Active Investment Decisions of Members in the Chilean DC Pension System: Performance and Learning over time

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October 2013

Preliminary Work – Please Do Not Cite

Abstract

This paper studies the investment decisions of members of the Chilean DC pension System using administrative data. Since 2002, members of the system have had the opportunity to choose between five different types of funds. However they have made little voluntary changes. This reinforces the importance of establishing adequate default investment allocations for affiliates. We characterize and study the performance of those affiliates that make changes and find that they are mostly men and are wealthier. These findings are supported by our non-parametric and regression analysis and are consistent with findings of previous studies. We also find that those affiliates that make fund changes generally display a poor performance, whether measured against pension funds, passive strategies and default strategies. Results indicate that 37.8% of all affiliates with voluntary transfers obtained a lower performance than the worst return obtained by a pension fund (fund A) over the period 2008-2013. Moreover, only 1.3% of individuals outperformed fund E, the refuge fund during the financial crisis of 2008. Furthermore we find that those who outperform don't have significantly better market timing abilities than the worst performers. Instead, the former tend to increase equity exposure during market turmoil, while the latter reduce their equity exposure. Regarding the presence of learning in investment decisions, rather than refining their market timing abilities, the affiliates who improve their investment performance during the period under study do so by keeping steady equity exposures in periods of high volatility instead of lowering their exposures.

Keywords: DC pension schemes, portfolio choice, pension risk, age-based investment strategies.

JEL codes: G23, G21, G32, J26, J32; C15

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1. Introduction

The Chilean pension system has a DC scheme as its main pillar, with mandatory contributions. In this context, one of main sources of uncertainty faced by members is the risk associated with the investments made with their individual savings accounts, which in turn determines their pension. Since 2002 there are five types of funds –the multifunds- that differ in their investment strategy and associated risk. In the event of members not choosing a type of fund, a default investment allocation mechanism is assigned according to his/her age. The Chilean default path was designed to replicate a life-cycle fund[4] in which the affiliate's savings are transferred between funds depending on age, equity /fixed income exposure and the investment horizon of pension savings.

Although the choice of an optimum investment strategy depends on individual characteristics, such as the degree of risk aversion, human capital, expected volatility of wages, work history, family composition, and other sources of wealth; in practice the vast majority of members of a pension system do not have sufficient knowledge to take a sensible decision with regard to the investment of their pension savings[5]. These elements become even more important in a system where participation is far more widespread at all educational levels of the population because of its mandatory nature, which is the case of Chile. In fact, mandatory contribution to a DC pension system in general implies not active involvement of a large part of their members, lack of information to take optimal decisions and poor financial education.

Given the number of complex and important decisions that individuals must take in a DC plan, the presence of biases could be detrimental for members' wellbeing. In this line, (Samuelson and Zeckhauser 1988) report the results of a series of decision-making experiments designed to test for status quo effects. The main finding is that decision makers exhibit a significant status quo bias, adhering to status quo choices more frequently than would be predicted by their canonical model.

Inertia in individuals' portfolio choices has been documented by (Bilias, Georgarakos and Haliassos 2010), who use US survey data. For 401(k) pension plans, (Madrian and Shea 2001), (Agnew, Balduzzi and Sundén 2003) and (Mitchell, et al. 2006) also report low involvement in investment decisions by members. These results have been used as arguments in favor of the introduction of default investment plans[6].

[4] The topic of life-cycle funds design has been study, among others, by (Campbell and Viceira 2002), (Cocco, Gomes and Maenhout 2005), (Gomez, Kotlikoff and Viceira 2008) and (Viceira 2007).

[5] See, e.g. (Berstein, Fuentes and Torrealba 2010) for evidence for the Chilean case, and (Lusardi and Mitchell 2005) and (2008) for the US case.

[6] Inertia in investment decisions has also been suggested as a possible cause for individuals' failure to sell (buy) persistently bad (good) investment opportunities. This type of behavior has been called the disposition effect. On this subject, see (Dhar and Zhu, N. 2006) and (Frazzini 2006), among others.

Among the few individuals that make investment decisions, (Agnew, Balduzzi and Sundén 2003) find that males, married members, and members with higher earnings and more years of tenure in their current jobs, tend to select higher equity exposures. (Engström and Westerberg 2003) study individuals that made an active investment decision in the Swedish pension. Their findings suggest that individuals who have prior experience and are more familiar with financial markets (e.g., individuals with financial wealth, a higher education, higher income, individuals who work in the financial sector or in the local government sector or have private pension savings) are more likely to make an active investment decision than other individuals. Also, women make active investment decisions to a larger extent than men. The results also show that younger individuals are more interested than older individuals in making an active investment decision and that married individuals make more active investment decisions. (Sundén and Surette 1998) use US survey data to examine whether workers differ systematically by gender in the allocation of assets in DC plans. The authors conclude that gender and marital status significantly affect how individuals choose to allocate assets in defined-contribution plans. The results indicate that single women and married men are less likely than single men (the comparison group) to choose a high exposition to equity. Neither education nor age seems to affect allocation decisions. In a related work that uses Swedish administrative data (Calvet, Campbell and Sodini 2009) find that wealthier individuals make more frequent investment decisions. (Ameriks and Zeldes 2004) study the portfolio decisions of affiliates to the TIAA-CREF pension fund. The authors find no evidence of a gradual reduction in portfolio shares as individuals grow older. However, they do find that older individuals tend to eliminate all their equity allocation when they are close to retirement age. (Cappelletti, Guazzarotti and Tommasino 2010) also find that equity holdings decrease with age after studying the behavior of members of an Italian pension fund.

Another strand of the literature analyzes brokerage house data. The studies by (Odean 1998), (1999) and (Barber and Odean 2001), find evidence of excessive trading by investors. The data shows that investors not only fail to outperform relevant benchmarks, but they also fail to cover trading costs. The authors argue that overconfidence is an important explanation for this finding. The reason is that existing psychological evidence shows that males, as a group, are more prone to display overconfidence than women. And it's precisely the former group who presents a higher amount of trading and underperformance.

Performance of investment decisions has also been analyzed by (Cronqvist and Thaler 2004). Using data from the Swedish pension system, the authors find that participants were more likely to make an active choice if they had more money at stake, and holding money constant, women and younger participants also were more likely to make an active choice. Moreover, those who selected portfolios for themselves selected a higher equity exposure, more active management, much more local concentration, and higher fees measured against the default investment option.

(Calvet, Campbell and Sodini 2007) investigate the efficiency of household investment decisions using comprehensive disaggregated Swedish data. Households with greater financial sophistication, as measured for instance by wealth or education, tend to invest more efficiently but also more aggressively. Their portfolios have higher Sharpe ratios but also higher volatility. For households with

low education, the authors find a lower propensity to participate and less inefficiency if they do participate.

The literature regarding portfolio choice and performance for the Chilean pension system is scarce. (Figueroa 2008) uses data from the 2006 Social Protection Survey to study the effects of age, sex, education, labor, income, risk aversion and knowledge of the pension system on the election of pension funds. The results show that people choose riskless funds when they get older. More educated people prefer riskier funds; women are more likely to choose less risky funds. Moreover, better pension fund understanding increases the probability of choosing the riskiest fund. Finally, marital status, labor, income and risk aversion do not contribute to explain the election.

This article is a contribution toward providing evidence of the performance of the investment decisions made by members in the Chilean Pension system between 2008 and 2013 through the use of administrative data. Our non-parametric analysis suggests that involvement in portfolio decisions is higher for men with higher education and potentially higher financial sophistication, measured as higher income and account balance, the existence of voluntary pension savings, and with higher contributions. These results are confirmed by regression analysis and are broadly consistent with those found by previous studies.

We estimate the performance of the investment strategies followed by affiliates that make voluntary changes and find that a non-negligible 37.8% of these individuals underperformed the worst fund (fund A) over the period. This group obtained an average yield of -12.5% well below Fund A's return of -5.9%. Only 1.3% of affiliates achieved a better return than Fund E (32.7% versus 24.6%) between 2008 and 2013. Also 82% of affiliates underperformed the default investment option.

The results from regression analysis imply that there is low market timing ability by affiliates that make voluntary fund changes. When we study the differences in behavior among affiliates in the best and worst performance groups, we find evidence of the former group having somewhat better market timing ability, but the most interesting difference emerges in terms of the reaction to market volatility. While the worst performance group shows a strong tendency to lower equity exposure during market turmoil, the best performance group, however, doesn't react as often to market volatility, and in some cases, their reaction is to increase equity exposure.

Our results regarding changes in behavior in the small group of individuals that managed to improve their investment performance shows that, rather than this being the result of increased market timing ability, the cause would be a change in attitude toward market volatility, going from lowering equity exposure in response to high volatility in returns to keeping a steady exposure during these periods.

The rest of the paper is structured as follows. In the next Section we describe the multifund scheme in the Chilean DC system and we also show the aggregate evolution of fund changes. Section 3 summarizes the evolution of affiliates´ selection of funds and studies the incidence of personal characteristics on fund selection. Section 4 provides the main results in terms of the investment performance for the members changing funds between 2008 and 2013. Section 5 contains preliminary results regarding the determinants of fund changes for the full sample and for interesting subsamples of affiliates. Lastly, Section 6 concludes.

2. The Evolution of Fund Changes

Since August 2002, both mandatory and voluntary savings have been managed under the multi-fund scheme. This consists of five types of fund (A, B, C, D and E), differentiated by the proportion of their portfolio invested in equity. The maximum investment limit in equities for these funds are 80%, 60%, 40%, 20% and 5%, respectively.[7] Historically, the Pension Funds Administrators have chosen portfolios close to this maximum limit.

Although members are free to choose their type of fund (with some restrictions), there is also an allocation of funds by default, which seeks to establish an investment path that is consistent with the life-cycle over the length of the members active period.[8] Given the design of the default allocation, funds A and E are voluntary funds. As of August 2012, 16% of all participants have chosen these voluntary funds. As percentage of total assets, funds A and E account for 28% of the total.

Given the differentiation in portfolio composition, the performance of the multifunds in terms of real returns has showed considerable dispersion.[9] The rise in volatility experienced during the global financial crisis stressed the issue of fund selection. As the crisis unfolded, fund changes by affiliates registered a first peak in November of 2008. Since 2008 affiliates have been much more reactive to financial news than in the past. As we will discuss in the following sections, it is possible that a large percentage of people making active decision of fund changes over the period 2008 - 2012 incurred in heavy losses because of their decisions, in particular those that during the crisis left from Fund A to Fund E.

Members of the Chilean DC pension system also present a high degree of inertia in investment. During the first years of the multifunds scheme, introduced in 2002, about 75% of members didn't choose a type of fund and were assigned to the default investment allocation. Nowadays

[7] From 1981 to 2000 only fund C was available. In 2000 fund E was introduced. For a complete discussion on the subject of the Chilean default investment strategy, see (Berstein, S.; Castañeda, P.; Fajnzylber, E.; Reyes, G.; 2009), (Berstein, Fuentes and Torrealba 2010) AND (Berstein, Fuentes and Villatoro 2013). For details on the investment regime of the Chilean multifunds see (Pensions Supervisor 2013).

[8] In this scheme the affiliate's savings are transfers between funds as the affiliate ages. The default path considers fund B, C and D. The allocation reduces the exposure to more risky funds as the legal retirement age approaches

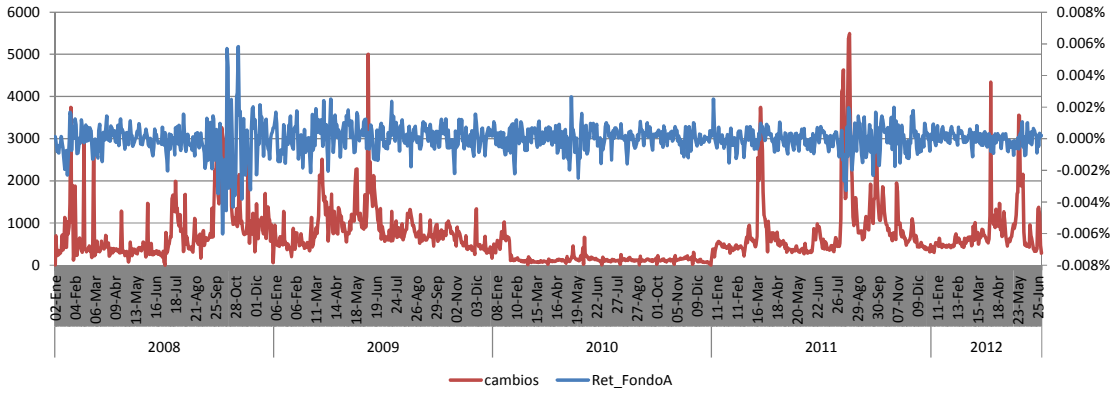
[9] Fund A records an average real annual return of 6.59% between September 2002 and September 2012. Fund B follows with a return of 5.52%. In the same period, Funds C, D and E show an average real annual return of 4.99%, 4.60% and 3.96%, respectively.

approximately 60% of affiliates remain in the default option. Those affiliates making an active investment decision face uncertainty about the most suitable type of fund, given their risk profile. Predicting the financial markets performance is very difficult and in the presence of low financial knowledge and understanding of the relevant investment horizon, individuals can make poor decisions about the most adequate investment strategy.

The source of information is the Affiliates and Pensioners Data Set which contains administrative records of all members in the private pension system (*BDA* as it acronym in Spanish). We follow the behavior of all affiliates reported as active (e.g. non-retired) from January 2008 to May 2013. This amounts to 6,229,015 affiliates, from which 463,587 made at least one voluntary change of fund. The data shows that a total of 940,520 changes were made during this period.

For our estimations we consider the exact day in which affiliates changed funds. This is will allow us to give a precise figure of the performance obtained by these affiliates. Figure 1: Daily transfers and daily nominal return of Fund A shows that the number of voluntary changes has increased over time and seems to be concentrated in periods of high volatility of pension funds' returns. It's not clear what type of variables motivates these changes and if they are beneficial for those individuals performing them. We will analyze these issues in the following sections.

Figure 1: Daily transfers and daily nominal return of Fund A



Source: Authors' estimations based on Pension Regulator's data.

3. Investment Choices

In order to study the investment choices made by individuals, we build a yearly panel, where each member's characteristics are updated annually. We will examine the difference among individuals in terms of the following variables.

i. **Equity exposure:** We define an individual's equity exposure as 80%, 60%, 40%, 20% or 5% if he was in fund A, B, C, D, or E, respectively. This implies that individuals who maintain their accounts in two types of fund can have different equity exposures. We use this definition in order to capture the intention of affiliates when they make a fund change. An alternative would be to use actual portfolio equity exposures, but this would include price and quantity effects, since fund managers adjust their portfolios over time.

ii. **Existence and number of fund changes:** We build a dummy variable that equals 1 if the individual has made at least one change and 0 otherwise. We also build a variable that counts the number of fund changes for each individual.

iii. **Size and direction of fund changes:** In order to capture the degree of aggressiveness in fund changes and their impact on equity exposures, we build two variables. The first one measures aggressiveness by estimating absolute value of the change in equity exposures resulting from fund changes. The second one measures the cumulative variation in equity exposure in order to detect if individuals have increased or lowered their holdings of this asset.

Table 1 shows the descriptive statistics for the full sample. The data shows that males compose more than half of the sample. Most affiliates are less than 35 years old. Only 4.43% has a voluntary savings account with a pension fund manager. The average contribution density exceeds 50%. The average equity exposure is 53.35%. Consistent with evidence for pension fund members, less than 2% of affiliates made at least one fund change.

Table 1: Descriptive Statistics – Full Sample

Personal Variables

Gender		**VPS**	
Female	42.06%	Without VPS	95.57%
Male	57.94%	With VPS	4.43%
Age		**Contribution Density**	
< 35 years	39.49%	<=0.25	19.95%
35 to 45	29.57%	0.25 to 0.5	12.41%
45 to 55	23.29%	0.5 to 0.75	14.38%
> 55 years	7.65%	>0.75	53.26%
Average Taxable Income		$ 326,252.20	
Average Balance – Mandatory Account		$ 7,918,382	
Average Balance – Voluntary Account (1)		$ 2,508,582	

Equity Allocation and Fund Changes

Equity Allocation – Mandatory Account	53.35%
At least one fund change	1.88%
Average annual fund changes (2)	0.42
Average change in equity allocation (2)	11.82
Average accumulated change in equity allocation (2)	-4.93

Source: Authors' estimations. (1) Only members with positive VPS balance are considered. (2) Only for members who make voluntary changes.

As Table 2 shows, the equity allocation has generally decreased over time, with 2010 being the only exception. Men tend to hold more equity than women, and this exposure decreases with age. In line with previous studies, we find that higher taxable income is associated with higher equity exposure. However, this also holds for the lowest income quintile. For wealth, measured as account balance, we find a negative relation with equity exposure. Having voluntary pension savings (VPS) is associated with higher equity exposure. However, there is no clear pattern between VPS quintile and affiliates' decisions to hold equity. Along the lines of (Calvet, Campbell and Sodini 2007), we find that affiliates with more background risk, proxied by being self-employed, tend to reduce their exposure to equity. This conclusion is reinforced by noting that affiliates with low density of contributions (presumably because of less stable jobs sources) have lower equity holdings.

Table 2: Equity Allocation (%) – Full Sample

	N	Average	SD		N	Average	SD
Year (1)				**Mandatory Account Balance Quintile (1)**			
Year 2008	6,199,374	55.51	15.54	1st Quintile	3,643,473	58.72	14.10
Year 2009	6,213,518	53.85**	16.96	2nd Quintile	6,636,454	57.27**	14.68
Year 2010	6,217,969	54.04**	16.96	3rd Quintile	8,434,143	54.70**	15.60
Year 2011	6,221,821	53.82**	17.25	4th Quintile	9,156,715	50.85**	17.26
Year 2012	6,223,151	52.10**	18.31	5th Quintile	9,429,574	49.75**	20.68
Year 2013	6,224,526	50.83**	19.11	**VPS Account Balance Quintile (1)**			
Gender (2)				1st Quintile	335,877	57.73	23.76
Female	15,678,985	53.17	17.49	2nd Quintile	327,970	56.11**	22.51
Male	21,621,374	53.49**	17.43	3rd Quintile	324,517	55.96*	23.02
Age (1)				4th Quintile	330,616	58.32**	23.55
< 35 Years	14,716,642	63.97	11.66	5th Quintile	335,506	56.28**	23.90
35 to 45 Years	11,041,495	51.64**	16.13	Without VPS	35,645,873	53.19**	17.11
45 to 55 Years	8,693,138	44.29**	15.79	**Type of Member (2)**			
> 55 Years	2,849,084	32.81**	15.88				
Taxable Income Quintile (1)				*Employed*	35,879,100	53.61	17.39
1st Quintile	8,655,863	53.08	16.34	Self-employed	1,110,848	46.09**	18.01
2nd Quintile	6,237,385	52.46**	15.28	Worker (3)	308,814	49.91**	17.45
3rd Quintile	7,467,787	51.03**	16.14	Voluntary (4)	1,597	49.52**	22.16
4th Quintile	7,471,461	53.37**	17.30	**Contribution Density (1)**			
5th Quintile	7,467,863	56.74**	20.97	<=0.25	7,414,147	51.43	15.39
VPS (2)				0.25 - 0.5	4,625,759	53.80**	15.74
Without VPS	35,645,873	53.19	17.11	0.5 - 0.75	5,366,147	54.63**	16.39
With VPS	1,654,486	56.89**	23.38	>0.75	19,894,306	53.62**	18.74

Source: Authors' estimations. Statistical significance is measured by a Bonferroni multiple-comparison test, *: 5% significance **: 1% significance.

(1) Significance is measured between the previous variable (for instance, the 3rd Quintile is compared to the 2nd one).
(2) Significance is measured comparing each variable with the variable in italics.
(3) Affiliates that have a contract, and thus are employed, but also have contribute as self-employed workers.
(4) Affiliates that contribute even though they don't have a formal labor contract. Given our sample period, this excludes women that became members to obtain the bonus per child benefit. Children with pension savings are also excluded.

Regarding the existence of fund changes, Table 3: Affiliates that make changes (%) – Full Sample shows that there are small, although statistically significant, changes in the proportion of affiliates that modify their type of fund. In line with the results of (Barber and Odean 2001), (Odean 1998) and

(Odean 1999), we find that males make more investment decisions than females. Having a voluntary pension savings account, which could be seen as a sign of financial sophistication, increases the odds of making fund changes. This finding is consistent with the evidence of (Calvet, Campbell and Sodini 2007). Moreover, the percentage of affiliates taking decisions raises with wealth, measured either as balance of the mandatory or VPS account. Affiliates with higher contribution density are also more prone to engage in fund changing. This variable is a proxy of labor stability, higher income, and higher involvement in pension issues.

Table 3: Affiliates that make changes (%) – Full Sample

	N	Average	SD		N	Average	SD
Year (1)				**Mandatory Account Balance Quintile (1)**			
Year 2008	6,199,374	2.2	14.7	1st Quintile	3,643,473	0.3	5.8
Year 2009	6,213,518	2.1**	14.5	2nd Quintile	6,636,454	0.3	5.8
Year 2010	6,217,969	0.4**	6.4	3rd Quintile	8,434,143	0.7**	8.3
Year 2011	6,221,821	2.1**	14.5	4th Quintile	9,156,715	1.5**	12.0
Year 2012	6,223,151	2.4**	15.3	5th Quintile	9,429,574	5.0**	21.9
Year 2013	6,224,526	2.0**	13.9	**VPS Account Balance Quintile (1)**			
Gender (2)				1st Quintile	335,877	8.9	28.5
Female	15,678,985	1.6	12.4	2nd Quintile	327,970	7.7**	26.6
Male	21,621,374	2.1**	14.4	3rd Quintile	324,517	8.6**	28.0
Age (1)				4th Quintile	330,616	11.2**	31.5
< 35 Years	14,716,642	1.2	10.8	5th Quintile	335,506	14.5**	35.2
35 to 45	11,041,495	2.1**	14.3	Without VPS	35,645,873	1.5**	12.1
45 to 55	8,693,138	2.4**	15.3				
>55 Years	2,849,084	3.1**	17.3	**Type of Member (2)**			
Taxable Income Quintile (1)				*Employed*	35,879,100	1.9	13.6
1st Quintile	8,655,863	0.8	8.7	Self-employed	1,110,848	1.8**	13.3
2nd Quintile	6,237,385	0.4**	6.4	Worker (3)	308,814	2.5**	15.5
3rd Quintile	7,467,787	0.7**	8.1	Voluntary (4)	1,597	6.7**	25.0
4th Quintile	7,471,461	1.5**	12.1	**Contribution Density (1)**			
5th Quintile	7,467,863	6.0**	23.8	<=0.25	7,414,147	0.3	5.3
VPS (2)				0.25 - 0.5	4,625,759	0.6**	7.9
Without VPS	35,645,873	1.5	12.1	0.5 - 0.75	5,366,147	1.1**	10.2
With VPS	1,654,486	10.2**	30.2	>0.75	19,894,306	3.0**	17.0

Source: Authors' estimations. Statistical significance is measured by a Bonferroni multiple-comparison test, *: 5% significance **: 1% significance.

(1) Significance is measured between the previous variable (for instance, the 3rd Quintile is compared to the 2nd one).

(2) Significance is measured comparing each variable with the variable in italics.

(3) Affiliates that have a contract, and thus are employed, but also have contribute as self-employed workers.

(4) Affiliates that contribute even though they don't have a formal labor contract. Given our sample period, this excludes women that became members to obtain the bonus per child benefit. Children with pension savings are also excluded.

Table 4 shows that the number of fund changes per affiliate has increased over the years. Among affiliates, the ones that tend to make more changes are: men; middle-aged; with VPS; with higher income and balance account; and with higher contribution density. Even though self-employed workers make fewer changes, those affiliates in this category that do take active decisions present a higher number of fund changes

Table 4: Number of Fund Changes by Affiliate – Affiliates with Changes

	N	Average	SD		N	Average	SD
Year (1)				**Mandatory Account Balance Quintile (1)**			
Year 2008	461,779	0.34	0.62	1st Quintile	69,192	0.20	0.50
Year 2009	462,891	0.35**	0.66	2nd Quintile	138,017	0.23**	0.66
Year 2010	463,133	0.07**	0.35	3rd Quintile	290,252	0.31**	0.82
Year 2011	463,442	0.38**	0.75	4th Quintile	575,562	0.38**	0.92
Year 2012	463,183	0.47**	0.92	5th Quintile	1,704,438	0.48**	1.06
Year 2013	463,033	0.92**	1.76	**VPS Account Balance Quintile (1)**			
Gender (2)				1st Quintile	96,630	0.66	1.34
Female	*1,021,816*	*0.38*	*0.89*	2nd Quintile	83,102	0.61**	1.28
Male	1,755,645	0.45**	1.03	3rd Quintile	89,190	0.60	1.24
Age (1)				4th Quintile	115,841	0.63**	1.27
< 35 Years	783,906	0.36	0.89	5th Quintile	142,274	0.71**	1.39
35 – 45	877,978	0.44**	1.00	Without VPS	2,250,424	0.37**	0.88
45 – 55 Years	771,123	0.46**	1.04	**Type of Member (2)**			
>55 Years	344,454	0.44**	1.02				
Taxable Income Quintile (1)				*Employed*	2,657,139	0.42	0.99
1st Quintile	337,764	0.26	0.68	Self-employed	80,331	0.46**	1.11
2nd Quintile	140,058	0.24**	0.67	Worker (3)	34,695	0.27**	0.64
3rd Quintile	240,472	0.28**	0.74	Voluntary (4)	403	0.65**	1.41
4th Quintile	495,082	0.32**	0.77	**Contribution Density (1)**			
5th Quintile	1,564,085	0.53**	1.14	<=0.25	98,858	0.33	0.92
VPS (2)				0.25 – 0.5	136,468	0.35**	0.93
Without VPS	2,250,424	0.37	0.88	0.5 – 0.75	254,547	0.36	0.90
With VPS	527,037	0.65**	1.31	>0.75	2,287,588	0.44**	1.00

Source: Authors' estimations. Statistical significance is measured by a Bonferroni multiple-comparison test, *: 5% significance **: 1% significance.

(1) Significance is measured between the previous variable (for instance, the 3rd Quintile is compared to the 2nd one).

(2) Significance is measured comparing each variable with the variable in italics.

(3) Affiliates that have a contract, and thus are employed, but also have contribute as self-employed workers.
(4) Affiliates that contribute even though they don't have a formal labor contract. Given our sample period, this excludes women that became members to obtain the bonus per child benefit. Children with pension savings are also excluded.

In Table 5: Average Percentage Change in Equity Allocation (%) – Affiliates with Changes we analyze the absolute variation in equity allocation. Each change can go from 0 (no change in equity exposure) to 60% (change from fund A to fund E or vice versa). The aggressiveness of changes has varied over time. Middle-aged affiliates and men make more aggressive changes. Also, there is a tendency of aggressiveness to increase with income and account balance quintile and with contribution density.

Table 5: Average Percentage Change in Equity Allocation (%) – Affiliates with Changes

	N	Average	SD		N	Average	SD
Year (1)				**Account Balance Quintile (1)**			
Year 2008	461,779	13.07	24.27	1st Quintile	69,192	5.11	13.32
Year 2009	462,891	11.81**	22.87	2nd Quintile	138,017	6.38**	17.31
Year 2010	463,133	2.16**	10.45	3rd Quintile	290,252	8.85**	20.61
Year 2011	463,442	13.49**	24.26	4th Quintile	575,562	10.96**	23.07
Year 2012	463,183	15.68**	25.91	5th Quintile	1,704,438	13.30**	24.72
Year 2013	463,033	14.59**	26.90	**Quintile VPS (1)**			
Gender (2)				1st Quintile	96,630	16.16	27.39
Female	*1,021,816*	*10.66*	*22.22*	2nd Quintile	83,102	15.57**	26.95
Male	1,755,645	12.46**	24.25	3rd Quintile	89,190	15.75	26.92
Age (1)				4th Quintile	115,841	16.34**	27.29
< 35 Years	783,906	10.24	22.42	5th Quintile	142,274	16.50	26.59
35 – 45 Years	877,978	12.94**	25.00	Without VPS	2,250,424	10.79**	22.53
45 – 55 Years	771,123	12.99	24.53	**Type of Member (2)**			
>55 Years	344,454	9.77**	19.18				
Taxable Income Quintile (1)				*Employed*	2,657,139	11.86	23.60
1st Quintile	337,764	7.96	19.89	Self-employed	80,331	11.56**	23.08
2nd Quintile	140,058	7.36**	18.41	Worker (3)	34,695	9.63**	21.26
3rd Quintile	240,472	8.74**	20.09	Voluntary (4)	403	13.09	24.43
4th Quintile	495,082	10.04**	21.59	**Contribution Density (1)**			
5th Quintile	1,564,085	14.06**	25.42	<=0.25	98,858	8.98	20.40
VPS (2)				0.25 – 0.5	136,468	9.39**	20.97
Without VPS	2,250,424	10.79	22.53	0.5 – 0.75	254,547	9.96**	21.67
With VPS	527,037	16.13**	27.00	>0.75	2,287,588	12.27**	23.98

Source: Authors' estimations. Statistical significance is measured by a Bonferroni multiple-comparison test, *: 5% significance **: 1% significance.

(1) Significance is measured between the previous variable (for instance, the 3rd Quintile is compared to the 2nd one).

(2) Significance is measured comparing each variable with the variable in italics.
(3) Affiliates that have a contract, and thus are employed, but also have contribute as self-employed workers.
(4) Affiliates that contribute even though they don't have a formal labor contract. Given our sample period, this excludes women that became members to obtain the bonus per child benefit. Children with pension savings are also excluded.

Finally, we measure the change in equity exposure between 2008 and 2013 for affiliates making voluntary changes. Table 6 shows that with the exception of 2009 and 2010, affiliates have reduced their equity exposure. Females have reduced their exposure more than males. Also, the reduction has been larger for with income and account balance quintile and with contribution density.

Table 6: Cumulative Variation in Equity Exposure – Affiliates with Changes

	N	Average	SD		N	Average	SD
Year (1)				**Account Balance Quintile (1)**			
Year 2008	461,779	-11.07	25.35	1st Quintile	69,192	-3.37	13.62
Year 2009	462,891	4.36**	23.88	2nd Quintile	138,017	-3.17	17.38
Year 2010	463,133	1.02**	9.63	3rd Quintile	290,252	-4.10**	20.69
Year 2011	463,442	-10.11**	24.78	4th Quintile	575,562	-4.84**	23.17
Year 2012	463,183	-10.02	27.24	5th Quintile	1,704,438	-5.30**	25.38
Year 2013	463,033	-3.74**	23.50	**Quintile VPS (1)**			
Gender (2)				1st Quintile	96,630	-5.98	27.65
Female	1,021,816	-5.07	22.62	2nd Quintile	83,102	-5.91	27.25
Male	1,755,645	-4.84**	24.61	3rd Quintile	89,190	-6.14	27.33
Age (1)				4th Quintile	115,841	-6.25	27.71
< 35 Years	783,906	-4.82	22.32	5th Quintile	142,274	-5.85**	27.14
35 – 45 Years	877,978	-4.96**	25.48	Without VPS	2,250,424	-4.67**	22.99
45 – 55 Years	771,123	-4.87	25.26	**Type of Member (2)**			
>55 Years	344,454	-5.18**	19.70				
Taxable Income Quintile (1)				*Employed*	2,658,701	-4.97	23.94
1st Quintile	337,764	-3.76	20.20	Self-employed	80,350	-4.74**	23.00
2nd Quintile	140,058	-3.61	18.66	Worker (3)	34,707	-1.73**	22.56
3rd Quintile	240,472	-4.15**	20.56	Voluntary (4)	403	-6.10	21.78
4th Quintile	495,082	-4.55**	22.34	**Contribution Density (1)**			
5th Quintile	1,564,085	-5.53**	25.90	<=0.25	98,858	-4.16	20.71
VPS (2)				0.25 – 0.5	136,468	-4.30	21.03
Without VPS	2,250,424	-4.67	22.99	0.5 – 0.75	254,547	-4.55**	21.81
With VPS	527,037	-6.02**	27.41	>0.75	2,287,588	-5.04**	24.40

Source: Authors' estimations. Statistical significance is measured by a Bonferroni multiple-comparison test, *: 5% significance **: 1% significance.

(1) Significance is measured between the previous variable (for instance, the 3rd Quintile is compared to the 2nd one).

(2) Significance is measured comparing each variable with the variable in italics.
(3) Affiliates that have a contract, and thus are employed, but also have contribute as self-employed workers.
(4) Affiliates that contribute even though they don't have a formal labor contract. Given our sample period, this excludes women that became members to obtain the bonus per child benefit. Children with pension savings are also excluded.

Taken as a whole, our non-parametric analysis suggests that involvement in portfolio decisions is higher for men with higher education and potentially higher financial sophistication, measured as higher income and account balance, the existence of voluntary pension savings, and with higher contributions. These results are broadly consistent with those found by previous studies.

4. Performance of Fund Changes

To evaluate the performance achieved by members making voluntary transfers, we construct three measures as a benchmark to perform the comparison. Firstly, we compare the return obtained by the affiliate´s strategy against the return obtained by the different pension funds. Secondly, we compare the return obtained by the affiliate´s strategy against the return that would have resulted had there been no change in funds (i.e. if affiliates had remained in the same 2008 fund during the entire period). Thirdly, we compare the performance of the affiliate´s strategy versus the default investment allocation.

To evaluate the affiliate´s strategy performance against the pension funds returns, we classify individuals according to the returns obtain by their investment strategies with respect to the performance achieved by the pension funds over the period 2008-2013. Given that we have information regarding the exact day in which the change occurs and since employ daily data for the funds' returns, we are able to give an accurate figure of the return earned by each affiliates' investment strategy. Table 7 presents a summary of the returns earned by the affiliates that made voluntary fund changes during our sample period.

Table 7: Descriptive Statistics of Active Strategies' Performance

Return Percentiles		**N° of Affiliates with Fund Changes**	463,587
1%	-28.5%	**Average Return**	-1.2%
25%	-8.6%	**SD**	11.3%
50%	-0.4%	**Minimum**	-45.0%
75%	6.2%	**Maximum**	90.3%
99%	26.5%		

Source: Authors' estimations. Return is measured in real terms for the 2008-2013 period.

There has been considerable heterogeneity in the returns obtained by affiliates, with an interquartile range of 14.8% and difference between the highest and lowest return of 135.3%. Both the median and average returns are negative.

We now turn our attention to the relative performance of affiliates' strategies against the different pension funds. Table 8 shows that almost 38% of affiliates who made fund changes underperformed the return of the worst fund in the period analyzed (fund A), while only 1.3% outperformed the best fund (fund E). More than 90% of affiliates underperformed the balanced fund C.

Table 8: Performance versus Pension Funds

Bracket	Performance Bracket	Affiliates' Average Return	N° Affiliates	%
1	**< Fund A**	-12.5%	175,184	37.8
2	**>Fund A & <Fund B**	0.0%	135,691	29.3
3	**>Fund B & <Fund C**	7.8%	108,808	23.5
4	**>Fund C & <Fund D**	14.7%	30,706	6.6
5	**>Fund D & <Fund E**	21.9%	7,214	1.6
6	**>Fund E**	32.7%	5,984	1.3
	Total	**-1.2%**	**463,587**	**100**

Source: Authors' estimations. Between 2008 and May 2013, the cumulative real returns of funds A, B, C, D and E were -5.9%, 4.0%, 11.8%, 19.1% and 24.6%, respectively.

According to our estimations 72% of the individuals that made fund changes underperformed the return of following a passive investment strategy (i.e. remaining in the fund that they had at the beginning of the sample). Moreover, 82% of affiliates underperformed the return obtained by the default investment strategy. Table 9 shows that the average Sharpe ratio of affiliates making fund changes was negative. Affiliates with a Sharpe ratio above 1 are less than 2%.

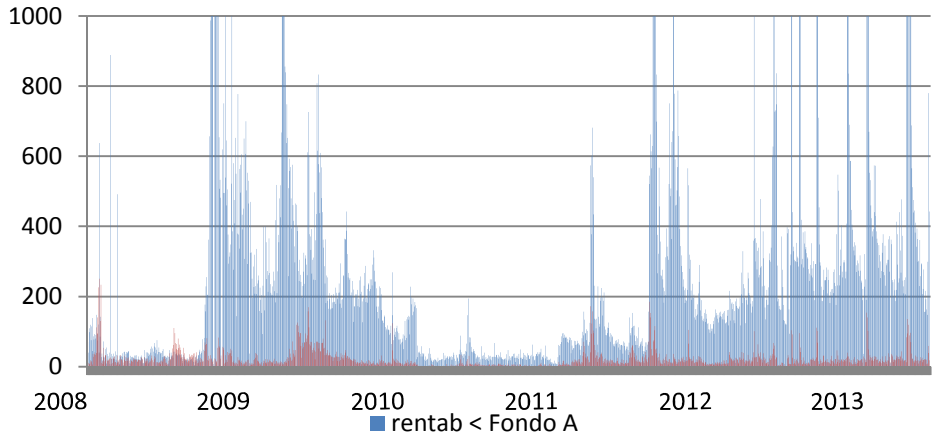
Table 9: Sharpe Ratio

Percentiles			
1%	-1.34	**Observations**	463,587
25%	-0.04	**Mean**	-0.04
50%	-0.02	**SD**	17.46
75%	0.00		
99%	1.80		

Source: Authors' estimations. The Sharpe ratio is measured using the default investment strategy as the relevant benchmark.

We are interested in analyzing the differences in behavior of individuals with an extremely good/bad investment performance. Figure 2 shows the evolution of the number of fund changes for affiliates who underperformed the worst fund (fund A) and for those who outperformed the best fund (fund E). It's interesting to note that both groups chose similar dates to make their fund changes.

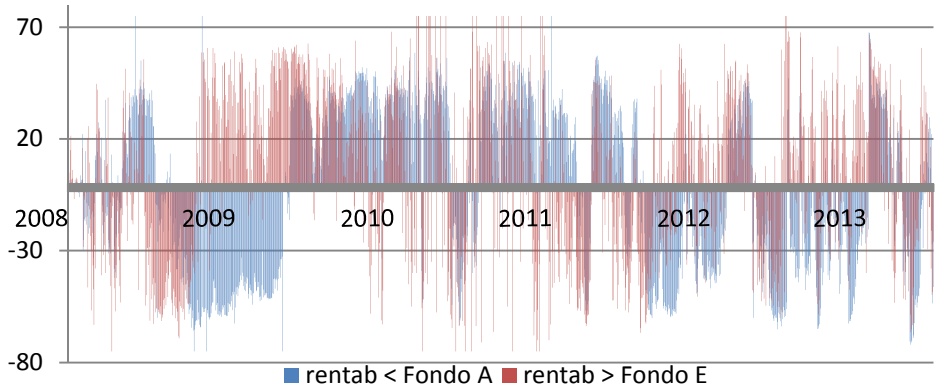
Figure 2: Number of Changes according to Performance Bracket



Source: Authors' estimations.

Figure 3 shows the direction of fund changes made in each day by the best and worst performance groups. We estimate the daily average equity exposure change for each group. The results show a striking difference for 2009. During this year, the best performance group considerably increased their equity exposure, while the worst performance group decreased it. A similar pattern is observed at the end of 2011 and the beginning of 2012 and 2013. This tendency was reversed during the first half of 2011, when the worst (best) performers increased (decreased) their equity exposure. This evidence shows that the directions of fund changes, along with their timing, are important to explain the difference in the performance of affiliates' investment strategies.

Figure 3: Change in Equity Exposure (%) according to Performance Bracket



Source: Authors' estimations.

To sum up, the results indicate that a non-negligible 37.8% of individuals underperformed the worst fund (fund A) over the period. This group obtained an average yield of -12.5% well below Fund A's return of -5.9%. On the contrary, only 1.3% of affiliates achieved a better return than Fund E (32.7% versus 24.6%) between 2008 and 2013. The main drivers of these results for people in group 1 (strategy return below fund A) and group 2 (strategy return above fund E) seem to be the differences in the timing and direction of funds transfers. In particular, individuals in group 1 move away from more risky funds during the time of higher volatility and large decreases of fund returns, as can be observed in Figures 2 and 3. Also, 72% of affiliates underperformed a passive strategy, and 82% underperformed the default investment option.

5. Determinants of Fund Changes

Following the previous results, it is worthwhile to investigate what motivates the decisions of funds transfers by individuals. In other words, we want to know what drives this group of members to change their pension savings between funds in a given direction and period of time. We are also interested in analyzing the difference in behavior between individuals in the best and worst performance groups. Finally, we also want to detect if there are changes in behavior by affiliates over time. This is, if there is evidence of affiliates learning from past mistakes in their fund change strategies.

We will study a total of 463,587 affiliates that made at least one change during our sample period. The dependent variable under study will be the change in equity exposition of affiliates that is caused by their investment decisions. Since there are five types of fund for affiliates to choose from, and up to two of these funds can be combined, the dependent variable is continuous. However, we will discretize it in a total of eight categories. We do this in order to capture the intention of affiliates when they make a change of fund. If we keep equity exposure as a continuous variable we would have to use the actual equity exposure of the different types of funds. This implies that we would be considering both price and quantity effects, since fund managers adjust their portfolio over time. Table 10 shows the descriptive statistics of our dependent variable.

Table 10: Descriptive Statistics of Dependent Variable

Variable	Equity Allocation Change (X)	N° of Changes	%
-4	X ≤ -60%	218,838	23.27
-3	-60% < X ≤ -40%	121,115	12.88
-2	-40% < X ≤ -20%	143,166	15.22
-1	-20% < X ≤ 0%	81,061	8.62
1	0% < X ≤ 20%	126,290	13.43
2	20% < X ≤ 40%	78,681	8.37
3	40% < X ≤ 60%	48,657	5.17
4	60% < X	122,714	13.05
Total		**940,522**	**100**

Source: Authors' estimations.

We will use the following observables to control for individuals' characteristics: **Gender** (Female = 0, Male = 1); **Age** (measured in years); **Taxable income quintile** (the quintile is measured at the month in which the fund change is made); **Mandatory account balance quintile** (the quintile is measured at the month in which the fund change is made); **Voluntary Pension Savings** (equals 1 if the individual has a voluntary pension savings account with a pension fund manager); **Contribution density** (percentage of months during which the individual has contributed to his mandatory account).

In order to capture market conditions, we will focus on the evolution of returns for fund A, which is the fund that has higher equity exposure. Specifically, we use of the following market variables: **Fund A's return:** monthly return of fund A; **Extreme fund A's return:** these are two dummy variables, that equal 1 if the return of fund A was in the top or bottom 10% of the return distribution over the period under study; **return of fund A's standard deviation:** volatility of fund A's returns measured using a GARCH(1,1) model; **return of fund A's extreme standard deviation:** a dummy variable that equals 1 if the volatility of fund A's returns are in the top 10% of the return distribution.

With the variables described above, we proceed to estimate multinomial logit models for affiliates with voluntary changes during the January 2008 - May 2013 period. We use two different specifications, making use of market variables as continuous variables in one case and as dummy variables in the other. The set of personal variables included is the same in both specifications.

Table 11 shows the marginal effects of our personal characteristics variables on the probability of choosing each of the alternatives included in the dependent variable. Since these results are not affected by whether we use market variables in levels or as dummies, only one table is discussed. The results show that males have a higher probability of making extreme fund changes (-4 or 4). Also, as affiliates grow older, they are less likely to make extreme changes and they become more likely to

make moderate changes. Having a higher account balance, a higher taxable income and having a VPS account also raises the probability of making extreme changes. Finally, having higher contribution density has a negative, although small effect on making extreme changes. Overall, these results are consistent with the non-parametric analysis of Section 3.

Table 11: Marginal Effect of Personal Characteristics

Variable	-4	-3	-2	-1	1	2	3	4
Gender	0.04**	-0.029**	-0.023**	-0.026**	0.007**	0.004**	-0.005**	0.031**
Age	-0.086**	0.027**	0.051**	0.032**	-0.012**	0.014**	0.016**	-0.042**
Taxable Income Quintile	0.003**	0.004**	-0.004**	-0.003**	-0.016**	0.001**	0.005**	0.011**
Account Balance Quintile	0.068**	-0.022**	-0.017**	-0.04**	-0.025**	0.007**	0.002**	0.028**
VPS	0.045**	-0.014**	-0.03**	-0.01**	-0.02**	-0.005**	0.006**	0.029**
Contribution Density	-0.011**	0.003**	0.004**	0.005**	0.011**	-0.004**	0	-0.009**

Source: Authors' estimations using a multinomial logit model that includes market variables. The marginal effects were estimated evaluating the different variables in their average value. ** 5% significance.

In order to gain a better understanding of the market variable effects, it's interesting to note that unreported estimations suggest a low degree of persistence in pension funds returns[10]. This implies that rational individuals should not react to lagged values of returns. Since returns are heteroscedastic, it could be argued that lagged values of volatility should be relevant for rational investors. Table 12 contains the marginal effects for the market variables that measure the return and standard deviation of returns for fund A. We present the results for the specification that uses market variables in levels and for the one that considers dummy variables for extreme returns and volatility. For both specifications we include the contemporaneous value of the market variables and two lags for each variable. We do this in order to detect if individuals take into account the past performance of pension funds when changing their equity exposures.

[10] Using monthly data, only the first lag of fund returns is significant. Moreover, this lag's coefficient presents a small value (0.21 with a 0.02 p-value).

Table 12: Marginal Effect of Market Variables

	Model 1: Continuous Market Variables							
Variable	-4	-3	-2	-1	1	2	3	4
Ret A	-0.005**	0	0.001**	-0.001**	-0.006**	0.002**	0.002**	0.009**
Ret A (-1)	-0.033**	-0.015**	-0.015**	-0.002**	0.022**	0.015**	0.008**	0.019**
Ret A (-2)	-0.014**	-0.005**	-0.002**	0.003**	0.009**	0.006**	0.003**	0
SD A	-0.019**	0.005**	0.009**	0.005**	0	0	0	0
SD A (-1)	-0.054**	-0.026**	-0.024**	0.004**	0.047**	0.032**	0.012**	0.009**
SD A (-2)	0.01**	0.018**	0.025**	0.006**	-0.014**	-0.019**	-0.008**	-0.019**
Variable	**Model 2: Dummy Market Variables**							
Ret A p90	-0.125**	-0.028**	-0.019**	0.01**	0.056**	0.05**	0.026**	0.031**
Ret A p90 (-1)	-0.214**	-0.104**	-0.1**	-0.022**	0.153**	0.118**	0.065**	0.104**
Ret A p90 (-2)	-0.139**	-0.08**	-0.068**	-0.004**	0.12**	0.08**	0.039**	0.052**
Ret A p10	-0.005**	0.04**	0.084**	0.044**	0.018**	-0.027**	-0.034**	-0.12**
Ret A p10 (-1)	0.051**	0.014**	0.047**	0.026**	-0.097**	-0.016**	-0.012**	-0.015**
Ret A p10 (-2)	-0.054**	-0.053**	-0.045**	-0.017**	0.103**	0.041**	0	0.026**
DS A p90	0.057**	0.054**	0	-0.017**	0.02**	-0.061**	-0.016**	-0.034**
DS A p90 (-1)	0.008**	0.015**	0.024**	0.005**	-0.054**	0	0.01**	-0.01**
DS A p90 (-2)	-0.012**	0.072**	0.12**	0.05**	-0.058**	-0.055**	-0.031**	-0.086**

Source: Authors' estimations using a multinomial logit model. The marginal effects were estimated jointly with personal characteristics variables. ** 5% significance.

The results show that the effect of contemporaneous return is small, with coefficients smaller than 1%. The lagged return's coefficient is larger in magnitude and it suggests a higher (lower) probability of increasing (reducing) equity exposure following a good performance for fund A. The second lag also turns out to be relevant to increase equity exposure. These results are consistent with those of (Agnew, Balduzzi and Sundén 2003), (Grinblatt and Keloharju 2001) and (Kaniel, Saar and Titman 2008), who also report a stronger effect of lagged rather than contemporaneous returns for investment decisions. These results can be interpreted as low market timing ability by affiliates. Standard deviation of fund A's returns has a negative contemporaneous effect on the probability of a strong reduction in equity exposure. Lagged values turn out to be significant, but the sign of the effect changes over time, with the first (second) lag leading to decrease (increase) equity exposure.

The model that uses dummy market variables generally displays coefficients of larger magnitude. The results for extremely good returns show that they have a positive effect on equity exposure. Although the contemporaneous dummy is significant and has the expected effect, the first and second lags have even larger effects. This suggests the existence of some market timing ability. In broad terms,

extremely low returns have the expected effect, leading to reductions in equity exposures. Again, lagged values are significant. In general terms, the presence of extreme volatility leads to lower equity exposure.

An interesting question that rises in the analysis is whether different individuals react in distinct ways to market conditions. In order to study this issue, we reestimate the multinomial logit models for the "best performance group" (i.e. affiliates whose return outperformed fund E) and for the "worst performance group" (i.e. affiliates whose return underperformed fund A)[11]. Although we focus on the dummy variables model, our main qualitative conclusions hold for the continuous market variables specification.

Table 13 shows that both groups react in a similar way to contemporaneous and lagged returns. However, the best performance group displays larger contemporaneous coefficients and doesn't react to 2-months lags in extremely good returns, which could be interpreted as better market timing ability. An interesting difference emerges in terms of the reaction to market volatility. Indeed, the worst performance group shows a strong tendency to lower equity exposure during market turmoil, even reacting to 2-months lags. The best performance group, however, doesn't react as often to market volatility, and in some cases, their reaction is to increase equity exposure.

[11] Since the effects of personal variables are similar to those showed in Table 11, these variables are excluded from the following analyses. As a robustness check, we also explored a second criterion to form performance groups in which we distinguished between affiliates whose return outperformed or underperformed a passive strategy (i.e. remaining in their original 2008 fund type). The main results turned out to be similar.

Table 13: Marginal Effect of Market Variables for Worst and Best Performance Groups

Variable	-4	-3	-2	-1	1	2	3	4
Worst Performance Group: Multinomial logit Marginal Effects								
Ret A p90	-0.156**	0.026**	0.037**	0.006**	0.043**	0.026**	0.016**	0
Ret A p90 (-1)	-0.356**	-0.083**	-0.077**	0	0.166**	0.1**	0.083**	0.162**
Ret A p90 (-2)	-0.244**	-0.066**	-0.052**	0.014**	0.119**	0.066**	0.057**	0.105**
Ret A p10	0	0.088**	0.083**	0.019**	0.01**	-0.019**	-0.034**	-0.141**
Ret A p10 (-1)	0.058**	-0.012**	0	0.031**	-0.044**	0	-0.014**	-0.016**
Ret A p10 (-2)	-0.078**	-0.034**	-0.027**	-0.018**	0.103**	0.047**	-0.007**	0.014**
SD A p90	0.06**	0.042**	0.017**	-0.008**	0.01**	-0.044**	-0.017**	-0.059**
SD A p90 (-1)	0.084**	0.028**	0.01**	-0.013**	-0.084**	-0.019**	0.009**	-0.014**
SD A p90 (-2)	-0.049**	0.157**	0.106**	0.026**	-0.026**	-0.045**	-0.038**	-0.132**
Best Performance Group: Multinomial logit Marginal Effects								
Ret A p90	-0.183**	-0.053**	-0.045**	-0.023**	0.022**	0.066**	0.066**	0.15**
Ret A p90 (-1)	-0.171**	-0.048**	-0.055**	-0.028**	0.052**	0.053**	0.054**	0.143**
Ret A p90 (-2)	0	0	0	0	0	0	0.016**	0
Ret A p10	0.119**	0.072**	0.057**	0.018**	0.038**	-0.06**	-0.063**	-0.181**
Ret A p10 (-1)	0.104**	0.032**	0.065**	0.029**	-0.092**	-0.056**	-0.025**	-0.056**
Ret A p10 (-2)	-0.143**	-0.05**	-0.043**	-0.01**	0.234**	0	0	0
SD A p90	-0.077**	-0.029**	0	0	0.124**	0	0	0
SD A p90 (-1)	-0.145**	-0.031**	-0.039**	-0.014**	0	0.113**	0	0.103**
SD A p90 (-2)	0	0	0	0.019**	-0.05**	0	0	0

Source: Authors' estimations using a multinomial logit model. The marginal effects were estimated jointly with market variables. ** 5% significance.

We also analyze if there is evidence of learning in the investment decisions of affiliates. In order to do this, we focus on a subsample of individuals that belonged to the 1st performance bracket during the 2008-2010 period (i.e. the worst performance group) that migrated to the 6th performance bracket for the 2011-2013 period (i.e. the best performance group). Moreover, we focus on individuals that make at least one fund change in both periods. As Table 14 shows, this leaves us with 75,342 individuals, of which 2,160 managed to show an important improvement in investment performance, migrating from Bracket 1 to Bracket 6. It's interesting to note that, in general terms, there is low persistence in performance, with a degree of migration between brackets.

Table 14: Transition Matrix – N° of Affiliates Migrating between Performance Brackets

	2011-2013 Bracket						
2008-2010 Bracket	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
1	14,823	2,436	5,989	3,415	2,724	2,160	**31,547**
2	7,036	1,271	3,374	1,686	1,157	602	**15,126**
3	4,593	909	2,183	983	579	227	**9,474**
4	3,049	526	1,262	508	380	98	**5,823**
5	1,346	185	498	273	193	108	**2,603**
6	6,094	739	1,739	1,164	745	288	**10,769**
Total	**36,941**	**6,066**	**15,045**	**8,029**	**5,778**	**3,483**	**75,342**

Source: Authors' estimations

In order to detect changes in the behavior of affiliates that improved their performance, we reestimate the multinomial logit models for this group twice. Once for the 2008-2010 period and the second time for the 2011-2013 period[12].

The results, showed in Table 15, suggest that these affiliates reacted to contemporaneous high returns in the wrong direction during the first period, lowering equity exposure. During the second period these affiliates ceased to react in the wrong way to contemporaneous high returns. However, lagged good returns become significant and lead affiliates to decrease equity exposure. Regarding to contemporaneous low returns, affiliates go from reacting by reducing equity exposure to moderate increases in such exposure, since during the second period the coefficients for extreme equity adjustments (X=-4 and X=4) become significant and negative, while the coefficients for moderate increases in equity (X=1 and X=2) become significant and positive. No clear patter seems to emerge from the coefficient of lagged bad returns. An interesting change occurs in terms of affiliates' reaction to market volatility. During the first period, affiliates reacted to high contemporaneous and lagged volatility by a strong reduction in equity exposure. During the second period, this reaction seems to diminish, suggesting that affiliates opted to keep steady during market turmoil, leaving their equity exposure unaltered.

[12] Since the effects of personal variables are broadly consistent with those showed in Table 11, these variables are excluded from the analysis. Also, our main qualitative conclusions hold for the continuous market variables model.

Table 15: Change in Redeemed Individuals Behavior

Variable	-4	-3	-2	-1	1	2	3	4
				Marginal Effects: 2008-2010 Period				
Ret A p90	-0.0958	0.1931**	-0.0216	-0.019**	-0.0197**	-0.0042	-0.0031	-0.0297**
Ret A p90 (-1)	-0.0835	0.0314	-0.059	-0.0018	0.037	0.0086	0.0173	0.05
Ret A p90 (-2)	0.066	-0.0542	-0.0569	0.0065	0.0036	0.0002	0.0045	0.0303
Ret A p10	0.0241	0.0859	-0.0424	-0.0324	0.03	0.0017	0.0013	-0.0681**
Ret A p10 (-1)	0.1135**	0.045	-0.0067	0.0146	-0.1379**	0.0007	-0.0086	-0.0206
Ret A p10 (-2)	-0.0538	-0.0858	0.0112	0.037	0.0365**	-0.001	0.0046	0.0513
DS A p90	0.2529**	0.0308	-0.0718	-0.0462	-0.0262	-0.035	-0.0235	-0.0809
DS A p90 (-1)	-0.066	0.0827**	0.0303	-0.014	-0.0104	-0.0049	-0.002	-0.0158
				Marginal Effects: 2011-2013 Period				
Ret A p90	-0.0769	-0.0036	0.1116	0.0304	0.1236	-0.0624	-0.0411	-0.0816
Ret A p90 (-1)	-0.1784**	0.9962**	-0.043**	-0.039**	-0.116**	-0.2211**	-0.1078**	-0.291**
Ret A p90 (-2)	-0.1145**	-0.0081**	-0.0105	-0.0193	0.0638	0.1448**	0.0227	-0.0788
Ret A p10	-0.0901**	-0.0057**	-0.02	-0.0138	0.1699**	0.0947**	-0.0096	-0.1253**
Ret A p10 (-1)	-0.1605**	-0.0012	-0.0365	-0.0261	0.1434	-0.0729	0.0248	0.1289
Ret A p10 (-2)	-0.106**	-0.0038**	-0.0481**	-0.0236	0.0175	0.0445	0.016	0.1036**
DS A p90	-0.0724	0.0052	0.0339	0.0359	0.0829	-0.0221	-0.0325	-0.0308
DS A p90 (-1)	0.1795	-0.0324**	-0.0093	-0.0059	-0.1072**	0.1223	0.0231	-0.17**

Source: Authors' estimations using a multinomial logit model. The marginal effects were estimated jointly with market variables. ** 5% significance.

Taken as a whole, our results imply that a small percentage of individuals managed to improve their investment performance. Rather than this being the result of increased market timing ability, the cause would be a change in attitude toward market volatility, going from lowering equity exposure in response to high volatility in returns to keeping a steady exposure during these periods.

6. Conclusions

This paper seeks to characterize those individuals making voluntary transfers between funds and assess whether their decisions were optimal over a five years horizon (2008-2013). The analysis consists in comparing the individual strategies versus static investment strategies or pre-defined strategies defined by the regulator. In the case of Chile, the default investment allocation, defined by law, is considered.

Our non-parametric analysis suggests that involvement in portfolio decisions is higher for men with higher education and potentially higher financial sophistication, measured as higher income and account balance, the existence of voluntary pension savings, and with higher contributions. These results are reinforced by regression analysis and are broadly consistent with those found by previous studies.

The results indicate that in general individuals did poorly in terms of the performance of their investment decisions regarding their pension savings. A non-negligible 37.8% of individuals underperformed the worst fund (fund A) over the period. This group obtained an average yield of -12.5% well below Fund A's return of -5.9%. On the contrary, only 1.3% of affiliates achieved a better return than Fund E (32.7% versus 24.6%) between 2008 and 2013. The main drivers of these results for people in group 1 (strategy return below fund A) and group 2 (strategy return above fund E) seem to be the differences in the timing and direction of funds transfers. In particular, individuals in group 1 move away from more risky funds during the time of higher volatility and large decreases of fund returns, as can be observed in Figures 2 and 3. Also, 72% of affiliates underperformed a passive strategy, and 82% underperformed the default investment option.

Given the large prevalence of inertia among affiliates, the existence of well-defined default investment strategies by pension regulators is relevant. The results strongly support the introduction of default investment strategies in a mandatory pension system where members lack the financial knowledge to take proper decisions, inertia to evaluate past decisions and inability to recognize the adequate investment horizon of their savings.

The results from regression analysis imply that there is low market timing ability by affiliates that make voluntary fund changes. When we study the differences in behavior among affiliates in the best and worst performance groups, we find evidence of the former group having somewhat better market timing ability, but the most interesting difference emerges in terms of the reaction to market volatility. While the worst performance group shows a strong tendency to lower equity exposure during market turmoil, the best performance group, however, doesn't react as often to market volatility, and in some cases, their reaction is to increase equity exposure.

Finally, our results regarding changes in behavior in the small group of individuals that managed to improve their investment performance shows that, rather than this being the result of increased market timing ability, the cause would be a change in attitude toward market volatility, going from lowering equity exposure in response to high volatility in returns to keeping a steady exposure during these periods.

7. References

1. Agnew, J., P. Balduzzi, and A. Sundén. "Portfolio Choice and Trading in a Large 401(k) Plan." *American Economic Review* 93, no. 1 (2003): 193-215.

2. Ameriks, J., and S. Zeldes. "How do household portfolio shares vary with age?" *Working Paper, Columbia University*, 2004.

3. Barber, B., and T. Odean. "Boys Will be Boys: Gender, Overconfidence and Common Stock Investment." *Quarterly Journal of Economics* 116, no. 1 (2001): 261-292.

4. Berstein, S., O. Fuentes, and F. Villatoro. "Default Investment Strategies in a Defined Contribution Pension System: A Pension Risk Model Application for the Chilean Case." *Journal of Pension Economics and Finance* 12, no. 4 (2013): 379-414.

5. Berstein, S., O. Fuentes, and N. Torrealba. "La Importancia de la Opción por Omisión en los Sistemas de Pensiones de Cuentas Individuales: Estrategias de Inversión de Ciclo de Vida." *Working Paper* (Pensions Supervisor), no. 44 (2010).

6. Berstein, S.; Castañeda, P.; Fajnzylber, E.; Reyes, G.;. *Chile 2008: A Second-Generation Pension Reform.* Pensions Supervisor, 2009.

7. Bilias, Y., D. Georgarakos, and M. Haliassos. "Portfolio Inertia and Stock Market Fluctuations." *Journal of Money, Credit and Banking* 42, no. 4 (2010): 715-742.

8. Calvet, L., J. Campbell, and P. Sodini. "Down or Out: Assessing the Welfare Costs of Household Investment Mistakes." *Journal of Political Economy* 115, no. 5 (2007): 707-747.

9. Calvet, L., J. Campbell, and P. Sodini. "Fight or Flight? Portfolio Rebalancing by Individual Investors." *The Quarterly Journal of Economics* 124, no. 1 (2009): 301-348.

10. Campbell, J., and L. Viceira. *Strategic Assel Allocation: Portfolio Choice for Long-Term Instructors.* Oxford: Oxford University Press, 2002.

11. Cappelletti, G., G. Guazzarotti, and P. Tommasino. "The Effect of Age on Portfolio Choices: Evidence from an Italian Pension Fund." *Working Paper, Banca D'Italia*, no. 768 (2010).

12. Cocco, J., F. Gomes, and P. Maenhout. "Consumption and Portfolio Choice over the Life Cycle." *Review of Financial Studies* 18, no. 2 (2005): 491-533.

13. Cronqvist, H., and R. Thaler. "Design Choices in Privatized Social-Security Systems: Learning from the Swedish Experience." *The American Economic Review* 94, no. 2 (2004): 424-428.

14. Dhar, R., and Zhu, N. "Up Close and Personal: Investor Sophistication and the Disposition Effect." *Management Science* 52, no. 5 (2006): 726-740.

15. Engström, S., and A. Westerberg. "Which Individuals Make Active Investment Decisions in the New Swedish Pension System?" *Journal of Pension Economics and Finance* 2, no. 3 (2003): 225-245.

16. Figueroa, C. «Determinantes de la Demanda por Fondos de Pensión.» *mimeo, Universidad Católica de Chile*, 2008.

17. Frazzini, A. "The Disposition Effect and Underreaction to News." *The Journal of Finance* 51, no. 4 (2006): 2017-2046.

18. Gomez, F., L. Kotlikoff, and L. Viceira. "Optimal Life-Cycle Investing with Flexible Labor Supply: A Welfare Analysis of Life-Cycle Funds." *American Economic Review* 98, no. 2 (2008): 297-303.

19. Grinblatt, M., and M. Keloharju. "What makes investors trade?" *The Journal of Finance* 56, no. 2 (2001): 589-616.

20. Kaniel, R., G. Saar, and S. Titman. "Individual investor trading and stock returns." *The Journal of Finance* 63, no. 1 (2008): 273-310.

21. Lusardi, A., and O. Mitchell. "Financial Literacy and Planning: Implications for Retirement Wellbeing." *De Nederlandsche Bank Working Paper*, no. 78 (2005).

22. Lusardi, A., and O. Mitchell. "Planning and Financial Literacy: How Do Women Fare?" *NBER Working Paper*, no. 13750 (2008).

23. Madrian, B., and D. Shea. "The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior." *The Quarterly Journal of Economics* 141, no. 4 (2001): 1149-1187.

24. Mitchell, O., G. Mottola, S. Utkus, and T. Yamaguchi. "The Inattentive Participant: Portfolio Trading Behavior in 401(k) Plans." *Working Paper, University of Michigan Retirement Research Center*, no. 115 (2006).

25. Odean, T. "Are Investors Reluctant to Realize Their Losses?" *The Journal of finance* 53, no. 5 (1998): 1775-1798.

26. Odean, T. "Do Investors Trade Too Much?" *American Economic Review* 89, no. 5 (1999): 1279-1298.

27. Pensions Supervisor. "Pension Funds Investment Regime." 2013.

28. Samuelson, W., and R. Zeckhauser. "Status Quo Bias in Decision Making." *Journal of Risk and Uncertainty* 1, no. 1 (1988): 7-59.

29. Sundén, A., and B. Surette. "Gender Differences in the Allocation of Assets in Retirement Savings Plans." *The American Economic Review* 88, no. 2 (1998): 207-211.

30. Viceira, L. "Life-Cycle Funds." *SSRN Working Paper*, no. 988362 (2007).