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Institutional Investors and Long-Term Investment

Evidence from Chile

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Abstract

Developing countries are trying to develop long-term financial markets and institutional investors are expected to play a key role. This paper uses unique evidence on the universe of institutional investors from the leading case of Chile to study to what extent mutual funds, pension funds, and insurance companies hold and bid for long-term instruments, and which factors affect their choices. The paper uses monthly asset-level portfolios to show that, despite the expectations, mutual and pension funds invest mostly in short-term assets relative to insurance companies. The significant difference across maturity structures is not driven by the supply side of debt or tactical behavior. Instead, it seems to be explained by manager incentives (related to short-run monitoring and the liability structure) that, combined with risk factors, tilt portfolios toward short-term instruments, even when long-term investing yields higher returns. Thus, the expansion of large institutional investors does not necessarily imply longer-term markets.

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INSTITUTIONAL INVESTORS AND LONG-TERM INVESTMENT: EVIDENCE FROM CHILE

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1. Introduction

One important and pending problem in almost all developing countries is the lack of development of markets for long-term finance. This crucial issue has become more prominent in the policy discussions, especially after the global financial crisis of 2008-2009, because having access to long-term funds allows governments and firms to finance large investments over time and reduce rollover risk and potential runs, which can lead to costly crises.[1] Moreover, from a social point of view, having access to long-term instruments might give households higher risk-adjusted returns. But despite the advantages of long-term debt for the debtors, many investors prefer short-term debt as a way to discipline debtors and cope with moral hazard, agency problems, risk, and inadequate regulations and institutions, among other things (Rajan, 1992; Rey and Stiglitz, 1993; Diamond and Rajan, 2001). So obtaining long-term contracts in equilibrium is not easy.

Because of their benefits and the difficulties in developing long-term markets, many countries have actively tried to foster long-term lending through various measures that tackle different parts of the financial system. One important component in this strategy is the promotion of institutional investors such as pension funds, which have grown rapidly since the 1990s. The expectation is that, by managing most domestic savings including those for retirement purposes, institutional investors would invest long term (including infrastructure projects) and, thus, foster long-term capital market development. This view has been expressed in several studies and articles, for example,

[1] In fact, the literature argues that short-termism can explain several well-known financial crises in both emerging and developed countries (Eichengreen and Hausmann, 1999; Rodrik and Velasco, 2000; Tirole, 2003; Borensztein et al., 2005; Jeanne, 2009; Alfaro and Kanczuk, 2009; Brunnermeier, 2009; Raddatz, 2010; Broner et al., 2013).

Caprio and Demirguc-Kunt (1998), Corbo and Schmidt-Hebbel (2003), BIS (2007), Borensztein, et al. (2008), Eichengreen (2009), Della Croce, et al. (2011), OECD (2013a,b), and The Economist (2013, 2014). Institutional investors are also expected to professionally manage assets, diversify risk, and overcome problems of asymmetric information and transaction costs that pervade financial markets. But how long institutional investors invest depends on many factors including their utility function, their liability structure, and the incentives managers face from markets and regulators (Bajeux-Besnainou, et al., 2001; Campbell et al., 2001; Campbell and Viceira, 2002).[2]

Despite the expectations that many authors have placed on institutional investors and their large size and continuing rapid growth in many countries, little evidence exists on whether these investors actually invest long term and how they structure the maturity of their portfolios. This lack of evidence is mainly due to the difficulty in obtaining detailed portfolio data on institutional investor holdings. The literature on portfolio composition has focused almost exclusively on specific institutional investors in developed countries (to a large extent, US mutual funds). The international evidence has concentrated on international mutual funds domiciled in international financial centers and their investments across countries, ignoring the behavior of the large domestic institutions and the heterogeneity across investor types. Moreover, the literature tends to center just on equity holding, and is therefore silent on the maturity choices of institutional investors.[3]

[2] For general references on their expected impact on capital markets, see, for example, Davis (1995), Davis and Steil (2001), and Impavido et al. (2003, 2010).

[3] See, for example, Grinblatt and Keloharjub (2000), Kim and Wei (2002), Borensztein and Gelos (2003), Kaminsky et al. (2004), Gelos and Wei (2005), Broner et al. (2006), Hau and Rey (2008), Jotikasthira et al. (2012), Raddatz and Schmukler (2012), and Didier et al. (2013).

This paper sheds new light on the extent to which institutional investors invest long term and the factors underpinning their maturity choices. To do so, we analyze unique data on the actual portfolios and bids of the universe of domestic institutional investors in the benchmark case of Chile. In particular, we assemble asset-level time-series portfolio holdings of bank deposits, sovereign bonds, and corporate bonds of medium- and long-term bond mutual funds, pension funds, and insurance companies at high frequencies (monthly, and also daily for pension funds). We also use detailed data on the individual biddings at government paper auctions and returns of government bonds at different maturities. The main data set on asset holdings by Chilean institutional investors contains 965,209 observations for mutual funds, 6,659,681 monthly observations for pension funds, and 4,071,927 observations for insurance companies.

The value added of the paper is twofold. First, it documents in detail the maturity structure of different kinds of institutional investors to establish to what extent these investors demand long-term assets. Second, the paper discusses what factors might be behind the maturity structure of institutional investors' portfolios by exploiting a rich data set on Chile, containing different types of investors within a single market. Because these investors operate in the same macroeconomic and institutional environment and have access to the same set of instruments, this approach allows us to control for specific sources of variation across investors and asset classes.

This paper studies different hypotheses related to the maturity choices of institutional investors. First, the equilibrium might be short term if borrowers do not issue long-term paper. Therefore, the paper explores if the supply side of instruments (the demand side of capital) is the one determining the equilibrium outcome. Second, the

paper studies if institutional investors hold short-term instruments for tactical reasons, to take advantage of large fluctuations in asset prices to purchase securities during crises. Third, the paper studies what role incentives play in the maturity choice, following the papers that argue that principal-agent problems can lead managers to invest short term.[4]

Three factors that can affect manager incentives are: the risk of different instruments, short-run monitoring, and the liability structure. Long-term instruments have more price risk, which can more easily generate deviations of each fund from the industry (provided that they do not hold the same assets). This is important for open-end mutual and pension funds that need to mark-to-market their portfolios and are monitored on a short-run basis by market participants and regulators. Poor performance could lead to costly outflows and penalties, among other things, that force managers to liquidate assets, reducing at the same time the pool of assets they administer and their associated fees (Rajan, 2005; Lim et al., 2013). Insurance companies, on the other hand, have fixed long-term liabilities and are not subject to these withdrawals due to their closed-end nature.[5] Our comparison of the maturity structure across institutional investor types offers useful information to this literature, which has mostly focused on micro evidence at the managerial level.

We find that asset-management institutions in Chile (both mutual funds and pension funds) hold a large amount of short-term instruments (bank deposits including cash, government paper, and corporate debt) that are easy to liquidate. For example, mutual funds and pension funds hold portfolios with an average maturity of 3.97 and 4.36

[4] See, for example, Narayanan (1985), Sharfstein and Stein (1990), Shleifer and Vishny (1990), Bebchuk and Stole (1993), Chevalier and Ellison (1999), Kapur and Timmermann (2005), Stein (2003, 2005), Bolton et al. (2006), Calomiris (2008, 2011), Chen and Pennacchi (2009), and Pennachi and Rastad (2011).
[5] Although not the case in Chile, in some countries pension funds also have this type of structure.

years, respectively. This similarity between mutual and pension funds is especially surprising considering that pension funds are supposed to save for the retirement of the pensioners. In contrast, insurance companies are significantly more tilted toward the long term, holding portfolios with an average maturity of 9.77 years.

The short-termism of pension funds is not determined by a lack of instruments or tactical behavior. In particular, of the outstanding government and corporate debt, pension funds do not exhaust the supply of long-term instruments. Moreover, individual biddings at government paper auctions suggest that pension funds bid less aggressively for long-term instruments, both relative to other instruments and relative to insurance companies. In addition, pension funds do not use their cash and other short-term investments to take advantage of buying opportunities that arise during fire sales related to crises.

Estimates of returns of government bonds of different maturities suggest that, given the risk-return tradeoff, investors with a short-run horizon have more incentives to invest in short-term instruments relative to investors with a long-term horizon. While long-term assets yield higher returns at a higher risk, the risk-return relation diminishes as the investment horizon lengthens. Thus, the prevalence of short-term assets in pension and mutual fund portfolios is consistent with them having relatively short-term investment horizons.

We provide evidence that the shorter investment horizon of mutual and pension funds compared to insurance companies might result from agency factors that tilt the managerial incentives. Namely, the fact that long-term assets are more volatile than short-term ones poses a risk to open-end funds subject to short-run monitoring. In the case of

mutual funds, the short-run monitoring is exercised by investors, who inject/redeem their assets based on the funds' short-run performance. In the case of pension funds, both common regulatory practices that punish the funds that deviate from industry averages and the owners of the asset-management companies exert a short-run monitoring. Investors, too, could monitor managers in the short-run, even when their investments are geared toward the long term. In contrast, insurance companies are not open-end asset managers, receive assets that cannot be withdrawn in the short run, and have long-term liabilities as investors acquire a defined-benefit plan when purchasing a policy. Thus, insurance companies are not subject to the same kind of short-run monitoring. This type of short-run monitoring seems to be behind the risk aversion of pension funds. When pension funds do poorly they cut risk by investing more short term, perhaps as a way to reduce the potential of having an even lower return. On the contrary, when mutual funds do poorly they invest more long term, maybe as a way to try to compensate for their low returns. This different behavior between Chilean pension and mutual funds is consistent with the incentives they face, as we describe in the paper.

The experience from the ideal benchmark case of Chile shows that the development of large and sophisticated intermediaries with deep pockets does not guarantee an increased demand for long-term assets. Relative to other emerging economies, Chile has a developed capital market (de la Torre et al., 2011) and its administrations have made a conscious effort from the supply and demand side of capital to provide an adequate framework to extend debt maturities. In particular, Chile was the first country to adopt in 1981 a mandatory, privately managed, defined-contribution (DC) pension fund model by replacing the old public, defined-benefit (DB) pension system.

Many developed and developing countries have followed suit and reformed their pension regimes, establishing this type of pension fund system with rather similar regulatory schemes.[6] Thus, the characterization of the maturity structure of Chilean pension funds and its comparison to that of other institutional investors offer some interesting lessons on the role that these investors play on the development of a long-term debt market.

The rest of the paper is organized as follows. Sections 2 and 3 briefly describe the institutional investors we analyze and the main data used (the other data sets are described throughout the paper). Section 4 characterizes the maturity structure of Chilean institutional investors. Section 5 analyzes to what extent the supply side of instruments, tactical behavior, risk, and managerial incentives might affect the maturity structure. Section 6 concludes.

2. Chilean Institutional Investors

As mentioned above, the Chilean institutional investors developed as part of a series of macroeconomic and financial sector reforms that targeted both the demand and supply side of capital. On the demand side, Chile has introduced reforms to foster capital market development. Corporations and the government have then issued a wide range of securities, including long-term local currency bonds. Moreover, Chile's stable macroeconomic performance since the early 1990s and its long history of issuing inflation-linked instruments have also reduced the risk and the cost of long-term assets.

[6] For example, the UK moved toward a multi-pillar pension system in 1986. Sweden modified in 1994 the pension system from a pay-as-you-go DB to a second-pillar system that includes a voluntary DC system. In the US, proposals to reform the social security system were also recurrently considered. Following Chile's example, many developing countries adopted similar reforms, including Argentina, Bolivia, Colombia, Costa Rica, the Dominican Republic, El Salvador, Hungary, Kazakhstan, Lithuania, Mexico, Peru, Slovakia, Poland, and Uruguay.

On the supply side, Chile has established relatively early a broad institutional investor base. As a consequence, during the period under study these investors grew considerably, received a steady inflow of funds, and became well established and large. By 2005, mutual funds, pension funds, and insurance companies collectively had assets under management equivalent to 84% of GDP. They have played an important role in financial markets, investing in different types of asset classes, such as bonds, deposits, equities, mortgages, and money market instrument, issued by both the private and the public sectors, domestically and abroad. Given their size and importance as conduits of savings, these institutional investors have offered different products and have been subject to different regulations.

Pension funds are the most important institutional investor in Chile, with assets under management equivalent to 56% of GDP in 2005. Since 2002, pension fund administrators (henceforth PFAs) offer five different funds ("A" to "E"), where fund "A" offers the highest return-risk profile, and fund "E" the lowest.

Because they are under a defined-contribution scheme, the investment portfolio of pension funds is not subject to any regulation regarding a target asset-liability term mismatch. The most important link between regulation and asset allocation is driven by the so called "structural limits," which basically restrict the proportion of foreign investment and the ratio of equity and fixed income investment to total assets in each type of fund. This implies that fund "A" is tilted to equity instruments, and fund "E" to fixed income.[7]

[7] There are several other limits, such as counterpart exposure and derivatives investments, which we omit from our analysis. For example, pension funds are allowed to use derivatives up to only 3% of their assets (including any type of derivatives). These rules, in practice, imply a quite small use of interest rate

Another important common regulatory restriction that pension funds face is that they need to deliver a minimum rate of return. This regulation establishes that pension funds 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 two or four percentage points, depending on the riskiness of each fund, or (ii) the average real return of all funds minus the absolute value of 50% of that average return. However, to minimize the impact of this regulation on herding, the average real rate of return to calculate the minimum return changed from 12 months to 36 months in October 1999, giving PFAs more flexibility to deviate in the short term from industry comparators. If a fund falls short in performance, the PFA must compensate for the difference.

This kind of pension fund regulation is not Chile-specific and is typical of systems that have DC pension programs, where the regulator wants to ensure the safety of public savings. For example, in Latin America, Colombia, El Salvador, Peru, and Uruguay (countries that have also reformed their pension fund systems) have similar minimum return bands. In Europe, Poland, the Slovak Republic, and Switzerland also have similar schemes. Other developed countries (Belgium and Germany) have analogous guarantees in their voluntary DC programs.

The insurance companies analyzed in our paper are life insurance companies, which by 2005 managed assets equivalent to 18% of GDP. These assets come mainly from funds accumulated by pensioners seeking an annuity income during their retirement period of around 20 years. Given the long-term nature of their liabilities, insurance companies have strong incentives to hedge their liabilities with long-maturity bonds to

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derivatives to change their maturity profile. Furthermore, interest rate derivatives markets were not very well developed in Chile during the period under study (Fernandez, 2006).

reduce their default risk and increase customers' demand. Still, life insurance companies are subject to different limits that intend to minimize the risk of their investments. One of them (removed at the end of 2011) is related to the asset-liability mismatch, by which cash flows are projected in ten tranches into the future and, based on the degree of mismatch in each tranche, the life insurance company adjusts its capital requirement. In addition, life insurance companies are subject to an asset adequacy test and other limits referred to a maximum exposition to some asset class (such as, equity and real estate) and the concentration to issuers and related investors.

Mutual funds are the institutional investor less exposed to regulatory requirements to structure their portfolios. In general, regulation is flexible and is mainly focused in diversification and disclosure requirements. Once a mutual fund company decides to offer a new fund, for example a "corporate fixed income fund," the fund is obligated to invest at least 90% of their assets in those instruments stated in the fund name. Therefore, each mutual fund company determines the investment portfolio composition of its funds.

3. Main Data

The main data used in this study consist of asset-level holdings of institutional investors during the relevant period 2002-2008, when institutional investors grew and consolidated in Chile and financial markets operated under relative normal circumstances. The data come from different sources.

The data on Chilean mutual funds and insurance companies come from the Superintendency of Securities and Insurance (*Superintendencia de Valores y Seguros, SVS*). The data on Chilean pension funds, the most comprehensive data, come from the

Superintendency of Pensions (*Superintendencia de Pensiones, SP*). The other data used, described throughout the paper, come from the Central Bank of Chile (*Banco Central de Chile*) and other sources (Appendix Table 1).

The data on Chilean mutual funds contain detailed portfolios of all existing medium- and long-term funds at a monthly frequency during the period January 2002 to December 2008. The database comprises 965,209 observations. It includes information on the type of security, currency denomination, price, units held, and maturity date. In addition to these medium- and long-term funds, there are several short-term mutual funds providing money market services. We exclude those from the analysis to focus solely on funds established to invest long term.[8]

For pension funds, we use a panel of their portfolio investments in fixed-term assets for each of the existing funds during the period 1996-2008 at monthly and daily frequencies. We perform more detailed analysis for the period 2002-2008, when the investment options expanded to more funds. We use panel data with the amount of deposits (including cash as deposits with a one-day maturity), corporate bonds, and government bonds held by fund per unit of time.[9] There are a total of 6,659,681 observations on a monthly frequency, representing the portfolio holdings of the funds. The data set contains information on the holdings of 76,498 different securities for 45

[8] Chilean mutual funds are classified according to the type and investment horizon of their assets. Fixed-income funds include money management funds (with horizons of less than 90 days or less than 365 days) and medium- and long-term funds. We only use the latter two, since the first ones would be tilted toward the short term by construction. In 2008, approximately 60% of the existing funds were categorized as medium- or long-term funds, 12% as money management funds (less than 365 days), and 28% as money management funds (less than 90 days).

[9] Since September 2002, each pension fund administrator (PFA) offers by law five funds with different risk profiles and investments in equity, subject to different portfolio regulations. The PFAs organize their trading desks in different forms that vary over time. For example, some pension fund companies have specialists for each asset class across fund types while others have dedicated managers for each fund, selecting the portfolio in each asset category.

funds between September 2002 and June 2008. In addition to this monthly data set, we use a daily data set with portfolios of the universe of funds and PFAs in operation, which contains 201,288,833 observations for 62 funds between July 1996 and July 2008.[10] The daily data have the same fields included in the monthly database.

The data on Chilean insurance companies comprise monthly portfolio holdings from January 2002 to December 2008. The database contains 4,071,927 observations corresponding to the fixed-term assets of 36 insurance companies. Information on security type, maturity date, and currency, among others, are available in this data set.

4. Maturity Structure

We describe the holdings of long-term assets by documenting in turn the maturity structure of mutual funds, pension funds, and insurance companies. For the case of mutual funds, Figure 1 plots the fraction of investments in fixed-term assets per year-to-maturity, both within each maturity range and accumulated. We construct the figure by determining at each point in time (each month) the term to maturity of each instrument in a mutual fund portfolio, measuring the fraction of the value of all assets invested at different terms to maturity, and then averaging these fractions across mutual funds 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

[10] The difference between the number of funds in the monthly and daily data sets is due to the extended period the daily data set covers.

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

where *I* denotes an indicator function that takes on the value one if the condition is met. The average fraction of fund k's fixed-term assets invested at maturity D across time is

(2) $$W_{D,k} = \frac{1}{T_k} \sum_{t=1}^{T_k} W_{D,k,t},$$

where T_k is the number of periods in which mutual fund k is active. The overall average fraction of fixed-term assets invested at maturity D across mutual funds and months corresponds to

(3) $$W_D = \frac{1}{N} \sum_{k=1}^{N} \frac{T_k}{T} W_{D,k},$$

where *T* denotes the number of months included in the entire sample period, and N is the number of active mutual funds.[11]

The fractions computed correspond to the empirical probability distribution function (PDF) of the term to maturity of a Chilean peso invested by mutual funds in fixed-term assets. 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, in addition to the average CDF, Figure 1 also reports the 25th and 75th percentiles of the CDF across mutual funds.

Figure 1, Panel A shows that mutual funds hold a large fraction of their assets short term. For example, they invest 38% of their portfolio up to one year, 59% up to three years, and 73% up to five years. Moreover, they hold almost all of their assets in

[11] Although we focus on maturity, in unreported results we also analyze if there are large differences between the maturity and duration structure of pension funds for which we have the necessary data to perform the comparison. We find that the proportion of the portfolio held within each maturity/duration range is not very different, except for short-term bonds with maturities of one to four years.

securities maturing within 15 years (95%). However, the distributions vary greatly across mutual funds, as shown by the 25th and 75th inter-quartile range across funds, averaged over time: the fraction of the fixed-term portfolio invested up to one year varies between 24% and 50%. Panel B shows that portfolio weights decline exponentially; the highest density is observed at short maturities, after which probabilities systematically decline.

Figure 2 shows the maturity structure of Chilean pension funds for the 2002-2008 period. Similar to mutual funds, PFAs are heavily invested in short-term assets. For example, they invest 40% up to one year, 56% up to three years, and 68% up to five years (Panel A). The distributions do not vary much by PFA as shown by the inter-quartile range calculated across PFAs over time. The fraction of the fixed-term portfolio invested up to one year varies only between 37% and 45% during the sample. Even smaller degrees of dispersion are observed at other ranges of the CDFs. Panel B shows that the portfolio weights decline exponentially, similarly to the case of mutual funds.

Figure 3 shows the maturity structure of Chilean PFAs by fund type. Funds A (the riskiest ones) have the lowest average maturity (2.72 years) and invest almost 62% of their assets in instruments up to one year. In contrast, funds E (the safest ones) have the highest average maturity (5.70 years) and invest almost 30% in instruments with maturity of seven years or more. More generally, the maturity structure tends to increase as funds become safer. The reason for this surprising finding might be related to the fact that each affiliate (aged 55 or younger) can choose freely the type of fund to invest. Then, within PFAs there might be competition between fund types to attract clients. To compensate for the fact that they can only invest 5% of their portfolios in stocks, funds E might invest in longer-maturity bonds to achieve better returns.

Figure 4 compares the maturity structure of Chilean mutual funds, pension funds, and insurance companies. We focus first on the differences between mutual funds and pension funds. The distributions of both types of institutional investors are very similar, with small differences for some maturities (Panels A and B). However, the average maturity of assets held by pension funds (4.36 years) is not statistically different from that held by mutual funds (3.97 years) (Panels C and D). Mostly because of the difference observed at particular maturities, a two-sample goodness-of-fit test for functional-data (henceforth KS test) rejects the hypothesis that the observed maturity structures of pension funds and mutual funds are generated by the same underlying distribution.[12] In unreported results we also compare the maturity structures at monthly frequency with a coarser distribution (grouping the maturities for each month in different bins); we cannot reject at conventional levels the hypothesis that the maturity structures of these two types of investors are generated by the same distribution.

The comparison between mutual and pension funds and insurance companies shows that insurance providers are much more heavily invested in long-term instruments than mutual and pension funds are (Figure 4). The differences are quite significant both

[12] This test was proposed by Cuesta-Albertos et al. (2006), and consists on applying a standard two-sample Kolmogorov-Smirnov (KS) test to the random projections of each set of functional data; in our case the samples of maturity structures of all pension funds and mutual funds, respectively. We start by forming two groups of vectors of length M corresponding to the time-average maturity structures of all individual pension and mutual funds $W_{D,k} = (1/T)\sum_t W_{D,k,t}$, discretized by month, with M corresponding to the longest maturity observed (in months). Each of these vectors is projected on a random direction $h \in \mathbb{R}^M$, obtaining two samples of random projections (one for each type of investor) of sizes n_1 and n_2, the number of pension funds and mutual funds respectively. The standard two-sample Kolmogorov-Smirnov test is then applied to these samples. The process is repeated M times using different random directions, and the resulting set of p-values is adjusted for false discovery rate under dependency as in Benjamini and Yekuteli (2001). The p-value reported in the table corresponds to the minimum of the adjusted p-values, which indicates the level of confidence with which at least one of the M hypotheses can be rejected. An alternative statistic proposed by Cuesta-Albertos et al. (2007), based on the fraction of rejections among the M hypotheses, yields similar conclusions (not reported).

economically and statistically at different points in the distribution. And these differences are reflected on the average maturity of Chilean insurance companies (9.77 years) relative to those of mutual and pension funds (3.97 and 4.36 years, respectively).[13]

In sum, the evidence suggests that Chilean mutual funds and pension funds are short-term investors relative to insurance companies in Chile and mutual funds in the US. Insurance companies in Chile are able to obtain a relatively long maturity structure even when compared to US mutual funds. This contradicts the expectation that mutual funds and pension funds are long-term investors, and raises the question of which factors might be driving them to invest short term and insurance companies to invest long term.

5. What Drives the Maturity Structure?

To analyze the potential factors that may contribute to the short-termism of mutual funds and pension funds, we rely on different types of evidence. We focus on four factors: (a) instrument availability, (b) rebalancing, (c) risk of investment instruments, and (d) managerial incentives.

5.A. Instrument Availability

From the previous evidence we know that insurance companies are significantly more tilted toward the long term, which signals that long-term securities are available in Chile. Yet, mutual and pension funds could still be constrained by the supply of long-

[13] In unreported results that use US fixed-income mutual funds as a benchmark comparison, we show that Chilean mutual and pension funds are much more tilted toward the short term than US mutual funds, while Chilean insurance companies are more long term. For example, for 2002-2005, Chilean pension funds hold 52% of their fixed-term instruments in assets with maturity of up to three years, while US multi-sector and short-term mutual funds hold, respectively, 24% and 48% of their portfolio in assets with that maturity. The differences persist throughout the distribution. All these differences result in a much longer average maturity for US multi-sector and short-term mutual funds (9.55 and 7.76 years, respectively) than for Chilean pension funds and mutual funds (4.61 and 3.88 years, respectively). These distributions are statistically different at all conventional significance levels.

term instruments. To study the role of the supply side, we analyze unique data on bonds held relative to bonds outstanding and bids at government bond auctions.

Figure 5 shows the total amount of bonds issued by the government at different maturities between 1998 and 2008 and the fraction of those issuances purchased by pension funds. The figure contains separate panels per currency: nominal Chilean peso, indexed Chilean peso (also known as UF, or inflation-linked), and US dollar. The figure shows that in all cases pension funds purchase significantly less than the total amounts issued. On average, pension funds purchase 3% of issuances in Chilean pesos, 40% of government issuances in inflation-indexed pesos, and 15% of issuances in US dollars. Also, within each denomination, the fraction of long-term issuances purchased by pension funds is not much larger than that of short-term issuances. Even when looking at inflation-indexed bonds that would allow pensioners to smooth their real lifetime consumption and obtain lower real return volatility, the share of bonds with maturities above ten years purchased by pension funds is only 41% (compared to 39% for indexed bonds with less than ten years of maturity). This observation is relevant because government bonds are considered relatively safe investments.[14]

Regarding corporate debt, there is no information on the amount of issuances purchased by PFAs. However, we have data on the amount of corporate debt held by PFAs as a proportion of the outstanding corporate debt and their average maturities. Table 1 shows that PFAs hold on average 40% of outstanding corporate debt, declining from 58% in 1997 to 28% in 2004. PFA holdings are tilted toward instruments with shorter maturities. While the average maturity of the outstanding debt is about 13 years,

[14] During 2002-2008, the gross total debt of the Chilean government was 8.4% of GDP. Furthermore, during the whole period Chile's sovereign debt was considered investment grade, with rating Baa1 in 2002 and A2 in 2008.

the average maturity of the debt held by PFAs is only five years.[15] Again, this type of information suggests that PFAs have not been constrained to expand their holdings of long-term bonds.[16]

Although the previous evidence helps us explore whether any type of institutional investor is exhausting the supply of long-term instruments, borrower decisions to issue securities likely depend on the demand for different maturities. To shed more light on the underlying demand of different institutional investors for securities with different maturities, we use unique data on auctions of government paper. The data set consists of detailed information on biddings for government bonds (in pesos, inflation-indexed pesos, and US dollars of maturity one year or longer) issued by the Central Bank of Chile and the Treasury between 2002 and 2009. The data come from the central bank, which organizes these auctions. The data set has information on biddings made by banks, insurance companies, and pension funds. Banks are likely to bid both for themselves and other institutions, notably mutual funds and small insurance companies that do not bid directly. This means that we cannot separately identify the bidding behavior of mutual funds. For this reason, and in light of the similarities in maturity structure between pension and mutual funds, we focus our analysis on the bids of pension funds. Although we do not explicitly analyze the bank bids, they are included in the sample as a control group. In total, the data set contains 1,185 auctions and 20,937 bids during 2002-2009.

[15] While there is no information on the amount of corporate debt issuances purchased by PFAs, we use data on the corporate debt holdings of PFAs as a proportion of the outstanding corporate debt (from Braun and Briones, 2008) and information on the average maturities of PFA corporate debt holdings compared to the average maturity of outstanding corporate debt (from the Chilean Superintendency of Pensions and the Superintendency of Securities and Insurance).

[16] With respect to the banking system, the proportion of certificate deposits held by PFAs has been very stable, oscillating between 25% and 30%. But banking sector information is less relevant to assess the extent to which PFAs might be constrained by instrument availability because banks can accept any amount of deposits.

With the auction data, we estimate how much pension funds request at different maturities and what price they offer for each quantity requested. We also compare the behavior of pension funds and large insurance companies. Table 2, Panel A shows the results, indicating when the differences between requests at different maturities (within institutions) are statistically significant. Estimated quantities are reported as a share of the total auction amount. Panel B reports the ratio of the share requested by insurance companies and pension funds at each maturity, in the same auction. When an investor is not bidding for an issuance we impute a zero for the quantity requested, but the estimations for prices only include information for those investors that present a bid. For this reason, the ratios of shares reported in Panel B do not include the cases when pension funds do not bid for a security, biasing the results against finding larger shares bid by insurance companies.

Table 2, Panel A shows that pension funds request larger shares of the issuance than insurance companies at most maturities, except for 30 year instruments. The shares requested by insurance companies increase monotonically with time to maturity. When comparing prices offered by both institutional investors, pension funds offer significantly higher prices for five and ten year bonds, while no differences are observed between prices offered for 20 and 30 year bonds. Moreover, a larger amount bid for by pension funds is expected since pension funds are significantly larger investors than insurance companies. Therefore, the smaller request of 30 year bonds reflects a lower preference by pension funds for those long-term instruments, especially considering that similar prices are offered for them across institutional investors. Furthermore, although pension funds typically ask for larger shares of issuances, the ratio between the quantities demanded by

insurance companies and pension funds hits a trough for bonds of ten year maturity (Panel B). In fact, insurance companies request 60% of the amount requested by pension funds of 20 year bonds and more than three times that of 30 year bonds.

The results in Table 2 show that pension funds bid for short-term instruments more aggressively than insurance companies; their relative bids weaken with the maturity of the bonds issued and even reverse for 30 year bonds. Moreover, the behavior of pension funds does not seem to be driven by low returns on long-term bonds. In fact, as shown below in Section 5.C, the long-term bonds yield substantial returns when compared to short-term ones.

Table 3 further exploits the auction data by analyzing the shares requested by each type of pension fund of inflation-indexed bonds (Panel A) and inflation-indexed, nominal peso, and dollars bonds (Panel B). The results show that even those funds with higher average maturity bid less aggressively for 30 year bonds than insurance companies. Therefore the results of Table 2 are not driven by the aggregation of all different types of funds and by the funds with lower average maturities.

To conclude, the evidence suggests that the short-termism of pension funds is not significantly constrained by the supply side of instruments. Pension funds seem to demand less heavily bonds with longer maturities and their demand seems to play an important role in their short-termism.

5.B. Rebalancing

Mutual funds and pension funds might hold a large fraction of short-term assets for tactical purposes to respond opportunistically to shocks, rebalancing their portfolios and taking advantage of good buying opportunities. This is known 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).

To shed light on the rebalancing effects, we display the behavior of short-term assets during crisis times. We focus on pension funds because we have exclusive access to high frequency (daily) portfolio data.[17] Pension funds experience significantly less outflows than mutual funds (as we show later), thus they should be especially able to use their liquidity to take advantage of market opportunities in turbulent times instead of meeting redemptions.

Several papers have proposed that crisis periods in emerging economies are frequently related to a lack of liquidity, when foreigners sell assets at fire-sale prices (Krugman, 1998; Aguiar and Gopinath, 2005). The natural question here is whether the domestic investors, who know the domestic market and have deep pockets, are the ones on the other side of those selloffs. To analyze changes in the short-term portfolio during crises, we study the evolution of short-term assets held by pension funds during the Asian and Russian crises of 1997-1998. This period was characterized by a significant degree of volatility that is especially useful for our purposes. Also, the 1997-1998 crises had a substantially larger impact in Chile than the 2008-2009 global financial crisis.

[17] In unreported results, we analyze many regulatory changes related to pension funds. Since these regulatory changes have typically been announced in advance, PFAs could accumulate liquidity prior to the deregulation to take advantage of such changes. In other words, if PFAs hold 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. We find that around the regulatory events the portfolio share of short-term assets does not change significantly. Namely, we find no evidence of liquidity hoarding before the regulatory changes.

Figure 6, Panel A shows the evolution of short-term assets during the major crisis period in the sample that affected Chile, indicating the dates of some of the main events in international financial markets. The pattern of short-term asset holdings shows an increase from an average of 2% one week before the Asian crisis hit the Republic of Korea in November 1997 (with the downgrade of Korean debt) to more than 3% two weeks afterward, and remains high for the rest of this turbulent period. If anything, the 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.

In principle, this pattern could be explained by a sudden inflow of capital into pension funds. Because it takes time for fund managers to find prudent long-term investments, in the short run the fund's average maturity might decline (Ferson and Warther, 1996) if managers have more capital to invest. However, the net inflows PFAs received during this period were around the two-year mean, within two standard deviations of the mean.[18] Therefore, the patterns in Figure 6, Panel A, do not seem to be significantly affected by sudden inflows of cash.[19] Furthermore, to explore if the reaction of PFAs was different from that of mutual funds and insurance companies, we run difference-in-differences regressions around the 1998 Russian crisis (Figure 6, Panel

[18] In unreported, more general results, we do find some evidence partly consistent with the effect documented by Ferson and Warther (1996). That is, in periods when pension funds receive large inflows, the allocation to short maturities increases more. Moreover, using the auction data we find that bids on short-term bonds tend to increase proportionally more (when net inflows are positive or above different means) than the bids on other bonds. However, this effect is small and managers do not change the type of bonds they demand in a significant way.

[19] Because pension funds do not guarantee a certain rate of return, during a crisis all pension funds could be yielding a negative return, as indeed happened in 2008 when all funds with equity exposure suffered large losses. Therefore, they are unlikely to be perceived as a safe heaven and thus witness more inflows during crises. In fact, the flows into pension funds tend to be very stable, including during crises, because they are mandatory savings.

B).[20] Panel regressions show that the reactions of pension funds during the crisis do not differ in statistical terms from those of mutual funds and insurance companies.

In sum, while the evidence analyzed here does not explain the average large holdings of short-term assets by pension funds, it illustrates whether pension funds use their large short-term positions to take advantage of buying opportunities. The evidence that short-term positions do not seem to decrease during the type of events analyzed here seems inconsistent with pension funds holding liquid assets to act opportunistically.

5.C. Risk of Investment Instruments

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 (Bajeux-Besnainou, et al., 2001; Campbell et al., 2001; and Campbell and Viceira, 2002). Thus, in principle, the short maturity structure of Chilean asset managers could result from the risk profiles of the assets in which they invest. We explore next some of the risks involved.

A first potential explanation related to risk is that inflation risk could tilt portfolios toward shorter maturities. Inflation movements are difficult to predict in the long term, adding extra risk to the price of bonds with longer maturities. In other words, the comparisons presented above could be misleading given that they aggregate all of the fixed-term instruments held by Chilean mutual and pension funds, including those in different currencies. To address this issue and shed light on how risk might be affecting managerial decisions, we report the maturity structure of portfolios by currency, separating the holdings in nominal pesos, "hard currencies" (US dollar, euro, British pound, and yen), and indexed pesos (inflation-linked).

[20] We do not have data on mutual funds and insurance companies during the Asian crisis.

Figure 7 shows the maturity structure of mutual funds and pension funds by currency. In the case of mutual funds, the maturity structure of holdings in pesos is similar to that in hard currencies (with holdings in pesos slightly longer), while the maturity structure of holdings in inflation-linked pesos is significantly longer. In the case of pension funds, the maturity structure differs significantly across currencies. Pension funds are very short-term investors in pesos. For example, 55% (78%) of peso holdings are held in instruments maturing in less than one (three) year(s). They are a little bit less short term in hard-currency assets; 46% (91%) are in assets maturing in less than one (three) year(s). On the contrary, they are more long term in indexed pesos instruments. For example, about 30% (47%) are held in instruments with maturity lower than one (three) year(s). The differences in the distributions are statistically significant, as shown by the KS tests displayed in Panel E.

The patterns illustrated in Figure 7 are consistent with pension and mutual funds being more tilted toward the short term in assets with higher long-term risk. The price of nominal peso instruments responds to inflation volatility, which tends to increase with the maturity of the bond, perhaps explaining the short-term structure. Investors would be more willing to go long in hard currencies than in Chilean pesos if holding hard currencies allowed investors to hedge part of the inflation risk, which does not seem to be strongly the case in Chile.[21] Not being exposed to currency or inflation risk, indexed peso bonds are relatively less risky than peso and hard-currency bonds, especially at longer maturities, which could account for the willingness of Chilean investors to buy more long-term indexed peso instruments. Therefore, for some types of instruments, asset

[21] While the correlation between monthly inflation and depreciations of the Chilean peso against the US dollar between 1990 and 2008 is about 0.17, the correlations between annual and bi-annual inflation and depreciations are 0.35 and 0.49, respectively.

managers might perceive a tradeoff between maturity, on the one hand, and currency and inflation risks, on the other hand. When managers can reduce those risks, they seem more willing to invest more long term. Still, the evidence shown here suggests that mutual and pension funds hold a significant fraction of short-term assets even when risks are reduced. For example, the average maturity for holdings of indexed peso bonds is 7.15 and 5.31 years for mutual and pension funds, respectively (compared to the average maturity of insurance companies, of 9.77 years, when holding indexed and non-indexed instruments).

In addition to the risk of different investment instruments, there exist the risks of investing at different maturities. Available evidence from other emerging economies suggests that, if anything, investors in emerging economies should tilt their portfolios toward the long term relative to investors in developed countries.[22] Here, we complement the existing evidence by compiling new data on prices of inflation-indexed government bonds at different maturities, measured, alternatively, by indices of traded bonds at different maturity buckets and indices derived from a model-based estimation of the yield curve.[23] We compute average returns, standard deviations, and Sharpe ratios (average returns over standard deviations) for securities of different maturities over different holding periods. These estimates are useful because, assuming zero covariance across

[22] Broner et al. (2013) compute Sharpe ratios of short- and long-term bonds in various emerging economies (excluding Chile) and show that, on average, the difference in the Sharpe ratio of long- and short-term bonds is higher in emerging countries than in developed countries. Moreover, those estimates have the advantage that they are computed with much longer time series. In our case, we only have a five-year sample, which might be short for this type of calculation. Still, the estimates in both papers lead to the same conclusions.

[23] We focus on inflation-indexed securities because, as discussed above, they are the ones that better allow investors to reduce risk and invest more long term. On a more pragmatic note, bonds issued by the central bank at maturities beyond ten years are almost exclusively inflation indexed. The price information comes from RiskAmerica, a private company that provides fair value pricing for the Chilean fixed income market. These prices are widely used by institutional investors that mark their portfolios to market.

bonds of different maturities, portfolios should be proportional to the Sharpe ratios. Although this is a strong assumption and more complex analysis is needed (Litterman and Scheinkman, 1991), these Sharpe ratios give a first approximation to the topic and allow us to compare the results to other papers that have used them.

Figure 8 shows that, as expected, investing in long-term bonds yields higher returns, albeit at a higher risk. For example, over a holding period of three months, annualized returns for the five year bond index is approximately 4%, in contrast to 7% for the 15 year bond index. Standard deviations also rise with longer maturities, being 4% and 7% for five and 15 year bond indices respectively, also considering a holding period of three months. In nearly all cases, we observe higher standard deviations when we decrease the holding period, especially so for the longer-term maturities.

The estimates also suggest that, given the risk-return tradeoff, investors with a short-run horizon have more incentives to invest in short-term instruments relative to investors with a long-term horizon. For example, Sharpe ratios for bond indices present a flat structure along different maturities for short holding periods but tend to increase with the maturities for longer holding periods. Similarly, Sharpe ratios obtained from the model of the yield curve strongly decline with maturity for short holding periods (except for maturities below three years) but are relatively flat for longer holding periods. Regardless of the maturity, Sharpe ratios are larger for longer holding periods, but especially so for longer maturities. This evidence suggests that, given the risk-return profile of Chilean securities, the portfolios of investors with short horizons will be more biased toward short-term securities than those of investors with long horizons. Moreover,

the fact that they choose to hold short portfolios suggests that the risk they face by going to longer horizons are larger than any extra risk-adjusted return they might obtain.[24]

Aside from the price risk, one potential additional risk is that of liquidity. A possible concern related to liquidity is that if prices for long-term bonds are not available, mutual funds and pension funds that need to mark their portfolios to market each day to calculate their net asset values (NAVs) may avoid debt for which market prices are not readily available. Therefore, the need to calculate daily NAVs might lead to a preference for shorter-maturity bonds whose market prices can be better estimated. However, in the Chilean case there exist official price providers who value the different assets in the market on a daily basis, including short- and long-term bonds. Therefore, PFAs and mutual funds can use those prices to mark their portfolios to market. Moreover, the bonds we analyze at different maturities are liquid enough to provide price signals for investors that need to mark to market their portfolios.

Another aspect of liquidity that can matter for the results is related to the fact that bonds of different maturities might have different liquidity. In unreported results, we compute two measures of liquidity, the turnover ratio and the "conventional liquidity ratio" (Gabrielsen et. al, 2011) for Chilean nominal and indexed peso bonds using data obtained directly from the Central Bank of Chile. The results for government bonds suggest that short-term bonds are more liquid than long-term bonds, although the relation is not monotonic. However, according to both of these estimations and market

[24] In unreported results, we simulate the returns and risks that pension funds would face in the case they took longer portfolios. In each simulation we increase the average maturity of all funds by lowering the shares of instruments with maturity lower than three years and increasing proportionally the shares of the rest. In all cases we do not change the total investment of each fund. The results show that the average returns and standard deviations increase with the average maturity of the portfolio. However, the standard deviations grow faster than the returns. Given the short-term holding period that PFAs seem to have, these results are consistent with those presented in Figure 8.

participants, long-term bonds are still fairly liquid. The results for corporate bonds suggest that their liquidity does not decrease with the maturity. For example, the turnover ratio is higher for bonds with initial maturities of 20 years than for short-term bonds. The difference between these results seems to come from the fact that government bonds include instruments issued by the central bank to conduct monetary policy, while corporate bonds are just instruments to finance corporate investment. The finding that long-term corporate bonds are more liquid than long-term government bonds might also explain another fact, that PFAs hold longer-term corporate bonds than government bonds. For 2002-2008, the average maturity of their corporate (government) bond holdings is 10.57 (5.47) years. Therefore, the liquidity of different bonds might explain to some extent part of the results and the risk of holding bonds of different maturities.

Taken as a whole, the evidence from Section 5.C suggests that the risk profile of the available investment opportunities might affect the degree of short-termism of mutual and pension funds. Institutional investors in Chile are sensitive to the risks involved in investing in different instruments. However, as we analyze next, these risks affect managers depending on the incentives they face.

5.D. Managerial Incentives: Market and Regulatory Monitoring

In the context of financial intermediation and principal-agent problems, short-run monitoring might affect manager incentives. In the case of open-end funds like pension funds and mutual funds, managers are monitored in the short run by the underlying investors (which can redeem their shares from the open-end funds), the regulator (which imposes penalties in the case of pension funds when a fund deviates from the industry average), and the asset-management companies (which tend to set compensation based on

performance relative to the peers). This monitoring might lead to short-run investment horizons and holdings of short-term instruments, because the higher volatility of long-term assets poses additional risk of generating outflows. In other words, short-run monitoring generates incentives for managers to be averse to investments that are profitable at long horizons (like holding long-term bonds) but can have poor short-term performance and let managers away from their competitors (Stein, 2005). If the risk of long-term investment is large, it would be difficult to deviate from an equilibrium in which all managers hold short-term assets. Historical reasons linked to high volatility and the desire to have stability in the assets managed by these funds might have pushed the equilibrium to the short term.

One way to study the degree of market monitoring is to analyze the flows to the funds and link them to performance at the fund level. The extent to which flows respond to performance will also likely affect how managers respond to performance. We study these two effects in turn.

To study the relation between the flows to the funds and performance, we first compute the outflow (negative inflow) that each fund faces each month. We calculate the net inflows to a fund k at time t, I_t^k, as the change in the fund value W_t^k during a month, adjusted by the gross return of the portfolio in that month R_t^k:

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

We use this method to calculate net inflows to mutual funds. For pension funds, we compute this measure by aggregating daily data on net inflows into each fund, directly collected by the Chilean Superintendency of Pensions.[25]

The results are displayed in Figure 9. Panel A shows the cumulative distribution of net inflows I_t^k relative to fixed-income assets for Chilean mutual funds and PFAs. As a benchmark, we also report those of US mutual funds. Negative (positive) values are outflows (inflows). The figure shows that Chilean mutual funds face significant outflows. For example, the historical probability of experiencing a net outflow of 3% of the portfolio or more is 33%. To complement this evidence, Panel B shows the fraction of fixed-term assets held in short-term assets (up to one and three months) and the probability of outflows of that magnitude.[26] Chilean mutual funds hold 9.3% of their fixed-term assets in instruments with maturity of less than one month, and the probability of an outflow of that magnitude occurring is almost 22%. US multi-sector bond funds are subject to fewer outflows. For example, the historical probability of experiencing a net outflow of 3% of the portfolio or more is 9% (instead of 33%). Therefore, the short-termism of Chilean mutual funds might be partly explained by the relatively large outflows they face.

Chilean pension funds, on the contrary, are not exposed to significant outflows. The distribution of net inflows of Chilean PFAs is significantly tilted to the right. So redemption risk does not seem to be an important factor explaining pension funds' short-

[25] Though not reported, we also compute the monthly inflows using the values and returns derived from our monthly database and obtain qualitatively similar results.

[26] 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 funds at maturities of up to 30 and 90 days. For US funds, we do not have information on the maturity structure at less than three years, so we use the extreme assumption that within the zero to three year interval, the maturity structure of US funds is proportional to that of Chilean mutual funds.

term holdings. For example, a net outflow of 1% of the portfolio has a historical probability of 3% for PFAs and 38% for mutual funds. Though they face very different outflows, the short-term positions of mutual funds and pension funds are not very different, as shown in Figure 4.[27] The estimations reported in Figure 9, Panel B also show that pension funds seem to hold a large fraction of liquid assets for low-probability events: they hold 4.4% of their fixed-term assets in instruments with a maturity of less than one month, while the probability of an outflow of that magnitude is negligible. To the extent that there is an opportunity cost of holding short-term instruments, pension funds are paying a high price for their elevated self-insurance levels.

Because mutual funds are subject to significant outflows, we analyze whether these outflows are related to performance, as a sign of short-run monitoring that generates incentives for managers (Lim et al., 2013). Table 4 shows the relation between outflows and returns. Indeed, outflows are associated with short-term returns. A positive (negative) return relative to the industry from a previous month is related to an inflow (outflow) into the mutual fund. Because the results are robust to controlling for time (and fund) effects, they are not capturing positive flows to all funds in good times or vice versa (although these flows could be consistent with short-run monitoring). The short-term relation vanishes when we use a longer-term horizon. This indicates that, while outflows respond to short-run performance, they do not seem to be affected by the long-term returns generated by a fund. Though not reported, the relation is never statistically significant for

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

pension funds.[28] These findings are consistent with studies that analyze US data (Ippolito, 1992; Sirri and Tufano, 1998; Del Guercio and Tkac, 2002).

Although the standard regulation applied to pension funds might complement the market forces that monitor asset managers on a short-run (monthly) basis, it does not indicate to any degree whether pension funds should invest long term or short term. Instead, pension funds are required to yield returns within established margins. Thereby, pension fund managers are penalized by regulations when they deviate from industry standards, having to cover these losses with their own capital. These regulations might also help explain why the companies that run the PFAs seem to monitor their managers through tracking error models that constrain them to be close to the average pension fund (Roll, 1992; Castañeda and Rudolph, 2009). While this regulatory discipline might generate herding among pension funds, the evidence on its effects is mixed (Raddatz and Schmukler, 2013) and it is not clear that herding should necessarily occur at the short-end of the maturity spectrum.

Next, we test how mutual and pension funds react when they underperform, following a large literature based on the US that finds mixed evidence (Brown et al., 1996; Busse, 2001; Goriaev et al., 2005; Chen and Pennacchi, 2009). The idea is that even when mutual and pension funds might choose a low volatility portfolio on average to try to minimize withdrawals, it could still be the case that when their returns are low, they move to more risky allocations.

[28] In the case of pension funds, for regulatory reasons PFAs send monthly reports of their real returns to future pensioners and must base their publicity on real returns. Thus, the reduction in real returns resulting from inflation can potentially affect their ability to capture new affiliates or generate outflows. Although there is not much evidence that the number of affiliates changes with returns, the ranking of PFAs by returns (typically used in advertisements) seems to be positively correlated with the number of affiliates across PFAs (Cerda, 2005).

In order to test how the Chilean mutual funds behave when they underperform, we analyze the reactions of the mutual fund managers whose funds have a return lower than the market average (in the previous month or over the previous six months) or a negative return. We do find evidence that mutual funds take more risk when their performance lags behind. In all cases, we observe that these managers tend to increase the average maturity of their portfolio (Table 5, Panel A).

When performing the same analysis for the case of PFAs, we find different results (Table 6, Panel A). When pension funds have a return lower than the market, they tend to move their portfolio more toward the short term. When returns are negative, they do not react. This suggests that only relative returns (not absolute ones) are important for PFA managers. In other words, if managers face negative returns but so does the market, then managers do not need to cut their risk exposure by moving to the short term. But when they lag other market participants, they try to avoid a further decline by moving to the short term. Furthermore, we find that the shortening of the maturity structure for pension funds comes from a switch in the types of instruments they hold (Table 6, Panel B). They increase their holdings of deposits and reduce their holdings of government and corporate debt, which have a longer term to maturity. In unreported results using the actual holdings by type of asset or the bids on government bonds, we do not observe that they change the maturity structure within asset class.

In alternative tests, we run a simplified version of the Brown et al. (1996) test. In particular, we analyze the reactions of mutual fund managers whose funds have a return lower than the market average in the first semester of each year, to see if they try to compensate for this poor performance later in the year. Thus, we compute the ratio

between the standard deviation of the returns in the second part of the year relative to the first part of the year. Although we find that mutual funds that underperform the market in the first semester do have on average higher ratios in the second half of the year, we do not find evidence that these differences are statistically significant (Table 5, Panel B). For pension funds we find, instead, that those funds that outperform the market in the first semester tend to have higher ratios in the second half of the year than those funds with lower returns in the first semester. These differences are statistically significant (Table 6, Panel C).

The evidence suggests that incentives work differently for mutual funds and pension funds. For the former, when they are not performing well they seem to have incentives to take more risk to try to catch up with the other funds. This evidence is consistent with part of the results in the US literature (Brown et al., 1996). On the contrary, pension funds are penalized if they do worse than the others and are not much rewarded when they do well. Therefore, when their performance lags with respect to the rest of the market (not in absolute terms), they cut their exposure to risk to avoid falling below the minimum return band (most pension funds are always within this band). They only take risk when it is safe to do so, when they are performing relatively well.

The bidding behavior of PFAs for Chilean peso, indexed Chilean peso, and US dollar denominated bonds seems to corroborate that PFAs do not want to deviate from market standards (Table 7). If for any reason, in the past month a PFA ends up with more exposure to US dollar instruments (measured as US dollars instruments relative to total investments) than the market average, then the PFA bids more aggressively for Chilean

peso and indexed peso instruments and less aggressively for US dollar bonds, thus reducing its exposure and converging to the market equilibrium.

Whereas the type of short-run monitoring analyzed here can play a role in open-end funds, it is unlikely to affect insurance companies. The latter are not evaluated on a short-term return basis by investors that can redeem their shares on demand and they are not required to be close to the industry at each point in time. Instead, the maturity structure of the insurance companies' assets seems to be determined by that of their liabilities. Insurance companies have long-term liabilities because they mostly provide annuities to pensioners. Thus, the need to meet these liabilities gives them incentives to hold long-term assets. In contrast, mutual funds and pension funds are pure asset managers and have no liabilities beyond their fiduciary responsibility.

In sum, the long-term nature of their liabilities shapes the incentives of the insurance companies toward portfolios with longer maturities. In contrast, given the lack of a liability structure, the incentives of Chilean pension and mutual funds to take maturity risk are determined mainly by the constant monitoring exerted by the underlying investors, their own companies, and the regulator. The discussion in this section provides evidence that such monitoring behavior focuses on short-term performance and seems to discourage investments in more volatile long-term instruments. Moreover, the fact that mutual fund flows are related to performance suggests that some disciplining device might be operating, and as consequence fund managers react by changing the degree to which they invest short term and the risk they take. These effects are consistent with the existence of a principal-agent problem. In the case of pension funds, though they are subject to fewer outflows, the regulation reinforces the market mechanism by punishing

those funds that underperform relative to a minimum return that depends on the market average.

The comparison of the maturity structure of insurance companies and pension funds is particularly illuminating because in principle both should be long-term investors: insurance companies provide mainly long-term annuities for retirement while pension funds invest for the retirement of their affiliates. Indeed, upon retirement an individual can choose between buying an annuity or keeping his/her assets in a pension fund and gradually drawing the principal according to a program that considers expected longevity. Despite the similarity in their implicit operational goals, pension funds have no explicit liabilities and face regulation that punishes short-run deviations from their peers, which gives them very different incentives to invest in long-term assets. Still, further work is required to analyze the optimal portfolio structure of each type of investor by incorporating equities, among other things.

6. Conclusions

Many developing countries are in the quest of developing markets for long-term financing. Chile has been at the forefront in these efforts. It has already relatively well developed capital markets and has tried to extend debt maturities through a broad range of macroeconomic and financial sector reforms. One notable feature has been the establishment and growth of sophisticated institutional investors by, among other things, reforming and introducing a new pension system in 1981, which has been emulated by many countries. These investors are expected to invest long term, especially those focused on providing funds for retirement.

Using the rich experience of Chile, this paper studies to what extent institutional investors invest long term and the factors that might affect their decisions to hold assets at different maturities. The paper finds that, despite all the favorable conditions, Chilean asset managers (mutual and pension funds) are significantly tilted toward the short-term end of the country's maturity structure, with a large portion of their portfolio in assets with maturities of less than one year. In contrast, insurance companies invest much more long term. This substantial difference across investors within the same country helps us understand what might be behind their short- and long-term investments.

The evidence in this paper is inconsistent with two hypotheses as determinants of the maturity structure. First, asset managers choose short-term instruments even when assets for long-term investments are widely available and when other investors hold them. That is, the supply side of instruments does not pose a mechanical constraint. On the contrary, the investor side (the supply side of funds) seems essential to understand debt maturity structures, which is consistent with the preferred habitat and investor clientele literature (Guibaud et al., 2013). Second, evidence from pension funds suggests that institutional investors do not hold short-term instruments for tactical reasons, to take advantage of buying opportunities and purchase assets at fire sale prices.

At least two factors seem to interact and play an important role in shaping investor demand and, consequently, the maturity structure of institutional investors: the risk profile of the available instruments and manager incentives linked to short-term monitoring and the liability structure. Mutual and pension funds invest more long term in less volatile indexed instruments. Moreover, mutual and pension funds hold a large proportion of the less risky short-term instruments, even when they yield low returns.

Managers forgo higher returns by not investing long term, especially as their investment horizon expands.

The incentive structure also seems to explain the short-term investment horizon of mutual and pension funds in different ways. The evidence in this paper suggests that incentives due to principal-agent problems might lead to investment in short-term instruments. The two types of incentives that appear to be relevant are: short-run monitoring (by investors or the regulator) and the liability structure of asset managers. First, mutual funds are subject to substantial investor redemptions related to short-run performance. In the case of pension funds, the short-run monitoring is exercised by common regulatory practices that punish funds that deviate from industry averages and by the owners of the asset-management companies. The short-term monitoring that mutual and pension funds face seems to generate short-term investment horizons and, given that the risk profile of the available instruments yields decreasing Sharpe ratios for short-term holding periods, it becomes natural for them to invest more heavily in short-term bonds. Second, mutual funds and pension funds do not have liabilities, and thus have incentives to invest in short-term assets that are less risky and, as a consequence, reduce the likelihood of deviating from their peers. In contrast, insurance companies have long-term liabilities and, as a result, their maturity structure is significantly more long term. In other words, given that asset managers and asset-liability managers face the same investment opportunities, the evidence in this paper highlights the importance of incentives in shifting the maturity structure.

A key policy lesson from our findings is that, despite the benefits of long-term debt, many economies like that of Chile might face an uphill effort in extending debt

maturities, even when many of the ex-ante conditions are in place. In particular, extending debt maturities by just developing institutional investors such as mutual and pension funds seems difficult to achieve and runs contrary to many of the initial expectations behind the promotion of these market players. Merely establishing asset-management institutions and assuming that managers will invest long term does not appear to yield the expected outcome, especially because they would involve a similar type of market and regulatory short-term monitoring as that in Chile.

There seems to be an important tradeoff between monitoring managers according to their short-term performance (which leads to short-term investments) and obtaining higher returns by investing long term (at the cost of higher risks). This has important social consequences given the large retirement savings managed by these institutional investors. In fact, some discussions have started to emerge in Chile and internationally about the pension system and how to reform it given the lower than expected replacement rates.[29] However, the socially optimal design to balance this tradeoff is not obvious (Acemoglu et al., 2007) and requires further work. Policymakers in Chile have tried to make the system more conducive for long-term investments, including regulatory changes, but so far they have not been able to shift the equilibrium out of the short term. Moreover, pensioners seem reluctant to see the value of their assets decline as a consequence of risk taking. Additional work is needed to understand whether the observed asset allocation of debt of different maturities among the various institutional and retail investors is socially inefficient, to what extent long-term debt is socially

[29] According to some estimates, the amount in the average 65 year old pensioner account is 55,000 US dollars. Given the expected remaining life of 15 years, this is equivalent to about 310 US dollars per month or one third of the average salary in Chile. E.g., http://www.elmercurio.com/blogs/2014/01/14/18619/Un-mejor-sistema-de-pensiones.aspx. For an international discussion, see Stewart (2014).

desirable, and how incentives could change to shift the investment horizon of institutional investors.

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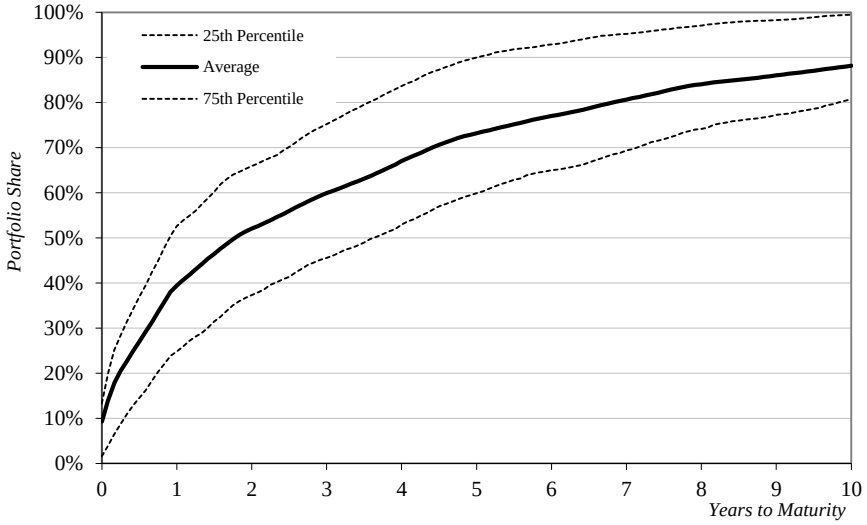
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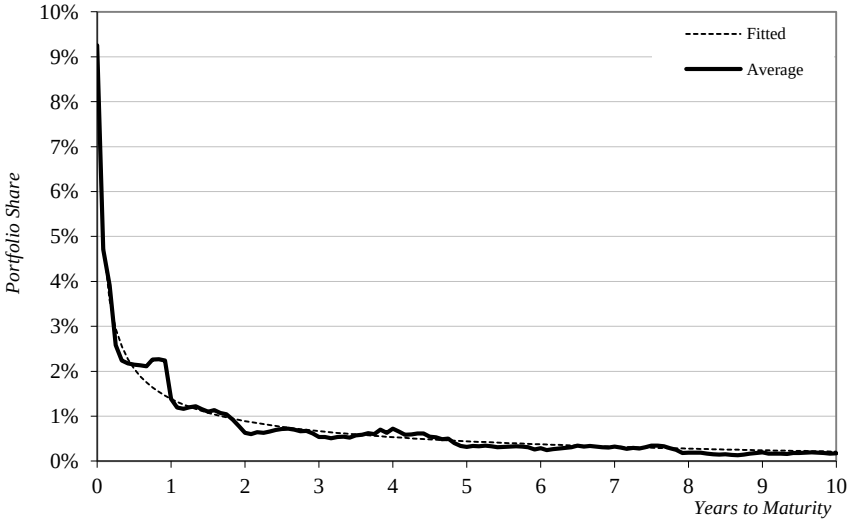
Figure 1
Maturity Structure of Chilean Mutual Funds

This figure presents the maturity structure of Chilean domestic bond mutual funds, that is, the proportion of the portfolio held at different terms to maturity. Shares are calculated as a fraction of the overall portfolio. Only medium- and long-term bond mutual funds are taken into account. The maturity structure is calculated per mutual fund and averaged across funds at each moment in time using monthly bins, and then averaged over time. The sample period is Sep. 2002-Jun. 2008. Panel A shows the average accumulated portfolio weight in each bin as well as the 25th and 75th percentiles across mutual funds. Panel B shows the average total portfolio weight within each monthly bin, along with the fitted value of the fractional polynomial regression of total portfolio weights on the term to maturity in months. Panel C shows the accumulated weights in a table format.

A. Accumulated Weights



B. Weights within Each Maturity Range



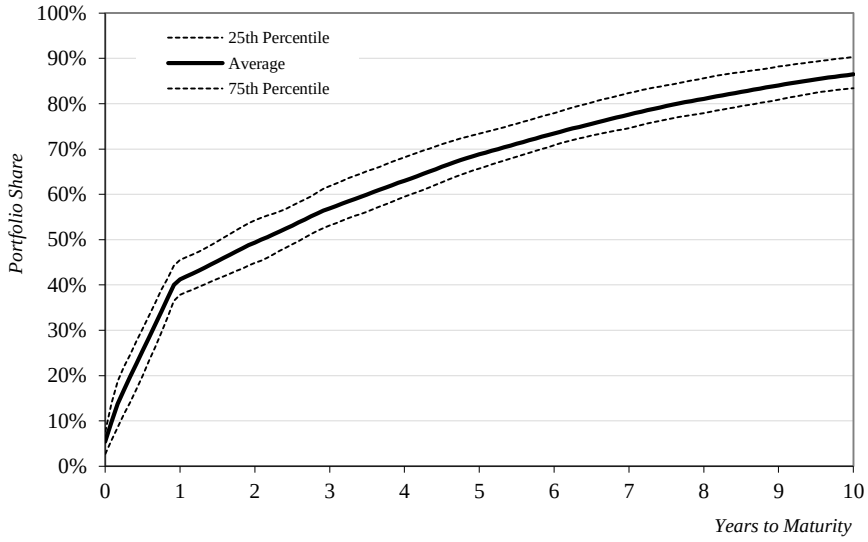
C. Accumulated Weights

	<1year (y)	<3y	<5y	<7y	<10y	<15y	<20y	<30y
Chilean Domestic Mutual Funds	38%	59%	73%	80%	88%	95%	99%	100%

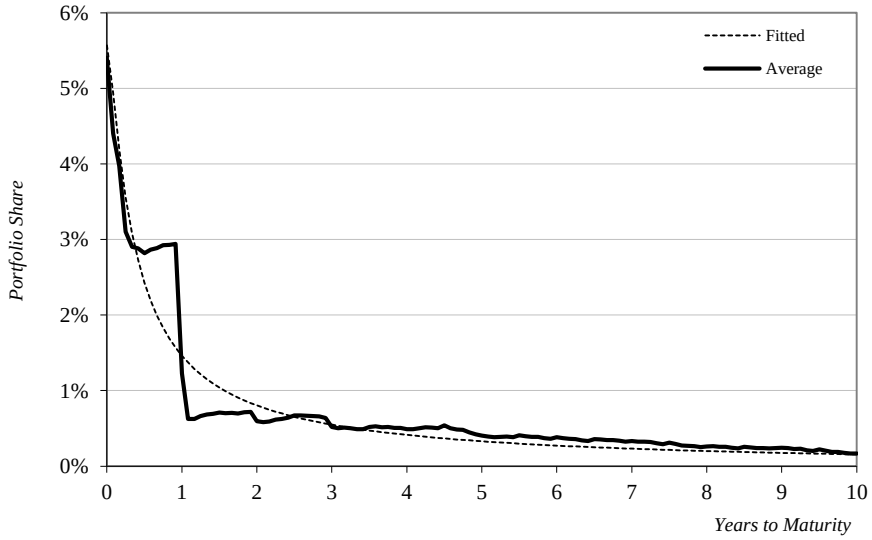
Figure 2
Maturity Structure of Chilean PFAs

This figure presents the maturity structure of Chilean pension fund administrators (PFAs), that is, the proportion of the portfolio held at different terms to maturity. Shares are calculated as a fraction of the fixed-term portfolio. The maturity structure is calculated per PFA (over all fund types) and averaged across PFAs at each moment in time using monthly bins, and then averaged over time. The sample period is Sep. 2002-Jun. 2008. Panel A shows the accumulated portfolio weight in each bin, as well as the 25th and 75th percentiles across PFAs. Panel B shows the total portfolio weight within each bin, along with the fitted value of the fractional polynomial regression of total portfolio weights on the term to maturity in months. Panel C shows the accumulated weights in a table format.

A. Accumulated Weights



B. Weights within Each Maturity Range



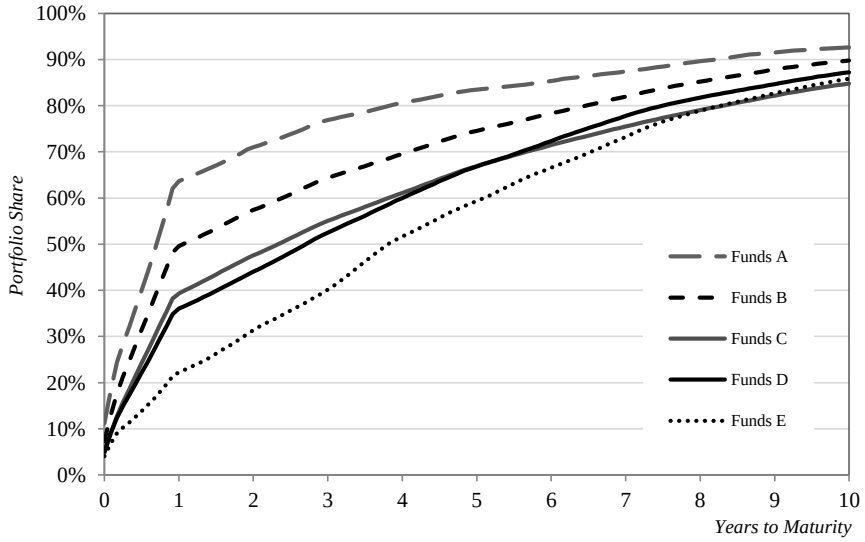
C. Accumulated Weights

	<1year (y)	<3y	<5y	<7y	<10y	<15y	<20y	<30y
Chilean PFAs	40%	56%	68%	77%	86%	93%	100%	100%

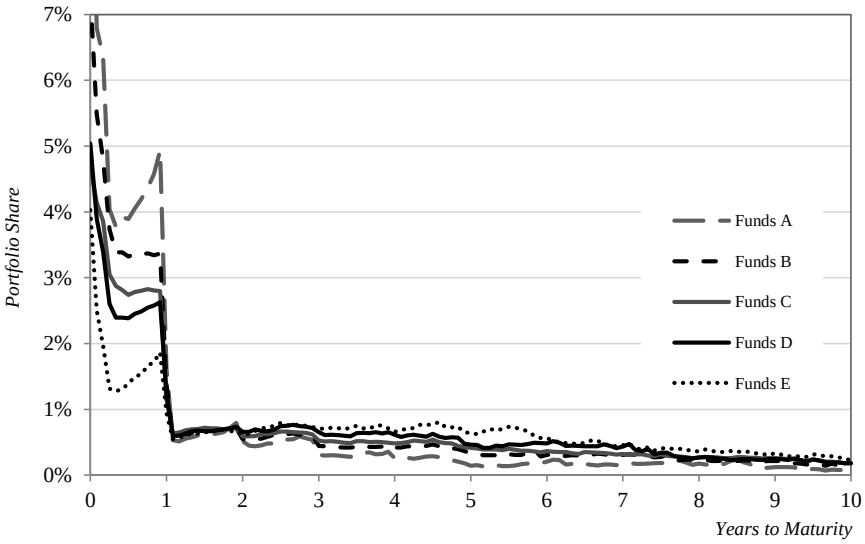
Figure 3
Maturity Structure of Chilean PFAs by Fund Type

This figure presents the maturity structure of Chilean pension fund administrators (PFAs) by fund type. Shares are calculated as a fraction of the fixed-term portfolio. The maturity structure is calculated per fund and averaged across funds of the same type at each moment in time using monthly bins, and then averaged over time. The sample period is Sep. 2002-Jun. 2008. Panel A shows the accumulated portfolio weight in each bin. Panel B shows the total portfolio weight within each bin. Panel C shows the accumulated weights and the average maturity in a table format.

A. Accumulated Weights



B. Weights within Each Maturity Range



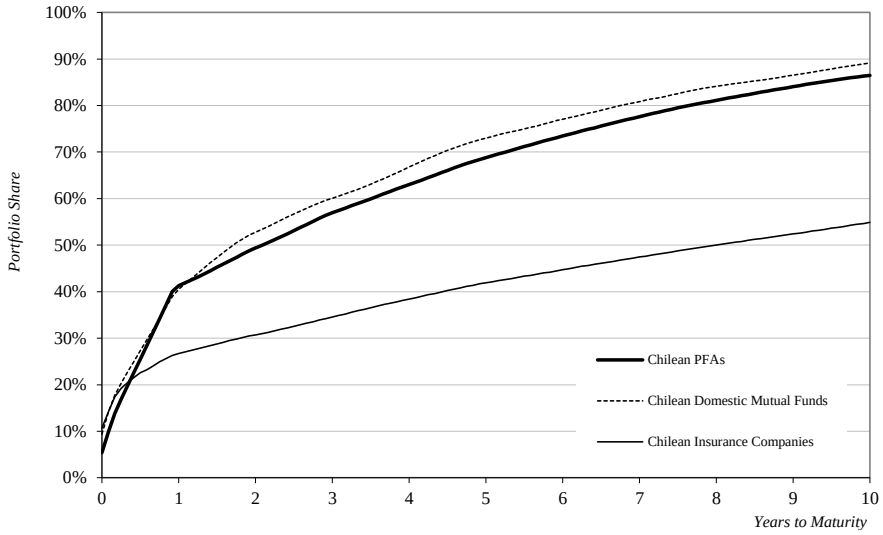
C. Average Maturity and Accumulated Weights

	Avg. Maturity	Accumulated Weights							
		<1year (y)	<3y	<5y	<7y	<10y	<15y	<20y	<30y
Funds A	2.72	62%	77%	83%	87%	93%	95%	100%	100%
Funds B	3.67	48%	64%	74%	82%	90%	94%	100%	100%
Funds C	4.62	38%	55%	66%	75%	85%	92%	100%	100%
Funds D	4.51	35%	52%	66%	77%	87%	93%	100%	100%
Funds E	5.70	22%	39%	56%	70%	83%	91%	100%	100%

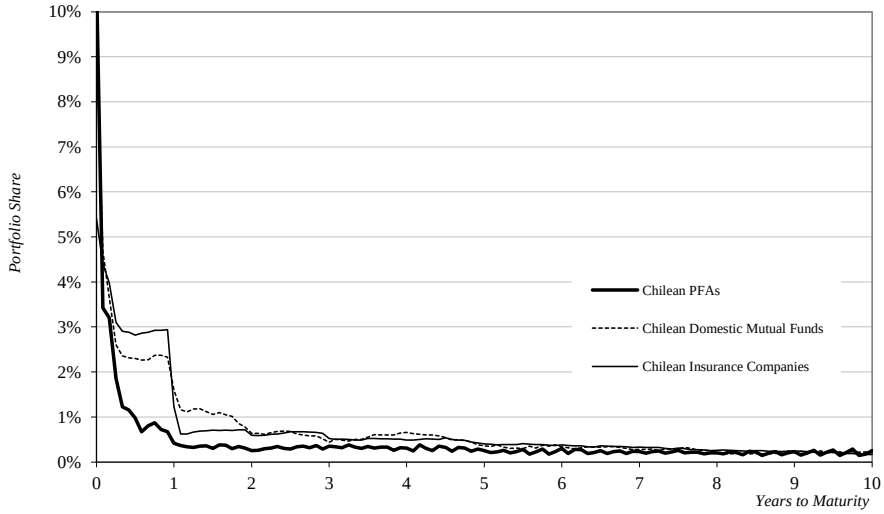
Figure 4
Maturity Structure of Chilean Insurance Companies Compared to Mutual Funds and PFAs

This figure compares the maturity structure of Chilean insurance companies to that of Chilean domestic mutual funds and PFAs. Only medium- and long-term bond mutual funds are taken into account. The maturity structure of Chilean mutual funds and PFAs (insurance companies) is calculated per mutual fund and PFA (company) and averaged across mutual funds and PFAs (companies) at each moment in time using monthly bins, and then averaged over time. PFA shares are calculated as a fraction of the fixed-term portfolio, whereas shares of insurance companies and mutual funds are calculated as a fraction of the overall portfolio. The sample period is Sep. 2002-Jun. 2008. Panel A shows the accumulated portfolio weights of the maturity structure of Chilean insurance companies, domestic mutual funds, and PFAs, and Panel B shows the same information within each monthly bin. Panel C shows the average maturity and accumulated weights in a table format. Panel D shows p-values for the two-sided t-tests of equality of average maturities, accumulated weights, and the Kolmogorov-Smirnov (KS) test of equality of the whole maturity structure. The KS test for functional data is based on the methodology proposed by Cuesta-Albertos et al. (2006) that relies on random projections of the samples of maturity structures. The p-value reported for this test is adjusted for false discovery rate as suggested by Benjamini and Yekutieli (2001) and corresponds to the minimum p-value obtained after repeating the test as many times as the number of maturity bins used to construct the figure, using a different random projection vector in each repetition. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

A. Accumulated Weights



B. Weights within Each Maturity Range



C. Average Maturity and Accumulated Weights

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
	Avg. Maturity	Accumulated Weights							
		<1year (y)	<3y	<5y	<7y	<10y	<15y	<20y	<30y
(1) Chilean Domestic Mutual Funds	3.97	39%	60%	73%	81%	89%	95%	99%	100%
(2) Chilean PFAs	4.36	40%	56%	68%	77%	86%	93%	100%	100%
(3) Chilean Insurance Companies	9.77	26%	34%	42%	47%	55%	68%	86%	100%

D. Hypothesis Testing

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
	Avg. Maturity	Accumulated Weights							
		<1year (y)	<3y	<5y	<7y	<10y	<15y	>20y	KS
(1) = (2)	0.24	0.30	0.12	0.02**	0.01**	0.01**	0.02**	0.04**	<0.01***
(1) = (3)	<0.01***	0.02**	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***
(2) = (3)	<0.01***	0.44	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***

Figure 5
Government Bonds Purchased by Chilean PFAs

This figure presents the total amount of government bonds issued by currency denomination and the total amount and the proportion purchased by PFAs. The panels are shown by currency and represent total issuances and purchases. The sample period is 1998-2008. Panel A shows the results for bonds denominated in nominal Chilean pesos, Panel B for bonds denominated in indexed (inflation-linked) Chilean pesos, and Panel C for bonds denominated in US dollars.

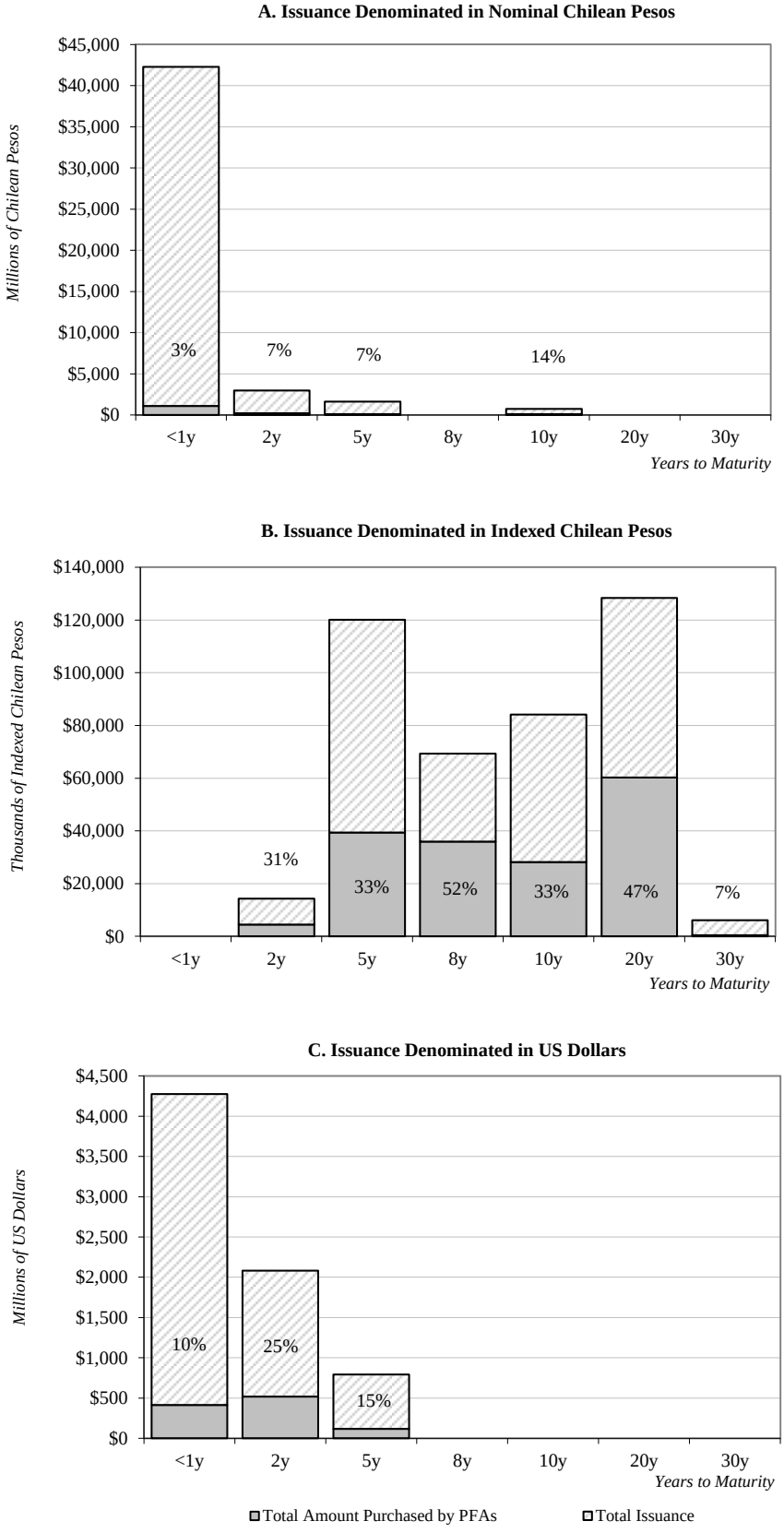
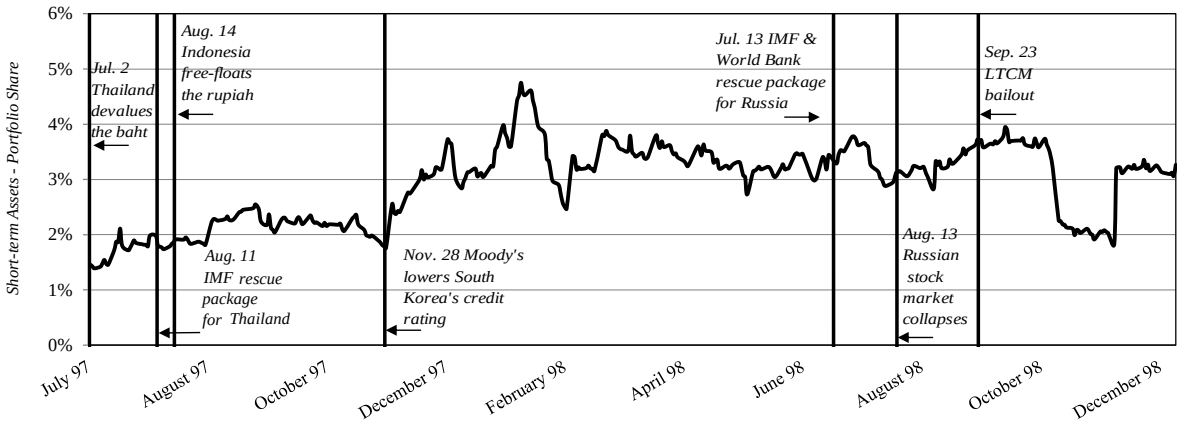


Figure 6
Evolution of PFA Short-term Assets around Events

This figure shows how the share of short-term assets in the portfolio of PFAs varies during the Asian and Russian crises of 1997-1998. Panel A presents the average share of domestic short-term fixed-income assets (those with a term to maturity of up to 30 days) held by Chilean PFAs. PFA shares are calculated as a fraction of the fixed-term portfolio, not the overall portfolio. Some of the major events occurring during this period are displayed in vertical lines. Panel B shows the results for the difference-in-differences regression between Chilean mutual funds, PFAs, and insurance companies for the 1998 Russian crisis. The variable PFA (Mutual Fund) Dummy is equal to one if the investor is a PFA (mutual fund). The variable Crisis Dummy is equal to one if the observation is in the crisis period (Aug. 1998-Oct. 1998). The Post-crisis Dummy is equal to one if the observation is in the post crisis period (Nov. 1998-Jan.1999). In all other cases, the dummy variables are equal to zero. The sample period is May 1998-Jan. 1999. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

A. Average Share of PFA's Short-term Fixed-Income Assets



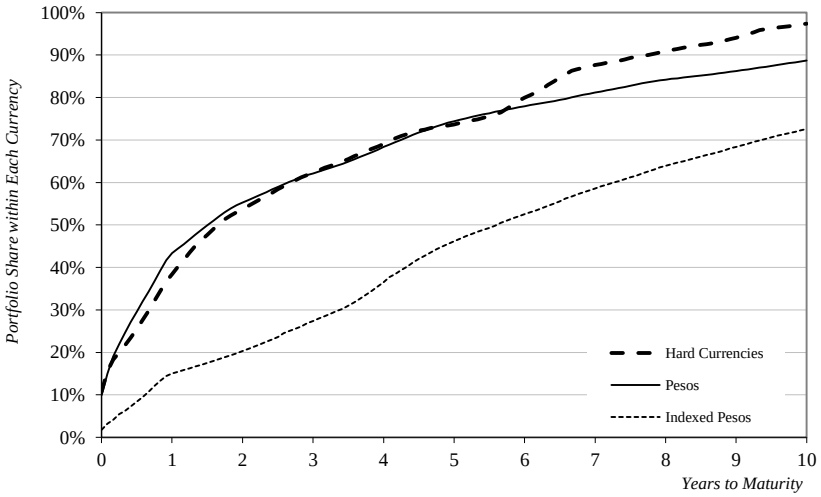
B. Difference-in-Differences Regressions

1998m5 -1999m1	Dependent Variable: Average Maturity					
	PFAs and Mutual Funds		**PFAs and Insurance Companies**		**Mutual Funds and Insurance Companies**	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
PFA Dummy	5.432 ***	0.504	-1.425	1.717		
Mutual Fund Dummy					-6.954 ***	1.397
Crisis Dummy	0.062	0.432	0.131	1.387	0.131	1.319
Post-crisis Dummy	-0.707 *	0.423	-0.172	1.311	-0.172	1.246
PFA Dummy*Crisis Dummy	-0.199	0.733	-0.383	2.499		
Mutual Fund Dummy*Crisis Dummy					0.133	1.942
PFA Dummy*Post-crisis Dummy	0.672	0.748	0.153	2.510		
Mutual Fund Dummy*Post-crisis Dummy					-0.508	1.872
Constant	3.344 ***	0.311	10.169 ***	0.991	10.169 ***	0.942
No. of Obs.	289		112		147	
R-Squared	0.55		0.20		0.38	

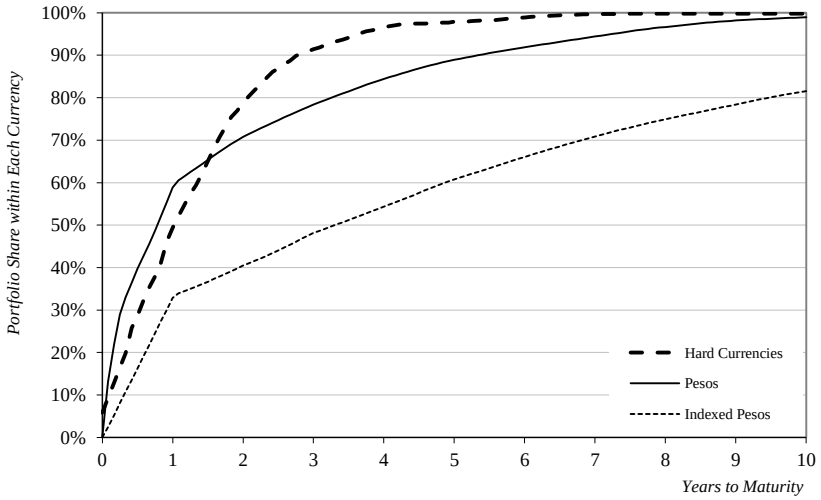
Figure 7
Maturity Structure of Chilean Mutual Funds and PFAs by Currency

This figure presents the maturity structure of Chilean domestic bond mutual funds and PFAs by currency: nominal Chilean pesos, indexed (inflation-linked) Chilean pesos, and "hard currencies" (US dollars, yens, euros, and British pounds). The maturity structure of Chilean mutual funds (PFAs) is calculated per mutual fund (PFA), and averaged across mutual funds (PFAs) at each moment in time using monthly bins. Weights are calculated over the entire portfolio and then normalized within each currency category. The sample period is Sep. 2002 - Jun. 2008. Panel A shows the maturity structure of Chilean domestic mutual funds and Panel B shows that of Chilean PFAs. Panel C shows the portfolio composition by currency. Panel D shows the average maturity by currency. Panel E shows p-values for the two-sided t-tests of equality of average maturities and the Kolmogorov-Smirnov (KS) test of equality of the whole maturity structure. The KS test for functional data is based on the methodology proposed by Cuesta-Albertos et al. (2006) that relies on random projections of the samples of maturity structures. The p-value reported for this test is adjusted for false discovery rate as suggested by Benjamini and Yekutieli (2001) and corresponds to the minimum p-value obtained after repeating the test as many times as the number of maturity bins used to construct the figure, using a different random projection vector in each repetition. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

A. Chilean Domestic Mutual Funds by Currency



B. Chilean PFAs by Currency



C. Overall Portfolio Weights by Currency

	(1) Pesos	(2) Indexed Pesos	(3) Hard Currencies
Chilean Domestic Mutual Funds	80.9%	5.9%	13.3%
Chilean PFAs	21.5%	75.2%	3.3%

D. Average Maturity

	(1) Pesos	(2) Indexed Pesos	(3) Hard Currencies
Chilean Domestic Mutual Funds	3.88	7.15	3.14
Chilean PFAs	1.85	5.31	1.60

E. Hypothesis Testing

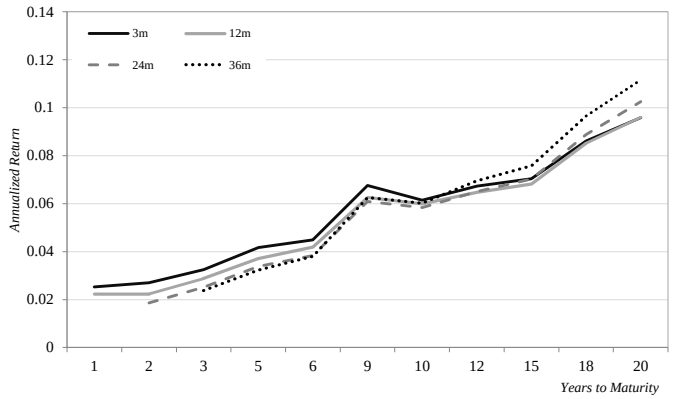
	(i) Chilean Mutual Funds	(ii)		(iii) Chilean PFAs	(iv)
	t-test	KS		t-test	KS
(1) = (2)	<0.01***	<0.01***	(1) = (2)	<0.01***	<0.01***
(1) = (3)	<0.01***	<0.01***	(1) = (3)	<0.01***	<0.01***
(2) = (3)	<0.01***	<0.01***	(2) = (3)	<0.01***	<0.01***

Figure 8
Bond Returns at Different Maturities and Holding Periods

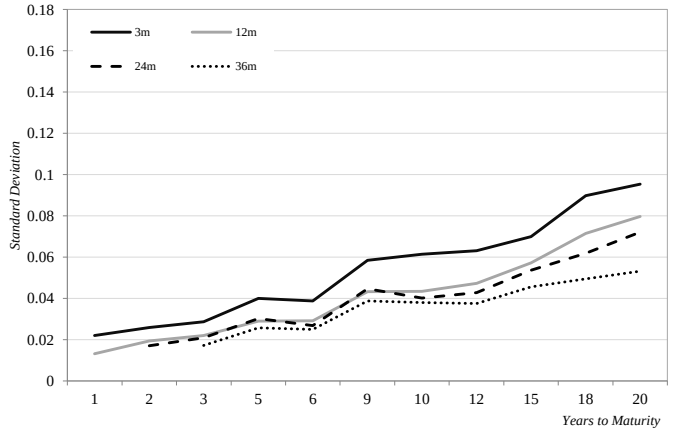
This figure presents the average annualized returns, standard deviations, and Sharpe ratios (average returns/standard deviations) of Chilean bonds of different maturities for various holding periods (3 months, 1 year, 2 years, and 3 years). Panel A shows statistics for indices of government inflation-indexed bonds. Panel B shows statistics using prices from model-based estimations of the yield curve. Returns for bonds of different maturities are daily, calculated using a rolling window for the different holding periods. The sample period is Jan. 2002-Dec. 2007.

A. Indices of Chilean Government Inflation-Indexed Bonds

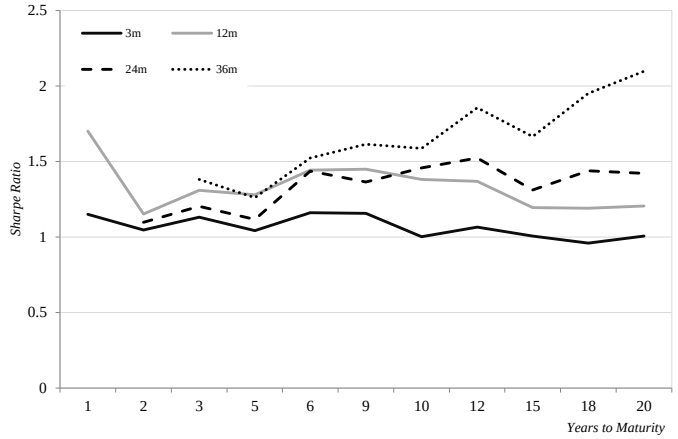
A1. Average Return



A2. Average Standard Deviation

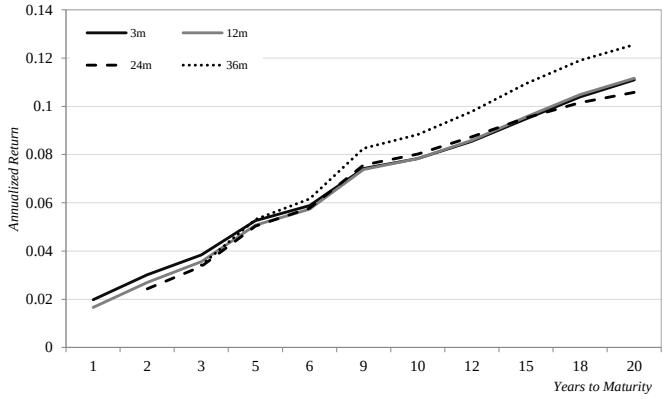


A3. Ratio between Average Return and Average Standard Deviation

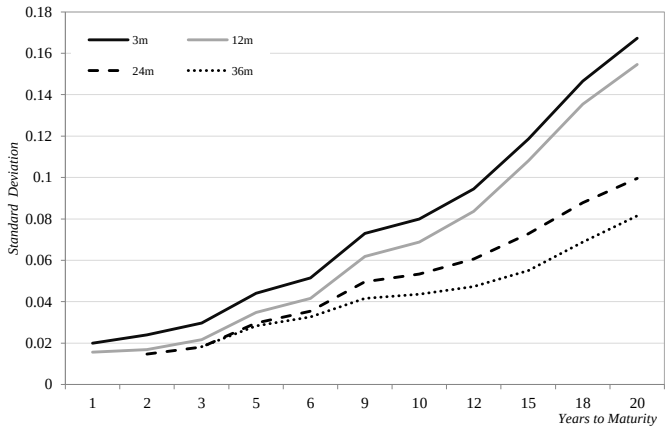


B. Indices Based on the Estimated Yield Curve

B1. Average Return



B2. Average Standard Deviation



B3. Ratio between Average Return and Average Standard Deviation

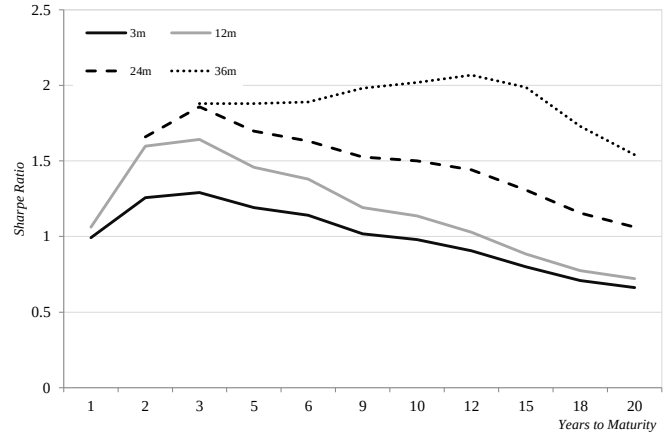
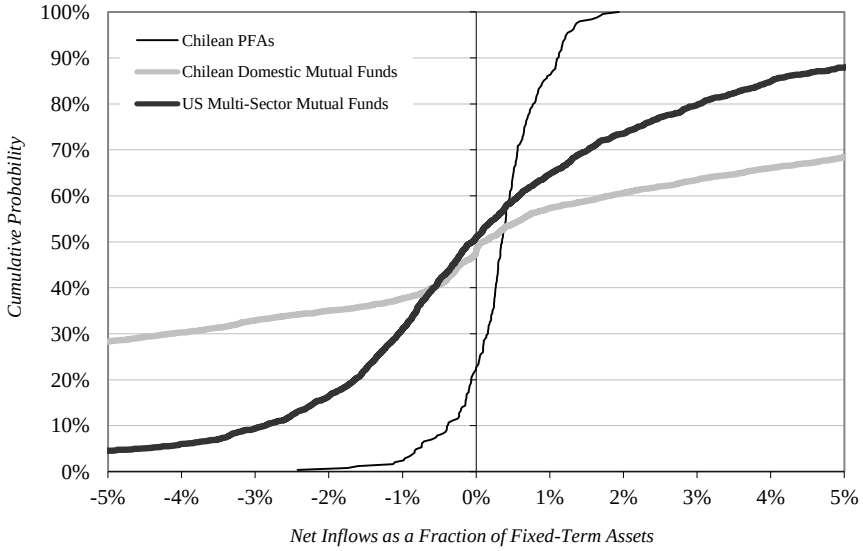


Figure 9
Net Inflows to Chilean Mutual Funds and PFAs Compared to US Mutual Funds

This figure presents the cumulative distribution of net monthly inflows of funds to Chilean domestic bond mutual funds, Chilean PFAs, and US bond mutual funds as a fraction of their fixed-term assets. Net inflows to Chilean and US mutual funds are computed for each mutual fund as the difference between the contemporaneous and lagged value of a mutual fund's assets and the returns accrued from the assets in the previous month's portfolio, and are divided by the contemporaneous value of a mutual fund's fixed-term assets. Net inflows to PFAs are calculated by aggregating daily data, directly collected by the Chilean Superintendency of Pensions. The sample period is Sep. 2002-Dec. 2005. Panel A shows the empirical cumulative probability distributions of these normalized inflows across mutual funds (PFAs) and months, under the assumption that normalized inflows are independent and identically distributed across mutual funds (PFAs) and time. The distribution of US and Chilean mutual fund inflows are shown only partially because they have been limited to fit the scale of the distribution of PFA inflows. Panel B reports the fraction of the fixed-term portfolio invested by the average mutual fund (PFA) up to one and three months (reported in the first and third columns) and the probabilities of observing an outflow larger than that magnitude (reported in the second and fourth columns). These probabilities are obtained from the empirical distributions shown in Panel A. Estimations for the US for Panel B are based on the assumption that within the zero to three year interval, the maturity structure of US funds is the same as that of Chilean mutual funds.

A. Cumulative Distribution of Net Inflows



B. Percentage of Assets Held Short Term and Probability of Outflows of that Magnitude

	% of Short-term Assets	Probability Outflows > % of Short-term Assets	% of Short-term Assets	Probability Outflows > % of Short-term Assets
	Up to 1 month		Up to 3 months	
Chilean Domestic Mutual Funds	9.3%	21.6%	17.9%	13.4%
Chilean PFAs	4.4%	0.0%	11.2%	0.0%
US Multisector Bond Funds	3.7%	6.6%	7.1%	2.8%

Table 1
PFA Holdings of Outstanding Corporate Debt

This table shows the corporate bond holdings of PFAs compared to the total outstanding corporate debt. Panel A presents the fraction of outstanding corporate debt that PFAs purchase. Panel B presents the average maturity of PFA corporate bond holdings compared to the average maturity of the total outstanding corporate debt. The data on outstanding corporate debt per year come from Braun and Briones (2008). The yearly amount purchased by PFAs is the average across monthly data, obtained from the Superintendency of Pensions. Panel B presents this information as of December 31 of each year during the period 2002-2005, obtained from the Superintendency of Pensions and the Superintendency of Securities and Insurance of Chile.

A. Fraction of Outstanding Corporate Debt Held by PFAs

Year	Outstanding Corporate Debt (Millions of US Dollars)	Purchased by PFAs (Millions of US Dollars)	Purchased by PFAs (Percentage of Outstanding Corporate Debt)
1997	$2,047	$1,195	58%
1998	$1,699	$941	55%
1999	$2,156	$1,214	56%
2000	$3,974	$1,388	35%
2001	$6,076	$1,723	28%
2002	$8,293	$2,331	28%
2003	$9,790	$2,901	30%
2004	$12,931	$3,650	28%

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

	Dec. 2002	Dec. 2003	Dec. 2004	Dec. 2005
PFA Holdings of Corporate Debt	4.9	5.0	5.8	6.1
Outstanding Corporate Debt	12.2	12.7	14	14.7

Table 2
Bids by PFAs and Insurance Companies in Government Bond Auctions

Panel A shows the shares pension funds and insurance companies bid for in auctions of Chilean government bonds of different maturities. Panel B shows the ratio between the shares requested by insurance companies and pension funds. P-values for the hypothesis tests of equal requests (measured as the ratio of insurance companies to pension funds) across the different maturities are shown on the right side of the panel. The data for this table include all government auctions from 2002 to 2009 of bonds denominated in pesos, inflation-indexed pesos, and US dollars. Regressions are run separately for inflation-indexed pesos and for all currencies, controlling for currency. Standard errors are clustered by auction and type of institutional investor. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

A. Shares Requested and Prices Offered

		(i)			(ii)			(iii)			(iv)		
		Dependent Variable: Shares Requested						Dependent Variable: Prices Offered					
	Time to Maturity (Years)	Indexed Pesos			Indexed Pesos, Pesos, and US Dollars, Controlling for Currency			Indexed Pesos			Indexed Pesos, Pesos, and US Dollars, Controlling for Currency		
		Coef.		Std. Error	Coef.		Std. Error	Coef.		Std. Error	Coef.		Std. Error
Pension Funds	1				0.029	***	0.010				106	***	0.521
	2	0.063	***	0.010	0.090	***	0.005	101.10	***	0.287	107.30	***	0.598
	5	0.118	***	0.006	0.108	***	0.005	107.20	***	0.309	107.20	***	0.320
	10	0.129	***	0.006	0.125	***	0.005	58.00	***	0.696	105.70	***	0.631
	20	0.163	***	0.010	0.163	***	0.010	96.00	***	0.899	96.00	***	0.898
	30	0.075	***	0.011	0.075	***	0.011	89.69	***	1.292	89.69	***	1.291
Insurance Companies	1												
	2	0.007	***	0.005	0.045	***	0.004	101.20	***	0.790	104.80	***	3.037
	5	0.012	***	0.003	0.035	***	0.003	100.60	***	0.447	101.70	***	0.581
	10	0.012	***	0.003	0.035	***	0.004	98.64	***	0.737	99.50	***	0.651
	20	0.076	***	0.010	0.076	***	0.010	95.55	***	0.687	95.55	***	0.686
	30	0.126	***	0.014	0.126	***	0.014	88.86	***	0.924	88.86	***	0.923
No. of Obs.		3,700			7,498			1,196			1,812		

When comparing within institutional investor across maturities, the differences between shares requested are all statistically significant (two-sided t-test of equality at 10% significance level), except in some cases. Differences are not significant when testing:

- 2y = 30y and 5y = 10y (indexed peso bonds) and 2y = 30y (all currencies) for shares requested by pension funds.
- 2y = 5y, 2y = 10y, and 5y = 10y (indexed peso bonds) and 5y = 10y (all currencies) for shares requested by insurance companies.

Differences between prices are all statistically significant (within institutional investor across maturities), with the following exceptions:

- 5y = 10y (indexed peso bonds) and 1y=10y and 2y = 5y (all currencies) for prices offered by pension funds.
- 2y= 5y (indexed peso bonds and all currencies) for prices offered by pension funds.

B. Ratio between Shares Requested by Insurance Companies and Pension Funds

	(i)			(ii)			(i)				(ii)				
	Dependent Variable: Ratio between Shares Requested						P-values for Hypothesis Tests of Equality between Maturities								
Time to Maturity (Years)	Indexed Pesos			Indexed Pesos, Pesos, and US Dollars, Controlling for Currency			Indexed Pesos				Indexed Pesos, Pesos, and US Dollars, Controlling for Currency				
	Coef.		Std. Error	Coef.		Std. Error	2 y	5 y	10 y	20 y	1 y	2 y	5 y	10 y	20 y
1				0.105	***	0.082									
2	0.168	***	0.145	0.053	***	0.076					0.212				
5	0.218	***	0.115	0.184	***	0.098	0.789				0.149	0.088			
10	0.119	***	0.044	0.167	***	0.044	0.746	0.424			0.449	0.144	0.858		
20	0.609	***	0.113	0.609	***	0.112	0.017	0.016	0.000		0.000	0.000	0.005	0.000	
30	3.473	***	1.701	3.473	***	1.701	0.054	0.057	0.049	0.094	0.048	0.045	0.054	0.052	0.093
No. of Obs.	418			666											

Table 3
Bids of PFAs in Government Bond Auctions by Fund Type

This table shows the shares that the different types of pension funds bid for in auctions of Chilean government bonds of different maturities and the ratio between the shares requested by insurance companies and pension funds. The data for this table include government auctions from 2003 to 2009 of bonds denominated in pesos, inflation-indexed pesos, and US dollars. Regressions are run separately for inflation-indexed pesos (Panel A) and for all currencies, controlling for currency (Panel B). Standard errors are clustered by auction. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

A. Indexed Pesos

Time to Maturity (Years)	Dependent Variable: Shares Requested									
	Funds A		Funds B		Funds C		Funds D		Funds E	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
1										
2	0.038 **	0.020	0.067 ***	0.022	0.120 ***	0.027	0.131 ***	0.027	0.071 ***	0.020
5	0.119 ***	0.017	0.148 ***	0.018	0.202 ***	0.020	0.163 ***	0.022	0.132 ***	0.020
10	0.105 ***	0.011	0.142 ***	0.016	0.202 ***	0.017	0.171 ***	0.016	0.141 ***	0.016
20	0.150 ***	0.021	0.171 ***	0.020	0.213 ***	0.021	0.197 ***	0.018	0.160 ***	0.020
30	0.072 ***	0.022	0.093 ***	0.022	0.119 ***	0.026	0.111 ***	0.026	0.077 ***	0.028
No. of Obs.	1,638		1,727		1,717		1,722		1,726	

Time to Maturity (Years)	Dependent Variable: Ratio between Shares Requested by Insurance Companies and Pension Funds									
	Funds A		Funds B		Funds C		Funds D		Funds E	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
1										
2					0.031 ***	0.097	0.028 ***	0.092	0.038 ***	0.108
5	0.067 ***	0.265	0.104 ***	0.351	0.183 ***	1.026	0.204 ***	1.109	0.229 ***	1.171
10	0.073 ***	0.192	0.076 ***	0.175	0.057 ***	0.157	0.061 ***	0.161	0.114 ***	0.356
20	0.652 ***	0.973	0.568 ***	1.001	0.431 ***	0.705	0.490 ***	0.775	0.565 ***	0.899
30	2.004 ***	1.234	2.288 ***	3.416	1.348 ***	0.741	1.642 ***	0.932	3.205 ***	3.769
No. of Obs.	209		236		274		258		220	

B. Indexed Pesos, Pesos, and US Dollars, Controlling for Currency

Time to Maturity (Years)	Dependent Variable: Shares Requested									
	Funds A		Funds B		Funds C		Funds D		Funds E	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
1	0.094 ***	0.017	0.120 ***	0.015	0.120 ***	0.015	0.116 ***	0.014	0.097 ***	0.016
2	0.038 **	0.020	0.067 ***	0.022	0.120 ***	0.027	0.131 ***	0.027	0.071 ***	0.020
5	0.111 ***	0.015	0.140 ***	0.016	0.213 ***	0.024	0.183 ***	0.025	0.153 ***	0.024
10	0.107 ***	0.012	0.139 ***	0.015	0.191 ***	0.016	0.154 ***	0.019	0.123 ***	0.019
20	0.150 ***	0.021	0.171 ***	0.020	0.213 ***	0.021	0.197 ***	0.018	0.160 ***	0.020
30	0.072 ***	0.022	0.093 ***	0.022	0.119 ***	0.026	0.111 ***	0.026	0.077 ***	0.028
No. of Obs.	1,954		2,047		2,037		2,041		2,045	

Time to Maturity (Years)	Dependent Variable: Ratio between Shares Requested by Insurance Companies and Pension Funds									
	Funds A		Funds B		Funds C		Funds D		Funds E	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
1										
2					0.031 ***	0.097	0.028 ***	0.092	0.038 ***	0.108
5	0.071 ***	0.261	0.110 ***	0.338	0.265 ***	1.330	0.205 ***	1.035	0.212 ***	1.069
10	0.118 ***	0.268	0.109 ***	0.237	0.083 ***	0.215	0.098 ***	0.247	0.137 ***	0.374
20	0.652 ***	0.973	0.568 ***	1.001	0.431 ***	0.705	0.490 ***	0.775	0.565 ***	0.899
30	2.004 ***	1.234	2.288 ***	3.416	1.348 ***	0.741	1.642 ***	0.932	3.205 ***	3.769
No. of Obs.	250		278		324		289		264	

Table 4
Mutual Fund Inflows and Past Returns

This table presents regressions of Chilean domestic bond mutual funds' monthly inflows (as a fraction of the assets at the beginning of the month) on funds' past returns. The different regressions use alternative independent variables, namely, lagged monthly, quarterly, semi-annual, and annual excess returns and returns. All independent variables are lagged one period. Excess returns are computed as the difference between each fund's returns over the average return across funds for the corresponding time span. Panel A shows regressions estimated using all funds (unbalanced panel). Panel B shows regressions only considering funds that exist throughout the whole sample period (balanced panel). Observations for which the monthly inflow is larger than one are excluded. The data cover the period Sep. 2002-Dec. 2005. Standard errors are clustered by fund. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

A. Unbalanced Panel

Dependent Variable: Inflows Relative to Total Assets							
Independent Variables (Lagged)	Coef.	Std. Error	Time Dummies	Fund Dummies	R-Squared	No. of Obs.	No. of Funds
Monthly Excess Return	0.261 ***	0.055	No	No	0.010	1,675	63
Monthly Return	0.257 ***	0.056	Yes	No	0.173	1,675	63
Monthly Return	0.218 ***	0.061	Yes	Yes	0.223	1,675	63
Quarterly Excess Return	0.123	0.095	No	No	0.001	1,465	63
Quarterly Return	0.124	0.119	Yes	No	0.179	1,465	63
Quarterly Return	-0.095	0.220	Yes	Yes	0.232	1,465	63
Semi-Annual Excess Return	0.035	0.064	No	No	0.000	1,201	58
Semi-Annual Return	0.033	0.074	Yes	No	0.160	1,201	58
Semi-Annual Return	-0.238	0.200	Yes	Yes	0.214	1,201	58
Annual Excess Return	0.180	0.150	No	No	0.001	864	49
Annual Return	0.181	0.165	Yes	No	0.189	864	49
Annual Return	-0.138	0.418	Yes	Yes	0.237	864	49

B. Balanced Panel

Dependent Variable: Inflows Relative to Total Assets							
Independent Variables (Lagged)	Coef.	Std. Error	Time Dummies	Fund Dummies	R-Squared	No. of Obs.	No. of Funds
Monthly Excess Return	0.244 ***	0.051	No	No	0.011	1,178	32
Monthly Return	0.209 ***	0.056	Yes	No	0.177	1,178	32
Monthly Return	0.200 ***	0.054	Yes	Yes	0.202	1,178	32
Quarterly Excess Return	0.218	0.159	No	No	0.003	1,058	32
Quarterly Return	0.150	0.216	Yes	No	0.182	1,058	32
Quarterly Return	0.113	0.256	Yes	Yes	0.204	1,058	32
Semi-Annual Excess Return	0.210	0.145	No	No	0.002	910	32
Semi-Annual Return	0.225	0.155	Yes	No	0.170	910	32
Semi-Annual Return	0.128	0.234	Yes	Yes	0.195	910	32
Annual Excess Return	0.211	0.139	No	No	0.001	700	32
Annual Return	0.263 **	0.118	Yes	No	0.189	700	32
Annual Return	0.055	0.358	Yes	Yes	0.221	700	32

Table 5
Effect of Mutual Fund Past Returns on Risk

This table shows the relation between past returns and the risks that mutual funds managers take. Panel A shows the changes in the average maturity of those funds that have a return lower than the market average or a negative return in the previous month. The maturity is expressed in months. Panel B shows the relation between the standard deviation of returns in the second semester vs. the first semester of each year and fund performance, following the Brown, Harlow, and Starks (1996) methodology. The variable Loser Dummy is equal to one if in the first semester of the year the fund has a total return lower than the market average. We refer to these funds as "losers" funds (otherwise they are "winners"). The Interim Performance variable is the accumulated returns of the second semester of each year. The Cumulative 1-year Performance variable is the accumulated returns over the last year. In both panels, the returns of the funds are computed using the "Indirect Method." The sample period is Feb. 1998-Sep. 2013. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. Average Maturity of the Portfolio

	Dependent Variable: Average Maturity								
	(i)			(ii)			(iii)		
Independent Variables	Coef.		Std. Error	Coef.		Std. Error	Coef.		Std. Error
Constant	53.222	***	2.846	53.707	***	2.554	53.144	***	2.810
Return(t-1)<Market Return(t-1) Dummy	4.595	***	0.514						
6-month Mean Return<6-month Market Mean Dummy				4.534	***	0.540			
Return(t-1)<0 Dummy							6.238	***	0.536
No. of Obs.	9,181			8,265			9,181		

Panel B. Ratio of Standard Deviation of Returns

	Dependent Variable: Std. Dev. of Returns (Second Semester) / Std. Dev. of Returns (First Semester)								
	(i)			(ii)			(iii)		
Independent Variables	Coef.		Std. Error	Coef.		Std. Error	Coef.		Std. Error
Constant	1.268	***	0.074	1.302	***	0.756	1.287	***	0.085
Loser Dummy	0.021		0.108	-0.006		0.109	0.001		0.116
Interim Performance				-0.029	**	0.014			
Cumulative 1-year Performance							-0.005		0.011
No. of Obs.	774			774			774		

Table 6
Effect of PFA Past Returns on Risk

This table shows the relation between past returns and the risks that pension funds managers take. Panel A shows the changes in the average maturity of those funds that have a return lower than the market average (for the same fund types) or a negative return in the previous month. The maturity is expressed in months. Panel B shows the weight composition for each asset class (government and corporate bonds and deposits) and the relation between these weights and past returns. Panel C shows the relation between the standard deviation of returns in the second semester vs. the first semester of each year and fund performance, following the Brown, Harlow, and Starks (1996) methodology. The variable Loser Dummy is equal to one if in the first semester of the year the fund has a total return lower than the market average (for the same fund type). We refer to these funds as "losers" funds (otherwise they are "winners"). The Interim Performance variable is the accumulated returns of the second semester of each year. The Cumulative 1-year Performance variable is the accumulated returns over the last year. The returns of the funds are computed using the "Indirect Method." The sample period is Sep. 2002-Dec. 2005 for Panel A and B and Jan. 1997-Dec. 2005 for Panel C. In all panels we control for fund type. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A. Average Maturity of the Portfolio

	Dependent Variable: Average Maturity					
	(i)		(ii)		(iii)	
Independent Variables	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
Constant	52.789 ***	0.346	52.378 ***	0.326	52.340 ***	0.283
Return(t-1)<Market Return(t-1) Dummy	-1.005 **	0.501				
6-month Mean Return<6-month Market Mean Dummy			-1.436 ***	0.527		
Return(t-1)<0 Dummy					-0.184	0.552
No. of Obs.	1,290		1,170		1,290	

Panel B. Weights within Each Asset Class

	Dependent Variable: Weight of Government Bonds					
	(i)		(ii)		(iii)	
Independent Variables	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
Constant	0.434 ***	0.003	0.432 ***	0.003	0.430 ***	0.003
Return(t-1)<Market Return(t-1) Dummy	-0.004	0.004				
6-month Mean Return<6-month Market Mean Dummy			-0.014 ***	0.005		
Return(t-1)<0 Dummy					0.006	0.005
No. of Obs.	1,290		1,170		1,290	

	Dependent Variable: Weight of Corporate Bonds					
	(i)		(ii)		(iii)	
Independent Variables	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
Constant	0.165 ***	0.002	0.163 ***	0.002	0.164 ***	0.001
Return(t-1)<Market Return(t-1) Dummy	-0.005 **	0.002				
6-month Mean Return<6-month Market Mean Dummy			-0.006 **	0.002		
Return(t-1)<0 Dummy					-0.003	0.003
No. of Obs.	1,290		1,170		1,290	

	Dependent Variable: Weight of Deposits					
	(i)		(ii)		(iii)	
Independent Variables	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
Constant	0.401 ***	0.004	0.405 ***	0.003	0.406 ***	0.003
Return(t-1)<Market Return(t-1) Dummy	0.009 *	0.005				
6-month Mean Return<6-month Market Mean Dummy			0.019 ***	0.006		
Return(t-1)<0 Dummy					-0.003	0.006
No. of Obs.	1,290		1,170		1,290	

Panel C. Ratio of Standard Deviation of Returns

	Dependent Variable: Std. Dev. of Returns (Second Semester) / Std. Dev. of Returns (First Semester)					
	(i)		(ii)		(iii)	
Independent Variables	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
Constant	1.871 ***	0.184	1.819 ***	0.189	1.705 ***	0.213
Loser Dummy	-0.238 **	0.105	-0.234 **	0.105	-0.210 **	0.106
Interim Performance			0.020	0.017		
Cumulative 1-year Performance					0.020	0.013
No. of Obs.	128		128		128	

Table 7
Bids by Pension Funds in Government Bond Auctions:
The Effect of Foreign Exposure

This table shows the shares and prices pension funds bid for in auctions of Chilean government bonds of different currencies. The data for this table include all government auctions from Sep. 2002 to Jun. 2008 of bonds denominated in pesos, inflation-indexed pesos, and US dollars. The variables for the different currencies show the shares requested and prices offered for each type of currency. The variable Exposure Dummy is equal to one if the investment of the fund in US dollars denominated instruments (as a % of the total investment) of the last month is greater than the market average of the same variable during the same month. Standard errors are clustered by auction and pension fund. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Indexed Pesos, Pesos, and US Dollars, Controlling for Currency

	Dependent Variable:					
	Shares Requested			Prices Offered		
Independent Variables	Coef.		Std. Error	Coef.		Std. Error
Indexed Pesos	0.107	***	0.006	105.5	***	0.446
Pesos	0.028	***	0.004	105.8	***	0.533
US Dollars	0.085	***	0.011	102.1	***	0.143
Indexed Pesos*Exposure Dummy	0.054	***	0.010	0.227		0.619
Pesos*Exposure Dummy	0.014	**	0.006	-0.556		0.782
US Dollars*Exposure Dummy	0.010		0.014	-0.574	***	0.213
No. of Obs.	4,533			1,093		

Appendix Table 1
Description of Main Data

This table presents information on the main data used in this paper by type of institutional investor. It includes the sample period, data frequency, number of observations, number of funds, and data source. Number of funds refers to the number of mutual funds, the number of insurance companies, or number of pension funds in each case.

Institutional Investor	Sample Period	Frequency	No. of Obs.	No. of Funds / Companies	Data Source
Chilean Domestic Mutual Funds	Jan. 2002 - Dec. 2008	Monthly	965,209	86	Superintendency of Securities and Insurance of Chile
Chilean Insurance Companies	Jan. 2002 - Dec. 2008	Monthly	4,071,927	36	Superintendency of Securities and Insurance of Chile
Chilean PFAs	Jan. 2002 - Jun. 2008	Monthly	6,659,681	45	Superintendency of Pensions of Chile
Chilean PFAs	Jul. 1996 - Jul. 2008	Daily	201,288,833	62	Superintendency of Pensions of Chile
US Mutual Funds	2003 - 2005	Annually	3,816	167	Morningstar