Institutional Investors and Long-Term Investment: Evidence from Chile

Luis Opazo, Claudio Raddatz, and Sergio L. Schmukler

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. Using monthly asset-level portfolios we 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 has averaged higher returns. Thus, expanding large institutional investors does not necessarily imply more developed long-term markets. JEL codes: G11, G20, G22, G23, O16

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One important goal of policymakers in almost all developing countries is the development of markets for long-term finance. This topic 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.[2] 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).[3] In particular, manager incentives vary significantly between mutual and pension funds and insurance companies. Mutual and pension funds are open-end vehicles subject to withdrawals and are monitored on a short-run basis. In contrast, insurance companies have fixed long-term liabilities and are not subject to these withdrawals due to their closed-end nature.

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

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; Alfaro and Kanczuk 2009; Brunnermeier 2009; Jeanne 2009; Raddatz 2010; Broner et al. 2013).

2. This view has been expressed in several studies and articles, for example, 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, 2013b), and The Economist (2013, 2014a).

3. For general references on their expected impact on capital markets, see, e.g., Davis (1995), Davis and Steil (2001), and Impavido et al. (2003, 2010).

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 profile of institutional investors.[4]

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 two-fold. 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. Given the lack of good benchmarks for what a long-term portfolio looks like, the analysis presented here allows us to analyze whether some institutional investors invest more short term than others. Second, the paper discusses what factors might be behind the maturity structure of institutional investors' portfolios by exploiting a rich data set, 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

4. See, e.g., 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).

incentives play in the maturity choice, following the papers that argue that principal-agent problems can lead managers to invest short term.[5]

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.[6] 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, 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 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. Furthermore, mutual and pension funds in Chile hold portfolios that invest more heavily in short-term assets than US mutual funds.

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 at fire sale prices during 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. In particular, long-term assets average higher returns at a higher risk

5. See, e.g., 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), Chen and Pennacchi (2009), Calomiris (2011), and Pennachi and Rastad (2011).

6. Although not the case in Chile, pension funds in some other countries also have this type of structure.

over the sample period; thus the risk-return relation diminishes as the investment horizon lengthens. In other words, 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 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 regimens, establishing this type of pension fund systems with rather similar regulatory schemes.[7] Thus,

7. For example, the United Kingdom 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 United States, 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.

the characterization of the maturity structure of Chilean pension funds and its comparison to that of other institutional investors offers 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 I and II briefly describe the institutional investors and main data used (the other data are described throughout the paper). Section III characterizes the maturity structure of Chilean institutional investors. Section IV analyzes to what extent the supply side of instruments, tactical behavior, risk, and managerial incentives might affect the maturity structure. Section V concludes.

I. The 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.

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 percent of gross domestic product (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. By 2005, pension fund assets under management were equivalent to 56 percent of GDP. Moreover, pension funds were around three times the size of life insurance companies and almost six times the size of mutual funds in 2005. Since 2002, pension fund administrators (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.[8]

Another important common regulatory restriction that pension funds face is the 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 percent 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 adopted at some point similar minimum return bands. In Europe, Poland and the Slovak Republic also have analogous schemes. Other developed countries (Belgium and Germany) have similar guarantees in their voluntary DC programs. Therefore, the effects we find in this paper related to the regulatory regime could affect countries with the same type of regulation.

The insurance companies analyzed in our paper are life insurance companies, which by 2005 managed assets equivalent to 18 percent 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 reduce their default risk and increase customer 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, whereby 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. Also, 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

8. 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 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).

company decides to offer a new fund, for example a "corporate fixed income fund," the fund is obligated to invest at least 90 percent of their assets in those instruments stated in the fund name. Therefore, each mutual fund company determines the investment portfolio composition of its funds.

II. 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 in the paper, come from the Central Bank of Chile (*Banco Central de Chile*) and other sources.[9]

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 the short-term funds from the analysis to focus solely on the funds established to invest long term.[10]

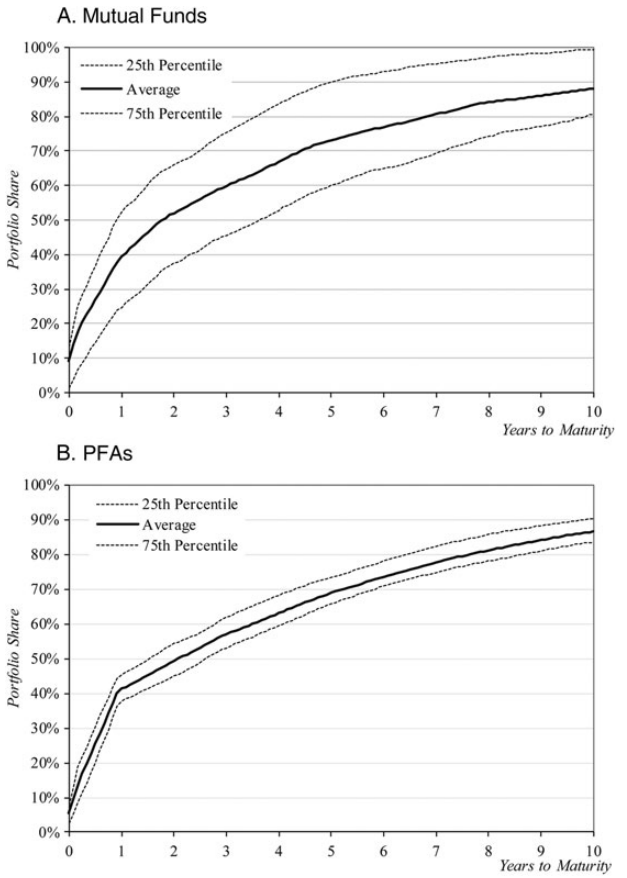
For pension funds, we use a panel of their portfolio investments in fixed-term assets for each of the existing funds during the period 1996–2008 at monthly and daily frequencies. We perform more detailed analysis for the period 2002–2008, when the investment options expanded to more funds. We use panel data with the amount of deposits (including cash as deposits with a 1-day maturity), corporate bonds, and government bonds held by fund per unit of time.[11] 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

9. The complete description of the data used is available in the Appendix Table 1.

10. 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 medium- and long-term funds because the money management funds would be tilted toward the short term by construction. In 2008, approximately 60 percent of the existing funds were categorized as medium- or long-term funds, 12 percent as money management funds (less than 365 days), and 28 percent as money management funds (less than 90 days).

11. 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.

FIGURE 1. Maturity Structure of Chilean Institutional Investors. (A) Mutual Funds. (B) PFAs. (C) Insurance Companies

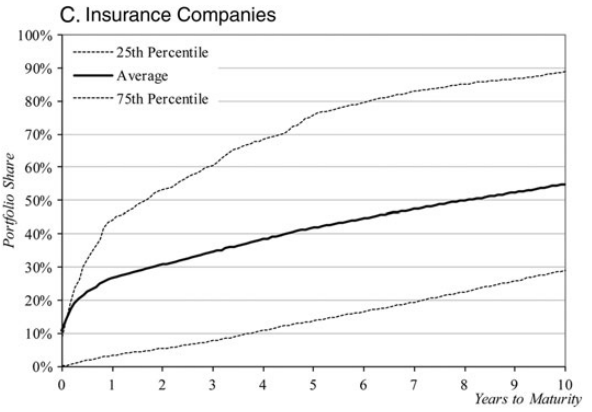


Notes: This figure shows the maturity structure of Chilean domestic mutual funds, Chilean pension funds administrators (PFAs), and Chilean insurance companies. Only medium- and long-term bond mutual funds are taken into account. The maturity structure of Chilean mutual funds and PFAs (insurance companies) 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. Panel A shows the cumulative distribution function for mutual funds, Panel B for PFAs, and Panel C for insurance companies. The sample period is Sep. 2002–Jun. 2008.

Source: Authors' analysis based on data from the Superintendency of Securities and Insurance and the Superintendency of Pensions of Chile.

on the holdings of 76,498 different securities for 45 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

FIGURE 1. Continued



201,288,833 observations for 62 funds between July 1996 and July 2008.[12] 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.

III. MATURITY STRUCTURE

We describe the holdings of long-term assets by documenting the maturity structure of Chilean mutual funds, pension funds, and insurance companies. Figure 1 plots the fraction of investments in fixed-term assets per year-to-maturity for 2002–2008. Panel A shows the empirical cumulative distribution function (CDF) for mutual funds, Panel B for PFAs, and Panel C for insurance companies. We construct the figure by determining at each point in time (each month) the term to maturity of each instrument in a fund (insurance company) portfolio, measuring the fraction of the value of all assets invested at different terms to maturity, and then averaging these fractions across funds (companies) and time. That is, we use an equally-weighted average across funds (companies). The supplemental appendix Figure S.1 (available at http://wber.oxfordjournals.org/) shows the results for a value-weighted average across funds (companies). The results are qualitative similar to the ones presented in the paper.

Let $d_{i,t}$ and $w^k_{i,t}$ 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

12. 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.

fraction of fund k's fixed-term assets with term to maturity D is:

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

where I is an indicator function that takes on the value one if the condition is met.

The average fraction of fund k 's assets invested at maturity D across time is:

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

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:

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

where T denotes the number of months included in the entire sample period, and N is the number of active mutual funds.[13]

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. 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 percent of their portfolio up to 1 year, 59 percent up to 3 years, and 73 percent up to 5 years. Moreover, they hold almost all of their assets in securities maturing within 15 years (95 percent). However, the distributions vary greatly across mutual funds, as shown by the 25th and 75th interquartile range across funds, averaged over time: the fraction of the fixed-term portfolio invested up to 1 year varies between 24 and 50 percent. Though not reported, plots of the density function show that the highest density is at short maturities, after which probabilities systematically decline.

13. 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 1 to 4 years.

Figure 1, Panel B shows that PFAs are also heavily invested in short-term assets. For example, they invest 40 percent up to 1 year, 56 percent up to 3 years, and 68 percent up to 5 years. The distributions do not vary much by PFA as shown by the interquartile range calculated across PFAs over time. The fraction of the fixed-term portfolio invested up to 1 year varies only between 37 and 45 percent during the sample. Even smaller degrees of dispersion are observed at other ranges of the CDFs. Similarly to the case of mutual funds, the portfolio weights decline exponentially.

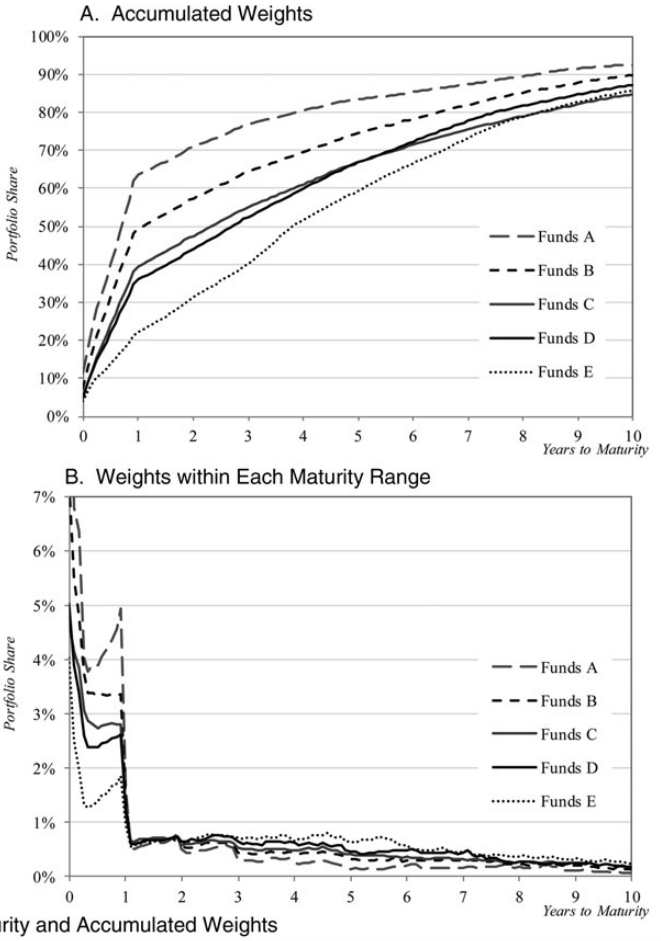
Figure 1, Panel C shows the maturity structure of Chilean insurance companies. Unlike mutual and pension funds, insurance companies are heavily invested in longer-term assets. For example, they only invest 34 percent up to 3 years and 45 percent of their holdings have a maturity longer than 10 years. Similar to mutual funds, the distributions vary significantly across insurance companies, as shown by the 25th and 75th interquartile range across funds, averaged over time.

Figure 2 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 percent of their assets in instruments up to 1 year. In contrast, funds E (the safest ones) have the highest average maturity (5.70 years) and invest almost 30 percent in instruments with maturity of 7 years or more. More generally, the maturity structure tends to increase as funds become safer. Notably, funds C (the intermediate-risk funds) have a similar maturity structure to the one of the aggregate portfolio of all pension funds (funds A–E), so the comparisons we make for the entire portfolio hold when comparing funds C with other institutional investors. Funds C have an average maturity of 4.62 years while the average maturity for all pension funds is 4.36 (Fig. 3).

Although outside the scope of this paper, several reasons could explain the differences between the riskiest and the safest funds. For example, the equity-oriented (funds A) might hold short-term instruments to manage their liquidity needs and thus might not focus on long-term bonds. Moreover, the safest bond funds (funds E) might try to match their maturities to the marginal investor's (longer-term) retirement horizon, even when pension funds are under a defined-contribution scheme and their investment portfolios are not subject to any regulation regarding a target asset-liability term mismatch. Furthermore, competition across different funds types might also play a role. In the case of Chile, 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 percent of their portfolios in stocks, funds E might invest in longer-maturity bonds to try to achieve better returns.

Figure 3 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

FIGURE 2. Maturity Structure of Chilean PFAs by Fund Type. (A) Accumulated Weights. (B) Weights within Each Maturity Range. (C) Average Maturity and Accumulated Weights



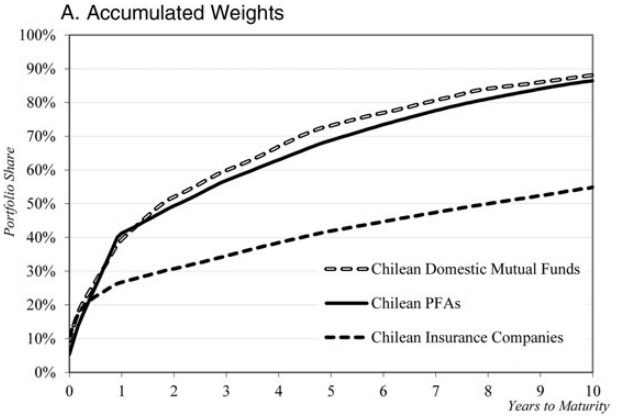
C. Average Maturity and Accumulated Weights

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(iv)
	Avg. Maturity	Accumulated Weights (percent)							
	(years)	<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

Notes: 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.

Source: Authors' analysis based on data from the Superintendency of Pensions of Chile.

FIGURE 3. Maturity Structure of Chilean Insurance Companies Compared to Mutual Funds and PFAs. (A) Accumulated Weights. (B) Weights within Each Maturity Range. (C) Average Maturity and Accumulated Weights. (D) Hypothesis Testing

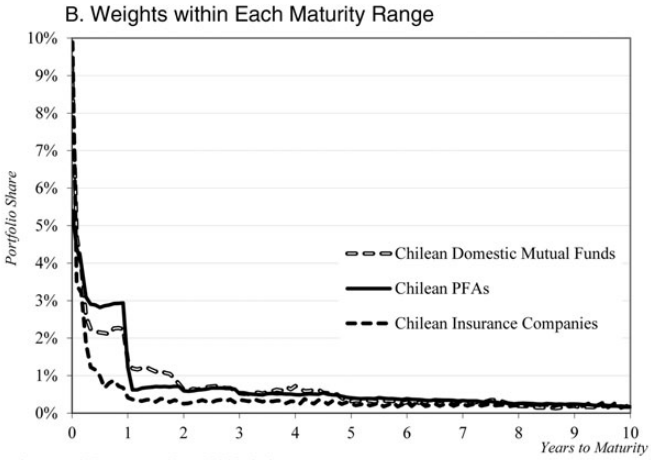


Notes: This figure compares the maturity structure of Chilean insurance companies to that of Chilean domestic mutual funds and PFAs. Only medium- and long-term bond mutual funds are taken into account. The maturity structure of Chilean mutual funds and PFAs (insurance companies) is calculated per mutual 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.

Source: Authors' analysis based on data from the Superintendency of Securities and Insurance and the Superintendency of Pensions of Chile.

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

FIGURE 3. Continued



C. Average Maturity and Accumulated Weights

	(i) Avg. Maturity (years)	(ii)	(iii)	(iv)	(v) Accumulated Weights (percent)	(vi)	(vii)	(viii)	(ix)
		<1year (y)	<3y	<5y	<7y	<10y	<15y	<20y	<30y
(1) Chilean Domestic Mutual Funds	3.97	38	59	73	80	88	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) Avg. Maturity (years)	(ii)	(iii)	(iv)	(v) Accumulated Weights	(vi)	(vii)	(viii)	(ix)
		<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***

mutual funds are generated by the same underlying distribution.[14] 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 (Fig. 3). The differences are quite

14. 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 $W_{D,k} = \frac{1}{T}\sum_t W_{D,k,t}$, 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).

significant both 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).

To provide more information about how short-term Chilean mutual and pension funds invest, Figure 4 compares them with US fixed-income mutual funds for a subperiod ending in 2005. The figure shows that Chilean mutual and pension funds are much more tilted toward the short term than US mutual funds. For example, Chilean pension funds hold 52 percent of their fixed-term instruments in assets with maturity of up to 3 years, while US multi-sector mutual funds hold 24 percent 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 multisector (9.55 years) than for Chilean mutual and pension funds (3.88 and 4.61 years, respectively). Panel C shows that these distributions are statistically different at conventional significance levels.

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 United States. 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 (at least in comparative terms) and raises the question of which factors might be driving them to invest relatively short term.

IV. 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.

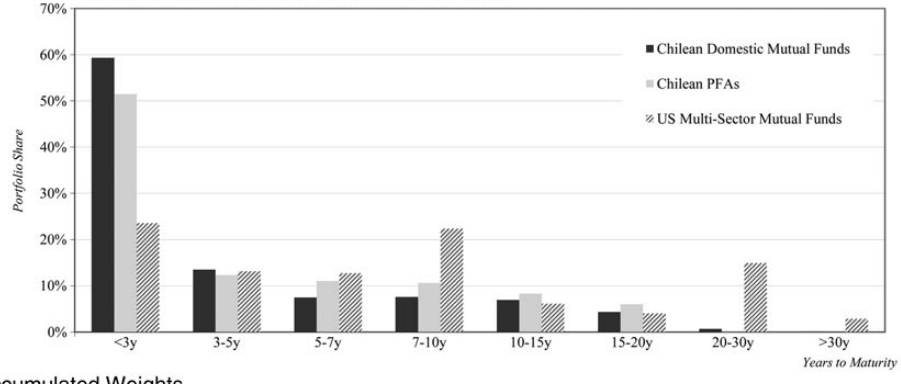
Instrument Availability

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

When analyzing 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, we find that PFAs are not exhausting the supply of long-term instruments. In fact, PFAs purchase 3 percent of issuances in Chilean pesos, 40% of government issuances in inflation-indexed pesos, and 15 percent 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-

FIGURE 4. Maturity Structure of Chilean Mutual Funds and PFAs Compared to US Mutual Funds. (A) Comparison to US Multi-sector Mutual Funds. (B) Average Maturity and Accumulated Weights. (C) Hypothesis Testing

A. Comparison to US Multi-sector Mutual Funds



B. Average Maturity and Accumulated Weights

	(i) Avg. Maturity (years)	(ii)	(iii)	(iv)	(v) Accumulated Weights (percent)	(vi)	(vii)	(viii)
		<3years (y)	<5y	<7y	<10y	<15y	<20y	<30y
(1) Chilean Domestic Mutual Funds	3.88	59	73	80	88	95	99	100
(2) Chilean PFAs	4.61	52	64	75	86	94	100	100
(3) US Multi-sector Mutual Funds	9.55	24	37	50	72	78	82	97

C. Hypothesis Testing

	(i) Avg. Maturity (years)	(ii)	(iii)	(iv)	(v) Accumulated Weights	(vi)	(vii)	(viii)
		<3years (y)	<5y	<7y	<10y	<15y	>20y	KS
(1) = (3)	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***
(2) = (3)	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***	<0.01***

Notes: This figure compares the maturity structure of Chilean domestic bond mutual funds and Chilean PFAs to that of US bond mutual funds (multi-sector mutual funds). PFA shares are calculated as a fraction of the fixed-term portfolio, whereas Chilean and US mutual fund shares are calculated over the entire portfolio. The maturity structure of Chilean mutual funds and Chilean PFAs is averaged across monthly data for the period Sep. 2002–Jun. 2005 and that of US mutual funds is averaged across annual data for the period 2003–2005. Panel A shows the weights within different maturity bins. Panel B shows the average maturity and accumulated weights in a table format. Panel C 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.

Source: Authors' analysis based on data from the Superintendency of Securities and Insurance and the Superintendency of Pensions of Chile. US mutual funds data are from Morningstar Direct.

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 (or equal to) 10 years purchased by pension funds is 41 percent (compared to 39 percent for indexed bonds with less than 10 years of maturity).[15] This observation is relevant because government bonds are considered relatively safe investments.[16]

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. PFAs hold an average 40 percent of outstanding corporate debt, declining from 58 percent in 1997 to 28 percent in 2004. PFA holdings are tilted toward instruments with shorter maturities. While the average maturity of the outstanding debt is about 13 years, the average maturity of the debt held by PFAs is only five years.[17] Again, this type of information suggests that PFAs have not been constrained to expand their holdings of long-term bonds.[18]

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 1 year or longer) issued by the Central Bank of Chile and the Treasury between 2002 and 2009.[19] The data come from the central bank, which organizes these

15. These results are available in the supplemental appendix Figure S.2.

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

17. The results are available in the supplemental appendix Table S.1. To construct that table, 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).

18. With respect to the banking system, the proportion of certificate deposits held by PFAs has been very stable, oscillating between 25 and 30 percent. 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.

19. In the Chilean system, agents offer the prices and quantities of government bonds they wish to purchase (the demand side), while the central bank announces the quantity of bonds it wishes to sell (the supply side). Once the offers are received, the central bank sorts the bids according to the prices offered (from maximum to minimum) until the sum of the demanded bonds equals the amount the central bank announced to sell. The price at which it sells all the bonds is the price that corresponds to the last bonds that exhaust the supply, the cut point where the demand meets the supply. This system is very similar to the one used in Europe, following the so-called Dutch auction. Mexico uses this system as well. The United States uses a similar system but combined with another system with two tranches, a noncompetitive offer for smaller amounts and a competitive one for larger ones.

TABLE 1. Bids by PFAs and Insurance Companies in Government Bond Auctions

A. Shares Requested and Prices Offered

		(i) Dependent Variable: Shares Requested		(ii) Dependent Variable: Shares Requested		(iii) Dependent Variable: Prices Offered		(iv) Dependent Variable: Prices Offered	
		Indexed Pesos		Indexed Pesos, Pesos, and US Dollars, Controlling for Currency		Indexed Pesos		Indexed Pesos, Pesos, and US Dollars, Controlling for Currency	
	Time to Maturity (Years)	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Pension funds	1			0.029 ***	0.010			106.00 ***	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:

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

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

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

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

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

TABLE 1. Continued

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

	(i) Dependent Variable: Ratio between Shares Requested		(ii)		(iii) *P*-values for Hypothesis Tests of Equality between Maturities				(iv)				
	Indexed Pesos		Indexed Pesos, Pesos, and US Dollars, Controlling for Currency		Indexed Pesos				Indexed Pesos, Pesos, and US Dollars, Controlling for Currency				
Time to Maturity (Years)	Coef.	SE	Coef.	SE	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										

Notes: 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 (SE) are clustered by auction and type of institutional investor. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Source: Authors' analysis based on data from the Central Bank of Chile.

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.

Using the auction data, Table 1 shows estimates of how much pension funds request at different maturities and what price they offer for the requested bonds. It also compares the behavior of pension funds and insurance companies. The regressions estimated in Panel A, columns (i) and (ii) are:

$$SR_{i,j} = \beta_1 D_{1,j} PFA_{i,j} + \beta_2 D_{1,j} IC_{i,j} + \ldots + \beta_{11} D_{30,j} PFA_{i,j} + \beta_{12} D_{30,j} IC_{i,j} + \varepsilon_{i,j}, \quad (4)$$

where $SR_{i,j}$ refers to the share of bonds requested (out of the total number of bonds offered in auction j) by the institutional investor i. $D_{m,j}$ equals one if the bonds requested in auction j is of maturity m ($m = 1, 2, 5, 10, 20, 30$), and zero otherwise. $PFA_{i,j}$ ($IC_{i,j}$) equals one if the institutional investors i that made the bid in auction j is a PFA (insurance company), and zero otherwise. $\varepsilon_{i,j}$ is the error term. The regressions in column (i) only include those auctions in which the bonds offered are denominated in indexed pesos. Those in column (ii) include all auctions, controlling for currency. The regressions in columns (iii) and (iv) are equivalent to the previous ones, but the dependent variable is the price offered.

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 1, 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 5- and 10-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.[20] Therefore,

20. PFAs are significantly larger investors even after removing equities from the portfolios of both PFAs and insurance companies. In our sample, PFAs' fixed-income assets average 36 billion US dollars, while insurance companies' ones average 10 billion. In terms of GDP, PFAs' fixed-income assets are equivalent to 30% of GDP, while insurance companies' fixed-assets represent around 9%.

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 percent of the amount requested by pension funds of 20 year bonds and more than three times that of 30-year bonds.

We further exploit the auction data by analyzing the shares requested by each type of pension fund. The results show that even those funds with higher average maturity bid less strongly for 30 year bonds than insurance companies.[21] Therefore the results presented in Table 1 are not driven by the aggregation of all different types of funds or by the funds with lower average maturities.

Overall, the results in this section show that the short-termism of pension funds is not significantly constrained by the supply side of instruments. 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. Thus, pension funds seem to demand less heavily bonds with longer maturities and their demand seems to play an important role in their short-termism. As shown below, the behavior of pension funds does not seem to be driven by low returns on long-term bonds. In fact, long-term bonds average significant returns when compared to short-term ones.

Rebalancing

Mutual 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 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.[22] Pension funds experience significantly less outflows than mutual funds (as we show later); thus they would be especially able to use their liquidity to take advantage of market opportunities in turbulent times instead of meeting redemptions.

21. The regressions are available in the supplemental appendix Table S.2.

22. 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.

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.

Figure 5, Panel A shows the evolution of short-term assets during the crisis period under analysis, 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 South Korea in November 1997 (with the downgrade of Korean debt) to more than 3 percent 2 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 2-year mean, within 2 standard deviations of the mean.[23] Therefore, the patterns in Figure 5, Panel A, do not seem to be significantly affected by sudden inflows of cash.[24] 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 5, Panel B).[25] 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

23. 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.

24. 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.

25. The regressions in Panel B include all the holdings of mutual funds, PFAs, and insurance companies, not just the very short-term assets as in Panel A. We only analyze the Russian crisis because we do not have data on mutual funds and insurance companies during the Asian crisis.

FIGURE 5. Evolution of PFA Short-term Assets around Events. (A) Average Share of PFA's Short-term Fixed-income Assets. (B) Difference-in-differences Regressions

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

B. Difference-in-differences Regressions

	Dependent Variable: Average Maturity					
	PFAs and Mutual Funds		**PFAs and Insurance Companies**		**Mutual Funds and Insurance Companies**	
Independent Variables	Coef.	SE	Coef.	SE	Coef.	SE
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	

Notes: 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 domestic bond 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.

Source: Authors' analysis based on data from the Superintendency of Securities and Insurance and the Superintendency of Pensions of Chile.

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.

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 they hold. 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 compute 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).[26]

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 percent (78 percent) of peso holdings are held in instruments maturing in less than 1 (3) year(s). They are a little bit less short term in hard-currency assets; 46 percent (91 percent) are in assets maturing in less than 1 (3) year(s). On the contrary, they are more long term in indexed pesos instruments. For example, about 30 percent (47 percent) are held in instruments with maturity lower than 1 (3) year(s). The differences in the distributions are statistically significant.

The described patterns 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

26. The results are available in the supplemental appendix Figure S.3.

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.[27] 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 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 nonindexed instruments).[28]

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.[29] 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.[30] 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 bonds of different maturities, portfolios should be proportional to the Sharpe ratios. Although this is a strong assumption and more complex analysis is needed

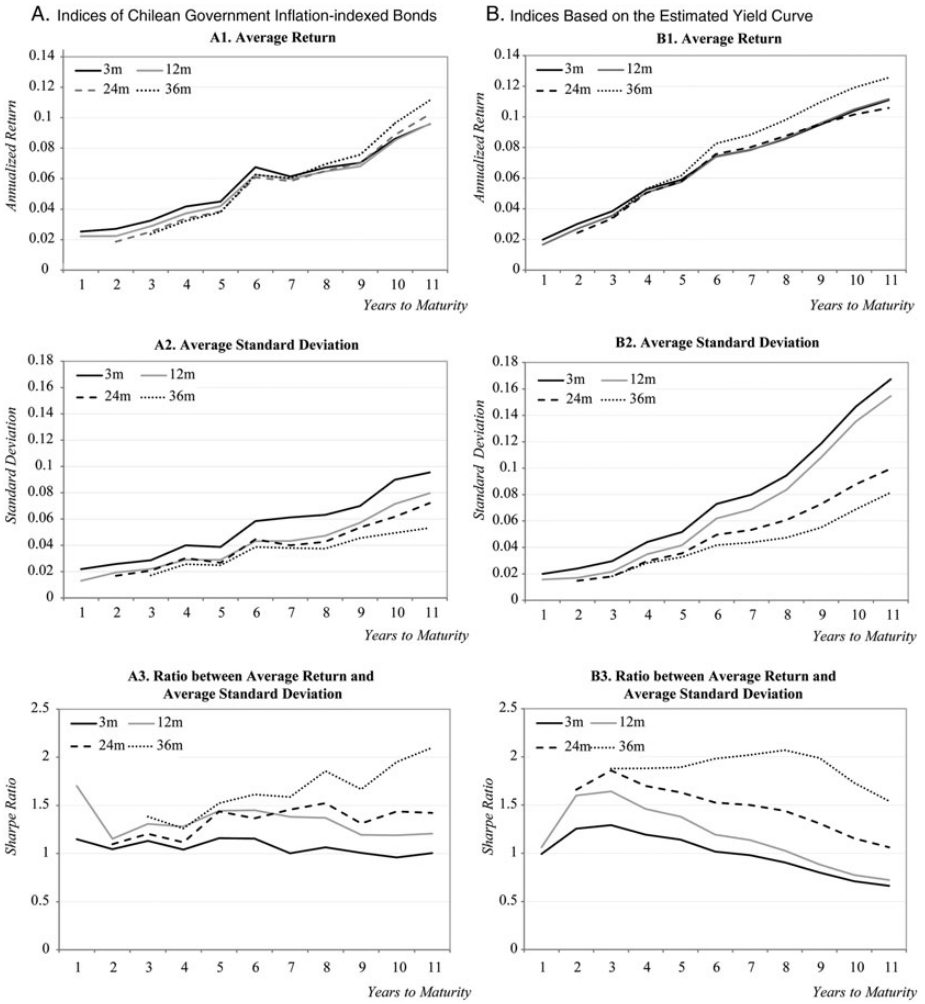
27. While the correlation between monthly inflation and depreciations of the Chilean peso against the US dollar between 1990 and 2008 is about 0.17, the correlations between annual and bi-annual inflation and depreciations are 0.35 and 0.49, respectively.

28. Given that 40% of PFA assets are equities, another possibility is that PFAs are hedging longer-run inflation risk with this type of instrument. However, equities in Chile have not been a good hedge for inflation. For example, the rolling 5-year correlation of inflation and stock market returns has not been very stable and in many years it has been negative.

29. 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, covering several default episodes and, thus, reducing the chances that the results are driven by a peso problem. In our case, we only have a six-year sample, which might be short for this type of calculation. Still, the estimates in both papers lead to the same conclusions.

30. 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.

FIGURE 6. Bond Returns at Different Maturities and Holding Periods. (A) Indices of Chilean Government Inflation-indexed Bonds. (B) Indices Based on the Estimated Yield Curve



Notes: 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.

Source: Authors' analysis based on data described in the text.

(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 6 shows that, as expected, investing in long-term bonds averages higher returns within the sample period, albeit at a higher risk. For example, over a

holding period of 3 months, annualized returns for the 5-year bond index is approximately 4 percent, in contrast to 7 percent for the 15-year bond index. Standard deviations also rise with longer maturities, being 4 and 7 percent for 5- and 15-year bond indices respectively, also considering a holding period of 3 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 3 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.[31]

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

31. 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 6.

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 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 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. 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 this section 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.

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, partly because the higher volatility of long-term assets poses additional risk of generating outflows. 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. Second, 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:

$$I_t^k = W_t^k - W_{t-1}^k(1 + R_t^k). \quad (5)$$

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.[32]

The results are displayed in Figure 7. 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 percent of the portfolio or more is 33 percent. 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.[33] Chilean mutual funds hold 9.3 percent 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 percent. US multi-sector bond funds are subject to less outflows. For example, the historical probability of experiencing a net outflow of 3 percent of the portfolio or more is 9 percent (instead of 33 percent). Therefore, the short-termism of Chilean mutual funds might be partly explained by the relatively large outflows they face.

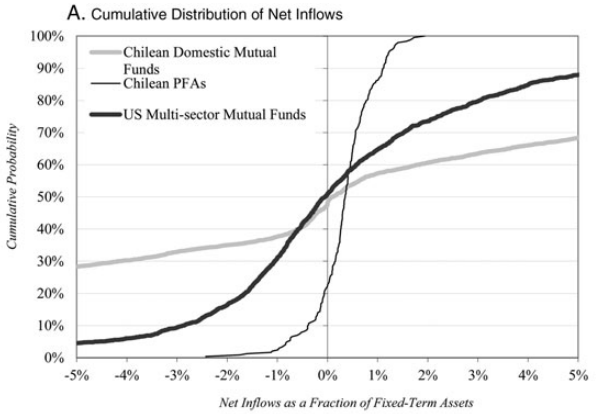
Chilean pension funds, on the contrary, are not exposed to significant outflows. The distribution of net inflows of Chilean PFAs is significantly tilted to the right. So redemption risk does not seem to be an important factor explaining pension funds' short-term holdings. For example, a net outflow of 1 percent of the portfolio has a historical probability of 3 percent for PFAs and 38 percent 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 3.[34] The estimations reported in Figure 7, Panel B also show that pension funds seem to hold a large fraction of liquid assets for low-probability events: they hold 4.4 percent 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

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

33. 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 0 to 3-year interval, the maturity structure of US funds is proportional to that of Chilean mutual funds.

34. 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.

FIGURE 7. Net Inflows and Short-term Assets. (A) Cumulative Distribution of Net Inflows. (B) Percentage of Assets Held Short Term and Probability of Outflows of that Magnitude. (C) Mutual Fund Inflows and Past Returns



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 (percent)		Up to 3 months (percent)	
Chilean Domestic Mutual Funds	9.3	21.6	17.9	13.4
Chilean PFAs	4.4	0.0	11.2	0.0
US Multi-sector Mutual Funds	3.7	6.6	7.1	2.8

Notes: This figure shows the net inflows and short-term assets held by Chilean domestic bond mutual funds, Chilean PFAs, and by US mutual funds. In addition, for Chilean mutual funds, the figure analyzes the relation between past returns and net inflows. 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 the net monthly inflows (as a fraction of the fixed-term assets) 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 and the probabilities of observing an outflow larger than that magnitude. Estimations for the United States 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. Panel C shows regressions of Chilean domestic 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 and quarterly 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. The regressions use all the available funds (unbalanced panel). Observations for which the monthly inflow, as a fraction of the fixed-term assets, is larger than one are excluded. Standard errors are clustered by fund. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Source: Authors' analysis based on data from the Superintendency of Securities and Insurance and the Superintendency of Pensions of Chile. US mutual funds data are from Morningstar Direct.

FIGURE 7. Continued

C. Mutual Fund Inflows and Past Returns

Dependent Variable: Inflows Relative to Total Assets							
Independent Variables (Lagged)	Coef.	Std. Error	Time Dummies	Fund Dummies	R-squared	No. of Obs.	No. of Func
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

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). Figure 7, Panel C 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.[35] 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 pension funds.[36] 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 guarantee a minimum return rate based on the market average return. 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

35. Regressions including lagged annual and semi-annual returns are shown in the supplemental appendix Table S.3.

36. 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).

TABLE 2. Effect of Past Returns on Risk

A. Chilean Mutual Funds

A1. Average Maturity of the Portfolio

	Dependent Variable: Average Maturity					
	(i)		(ii)		(iii)	
Independent Variables	Coef.	SE	Coef.	SE	Coef.	SE
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	

A2. 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.	SE	Coef.	SE	Coef.	SE
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	

B. Chilean PFAs

B1. Average Maturity of the Portfolio

	Dependent Variable: Average Maturity					
	(i)		(ii)		(iii)	
Independent Variables	Coef.	SE	Coef.	SE	Coef.	SE
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	

TABLE 2. Continued

B2. 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.	SE	Coef.	SE	Coef.	SE
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	

Notes: This table shows the relation between past returns and the risks that Chilean domestic bond mutual funds and pension funds managers take. Panels A show the results for Chilean mutual funds, while Panels B show the results for Chilean PFAs. Panel A1 (B1) shows the changes in the average maturity of Chilean mutual funds (pension 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 A2 (B2) 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 mutual fund (pension fund) has a total return lower than the market average. We refer to these funds as "losers" funds. The Interim Performance variable is the fund accumulated return of the second semester of each year. The Cumulative 1-year Performance variable is the fund accumulated return of the last year. In all cases, the returns of the funds are computed using the "Indirect Method." The sample period is Feb. 1998–Sep. 2013 for mutual funds and Jan. 1997–Dec. 2005 for PFAs. In the PFAs' regressions, we control by fund type. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively. SE = standard error.

Source: Authors' analysis based on data from the Superintendency of Securities and Insurance and the Superintendency of Pensions of Chile.

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; Pedraza Morales 2014), and herding does not need to 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 United States 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.

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 6 months) or a negative return.[37] We do find evidence that mutual funds take

37. The market average is computed as the average return for all Chilean bond mutual funds of the sample.

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 2, Panel A1).

When performing the same analysis for the case of PFAs, we find different results (Table 2, Panel B1). 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. They increase their holdings of deposits and reduce their holdings of government and corporate debt, which have a longer term to maturity.[38] 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 within an 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 2, Panel A2). 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 2, Panel B2).

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.

38. These results are available in the supplemental appendix Table S.4.

TABLE 3. Bids by PFAs in Government Bond Auctions: The Effect of Foreign Exposure

Independent Variables	Dependent Variable:			
	Shares Requested		Prices Offered	
	Coef.	SE	Coef.	SE
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	

Notes: 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 estimates 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 (SE) are clustered by auction and pension fund. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Source: Authors' analysis based on data from the Central Bank and the Superintendency of Pensions of Chile.

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 3). 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 consequently 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. Though pension funds are subject to less outflows, the regulation reinforces the market mechanism by punishing the pension 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.

V. 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 1 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 average 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 elsewhere about the pension systems and how to reform them given the lower than expected replacement rates.[39] However, the socially optimal design to balance this tradeoff is not obvious (Acemoglu et al. 2007) and requires further work. Policy makers 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 maturity allocation amongst the various institutional and retail investors is socially inefficient, to what extent long-term debt is socially desirable, and how incentives could change to shift the investment horizon of institutional investors. Moreover, despite all the new work shown here, the paper does not disentangle what ultimately determines the equilibrium maturity structure in Chile. Disentangling the effects of the demand and supply is difficult as there is no obvious instrument to use in this regard. This type of analysis falls outside the scope of this paper and deserves future attention.

39. 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. See, e.g., Accessed February 03, 2015. http://www.elmercurio.com/blogs/2014/01/14/18619/Un-mejor-sistema-de-pensiones.aspx. For an international discussion, see Stewart (2014) and The Economist (2014b).

APPENDIX TABLE 1. Description of Main Data

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	Jan. 2003 - Dec. 2005	Annually	3,816	167	Morningstar

Notes: 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.

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