up to 5 years. Relative to the US, the maturity structure of Chilean pension funds is much shorter. For example, during the relevant

¹⁰ We consider PFAs that result from the merger of 2 existing administrators as different from their predecessors.

¹¹ In fact, as Raddatz and Schmukler (2008) show, these instruments are held up to maturity, so they are not liquidated in secondary markets.

period, pension funds in Chile hold 61% of their portfolio in assets with a maturity of up to three years, while US multi-sector mutual funds and US short-term mutual funds hold 10% and 36% of their portfolios in assets with a maturity of up to 3 years, respectively. That is, Chilean pension funds are shorter-term investors even when compared to US *short-term* mutual funds. Also, the maturity structure of pension funds is similar to that of Chilean mutual funds, indicating that the difference in maturity structure as compared to the US is not particular to Chilean pension funds but seems to be a common characteristic among Chilean fund managers.

In addition to documenting the surprising degree of short-termism of Chilean pension funds, the paper also investigates some of its potential causes. We find that the short-termism is not driven by liquidity needs, tactical behavior, or lack of instruments. For example, during the period under analysis, pension funds have constantly received large net inflows (not outflows) from new and existing pensioners. Outflows for individual administrators are negligible. This contrasts with the significant outflows mutual funds in Chile and the US witnessed during the period analyzed. Moreover, pension funds do not seem to accumulate cash and other short-term investments in anticipation of future buying opportunities, such as the relaxation of regulation or an unexpected crisis. Also, pension funds are not exhausting the availability of long-term instruments. In fact, pension funds demand well below the total issuance of government bonds at different maturities.¹² Part of the explanation for the maturity structure of pension funds could come from their risk management strategies and from the incentives managers face. Pension funds are significantly more long-term oriented when investing in

¹² This is consistent with the results in Raddatz and Schmukler (2008) that show that pension funds do not invest in all of the available and pre-approved assets in the Chilean market.

inflation-indexed and US dollar instruments relative to nominal ones. This suggests that pension funds try to hedge inflation and currency risks. However, this is only part of the explanation. Agency factors could also be explaining their behavior. Although pension funds are expected to invest long term, they seem to behave as pure asset managers and evidence suggests that they face incentives to generate short-term returns and to avoid deviating from average industry returns. The combination of these managerial incentives and the relative riskiness of long-term investments in emerging markets could in principle account for the short-termism we document.

The rest of the paper is organized as follows. Section 2 summarizes very briefly the main features of the Chilean pension system. Section 3 describes the data. Section 4 characterizes the maturity structure of pension funds. Section 5 analyzes what factors might determine the maturity composition. Section 6 concludes.

2. Brief Account of the Chilean Pension Fund System

Chile was a pioneer in pension fund reform and, as a consequence, its pension fund system offers a long and rich history to analyze. Chile introduced a reform towards privately-managed, defined-contribution pension funds in 1980 with the objective of overcoming the inherited fiscal burden of the old regime, reducing the public sector's role in economic affairs, reducing taxes, and fostering capital market development, among other objectives.¹³ In May 1981, the pension law replaced the pay-as-you-go system with a fully-funded capitalization system based on individual accounts operated by the private sector and regulated by the Superintendency of Pensions (*Superintendencia de Pensiones*). At the time of the transition, contributors were given the choice of remaining

¹³ For more details, see Larraín (1993), Edwards (1996), and SAFP (2003).

in a national state-run defined-benefit system or transferring to the new individual account system. All new entrants to the wage workforce would be automatically enrolled in the new scheme and would need to select a pension fund administrator (PFA) to manage their accounts, but could not select individual investments themselves.

During the first 10 years of the system, each PFA managed a unique fund in which all contributions were invested according to a set of quantitative regulations that we describe below, thus offering no choice to the individuals in terms of risk-return combinations. The set of choices was expanded in March 2000 by the introduction of a new fund type (Fund 2), and again in August 2002 by the implementation of the multi-fund scheme in which all PFAs started offering a set of 5 different funds to their contributors (Funds A to E). These funds are each subject to different restrictions on their asset allocation and, therefore, offer a different risk-return combination, with Fund A (Fund E) being the most (least) risky. Depending on their age and gender profile, contributors can choose among a subset of these 5 funds. In our analysis, we consider separately the entire available sample period (July 1996 to December 2005) and the multi-fund period (September 2002 to December 2005), to allow for adequate comparisons. The latter period is considered to be a more stable period, more representative of the current characteristics of the system. It is less affected by mergers and acquisitions as the system consolidated after the reforms carried out in September of 2002.

Pension funds are subject to a minimum return regulation that establishes that administrators are responsible for ensuring an average real rate of return over the previous 36 months that exceeds either (i) the average real return of all funds minus 2

percentage points for Funds C, D, and E, and minus 4 percentage points for Funds A and B, or (ii) 50% of the average real return of all the funds, whichever is lower.^{14,15}

Several regulations exist with respect to how each pension fund and pension fund administrator can invest in different instruments. However, importantly for this paper, no regulation exists on the maturity structure of their investments. That is, pension funds can hold assets of any maturity as they see fit to achieve their goals. With respect to the regulations on instruments, limits on domestic fixed-income (variable-income) investments gradually increase (decrease) as funds become less risky (i.e., when one moves from Fund A towards Fund E).^{16,17}

Since their inception, assets under pension fund management increased substantially both in absolute and relative terms. In 2005, pension funds managed around 75 billion dollars, an amount that was almost 2.5 times the 1996 value in real terms. As a share of GDP, assets managed by pension funds increased 1.6 times, from 37.4% in 1996 to 57.5% in 2005. Since the creation of the multi-fund scheme in August 2002, Fund C, which is the continuation of the former Fund 1, has been the fund with the largest relative

¹⁴ The average real rate of return to calculate the minimum return changed from 12 months to 36 months in October 1999.

¹⁵ For this purpose, PFAs must keep a return fluctuation reserve equal to 1% of the value of each fund, which is used if the minimum return is not achieved. When the difference is not completely covered by this reserve or the administrator's funds, the state must provide it. However, in this case or when the reserve is not restored after being used (in a 15-day period), the PFA's operating license can be revoked.

¹⁶ Fund A is the riskiest fund, having the lowest (highest) limits on domestic fixed-income (variable-income) instruments across all 5 funds. Fund E is the most conservative fund, having the highest limits on fixed-income instruments, the only instruments in which its assets are allowed to be invested. Limits on shares of domestic mutual funds are the same (5%) for Funds A, B, and C, but the aggregate limit for shares of domestic mutual and investment funds gradually decreases – from 40% (Fund A) to 20% (Fund B) to 10% (Fund C). For foreign investments, the limit is set at the PFA level and was relaxed twice during 2003 (becoming effective in May 2003 and March 2004). The maximum allowed by law is 30% of the value of all funds managed by a single PFA.

¹⁷ Regarding limits for specific instruments, 2 of them address instruments that do not require the Risk-Rating Commission (*Comisión Clasificadora de Riesgo*, CCR) approval. For corporate stocks and shares of mutual and investment funds that do not require the CCR's approval, pension funds can invest either 3% (Funds A and B) or 1% (Funds C and D) of their assets. For foreign investments and other publicly traded securities that do not need such approval, the investment limit as a share of the pension fund's assets is 1% for Funds A, B, C, and D.

share of assets in the system. However, the relative participation of the 2 riskiest funds (Funds A and B) has been steadily increasing.¹⁸

3. Data Description

The data used in this study consist of holdings and returns of institutional investors and come from different sources. The data on pension funds come from the Superintendency of Pensions (*Superintendencia de Pensiones, SP*). The data on Chilean mutual funds come from the Superintendency of Securities and Insurance (*Superintendencia de Valores y Seguros, SVS*). The data on US mutual funds come from Morningstar and the Investment Company Institute (ICI). Additional data come from the Central Bank of Chile (*Banco Central de Chile*).

For pension funds, we use a panel of their portfolio investments in fixed-term assets for each of the existing funds during the period 1996-2005 at monthly and daily frequencies. We use panel data with the amount of deposits (including cash as deposits with a 1-day maturity), corporate bonds, and government bonds held by fund per unit of time. We define a fund as a pair PFA/fund type (e.g., Fund C of PFA *Aporta* configures a single fund). At a monthly frequency, there are a total of 7,501,210 observations, representing all securities held by at least 1 fund. The dataset contains information on the holdings of 104,789 different securities, for up to 57 funds, between July 1996 and

¹⁸ The increasing importance of Funds A and B is due to: (i) SP's automatic allocation of contributors who do not choose a fund in which to deposit their monthly contributions to a specific fund, especially from November 2002 to November 2003, and (ii) the voluntary switching of accounts from more conservative to riskier funds as an attempt of younger affiliates to achieve higher returns. The automatic allocation works as follows: (i) contributors younger than 35 years-old are assigned to Fund B, (ii) contributors older than 35 years-old but younger than 55 (men)/50 (women) years-old are assigned to Fund C, and (iii) contributors older than 55 (men)/50 (women) years-old are assigned to Fund D. As of April 2007, about 68.6% of the system's 8.63 million affiliates had been automatically assigned by SP, of which 42%, 46%, and 12% were assigned to Funds B, C, and D, respectively.

December 2005.¹⁹ In addition to this monthly dataset, we had indirect access through the Chilean Superintendency of Pensions to a dataset containing the detailed daily portfolios of the universe of funds and PFAs operating between July 1996 and July 2008, which contains 201,288,833 observations, for 62 funds.²⁰ The daily data contain the same fields as the monthly database.

The number of PFAs and pension funds in our data vary over the sample period. The number of PFAs decreased by two-thirds while the number of pension funds doubled. The number of PFAs decreased from 15 to 6 due to a series of mergers and acquisitions that mostly took place in the late 1990s.²¹ The number of pension funds in the market has been proportional to the number of PFAs. Thus, from July 1996 to December 2005, the number of pension funds increased from 15 (1 per PFA) to 30 (5 per PFA).

The data on Chilean mutual funds we obtained from the Superintendency of Securities and Insurance contain the detailed portfolios of all existing mutual funds at monthly frequency during the period 2002-2005. Among these mutual funds we focus on funds that mainly invest on medium- and long-term fixed-income instruments to provide an appropriate comparison with Chilean PFAs.²² The resulting database contains a monthly panel of detailed portfolios held by these funds comprising 463,272 observations

¹⁹ See Raddatz and Schmukler (2008) for a more detailed description of the monthly data and how the datasets were assembled. We do not have direct access to the daily dataset, but indirect access has been granted through the Superintendency of Pensions.

²⁰ The difference between the number of funds in the monthly and daily dataset is due to the merge of the PFA *Bansander* and *Santa María* in April 2008, resulting in the creation of 5 new funds.

²¹ Of the 3 largest Chilean PFAs, 2 of them – *Cuprum* and *Habitat* – have never merged with or acquired competitors, while the current PFA *Provida* results from 3 mergers between *Provida* and *El Libertador* in 1995, *Unión* in 1998, and *Protección* in 1999.

²² Chilean mutual funds are classified according to the type of asset they invest in and the duration of these assets. Funds that invest in fixed-income, fixed-term assets, are separated from money management funds (with horizons of 90 and 360 days) and medium- and long-term funds.

and including information on the type of security, currency of denomination, risk rating, units held, internal rate of return, fraction of the fund's portfolio invested in the instrument, and maturity date. The data shows that both the total number of active funds in this group and the median number of securities held by each fund in its portfolio have steadily increased during the period, the former from about 40 to 70 (for a total of 79 different funds), and the latter from about 200 to 400. During this short period the total assets under management of these funds have also increased from about 1 to 3 billion US dollars, corresponding to an increase from 2% to almost 3% of Chilean GDP.

The detailed portfolio data of Chilean institutional investors was complemented with data of the maturity structure of US Mutual Bond Funds obtained from Morningstar. The available data consists of the fraction of the total portfolio invested in at various segments of terms to maturity (up to 3 years, between 3 and 5 years, 5 and 7 years, 7 and 10 years, 10 and 15 years, 15 and 20 years, 20 and 30 years, and above 30 years) for the universe of 500 US multi-sector and short-term mutual funds operating between 2003 and 2005, at an annual frequency with a total of 11,440 data points.²³

4. Maturity Structure

Figure 1 shows the maturity structure of Chilean pension fund administrators for the entire sample period 1996-2005 and for the multi-fund period 2002-2005. The figure plots both the cumulative and actual fraction of investments in fixed-term assets per year

²³ US mutual bond funds are grouped into each category (multi-sector or short-term) according to Morningstar's definitions. Multi-sector bond funds are usually more diversified than other types of bond funds, investing in foreign and domestic government and corporate bonds. Short-term bond funds generally invest in a variety of bonds, from the most creditworthy, such as Treasury bonds, to mortgages and corporate bonds (they may invest in more speculative high-yield and emerging-markets debt on rare occasions). Data is available for approximately 360 multi-sector bond funds and 140 short-term bond funds.

to maturity. The figure is built by determining at each point in time (each month) the term to maturity of each instrument in a PFA's portfolio, measuring the fraction of the value of fixed-term assets invested at different terms to maturity, and then averaging these fractions across PFAs and time. Let $d_{i,t}$ and $w_{i,t}^k$ denote the term to maturity of asset i at time t , and the share of fixed-term assets invested in asset i at time t by fund k , respectively. The fraction of fund k 's fixed-term assets with term to maturity D is

$$(1) \quad W_{D,k,t} = \sum_i w_{i,t}^k I(d_{i,t} = D),$$

where $I()$ denotes an indicator function that takes on the value 1 if the condition inside is met. The average fraction invested at maturity D at time t across PFAs is, therefore,

$$(2) \quad W_{D,t} = \frac{1}{N_t} \sum_k W_{D,k,t},$$

where N_t is the number of PFAs active at month t . Finally, the overall average fraction of fixed-term assets invested at maturity D across PFAs and months corresponds to

$$(3) \quad W_D = \frac{1}{T} \sum_k W_{D,t}.$$

The fractions computed in this way correspond to the empirical probability distribution function (PDF) of the term to maturity of a peso or dollar invested by PFAs in fixed-term assets, and the empirical cumulative distribution function (CDF) of the term to maturity can easily be obtained by adding these fractions up to a given maturity. Finally, we construct the empirical distribution of the PDFs by computing the different percentiles of $W_{D,k,t}$ across PFAs for each month, and then averaging those percentiles across time. We follow a similar procedure to obtain confidence bands for the CDFs.

Figure 1 shows that in both periods PFAs are heavily invested in short-term assets. For example, for the entire period (multi-fund) period, they invest 25% (36%) up to 1 year, 46% (61%) up to 3 years, and 75% (80%) up to 5 years. Moreover, they hold almost all of their securities in assets maturing within 15 years. The distributions do not vary much by PFA as shown by the 25th and 75th inter-quartile range. The fraction of the fixed-term portfolio invested up to 1 year varies only between 19% and 32% during the entire sample period and 30% and 45% during the multi-fund period. Even smaller degrees of dispersion are observed at other ranges of the CDFs. The panels on the right (A2 and B2), which display the average empirical PDFs and are summarized in table C2, show that the portfolio weights decline exponentially; the highest density is observed at short maturities after which probabilities systematically decline.

Appendix Figure 1 shows the composition of holdings by asset class. It shows that bank deposits are basically very short-term investments. During the multi-fund period, about 90% of deposits are held in instruments with a remaining term to maturity of up to 1 year. In fact, the right panels show that a large share of deposits are indeed very short term. For example, during the entire period, 60% of deposits have a maturity of up to 3 months. Sovereign and corporate bonds have a longer maturity. However, the assets with the longest maturity, corporate bonds, are the ones with the least weight in the fixed-term portfolio, 6% and 14% in the entire and multi-fund period, respectively.

Although the maturity structure of pension fund investments looks short term, it is necessary to compare it to that of other institutional investors that can serve as benchmarks. To do so, we analyze the maturity structure of Chilean and US mutual bond funds. As discussed in the Introduction, bond fund managers are pure asset managers.

They are open-ended funds subject to redemptions and the investment horizon of individual investors is unknown. Therefore, one could expect pension funds to have longer investment horizons, at least during the “accumulation phase” (when young pensioners contribute to the funds’ growth and outweigh old, retiring pensioners). In other words, during this period, funds do not need to hold liquid assets to meet cash withdrawals. However, more nuances are described below, in Section 5.A.

The comparison with Chilean and US mutual bond funds is interesting for several reasons. US funds provide a benchmark of how funds operating in the most developed capital markets behave. That is, even though these funds are subject to redemptions, they face a different set of investment opportunities and allow us to compare the maturity structures of institutional investors between a developed and a developed country. However, given that the comparison to US mutual funds changes 2 dimensions (pension funds vs. mutual funds and Chile vs. the US), we also include a comparison to Chilean mutual funds. This comparison is interesting because mutual funds in Chile operate in exactly the same environment as pension funds and have to make their investment decisions by choosing among the same set of instruments.

In order to compare the maturity structure of these institutional investors, we use Kolmogorov-Smirnov (KS) tests. We first test whether the average distributions that we are comparing in the figures are statistically different by testing for differences in the maturity structures generated by their CDFs. We draw a random sample of equal valued assets (1 US dollar) from each distribution and use the KS approach to test whether those samples come from the same distribution. The p-value of those tests and the level of significance are reported in the table that accompanies each of the figures that compare

the maturity structure of these institutional investors. We also computed the bootstrapped version of this test and obtained similar results.²⁴

In order to compare pension funds to US mutual funds we present the maturity structure grouped within 8 large bins, determined by the availability of US data from Morningstar. In the case of Chilean mutual funds, we have data on a monthly basis so we use a much more continuous distribution in the comparison with pension funds.

Figure 2 shows that pension fund holdings are much more tilted towards the short term than US mutual bond funds are. Notably, this is even the case when comparing pension funds to US short-term mutual bond funds. For example, while pension funds hold 61% of their fixed-term instruments in assets with a maturity of up to 3 years, US multi-sector mutual bond funds and short-term bond funds hold 10% and 36% of their portfolio in assets with that maturity, respectively. The differences persist throughout the distribution. For example, Chilean pension funds hold 25% in assets up to 5 years, while US mutual and short-term funds hold only 25% and 55%, respectively, at that horizon. While Chilean pension funds do not hold assets with a term to maturity above 15 years, both US multi-sector and short-term mutual funds hold 25% of their portfolio in assets with a term to maturity above 15 years, with some instruments surpassing a maturity of 30 years. Naturally, these distributions are statistically different at all conventional significance levels. Panel D shows that Chilean pension funds are shorter than both US

²⁴ We computed the bootstrapped version of this test for 2 reasons. First, the average distributions are estimated from the observed individual distributions, so they contain sampling error and tests based on the point estimates may tend to over-reject the null that the distributions are identical. Second, even though the average distributions across individuals may be similar it may be most individual distributions are different across the 2 groups. The bootstrapped version of the test is performed by computing the empirical average CDFs for each fund in each group, and then randomly selecting 1 fund from each group and using a KS test to assess if their distributions are statistically different. The fraction of the individual tests where the hypothesis of equality can be rejected is shown in the table next to the p-value of the standard test. If the process that generates the CDFs of funds in both groups is the same we would expect the fraction of rejecting tests to be less than 10%.

multi-sector mutual funds and short-term mutual funds at the 1% significance level. At the same time, the Kolmogorov-Smirnov tests show that we can easily reject the hypothesis that the 2 distributions are identical against the alternatives that they are different and that PFAs have a shorter maturity structure than US mutual funds, but we cannot reject the hypothesis that they are equal against the alternative that pension funds are longer than US bond funds. Therefore, the tests indicate that, as shown in the figures, maturity structures of PFAs are significantly shorter than those of US mutual funds.

We perform a similar comparison between Chilean pension funds and Chilean mutual bond funds. Figure 3 shows the results. The distributions of both types of institutional investors are very similar. In fact, the Kolmogorov-Smirnov tests cannot reject that the average distributions of pension funds and mutual funds are equal, as shown in Panel D. Also, the hypothesis that the maturity structure of any pair of PFAs and mutual funds randomly selected are identical can only be rejected at a 23% confidence level. For example, using the same bins used for the case of US mutual funds, Panel C shows that both pension funds and mutual funds hold 61% of their fixed-term assets at a maturity of up to 3 years. Above that maturity, pension funds become more short-term investors relative to mutual funds. For example, pension funds hold 80% of their assets up to 5 years, while mutual funds hold 74% up to that maturity.

5. What Drives the Maturity Structure?

Different factors may contribute to the short-termism shown in the previous section. In this section we discuss several potential factors and to what extent they might be playing a role in determining the maturity structure of pension funds. In particular, we

focus on 5 factors: (a) instrument availability, (b) rebalancing (tactical behavior), (c) asset allocation and risk management, (d) outflows, (e) and managerial incentives.

5.A. Instrument Availability

It is possible that pension funds purchase short-term instruments because long-term ones are not available. Several papers have argued that emerging market governments tend to borrow short term because of moral hazard considerations (Calvo 1988; Blanchard and Missale, 1994), commitment motives (Rodrik and Velasco, 1999; Jeanne, 2004), or due to the relative cost of borrowing long term resulting from investors' risk aversion (Broner et al., 2007). Since most of pension fund's fixed-term investment is in domestic bonds, their holdings could be constrained by the availability of long-term instruments.

Figure 4 shows the accumulated issuances of government bonds (Central Bank and Treasury bonds) between 1998 and 2008 and the fraction of those issuances purchased by pension funds (as compiled by the Central Bank of Chile).²⁵ The figure contains separate panels per currency: nominal pesos, US dollar, and indexed pesos. The figure shows that in all cases pension funds purchase significantly less than the total amounts issued. This observation is relevant because government bonds are considered to be safe investments. That is, pension funds are not foregoing these opportunities because they are risky bets. During this period, pension funds purchase 4.9% of total government

²⁵ The Central Bank of Chile reports the information aggregating PFAs and insurance companies due to historical reasons. However, the incidence of insurance companies on these figures is negligible because they correspond to direct purchases and insurance companies make almost all of their purchases through intermediaries (banks). In contrast, pension funds directly bid for Central Bank papers.

issuances.²⁶ Not even in long-term bonds do pension funds purchase most of those bonds. Appendix Table 1 provides more detailed information per year of issuance. If one considers inflation-linked bonds, the estimated amount of issuance purchased by PFAs at the longest maturity (30 years) is just 7%. Moreover, PFAs are not especially constrained at long maturities with respect to short ones. For example, PFAs purchased 42% of the 5-year bond issuance and 34% of the 20-year bond issuance. With respect to nominal bonds, the data indicate that since 2007 PFAs have been more prone to invest at longer maturities. The share of 10-year bonds purchased by PFAs increased from 1.7% to 32.3% between 2006 and 2008, while the acquisition of 2-year bonds decreased from 12.8% to 5.0% during the same period. Notwithstanding, the absolute value of 10-year bonds purchases by PFAs is still relatively low, given the relative importance of PFAs in the Chilean financial system.

Regarding corporate debt, there is no information on the amount of issuance purchased by PFAs. We only have information on the amount of corporate debt held by PFAs as a proportion of the outstanding corporate debt.²⁷ This information is reported in Table 1. The data indicate that the proportion of corporate debt held by PFAs has fluctuated between 37% and 48% between 2002 and 2005 (although PFAs' demand is systematically concentrated in longer maturities). Again, this type of information suggests that PFAs have not been constrained to expand their holdings of long-term bonds.²⁸

²⁶ During the period 1998-2008, PFAs and insurance companies purchased 40% of government bonds issued in indexed pesos, 3% in nominal pesos and 15% in US dollars.

²⁷ Information is currently available until 2005.

²⁸ With respect to the banking system, the proportion of certificate deposits held by PFAs has been very stable, oscillating in the range of 25% to 30%. But banking sector information is less relevant to assess to what extent PFAs might be constrained because banks can accept any amount of deposits.

5.B. Rebalancing

Based on three types of event studies, this section sheds light on the incidence of rebalancing motives on pension fund short-termism, that is, to what extent pension funds hold liquidity to take advantage of good buying opportunities. This is known in the academic literature as “cash-in-the-market” pricing, and refers to the idea that holding liquidity is costly because less liquid assets have higher expected returns but agents may hold liquidity because on occasion they are able to make a profit by buying assets at fire-sale prices (Allen and Gale, 1994, 1998; Allen and Carletti, 2008). The events under analysis are: (a) the relaxation of regulatory constraints to hold foreign assets, (b) the monthly release of information on PFA’s asset portfolios and, finally, 2 crisis/distress periods: (c) the Asian and Russian crises, and (d) the terrorist attacks of September 11, 2001.

Relaxation of Regulatory Constraints. The current legislation sets limits to the amount of foreign assets held by PFAs. This threshold has been expanded from 16% to 45% of total assets through 6 amendments since 2002, increasing 4% on March 1st, 2002 and 5% in each of the remaining cases.²⁹ Data on portfolio composition indicate that these limits have been binding for Chilean PFAs (Raddatz and Schmukler, 2008), a fact that is consistent with the historical lobbying efforts of PFAs in favor of increasing these limits. In addition, data suggests that, from the point of view of PFAs, there are unexhausted investment opportunities abroad. Moreover, these regulatory changes have typically been announced in advance and, therefore, PFAs could accumulate liquidity prior to the deregulation to take advantage of such changes. In other words, if PFAs hold

²⁹ The remaining dates are May 29th, 2003; March 1st, 2004; August 9th, 2007; December 18th, 2007; and April 24th, 2008.

liquidity to take advantage of investment opportunities we should expect an increase in short-term holdings before the limits change and a reduction after their implementation.

Figure 5 (Panel A) shows the share of very short-term assets (those with maturity under 30 days) held by PFAs 40 days prior to and 40 days after the regulatory change. The share corresponds to the average across PFAs and is computed as a proportion of each PFA's total fixed-term assets. The figure shows that around the regulatory relaxation events, the portfolio share of short-term assets does not change significantly. Moreover, short-term holdings before a regulatory change are lower than the average holdings after the change. Concretely, the average share of short-term assets is 4.7% during the 40 days prior to a change in the limit and 5.4% during the 40 days after the modification of the limit, registering a peak of 5.9% around the 30th day after the change in the limit. Additional inspection of each event (not reported) indicates a large heterogeneity across events: depending on the case, the share of short-term assets increases, decreases, or stays constant. Therefore, this evidence does not support the hypothesis that PFAs modify their short-term asset holdings due to rebalancing purposes.

Information Release. The Superintendency of Pensions releases information about the detailed portfolio composition (at the security level) of each PFA around the 10th day of each month. This information is relevant not only because it allows PFAs to identify potential buying opportunities for specific assets, but also because this information could be useful to reduce the risk of obtaining a return that diverges significantly from the average return across PFAs, which is used as a benchmark for performance (and thus get

penalized).³⁰ Therefore, we would expect an accumulation of short-term assets ahead of the release of the portfolio information of PFAs, and a reversion of this trend afterwards.

Figure 5 (Panel B) shows a similar analysis to the previous one. We obtain the share of assets with a maturity of up to 30 days across PFAs in a window around the day when the information is released. We use data for the period January 2006 to June 2008, analyzing the 30 episodes of release of PFA portfolio information. The pattern displayed does not suggest that PFAs increase their liquidity prior to the release of information.

Crisis Periods. Several papers have proposed that crisis periods in emerging markets are frequently related to lack of liquidity where assets are sold at fire sale prices (Krugman, 1998; Aguiar and Gopinath, 2005). To analyze changes in the short-term portfolio during crises, we first study the evolution of short-term assets during the Asian and Russian crises, focusing on the period of July 1997 to December 1998. The main events during 1997 and 1998 can be summarized as follows: (a) announcement of negotiations between the IMF and Korea on November 21st, 1997, (b) approval of IMF and World Bank package of 22.6 billion US dollars to stabilize the Russian market on July 13th, 1998, (c) collapse of the Russian stock, bond, and currency markets as a result of investors' fears on August 13th, 1998.³¹

Figure 5 shows the evolution of short-term assets during the Asian-Russian crises period. The pattern of short-term asset holdings seems to show an increase from 2% to 3.5% after the Asian Crisis hit South Korea in November 1997 (with the downgrade of Korean debt) and remains high for the rest of this turbulent period. If anything, the

³⁰ As was mentioned above, each PFA is responsible for obtaining a real rate of return of at least 2% below the average over the previous 36 months for funds C, D, and E, and at least 4% below the average for funds A and B, or at least 50% of the average return of all funds.

³¹ See Desai (2000) for more details.

evolution of short-term assets is more consistent with a flight-to-liquidity strategy than with the hoarding of liquidity to take advantage of fire sale asset prices.

September 11th, 2001. The terrorist attack on September 11, 2001 was an unexpected shock to financial markets that created a highly uncertain environment. Following the discussion for the Asian-Russian Crises, these uncertainty could have led to a departure of Chilean asset prices below fundamentals and, therefore, on investment opportunities for investors with deep pockets. To evaluate if this shock generated a portfolio rebalancing effect, Figure 5 (Panel D) shows the average share of short-term assets between August 2001 and December 2001. In this case, we again find evidence pointing towards a slight increase in short-term asset holdings after September 11th. The average share fluctuated between 4% and 5% before the shock, and after the shock it increased steadily until reaching 6% shortly after the episode, returning to previous levels by October. This result suggests that the observed changes in uncertainty affected the short-term assets held by PFAs. However, the changes are in the opposite direction than what would be expected. As in the case of the Asian Crisis, instead of using their cash to purchase assets that have declined after the shock, pension funds hoarded additional liquidity.³²

In sum, all the events in this section do not seem to suggest that pension funds hold liquidity to act opportunistically and purchase securities at fire sale prices. Instead, short-term positions do not seem to respond to events.

5.C. Asset Allocation and Risk Management

³² This evidence is consistent with pension funds following momentum rather than contrarian strategies, as documented in Raddatz and Schmukler (2008).

Standard models of asset allocation indicate that the portfolio composition of an investor depends on the risk-return combination of the different assets available for investment (Campbell et al., 1998; Campbell and Viceira, 2002). Thus, in principle, the shorter maturity structure of Chilean PFAs relative to US mutual funds could result from differences in the risk-return profiles of the assets in which they invest. In what follows we explore several potential sources of these differences.

A first potential explanation along these lines is that the presence of higher inflation risk in Chile than in the US could tilt the portfolios of PFAs towards shorter maturities because inflation and currency movements are more difficult to predict in the long term, adding extra risk to long-term holdings.

Since the figures presented in the previous section aggregate all fixed-term instruments held by pension funds and other institutional investors, the comparison of Chilean PFAs and mutual funds with US mutual funds could be misleading, since they do not hold instruments of different denomination in the same proportion. For sure, US mutual funds do not hold instruments denominated in Chilean pesos, so the finding that they are more long-term than pension funds could be driven by the less risky nature of their investments. To address these issues and shed light on how risk might be affecting managers' decisions, we report the maturity structure of portfolio holdings by currency. Namely, we consider holdings in nominal pesos, "hard currencies" (US dollar, euro, British pound, and yen), and indexed pesos (inflation-linked), with the latter representing a significant proportion of pension fund portfolios.

Figure 6 shows the maturity structure of Chilean pension funds by currency for the entire sample period and for the multi-fund period. The panels on the left display the

maturity structure up to 10 years while the ones on the right show a close-up of the maturity structure up to 3 years. The figure shows that the maturity structure differs significantly across currencies. Pension funds are very short-term investors in pesos, less so in hard currencies, and even less so when considering inflation-linked instruments. For example, more than 80% of peso holdings are held in instruments maturing in less than 1 year, and almost 100% of holdings are held in assets maturing in less than 3 years. On the contrary, when considering the entire sample period, less than 40% of hard-currency assets and about 20% of inflation-linked ones are in assets maturing in less than 1 year. The differences in the distributions are statistically significant, as shown by the Kolmogorov-Smirnov tests displayed in Panel D.

The patterns illustrated in Figure 6 are consistent with pension funds being more tilted towards the short-term in assets with higher inflation and currency risk. Certainly, nominal peso instruments do not offer any type of hedge against inflation, thus the short-term structure.³³ Hard currencies protect pension funds against currency depreciations, but expose them to currency appreciations. In other words, as mentioned in the Introduction, pension funds perceive a tradeoff between maturity, on the one hand, and currency and inflation risk, on the other hand. When they can hedge those risks, they seem more willing to invest more long term. This confirms the importance of comparing pension funds and mutual fund portfolios by the currency denomination of investments.

³³ Although we have argued that PFAs are asset managers and therefore have no liabilities to hedge against, for regulatory reasons they send monthly reports of their real returns to future pensioners and must base their publicity on real returns (SAFP, 2002). Therefore, the reduction in real returns resulting from inflation can potentially affect their ability to capture new affiliates or result in some affiliates leaving the fund. Although there is not much evidence that the number of affiliates changes according to the fund's return, the ranking of PFAs by returns typically used in publicities seems to be positively correlated with the number of affiliates that PFAs have (Cerdeira, 2005).

Figure 7 compares the holdings of pension funds to that of US multi-sector bond funds and short-term bond funds for the relevant currencies (hard currencies and indexed pesos). The figures show that even when one focuses on currencies with little risk, pension funds are more tilted towards the short term than US funds are. This is even the case when comparing pension funds to US short-term funds. Panel C shows that the differences are statistically significant at the 1% level.

In addition to the different inflation risk entailed in Chilean PFA and US mutual fund investments, differences in their maturity structure could be a result of differences in the set of instruments in which these funds invest. Our previous exercises have compared the maturity structure of PFA investments in fixed-term instruments to that of US fixed-term mutual funds, but have overlooked the fact that Chilean PFAs hold an important part of their portfolio in variable-income assets, while by definition US fixed-term mutual funds do not. This difference could in principle affect the results because standard portfolio allocation models predict that the share invested in an asset depends on the asset modified Sharpe ratio that takes into account the whole covariance matrix of the set of available risky assets (Campbell and Viceira, 2002). In other words, it could be possible that equity and other variable-income assets in PFAs' portfolios play the role that long-term bonds play in mutual funds' portfolios. There are 2 reasons for this not to be the case. First, there is evidence that funds investing in various asset classes delegate the asset selection process to various independent asset class managers (these are the so-called multi-manager funds) and Chilean PFAs are not the exception. Thus, although Tobin's mutual fund theorem (Tobin, 1958) does not extend to investments across risky asset classes, in practice, asset managers seem to behave as if it did. Second, as shown

above, Chilean mutual bond funds, which are restricted to invest mainly in fixed-income instruments, also have a shorter maturity structure than that of US mutual funds. Finally, this potential problem in the comparison between Chilean PFAs and US mutual funds can be directly tackled by exploiting regulatory differences across the various funds held by PFAs and comparing US bond funds to Chilean PFA Fund E, which is also a bond fund. This comparison, exhibited in Figure 8, shows that, as in the case for PFAs' overall portfolio (considering all fund types), the maturity structure of Fund E is shorter than that of US multi-sector mutual funds and US short-term funds. Overall, the evidence does not indicate that the differences in maturity structure between Chile and the US are driven by differences in the set of instruments in which these funds invest in.

As mentioned above, standard asset allocation models predict that the share of various risky assets in an investor's portfolio will depend on the assets' risk-return profile. It is, therefore, possible that the differences observed in US and Chilean maturity structures could result from differences in the risk-return characteristics of long- and short-term assets. Properly testing this hypothesis requires a complete characterization of the statistical properties of the excess returns of various risky assets available in these 2 markets, which is beyond the scope of this paper. However, available evidence from other emerging markets suggests that this explanation is unlikely to account for the observed patterns by itself. Broner et al. (2007) computed the Sharpe ratios of short- and long-term bonds in various emerging markets and showed that, on average, the difference in the Sharpe ratio of long- and short-term bonds was higher in emerging markets than in developed countries. Although these simple Sharpe ratios that do not consider the covariance of these assets are rough indicators of investment motives, they suggest that,

if anything, investors in emerging markets should tilt their portfolios towards the long term relative to investors in developed countries.

5.D. Outflows

Another explanation of why pension funds hold a substantial fraction of short-term assets is because they face outflows. Although pensioners must contribute to the pension fund system, they are able to select any pension fund administrator (and any fund within the pension fund administrator itself). Namely, pensioners can switch among funds, both across and within administrators. This poses 2 risks to pension fund managers. First, they need to maintain a certain level of liquidity to meet redemptions. This *redemption risk* is analyzed below in this section. Outflows are a sign that pensioners are opting for other pension fund administrators. By experiencing outflows, pension fund administrators also forgo future inflows, and the income that they would have generated. Furthermore, outflows could be a sign that the pension fund administrator is not receiving all the potential inflows. This second risk *income risk* is discussed in the next section.

To analyze how significant outflows are, we compute the outflow that each pension fund administrator faces each month. We do so for the entire sample period, which includes an important consolidation in the industry with entry and exit of some pension fund administrators, and for the multi-fund period, when the industry was already stabilized. We use daily data from the Superintendency of Pensions on the value and returns of all pension funds to compute net inflows of PFA k at time t , I_t^k , as the change in the fund value W_t^k in two consecutive days adjusted by the gross return of the portfolio between those days R_t^k , as reported by the SP:

$$(4) \quad I_t^k = W_t^k - W_{t-1}^k(1 + R_t^k).$$

We obtain the monthly net inflows by adding the daily flows. We also computed the monthly inflows using the values and returns derived from our monthly database and obtain qualitatively similar results.

The results are displayed in Figure 9, which shows the cumulative distribution of net inflows I_t^k relative to fixed-income assets, pooling all monthly observations across PFAs. Negative (positive) inflows are outflows (inflows). The same distribution, but for the multi-fund period, is displayed in thinner lines. The figure shows that pension funds face very few outflows. The distribution is significantly tilted to the right. The probability of having net outflows in a given month is 28% (23% in the multi-fund period) and the probability of having outflows of 1% of the value of fixed-income assets is 12% (4% during the multi-fund period).

Can these outflows explain the significant proportion of short-term assets held by pension funds? There are 2 ways to try to tackle this question. One is to analyze to what extent short-term assets held by pension funds are matched by the likelihood of outflows of that magnitude, that is, to what extent pension funds are holding assets for low-probability events. The second alternative is to compare the outflows and short-term assets held by pension funds to those held by mutual funds. We perform these analyses in turn.

The Table in Panel B at the bottom of Figure 9 shows the fraction of fixed-term assets held in the short term and the probability of outflows of that magnitude. Therefore, the values reported correspond to the probability that would be required to have a value at risk (VAR) equal to the fraction of fixed-term assets held by PFAs at maturities of 30 and

90 days. The table shows that during the entire sample period pension funds held 4% of their assets in instruments with a maturity of less than 1 month and 11.2% in instruments with a maturity of less than 3 months. The probability of having outflows of 4% is 3.1% and that of having outflows of 11.2% is 0.3%. In other words, the probabilities required to have a value at risk equal to the fraction of the portfolio held at 30 and 90 days are 3% and 0.3%, respectively, implying confidence intervals for the VAR of 97% and 99% respectively, both higher than the 95% and 99% confidence intervals typically used in VAR analysis. Thus, pension funds seem to be holding a large fraction of assets for a low-probability event. These numbers are even more extreme during the multi-fund period. In that case, pension funds held 4.7% of their fixed-term assets in instruments with a maturity of less than 1 month, while the probability of an outflow of that magnitude occurring is less than merely 0.4%. Moreover, the probability of having outflows of 12% (the fraction held in instruments with a maturity of under 3 months) is about the same.

A related way to analyze the amount of short-term assets that pension funds want to hold is to ask how many assets should be short term to face certain type of adverse events (the Value at Risk). For example, to be able to face outflows that, on average, tend to occur every 5 years (an event with a confidence interval of 98.3%), pension funds should have 7% of their fixed-term assets (the VAR) short term if one considers the outflows witnessed in the entire period. However, when one considers the distribution of outflows during the multi-fund period, this number drops to 1.5%. For events that tend to happen every 10 years (confidence interval of 99.2%), pension funds should have 10% or 2% of fixed-term assets in short-term instruments, depending on whether one considers

the entire or multi-fund distribution, respectively. As stated above, this means that pension funds are holding short-term assets and insuring themselves for rare events. To the extent that there is an opportunity cost of holding these short-term instruments, pension funds are paying a high price for this insurance. Pension funds are insuring themselves for an idiosyncratic risk (the probability that some pensioners decide to switch to another pension fund administrator) and could easily liquidate their other assets (including international holdings) to meet those redemptions with relatively little cost. In fact, the pension fund administrator that faces an outflow could easily trade with the one facing the corresponding inflow, at a low cost.

Comparing pension fund short-term holdings relative to mutual funds is also interesting. Figure 10 compares the distribution of outflows for mutual funds with the distribution for pension funds during the multi-fund period. It is evident that mutual funds are subject to more significant outflows than pension funds. The cumulative distribution of outflows for mutual funds is significantly shifted to the left, with these differences being statistically significant. For example, a 1% net outflow has a historical probability of 4% for PFAs and 38% for mutual funds. However, the short-term positions of mutual funds and pension funds are not very different. For example, as shown above and reproduced in Panel B of Figure 10, pension funds hold about 5% of their fixed-term portfolio at a maturity of less than 1 month and mutual funds hold 11% of their portfolio at this maturity. At a maturity of 90 days the differences are even smaller, with PFAs and mutual funds holding 13% and 19% of their fixed-term portfolios at less than that maturity. At maturities under 1 year, they invest approximately the same proportion of their portfolio. This evidence indicates that pension funds are insuring themselves much

more than pension funds to meet redemptions. This is even more striking when one considers that mutual fund redemptions can be systemic aside from idiosyncratic (investors tend to massively pull out of mutual funds when market conditions worsen).³⁴ The systemic nature of mutual fund redemptions makes liquidations by mutual funds more costly as all funds liquidate their positions at the same time.

5.E. Managerial Incentives

Traditional theories of asset allocation focused on the problem of an isolated investor whose goal was to maximize wealth or consumption at some point in time. Recent papers have started to study the consequences that conflicts of interest between fund managers and investors, and the incentive schemes that may arise as a result, have for managers' risk-taking behavior (Chevalier and Ellison, 1999; Kapur and Timmermann, 2005; Stein, 2005; and Sharfstein and Stein, 1990). When the objectives of fund managers and investors (or fund management companies) differ because of the cost of unobservable effort or career concerns, high powered incentives are offered to managers to partly overcome the underlying information asymmetries.

This section discusses the potential role of these incentives in shaping the maturity structure of Chilean pension funds. We lack, however, necessary data to assess the importance of this possible explanation and rely instead on indirect evidence, so the discussion is more speculative than in previous sections. The available evidence suggests that the basic ingredients for these mechanisms to explain the documented patterns are in place. In the conclusion we hint some possible avenues for formally testing this hypothesis.

³⁴ See Kaminsky, Lyons, and Schmukler (2004).

Similarly to US fund managers, managers of Chilean pension funds face market-discipline incentives in the form of redemptions or the risk of clients switching to a different fund, and relative-performance evaluation schemes. In addition, pension funds face regulatory incentives to maintain returns within some margins. We briefly discuss below the potential implications of these incentives for the maturity structure of Chilean pension funds.

Pension fund managers are asset managers, not asset-liability managers, and as our results show, they behave as open mutual funds even when they face less stringent market discipline in the form of redemption risk. If this discipline is based on short-term returns, risk averse managers have incentives to obtain returns that are similar to the competition at a high frequency, which makes them averse to engaging in investments that are profitable in the long run but can have poor short-term performance (Shleifer and Vishny, 1990; Stein, 2005). Note that this discipline does not need to be reflected in actual outflows. The risk of having those outflows is what makes market discipline operate.

Another force that shapes incentives to avoid risk-taking is regulatory discipline. Pension fund managers are penalized by regulations when they deviate from industry standards, having to cover these losses with their own capital. Additionally, and probably as a consequence of the presence of market and regulatory discipline, there is evidence that Chilean pension fund managers follow a tracking-error model of investment, where they are constrained not to deviate significantly from the average pension fund (Castaneda, 2007; Roll, 1992).

Finally, the way that fees are structured might also shape incentives towards short-termism. Pension fund managers get their fees in a front-loaded manner; that is, pensioners pay the fees of managing each dollar contributed to the pension fund upfront. Therefore, pension funds do not profit from taking higher risks to make the assets they manage grow. This is not the case with mutual funds, which charge a fee over time for the value of the assets they manage. If the latter increase, their revenues increase as well. At the same time, trying to capture higher returns entails the risk of market discipline and regulatory discipline.

Available evidence permits the conjecture that these sources of managerial incentives to avoid risk-taking could explain the short-termism of Chilean fund managers relative to the US because of their interaction with the risk-return profile of investment at different maturities in emerging markets in general and Chile in particular. The reason is that, although the relative Sharpe ratios of long-term bonds in emerging markets are higher than in developed countries, long-term investments are also relatively riskier in emerging economies (Broner et al., 2007). Since short-term assets are less volatile, they allow managers to be within the industry and cope with market and regulatory discipline. Moving to more long-term investments can have rewards, but they come at a risk: their upside potential for returns is accompanied by a higher downside risk. If the risks are greater than the extra returns, it would be difficult to deviate from an equilibrium in which all managers hold short-term returns. On the other hand, an equilibrium in which all managers are tilted towards long-term investments is not sustainable to the extent that investors monitor manager behavior on a short-term basis (Stein, 2005). Holding long-term assets is more likely to make returns more volatile and discipline managers.

Although possible, it is important to emphasize that the available evidence cited above is not sufficient to conclude that the interaction between managerial incentives and differences in risk-return profiles explains the relative short-termism of Chilean pension funds. Doing so would require us to control for differences in the power of incentives faced by managers in developed and emerging markets and the detailed risk–return characteristics of the assets in which they invest, beyond the Sharpe ratios and relative volatilities of a few assets, which is outside the scope of this paper. We discuss in the Conclusions some potential avenues to advance on these issues in future research.

6. Conclusions

This paper has studied the case of Chilean pension funds compared to US mutual funds to shed light on how the supply side of capital manages the maturity structure of its investments. This analysis provides a benchmark of how long the maturity structure of investments in emerging economies can be extended, given that pension funds in Chile are large institutional investors with a long history and are expected to invest long term for retirement. Moreover, Chile has relatively developed capital markets and has made a conscious effort of trying to extend debt maturities to finance investments and reduce rollover risk through a broad range of reforms.

We found that pension funds hold a significant proportion of their portfolio short term in very liquid assets. They are much shorter term than US mutual funds. This short-termism is not particular of pension funds since Chilean mutual funds have similar maturity structures to pension funds. This presents a puzzle since pension funds are less subject to redemption risk than mutual funds are, and pensioners are likely to have a different investment horizon than that of mutual fund investors.

It is difficult to explain the extent of pension fund short-termism directly by the redemption risk of facing outflows. During the period analyzed, pension funds received and were expected to receive inflows. Although particular pension fund administrators faced outflows, the amount of short-term assets they held seems too large to be justified solely by those redemptions. Furthermore, pension funds do not hold short-term instruments for tactical reasons to take advantage of buying opportunities or as a response to shocks. Neither are pension funds restricted by the availability of long-term instruments, nor induced to invest shorter term than their counterparts in developed countries by the risk-return profile of instruments at different maturities.

Then why are pension funds so much in the short term? The answer to this question requires further research, but available evidence leads us to conjecture that the explanation is likely related to the interaction of managerial incentives and the relative risk-return profiles of long- and short-term maturities in emerging markets and Chile. On the one hand, incentives faced by Chilean pension fund managers lead them to avoid risk-taking and also avoid departure from their peers at high frequencies. On the other hand, long-term bonds are much riskier relative to short-term bonds in emerging markets than in developed countries. This means that, faced with similar incentives, fund managers would favor short-term bonds relative to their counterparts in developed countries.

To conclude, despite the benefits of long-term debt, emerging economies seem to face an uphill effort to extend debt maturities, even when many of the ex-ante conditions are in place. There is a strong tradeoff between monitoring managers, on the one hand, and obtaining higher returns and incurring higher risks, on the other hand. What is the socially optimal design to balance this tradeoff? As discussed in recent papers (Acemoglu

et al., 2007), this is a difficult question to answer, and requires further research. For example, it would be interesting to estimate more explicitly the cost to pensioners of investing short term versus long term. Moreover, new research could be done to characterize in more detail how the supply-side of funds behaves and how managers respond to incentives. Comparing pension funds and mutual funds with insurance (annuity) companies seems an obvious extension to this work. This would provide a better benchmark of what investing long term means. Along the same lines, comparing US emerging market bond funds and domestic funds could shed light on whether managers in developed and emerging market face similar incentives. We leave this work for future research.

7. References

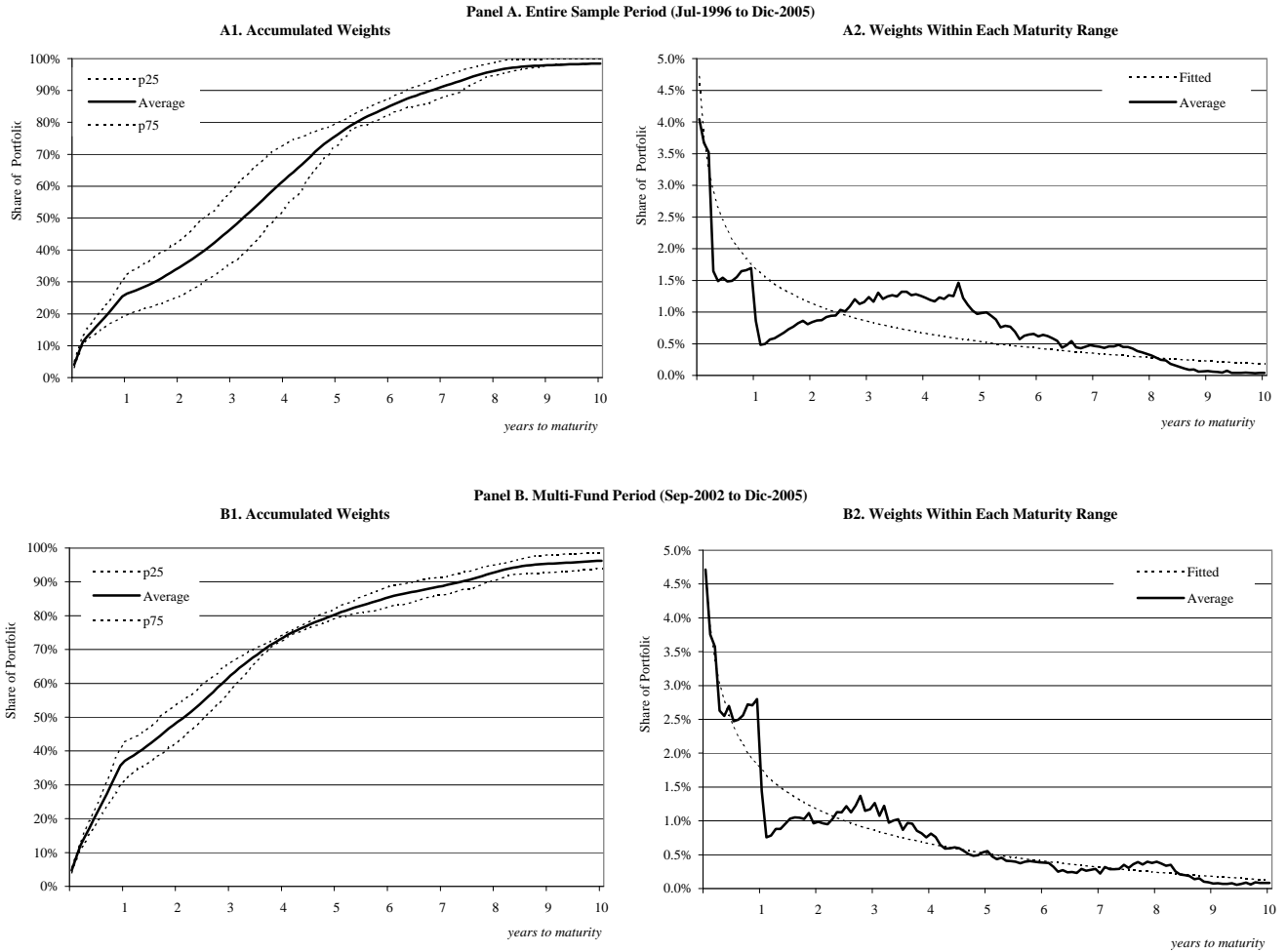
- Acemoglu, D., M. Kremer, and A. Mian, 2007. Incentives in Markets, Firms, and Governments, *Journal of Law, Economics, and Organization* 24(2), 273-306.
- Aguiar, M. and G. Gopinath, 2005. Fire-Sale Foreign Direct Investment and Liquidity Crises, *Review of Economics and Statistics* 87(3), 439-452.
- Allen, F. and E. Carletti, 2008. Mark-to-Market Accounting and Liquidity Pricing, *Journal of Accounting and Economics* 45(2-3), 358-378.
- Allen, F. and D. Gale, 1994. Limited Market Participation and Volatility of Asset Prices, *American Economic Review* 84(4), 933-955.
- Allen, F. and D. Gale, 1998. Optimal Financial Crises, *Journal of Finance* 53(4), 1,245-1,284.
- Blanchard, O. and A. Missale, 1994. The Debt Burden and Debt Maturity, *American Economic Review* 84(1), 309-319.
- Broner, F., G. Lorenzoni, and S.L. Schmukler, 2007. Why Do Emerging Economies Borrow Short Term? NBER Working Paper 13076.
- Calomiris, C., 2008. The Subprime Turmoil, What's Old, What's New, and What's Next. Manuscript for the Federal Reserve Bank of Kansas City Annual Conference.
- Calvo, G., 1988. Servicing the Public Debt: The Role of Expectations, *American Economic Review* 78(4), 647-661.
- Campbell, J.Y., S. Kim, and M. Lettau, 1998. Dispersion and Volatility in Stock Returns: An Empirical Investigation, CEPR Discussion Paper 1923.
- Campbell, J.Y. and L.M. Viceira, 2002. Strategic Asset Allocation: Portfolio Choice for Long-Term Investors. Oxford University Press.
- Castaneda, P., 2007. Long Term Risk Assessment in a Defined Contribution Pension System. Mimeo, Superintendencia de Pensiones, Chile.
- Cerda, R., 2005. Does Social Security Affect Retirement and Labor Supply? Evidence from Chile, *Developing Economies* 43(2), 235-264.
- Chevalier, J. and G. Ellison, 1999. Career Concerns of Mutual Fund Managers, *Quarterly Journal of Economics* 114(2), 389-432.
- Davis, E.P., 1995. Pension Funds: Retirement Income Security and Capital Markets-An International Perspective, Oxford University Press, Oxford.
- de la Torre, A. and S.L. Schmukler, 2004. Coping with Risks through Mismatches: Domestic and International Financial Contracts for Emerging Economies, *International Finance* 7(3), 349-390.
- De Ferranti, D., D. Leipziger, and P.S. Srinivas, 2002. The Future of Pension Reform in Latin America, *Finance and Development* 39(3), 39-43.
- De Mesa, A. and C. Mesa-Lago, 2006. The Structural Pension Reform in Chile: Effects, Comparisons with Other Latin American Reforms, and Lessons, *Oxford Review of Economic Policy* 22(1), 149-167.
- Desai, P., 2000. Why Did the Ruble Collapse in August 1998? *American Economic Review* 90(2), 48-52.
- Disney, R. and C. Emmerson, 2005. Public Pension Reform in the United Kingdom: What Effect on the Financial Well Being of Current and Future Pensioners? *Fiscal Studies* 26(1), 55-82.

- Edwards, S., 1996. The Chilean Pension Reform: A Pioneering Program, NBER Working Paper 5811.
- Gill, I., T. Packard, and J. Yermo, 2005. Keeping the Promise of Social Security in Latin America, Stanford University Press and World Bank.
- Holzmann, R. and R. Hinz, 2005. Old-Age Income Support in the 21st Century: An International Perspective on Pension Systems and Reform, World Bank, Washington, D.C.
- Impavido, G. and A.R. Musalem, 2000. Contractual Savings, Stock, and Asset Markets, World Bank Policy Research Paper 2490.
- Impavido, G., A.R. Musalem, and T. Tressel, 2003. The Impact of Contractual Savings Institutions on Securities Markets, World Bank Policy Research Paper 2948.
- Jeanne, O., 2004. Debt Maturity and the International Financial Architecture, IMF Working Paper 04/137.
- Kapur, S. and A. Timmermann, 2005. Relative Performance Evaluation Contracts and Asset Market Equilibrium, *Economic Journal* 115(506), 1,077-1,102.
- Krugman, P., 1998. Fire-sale FDI, <http://web.mit.edu/krugman/www/firesale.htm>.
- Larraín, L., 1993. Social Security Reform, in The Chilean Experience: Private Solutions to Public Problems, Ed. C. Larroulet, Center for International Private Enterprise, Santiago, Chile.
- Malevergne, Y. and D. Sornette, 2008. How to be Moral at the Edge of Legality. The Financial Times, March 31, 2008.
- Palmer, E., 2000. The Swedish Pension Reform Model: Framework and Issues, World Bank Pension Reform Primer Social Protection Discussion Paper 0012.
- Queisser, M., 1998. Pension Reform: Lessons from Latin America, OECD Development Centre Policy Brief 15.
- Raddatz, C. and S.L. Schmukler, 2008. Pension Funds and Capital Market Development: How Much Bang for the Buck? Mimeo, World Bank.
- Rodrik, D., and A. Velasco, 1999. Short-Term Capital Flows, in Annual World Bank Conference on Development Economics, World Bank, Washington, D.C.
- Roll, R., 1992. A Mean/Variance Analysis of Tracking Error, *Journal of Portfolio Management* 18(4), 13-22.
- Rutkowski, M., 1998. A New Generation of Pension Reforms Conquers the East: A Taxonomy in Transition Economies, *Transition* 9(4), 16-19.
- Rutkowski, M., 2002. Pensions in Europe: Paradigmatic and Parametric Reforms in EU Accession Countries in the Context of EU Pension System Changes, *Journal of Transforming Economies and Societies* 9(1), 2-26.
- SAFP, 2003. Improvements to the System and Pending Challenges, in SAFP, The Chilean Pension System, Superintendencia de Administradoras de Fondos de Pensiones, Santiago, Chile.
- SAFP, 2002. Circular 1,210, Superintendencia de Administradoras de Fondos de Pensiones.
- Sharfstein, D. and J. Stein, 1990. Herd Behavior and Investment, *American Economic Review* 80(3), 465-479.
- Shleifer, A. and R.W. Vishny, 1990. Equilibrium Short Horizons of Investors and Firms, *American Economic Review* 80(2), 148-153.

- Stein, J., 2005. Why are most Funds Open-end? Competition and the Limits of Arbitrage, *Quarterly Journal of Economics* 120(1), 247-272.
- The Economist, 1999. Survey of Global Finance: Time for a Redesign.
- Tobin, J., 1958. Liquidity Preference as Behavior Towards Risk, *Review of Economic Studies* 25(2), 65-86.

Figure 1
Maturity Structure of Chilean PFAs

This figure presents the maturity structure of Chilean PFAs, that is, the proportion of the portfolio held at different terms to maturity, measured in years in the figure. Shares are calculated as a fraction of the fixed-term portfolio, not the overall portfolio. The maturity structure is calculated per PFA (over all fund types) and averaged across PFAs at each moment in time, using monthly bins. Panels A.1 and B.1 present the accumulated portfolio weight in each bin averaged across time, and the 25th and 75th percentiles across time as well. Panels A.2 and B.2 present the total portfolio weight within each bin averaged across time, along with the fitted value of the fractional polynomial regression of total portfolio weights on the term to maturity in months. Panel A presents the results for the entire sample period (Jul-1996 to Dic-2005) and Panel B presents the results for the Multi-Fund period (Sep-2002 to Dic-2005). Panel C presents the information in a table format, using accumulated weights in Panel C.1 and weights within each bin in Panel C.2.



Panel C. Maturity Structure

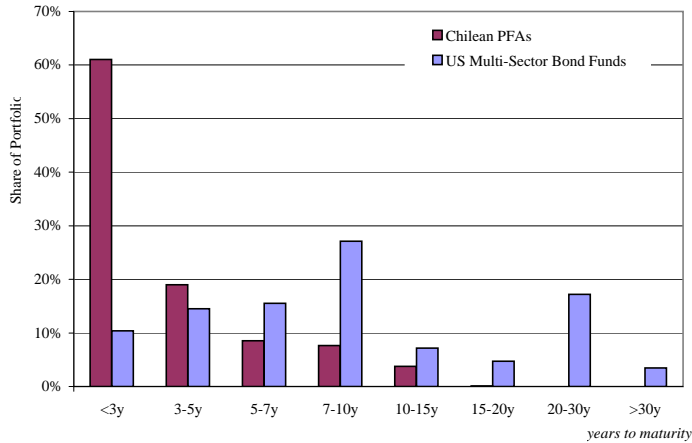
C1. Accumulated Weights								
	<1y	<3y	<5y	<7y	<10y	<15y	<20y	<30y
Entire Sample Period	25%	46%	75%	91%	98%	100%	100%	100%
Multi-Fund Period	36%	61%	80%	89%	96%	100%	100%	100%

C2. Weights Within Each Maturity Range								
	<1y	1-3y	3-5y	5-7y	7-10y	10-15y	15-20y	20-30y
Entire Sample Period	25%	20%	29%	16%	8%	2%	0%	0%
Multi-Fund Period	36%	25%	19%	9%	8%	4%	0%	0%

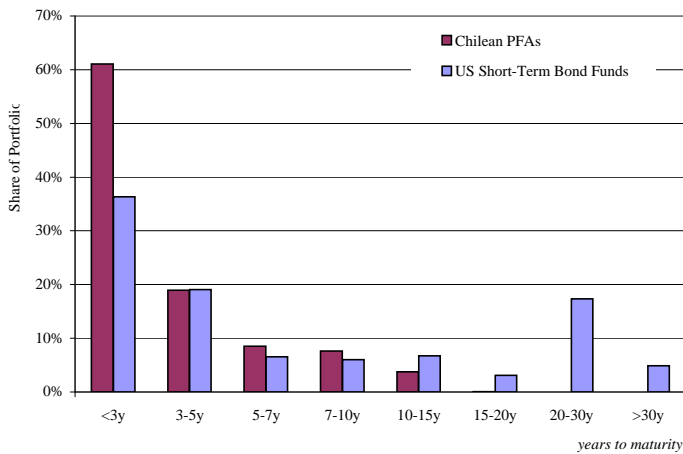
Figure 2
Maturity Structure of Chilean PFAs Compared to US Mutual Bond Funds

This figure compares the maturity structure of Chilean PFAs with that of select US mutual bond funds: multi-sector bond funds and short-term bond funds, according to the Morningstar definition of mutual bond funds. PFA shares are calculated as a fraction of the fixed-term portfolio, not the overall portfolio. The maturity structure of Chilean PFAs is averaged across monthly data for the multi-fund period (Sept-2002 to Dic-2005) and that of US bond funds is averaged across annual data for the period 2003 to 2005. Panel A compares the maturity structure of Chilean PFAs with that of US multi-sector bond funds and Panel B compares the maturity structure of Chilean PFAs with that of US short-term bond funds. Both panels present the total portfolio weight contained in each bin. Panel C presents the same information in a table format. Panel D presents the results of the Kolmogorov-Smirnov test of equality of

Panel A. Compared to US Multi-Sector Mutual Bond Funds



Panel B. Compared to US Short-Term Mutual Bond Funds



Panel C. Maturity Structure

C1. Accumulated Weights							
	<3y	<5y	<7y	<10y	<15y	<20y	<30y
Chilean PFAs (Multi-Fund Period)	61%	80%	89%	96%	100%	100%	100%
US Multi-Sector Bond Funds	10%	25%	40%	67%	75%	79%	97%
US Short-Term Bond Funds	36%	55%	62%	68%	75%	78%	95%

C2. Weights Within Each Maturity Range							
	<3y	3-5y	5-7y	7-10y	10-15y	15-20y	20-30y
Chilean PFAs (Multi-Fund Period)	61%	19%	9%	8%	4%	0%	0%
US Multi-Sector Bond Funds	10%	14%	16%	27%	7%	5%	17%
US Short-Term Bond Funds	36%	19%	7%	6%	7%	3%	17%

Panel D. Kolmogorov-Smirnov Test of Equality of Distributions

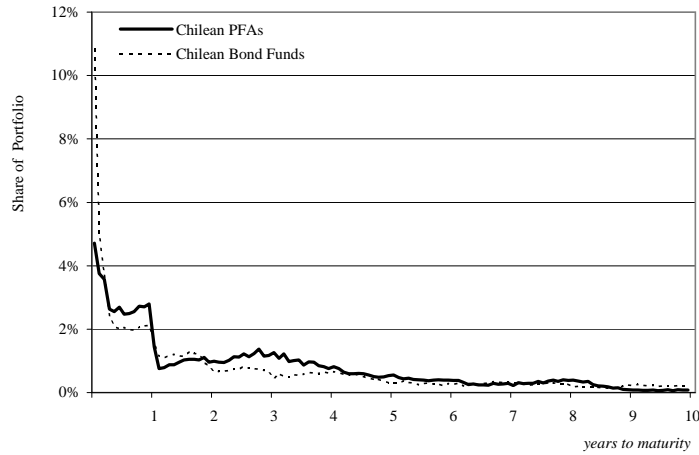
D.1. Chilean PFAs vs Multi-Sector Bond Funds		
	Overall	% Rejections
Two sided test	<.01***	99%
One sided tests (HA: PFA<MF)	<.01***	99%
One sided tests (HA: PFA>MF)	1.00	0%

D.2. Chilean PFAs vs Short-Term Bond Funds		
	Overall	% Rejections
Two sided test	<.01***	99%
One sided tests (HA: PFA<MF)	<.01***	99%
One sided tests (HA: PFA>MF)	1.00	0%

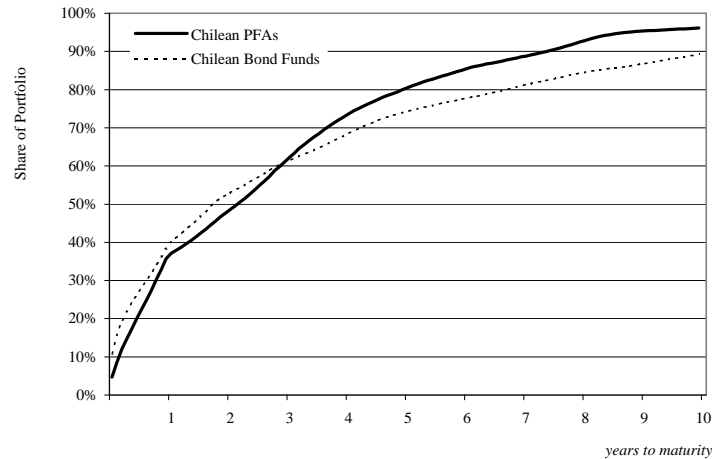
Figure 3
Maturity Structure of Chilean PFAs Compared to Chilean Mutual Bond Funds

This figure compares the maturity structure of Chilean PFAs to that of a select Chilean mutual bond fund: the medium- and long-term bond fund (bond fund type 3). For the Chilean PFAs, the maturity structure is calculated per PFA (over all fund types) and averaged across PFAs at each moment in time, using monthly bins. PFA shares are calculated as a fraction of the fixed-term portfolio, not the overall portfolio. Panel A compares the maturity structure of Chilean PFAs to that of the Chilean medium- and long-term bond fund and Panel B presents the same information, accumulated over the monthly bins. The results are the average of monthly data for the multi-fund period (Sept-2002 to Dic-2005). Panel C presents the same information in a table format. Panel D presents the results of the Kolmogorov-Smirnov test of equality of distributions.

Panel A. Chilean PFAs Compared to Chilean Medium- and Long-Term Mutual Bond Funds (Weights Within Each Bin)



Panel B. Chilean PFAs Compared to Chilean Medium- and Long-Term Mutual Bond Funds (Accumulated Weights)



Panel C. Maturity Structure

C1. Accumulated Weights							
	<3y	<5y	<7y	<10y	<15y	<20y	<30y
Chilean PFAs	61%	80%	89%	96%	100%	100%	100%
Chilean Mutual Bond Funds	61%	74%	81%	89%	96%	99%	100%

C2. Weights Within Each Maturity Range							
	<3y	3-5y	5-7y	7-10y	10-15y	15-20y	20-30y
Chilean PFAs	61%	19%	9%	8%	4%	0%	0%
Chilean Mutual Bond Funds	61%	13%	7%	8%	6%	4%	1%

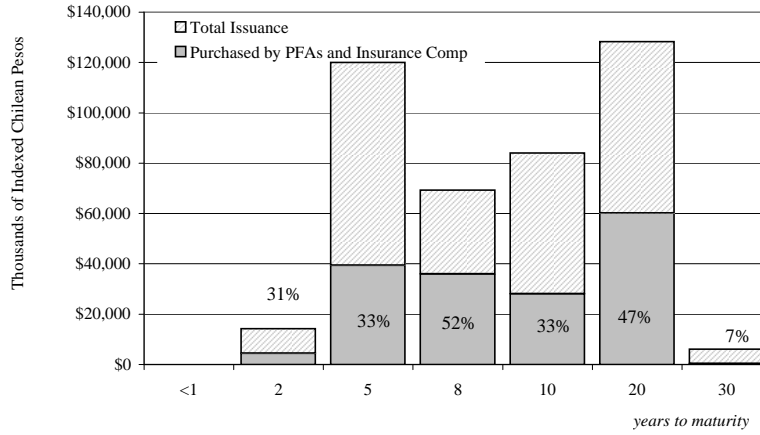
Panel D. Kolmogorov-Smirnov Test of Equality of Distributions

	Overall	% Rejections
Two sided test	0.58	77%
One sided test (HA: PFA<MF)	0.30	52%
One sided test (HA: PFA>MF)	0.53	42%

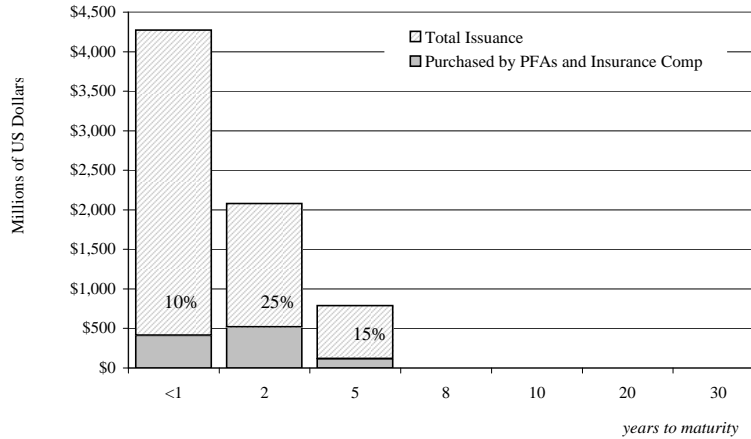
Figure 4
Proportion of Total Issuance of Government Bonds Purchased by PFAs

This figure presents the total amount of government bonds issued by currency denomination, and the proportion purchased by PFAs and insurance companies. The data are presented in each currency and represent total issuances and purchases during the period 1998-2008. Panel A presents the results for bonds denominated in indexed Chilean pesos, Panel B for nominal Chilean pesos, and Panel C for US dollars.

Panel A. Issuance Denominated in Indexed Chilean Pesos



Panel B. Issuance Denominated in US Dollars



Panel C. Issuance Denominated in Nominal Chilean Pesos

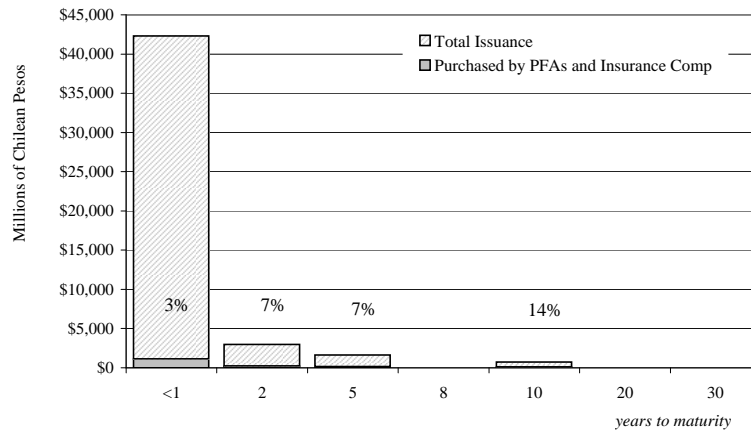


Figure 5

Average Share of Short-Term Domestic Fixed-Income Assets Around Events Linked to Investment Opportunities

This figure presents the average share of domestic short-term fixed-income assets in Chilean PFA's portfolios. Specifically, it considers assets with a term to maturity of up to 30 days. PFA shares are calculated as a fraction of the fixed-term portfolio, not the overall portfolio. The figure shows how the share of short-term assets in PFA's portfolios varies during several events related to changes in the investment opportunities faced by PFAs. Panel A presents the evolution of this share around the events in which regulatory constraints to investment abroad are relaxed, during the period 2002 to 2008. The share is calculated per event at each moment in time as the average across PFAs using daily frequencies, and finally, the share is averaged across all six events. Panel B displays the evolution of the same series around the dates of monthly releases of information of the detailed portfolio composition of all PFAs by the Chilean Superintendency of Pension Fund Administrators, from Jan-2006 to Jun-2008. The reported values are the average share across the thirty releases that occurred during the period. Panel C plots the same series during the Asian and Russian Crises of 1997-1998. Various events occurring during this period are displayed in vertical lines. Panel D presents the same information during the terrorist attacks of September 11th, 2001, considering one month before and after the event.

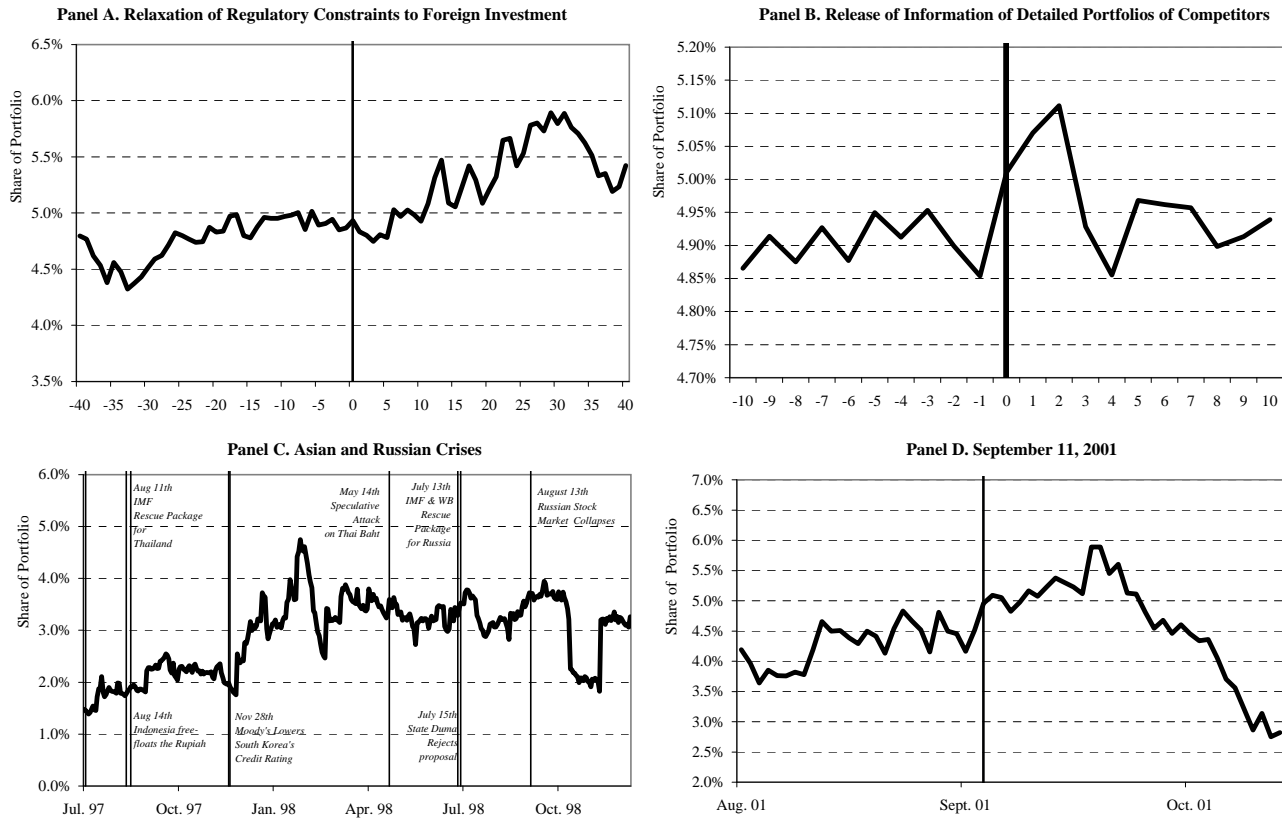
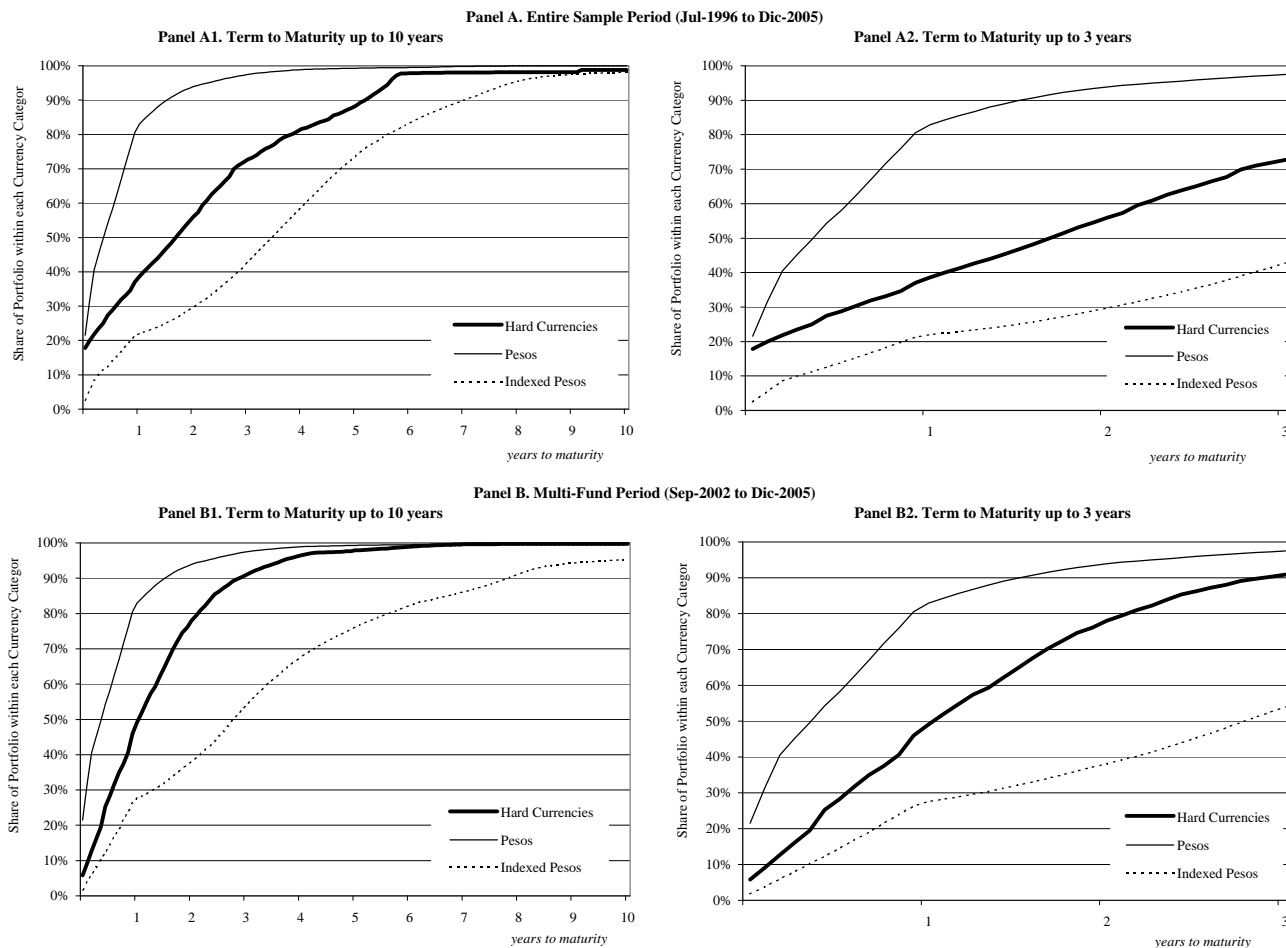


Figure 6
Maturity Structure of Chilean PFAs by Currency

This figure presents the maturity structure of Chilean PFAs, that is, the proportion of the fixed-term portfolio held at different terms to maturity, by currency: nominal Chilean pesos, indexed Chilean pesos, and "hard currencies" (US dollars, yens, euros, and British pounds). The maturity structure is calculated per PFA (over all fund types) and averaged across PFAs at each moment in time, using monthly bins. Weights are calculated over the entire portfolio and then normalized within each currency category. Panel A presents the results for the entire sample period (Jul-1996 to Dic-2005) and Panel B presents the results for the multi-fund period (Sept-2002 to Dic-2005). Panel C presents the overall portfolio weights by currency for both the entire sample period and the multi-fund period. Panel D presents the results of the Kolmogorov-Smirnov test of equality of distributions.



Panel C. Overall Portfolio Weights by Currency

	Hard Currencies	Pesos	Indexed Pesos
Entire Sample Period	4%	6%	90%
Multi-Fund Period	6%	14%	80%

Panel D. Kolmogorov-Smirnov Test of Equality of Distributions

	Overall	% Rejections
i) Hard vs Pesos		
Two sided test	<.01***	100%
One sided tests (HA: Hard<Pesos)	1.00	0%
One sided tests (HA: Hard>Pesos)	<.01***	100%
ii) Hard vs UF		
Two sided test	<.01***	100%
One sided tests (HA: Hard<UF)	<.01***	100%
One sided tests (HA: Hard>UF)	1.00	0%
iii) Pesos vs UF		
Two sided test	<.01***	100%
One sided tests (HA: Pesos<UF)	<.01***	100%
One sided tests (HA: Pesos>UF)	1.00	0%

Figure 7
Maturity Structure of Chilean PFAs Compared to Chilean and US Mutual Bond Funds

This figure compares the maturity structure of Chilean PFAs, by currency, to that of select Chilean and US mutual bond funds. Panels A compares the maturity structure of Chilean PFAs invested in "hard currencies" (US dollars, yens, euros, and British pounds) and in indexed Chilean pesos to US multi-sector bond funds and to US short-term bond funds, respectively. The maturity structure of Chilean PFAs represent shares within each currency category. Panel B presents the comparison of the portfolio of Chilean PFAs and Chilean medium- and long-term bond funds, by currency. Panel B1 compares the portion of each portfolio invested in "hard currencies" and Panel B2 in indexed Chilean pesos. In both cases, weights are calculated within each currency category. Data for US multi-sector bond funds and US short-term bond funds come from Morningstar and are averaged across annual data for 2003, 2004, and 2005. Both mutual bond funds are determined by the Morningstar definition of mutual bond funds. The results for the Chilean PFAs and mutual bond funds represent the average of monthly data for the multi-fund period (Sept-2002 to Dic-2005), and the results for the US mutual bond funds represent the average of annual data for the period 2003 to 2005. Panel C presents the results of the Kolmogorov-Smirnov test of equality of distributions.

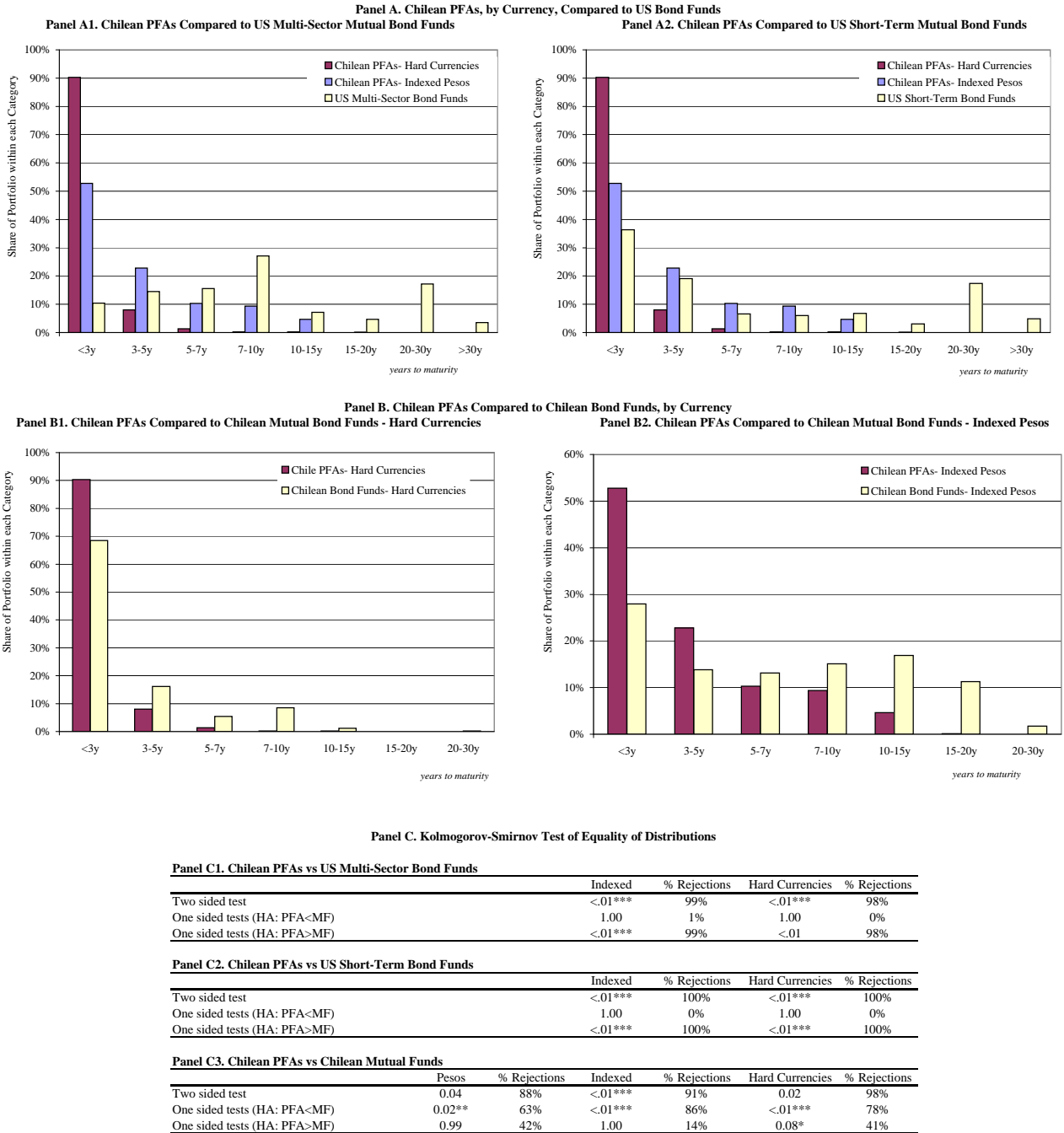
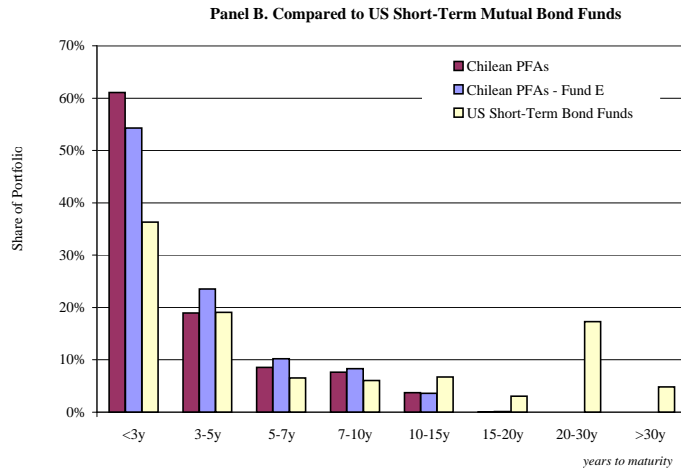
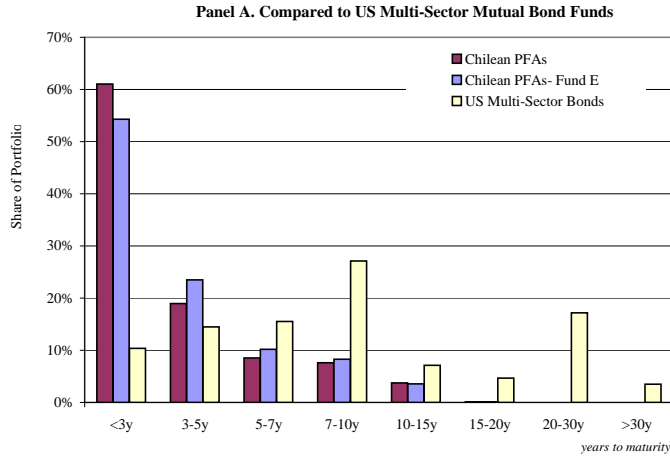


Figure 8
Maturity Structure of Chilean PFAs Compared to US Mutual Bond Funds

This figure compares the maturity structure of Chilean PFAs, overall and for Fund E only, with that of select US mutual bond funds: multi-sector bond funds and short-term bond funds, according to the Morningstar definition of mutual bond funds. The maturity structure of Chilean PFAs is averaged across monthly data for the multi-fund period (Sept-2002 to Dic-2005) and that of US bond funds is averaged across annual data for the period 2003 to 2005. Panel A compares the maturity structure of Chilean PFAs (overall and for Fund E) with that of US multi-sector bond funds and Panel B compares the maturity structure of Chilean PFAs (overall and Fund E) with that of US short-term bond funds. Both panels present the total portfolio weight contained in each bin. Panel C presents the same information in a table format. Panel D presents the results of the Kolmogorov-Smirnov test of equality of distributions.



Panel C. Maturity Structure

C1. Accumulated Weights	<3y	<5y	<7y	<10y	<15y	<20y	<30y
Chilean PFAs (Multi-Fund Period)	61%	80%	89%	96%	100%	100%	100%
US Multi-Sector Bond Funds	10%	25%	40%	67%	75%	79%	97%
US Short-Term Bond Funds	36%	55%	62%	68%	75%	78%	95%

C2. Weights Within Each Maturity Range	<3y	3-5y	5-7y	7-10y	10-15y	15-20y	20-30y
Chilean PFAs (Multi-Fund Period)	61%	19%	9%	8%	4%	0%	0%
US Multi-Sector Bond Funds	10%	14%	16%	27%	7%	5%	17%
US Short-Term Bond Funds	36%	19%	7%	6%	7%	3%	17%

Panel D. Kolmogorov-Smirnov Test of Equality of Distributions

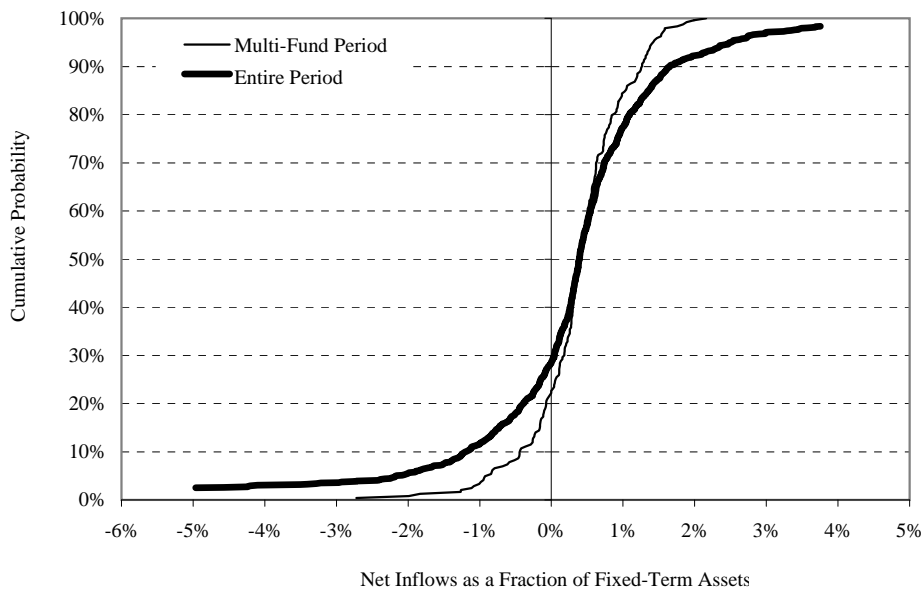
D.1. Chilean PFAs vs Multi-Sector Bond Funds	Overall	% Rejections
Two sided test	<.01***	99%
One sided tests (HA: PFA<MF)	<.01***	99%
One sided tests (HA: PFA>MF)	1.00	0%

D.2. Chilean PFAs vs Short-Term Bond Funds	Overall	% Rejections
Two sided test	<.01***	99%
One sided tests (HA: PFA<MF)	<.01***	99%
One sided tests (HA: PFA>MF)	1.00	0%

Figure 9 Net Inflows of Funds of Chilean PFAs

This figure presents the cumulative distribution of the net inflows of funds of Chilean PFAs as a fraction of their fixed-term assets. Net inflows are computed for each PFA and month as the difference between the contemporaneous and lagged value of a fund's assets less the returns accrued from the assets in the previous month's portfolio and are divided by the contemporaneous value of a fund's fixed-term assets. Panel A presents the empirical cumulative probability distributions of these normalized inflows across PFAs and months during the entire sample period and the multi-fund period, both obtained under the assumption that normalized inflows are independent and identically distributed across PFAs and time. Panel B reports the probabilities of observing an outflow that is larger than the fraction of the fixed-term portfolio invested by the average PFA at 30 and 90 days (reported in the first and fourth columns) obtained from the empirical distributions shown in Panel A. The first of such probabilities is derived from the empirical distribution corresponding to the sample period described in each row. The second of those probabilities, marked with an asterisk (*) is obtained from the cumulative distribution of the entire sample period.

Panel A. Cumulative Distribution of Net Inflows as a Fraction of Fixed-Term Assets



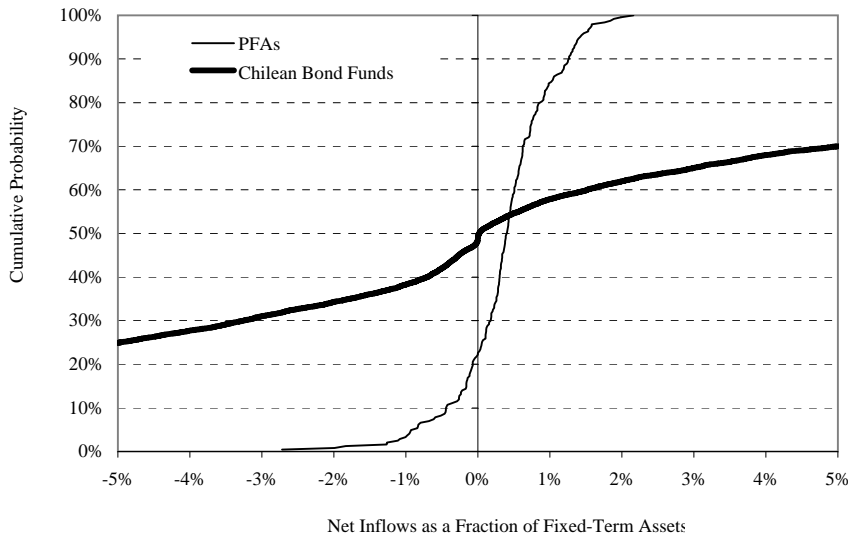
Panel B. Percentage of Fixed-Term Assets Held at Short Term and Probability of Outflows of that Magnitude

	% < 1 month	Probability Outflow > % 1mo	Probability Outflow > % 1 mo*	% < 3 month	Probability Outflow > % 3mo	Probability Outflow > %3 mo*
Entire Sample Period	4.0%	3.1%	--	11.2%	0.3%	--
Multi-Fund Period	4.7%	<0.4%	2.5%	12.0%	<0.4%	0.2%

Figure 10 Net Inflows of Funds of Chilean PFAs and Mutual Funds

This figure presents the cumulative distribution of the net inflows of funds of Chilean PFAs and mutual bond funds as a fraction of their fixed-term assets. Net inflows are computed for each fund and month as the difference between the contemporaneous and lagged value of a fund's assets less the returns accrued from the assets in the previous month's portfolio and are divided by the contemporaneous value of a fund's fixed-term assets. Panels A presents the empirical cumulative probability distributions of these normalized inflows across observations for PFAs (thin line) and mutual bond funds (thick line) during the multi-fund period, both obtained under the assumption that normalized inflows are independent and identically distributed across observations. The distribution of mutual bond fund inflows is shown only partially because it has been limited to fit the scale of the distribution of PFA inflows. Panel B reports the probabilities of observing an outflow that is larger than the fraction of the fixed-term portfolio invested by the average PFA and funds at 30 and 90 days, which is obtained from the empirical distributions shown in panel A.

Panel A. Cumulative Distribution of Net Inflows as a Fraction of Fixed-Term Assets



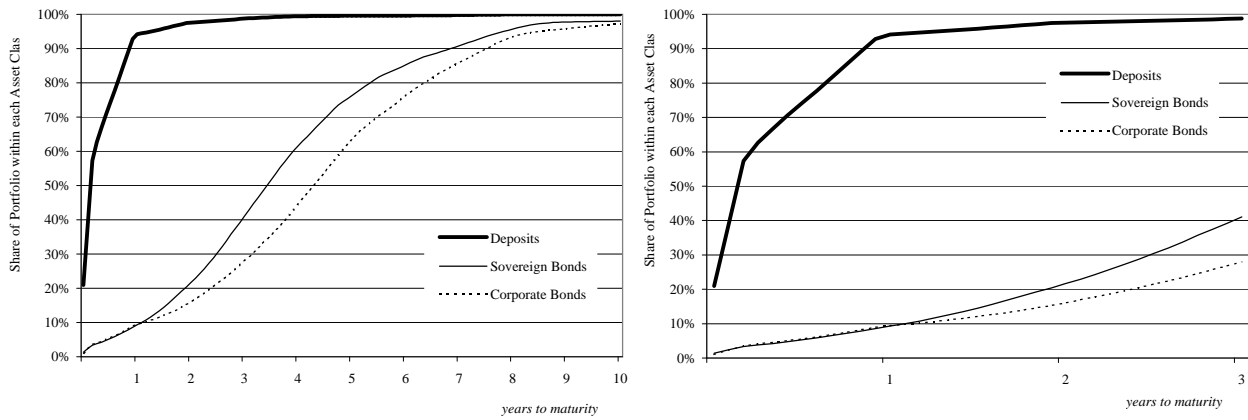
Panel B. Percentage of Fixed-Term Assets Held at Short Term and Probability of Outflows of that Magnitude

	% < 1 month	Probability Outflow > % 1mo	% < 3 month	Probability Outflow > % 3mo
PFAs	4.7%	<0.4%	12.0%	<0.4%
Chilean Bond Funds	10.8%	16.0%	19.5%	9.0%

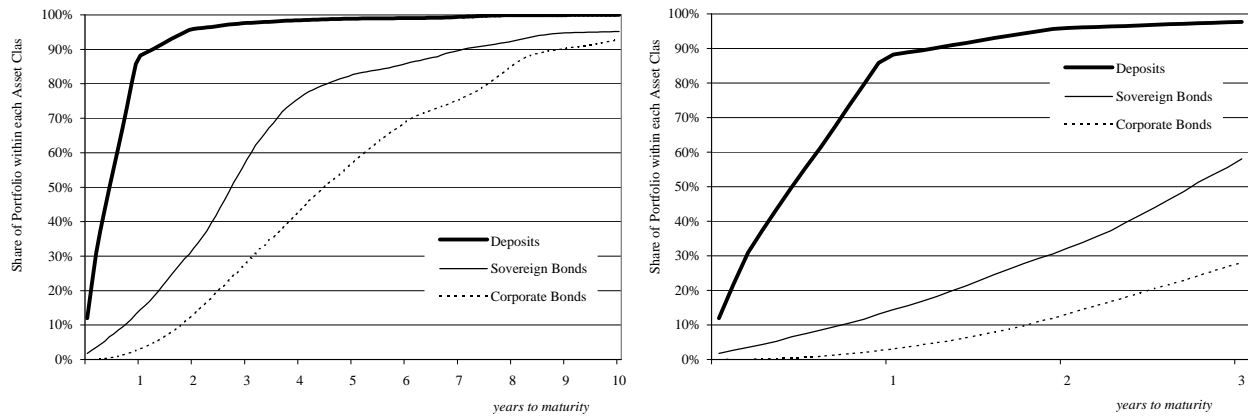
Appendix Figure I Maturity Structure of Chilean PFAs by Asset Class

This figure presents the maturity structure of Chilean PFAs, that is, the proportion of the portfolio held at different terms to maturity, by asset class. Shares represent within-asset-class weights. The maturity structure is calculated per PFA (over all fund types) and averaged across PFAs at each moment in time, using monthly bins. The figure displays the accumulated weight at each term to maturity. The figures to the left present the within-asset-class weights accumulated per asset class up to 10 years of maturity and the figures to the right present a close-up of the same information only accumulated up to a term to maturity of 3 years. Panel A presents the results for the entire sample period (Jul-1996 to Dic-2005) and Panel B presents the results for the multi-fund period (Sept-2002 to Dic-2005). Panel C presents the overall portfolio weights of each asset class, for the entire sample period and the multi-fund period.

Panel A. Entire Sample Period (Jul-1996 to Dic-2005)



Panel B. Multi-Fund Period (Sep-2002 to Dic-2005)



Panel C. Overall Portfolio Weights by Asset Class

	Deposits	Sovereign Bonds	Corporate Bonds
Entire Sample Period	20%	37%	6%
Multi-Fund Period	35%	32%	14%

Table 1
PFA's Holdings of Outstanding Corporate Debt

This table shows the corporate bond holdings of PFAs compared to total outstanding corporate debt. Panel A presents the fraction of outstanding corporate debt that PFAs purchase and Panel B presents the average maturity of PFA corporate bond holdings compared to the average maturity of total outstanding corporate debt. Both panels present this information as of the 31st of December of each year during the period 2002 to 2005. Source: Superintendencia de Pensiones and Superintendencia de Valores y Seguros.

Panel A. Fraction of Outstanding Corporate Debt Held by PFAs

	Dec-02	Dec-03	Dec-04	Dec-05
	43.90%	40.60%	37%	48.70%

Panel B. Average Maturity (in years) of PFA Corporate Bond Holdings vs. Total Outstanding Corporate Debt

	Dec-02	Dec-03	Dec-04	Dec-05
PFA Holdings of Corporate Debt	4.9	5	5.8	6.1
Outstanding Corporate Debt	12.2	12.7	14	14.7

Appendix Table 1

Proportion of Total Issuance of Government Bonds Purchased by PFAs

This table presents the fraction of total government bond issuance purchased by PFAs and insurance companies. The Central Bank of Chile reports the information aggregating PFAs and insurance companies due to historical reasons. However, the incidence of insurance companies on these figures is negligible because they correspond to direct purchases and insurance companies make almost all of their purchases through intermediaries (banks). In contrast, pension funds directly bid for Central Bank papers. Therefore these figures can be considered to represent the proportion of total government issuance purchased by PFAs.

	2002	2003	2004	2005	2006	2007	2008
Inflation-Linked Bonds							
<i>Tesoreria</i>							
10 years				35.8%			
20 years		32.7%	57.2%	56.9%		41.9%	28.7%
30 years							7.1%
<i>Central Bank</i>							
2 years							31.3%
5 years	55.4%	25.3%	14.6%	11.4%	52.6%	30.9%	42.3%
10 years	34.3%	21.3%	27.2%	22.0%	58.4%	28.1%	39.0%
20 years							34.4%
Nominal Bonds							
<i>Tesoreria</i>							
10 years						14.9%	26.1%
<i>Central Bank</i>							
2 years	1.2%	1.6%	6.5%	18.0%	12.8%	8.3%	5.0%
5 years	6.4%	2.0%	0.0%	4.5%	23.8%	8.7%	7.5%
10 years			0.0%	1.7%	21.5%	65.0%	32.3%
Dollar-Denominated Bonds							
<i>Central Bank</i>							
1 year			18.3%	3.0%	0.0%		
2 years	15.9%	33.7%					
5 years	16.6%	12.8%					