"A pooled time-series analysis on the relation between prior performance and pension fund choice"

Waldo TAPIA,
Consultant, Inter-American Development Bank.
Ph.D. student, University of Paris 9 Dauphine. Paris, France.

Introduction

A basic policy question in private pension systems is how much choice workers should have over key decisions, such as the choice of investment portfolio. In countries where mandatory individual account pension systems are large, these financial decisions can determine their standard of living in old age. These decisions are all the more relevant given that participation in these systems is mandatory and that the contribution rate is set by law. If workers need to be obliged to participate in the system ad to contribute a certain percentage of their salary, can they be expected to make informed choices over, for example, investment portfolios?

Conventional economic theory suggests that informed economic agents act rationally to maximize their self interest. In theory, optimal investment selection requires that plan members participate actively in the allocation of their investments. Members may have different preferences related to their aversion to risk, and these preferences should be reflected in a different composition of their investment portfolio. Members should be able to choose from a broad range of choices the pension fund and investment portfolio that best matches their personal attitude to investment risks and horizon. They should also have the freedom to switch to another pension fund later if they so choose.

However, a growing research literature in behavioural economics suggests that plan members make systematic errors with respect to their retirement saving, leading ultimately to reductions in economic welfare. While lack of adequate disclosure or knowledge over financial matters may be partially responsible, there is also evidence that even when correcting such problems, individuals are sometimes unable or unwilling (or both) to select an investment portfolio that matches their risk and return preferences. Moreover, in order to be effective in preparing the general population, financial education programmes require a breadth in scope and intensity that can only be achieved over many years and at a high cost. The implementation of investment choice in mandatory individual account systems can therefore have unintended consequences on welfare that should not be ignored.

Using data of the Chilean Pension Systems, this paper will estimate a pooled time series model between prior performance and pension fund choice by applying random effects and fixed effects panel models. The paper will assess the impact of past returns on pension members' decisions and evaluates how members' decision change based on the time scale of prior information. It will also describes the extent to which plan members make active investment decisions in these systems and assesses the policy solutions that have been put forward to facilitate choice. The first part provides a brief summary of the exiting literature on behavioural economics, investment options and portfolio choice. The second part offers an analysis of the investment choice system in the Chilean mandatory individual account pension system. Finally, the third part describes the methodology used in the paper.

I. Literature on behaviour economics: heuristics decision-making and framing effect

In individual account systems, members bear the risks and consequences of their investment decisions. If participants behave as predicted by economic theory, such responsibility would be welfare-enhancing as members would invest and hold a portfolio of financial assets with a risk-return combination consistent with their investment horizon, degree of risk aversion and the portfolio of other assets they hold, including their human capital and, where relevant, their home[1]. Following the same idea, much of the

[1] The optimal asset allocation for a long-term investor has been analyzed by Campbell and Vicera (2002). See Larrain (2007) for a thorough review of the literature (as assumed under the standard utility theory).

discussion concerning the implementation of investment choice assumes that individuals are both exceptionally good decision makers and are able to carry out their investment decisions. In other words, members have the knowledge, willpower and self-control to exercise choice.

Behavioural economists, on the other side, have shown that in reality several obstacles and behavioural challenges compromise good investment decision making. Many individuals are not particularly good at the retirement savings problem either because they lack the necessary cognitive ability to solve the optimization problem, because they have insufficient will power to execute it, or even sometimes because they are overconfident. Surveys and empirical researches suggest that individuals do not follow the traditional assumptions about rational economic decision-making.

This point of view is consistent with the fundamental economic proposition that people can and do try to maximize their self-interest, but it also recognizes that such decisions are often sub-optimal, given available information[2]. These outcomes have been attributed to various behavioural factors including choice and information overload, unstable or undefined preferences, heuristic decision-making, "framing effects" and investment menu design, procrastination and inertia, and overconfidence. Work on utility functions has also highlighted asymmetries in attitudes to probable losses and gains[3].

Heuristic decision making: members use of prior performance data

One systematic violations of rationality that affect investment decision have been attributed to specific shortcuts or 'heuristics'. Heuristics are simple rules of thumb which have been proposed to explain how people make decisions, come to judgments and solve problems, typically when facing complex problems or incomplete information.

Faced with a large number of complex decisions, members frequently rely on heuristics, or "rules of thumb", that serve to reduce the complexity of assessing probabilities into simpler judgments. In many circumstances, members appear to be influenced by factors that are not necessarily relevant to the outcome, and consequently their choices may not correspond to their underlying risk attitudes. More worryingly in the investment arena, heuristics may result from individual being unable to asses risk in term of probabilities.[4]

Investors are confronted daily with a large amount of information that should allow them to make informed and economically rational decisions. The decision making process, however, is not a strictly rational one where all relevant information is collected and objectively evaluated. Rather, the decision maker takes mental 'short cuts' (Kahneman and Tversky 1974). There may be good practical reasons for adopting a heuristic decision making process, particularly when there is time pressure, or when other factors make fully evaluating all choices difficult.

To illustrate, investors who have the possibility to allocate part of their pension savings between different options are confronted with a complex sequence of choices. First, they have to decide whether to invest in the default option or in other fund. Second, they have to decide in how many funds to invest in. Third, they have to choose in which funds to invest in. Finally, they have to decide what percentage should be invested in each fund. In such situations, Benartzi and Thaler (2001) find support for the existence for the "1/n" strategy (and other "naïve diversification strategies"), which leads participant to split their contribution equally amongst "n" funds offered by the plan. Huberman and Jiang (2006) also find that the use of the 1/n rule is related to the ease of applying it.

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[2] Mitchell and Utkus, 2003.

[3] Kahneman and Tversky, 1979, identified loss aversion, a tendency to weigh losses about twice as much as gains. They also find that individuals judge how their decisions affect incremental gains and losses to their wealth, rather than their total wealth.

[4] Examples of risk myopia abound in the United State behavioural economics literature. One of the egregious employees' perception of their company's stock as less risky than or equally risky as, a well-diversified equity fund (Mitchell and Utkus, 2004)

In terms of prior performance data, Mitchell and Utkus (2004) attribute many investors' predilection for past performance to behavioral heuristics such as representativeness and availability: patterns suggesting superior performance are constructed from small samples drawn from skill or luck. Furthermore the pervasiveness of past performance data leads to an inevitable reliance on past performance, despite the legal caveats, and may also involve an anchoring effect on any salient 'high' or 'low' points on the chart (Mussweiler & Schneller, 2003; Nelson, 2005).

Another evidence of heuristic decisions is individuals' reliance on recent past performance when choosing mutual funds (Patel et al., 1991). Investors often select funds based on returns over the last 5 years or less, even though over such short periods over-performance could be simple due to luck. Benartzi (2001) also finds that members' high allocation to company stock in 401(k) plans was based on simple extrapolation of the company's historic return.

Framing effect: how members' decision change based on the time scale of prior information

Another bias in decision-making is a result of the fact that many participants are easily swayed by the way in which saving and investment question are presented or "framed" for them. If a number of different investment options is presented, issues such as numbering and the order in which they appear will affect the choice made. Several studies about discretionary 401(k) plans have emphasised the fact that employees' choices are strongly influenced by "framing effects" (Mitchell and Utkus, 2004). In a panel data study, Brown et al. (2007) found that the number and mix of investment option has an important effect on overall asset allocation.

Benartzi and Thaler (1999) also find that simple changes in the way information is presented can affect individuals' choices. According to their experiments, investors react differently according to whether the long-run results or short-run results are presented. They varied the time horizon of past performance between one year and 30 years. They found that participants who were showed different holding periods made quite different investment decisions in terms of the proportion of a retirement fund devoted to equities. Again, the question that can be asked about all these findings is whether they are simply evidence of insufficient cognitive ability or knowledge to solve complex portfolio optimization decisions.

II. International evidence on investment choice in mandatory individual account systems

Investment options

In the Chilean mandatory pension system the investment menu offers far fewer choices than other countries, such as Australia or Sweden. The typical approach is to allow fewer than five lifestyle funds, offering varying allocations to bonds and equities, which attempt to provide some age-related profiling. In these systems, members must also make two sequential choices. First, they choose provider (Pension Fund Administrator, AFP), and only then they choose a specific lifestyle fund.

During the first two decades of the Chilean mandatory pension system, participants were not permitted to make asset allocation decisions. This approach was taken in order to reduce administrative costs and complexity. In 2000, the government required that AFPs open a more conservative fund for retirees or near-retirees. Two years later, each fund administrator was permitted to expand the number of investment offerings from two to five in order to allow participants to diversify their asset allocations. Under this new investment menu, each AFP offers up to five funds, called simply A, B, C, D and E. The funds are differentiated by the proportion of their portfolio invested in variable income securities and fixed income. An adequate range is given between the minimum and the maximum limits to enable the portfolio manager to optimize the investment in each fund (see Table 1).

Table 1: Maximum and minimum limit by pension fund in Chile

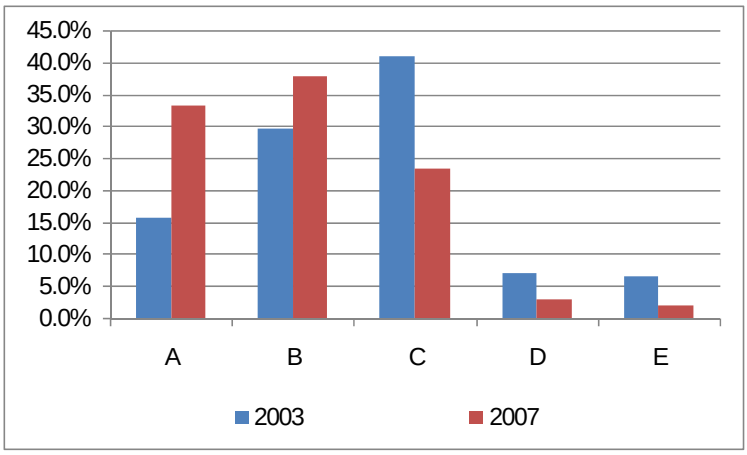
Fund	Limit on investment in equities (as a percentage of total assets)	
	Minimum limit	Maximum limit
A	40%	80%
B	25%	60%
C	15%	40%
D	5%	20%
E	Mainly fixed income instruments	

Source: Superintendency of Pension Fund Administrators (SAFP).

Investment choice by fund type

Fund allocation in the Chilean mandatory pension funds also illustrate that active participants are taking a substantial level of equity risk in their retirement portfolios. By the end of 2007, approximately 70% of total members who made an active choice opted for those funds with an equity exposure over 60%. Classifying by type of fund, the share of participants that have actively chosen fund A (up to 80% of equities) rose from 16% in 2003 to 33% in 2007. For fund B (up to 60% of equities), this proportion has increased from 30% to 38% during the same period (see Chart 1). On the other hand, Fund C (up to 40% in equities), which represented the largest share of active participant at the inception of the programme fell from 41% to 24%. Simultaneously, the individual preferences for those funds with the highest proportion of fixed income securities (Fund D and E) fell to 3% and 2% respectively.

Chart 1: Fund allocation among members that made an active choice, Chile



Source: Authors calculations and SAFP.

Two factors may explain why most active participants in Chile are choosing the riskiest portfolios. The first is the high returns of the equity market in Chile over the last 4 years and the second is the young structure of the population. Most financial planners advise young people to invest in funds A and B, on the basis that stock funds have historically provided higher returns than fixed income funds. Implicit in this recommendation is the expectation that the positive equity premium will continue in the future, at least over the long term. As shown in Table 3, between September 2003 and December 2007, the overall real rate of return before administrative cost of fund A, was 96.7% in real term (17.2% annual average return), while the result achieved by the Fund E, which is invested only in fixed income securities, was 16.9% (3.7% annual average return).

Table 3: Invest return and number of months with negative and positive returns in the Chilean multifund pension system (Sep 2003 - Dec 2007)

	Accumulated real return	annual average real return	Number of months with negative yield	Number of months with positive yield	Total period (months)
A	96.7%	17.2%	13	38	51
B	63.3%	12.2%	12	39	51
C	45.1%	9.1%	12	39	51
D	32.5%	6.9%	10	41	51
E	16.9%	3.7%	14	37	51

Source: Association of AFP, December 2007

While a high allocation to equities may be appropriate given the young structure of the population (60% of total participants are younger than 40, while only 15% are older than 50), there is evidence that most members do not understand the risks involved. A survey published in 2006[5], documents that only one-third of participants know how many funds there are in the investment choice scheme and only around one-fifth can give the correct total number of funds. Further, only 16% of participants know correctly their type of funds.

Another important observation from the Chilean pension system is that most participants in each age band rely on the default option. By the end of 2007, between 62% and 79% of total participants had remained in the default allocation as their investment strategy. This result may be explained because this option meets the needs of participants. However, it is also likely that workers are convinced of its suitability precisely because it has been identified or "framed" as the default portfolio for their given age.

This "framing effect" may be demonstrated by the fact that during the last three years Chilean participants have switched actively from their default option to the fund immediately above in terms of equity exposure. This has happened in the three age bands. For example, the proportion of the first age group members whose choice correspond with their default option (fund B) has decreased from 87% in 2003 to 79% in 2007, whereas the proportion of members in the same band who have opted for fund A has increased from 5% to 16% (see Table 4). The shift among participants in the third age band is even more significant. The proportion of members in the default option fell by 22 percentage points between 2003 and 2007, whereas the proportion in the fund immediately above in terms of equity exposure increased by 20 percentage points.

Table 4: Member allocation in the Chilean pension system by age group, 2003 - 2007 (the default option is shaded)

	Age band						Total	
	1-age group		2-age group		3-age group			
	2003	2007	2003	2007	2003	2007	2003	2007
A	5%	16%	2%	8%	0%	1%	3%	10%
B	87%	79%	5%	18%	2%	6%	42%	41%
C	7%	4%	90%	72%	10%	30%	44%	39%
D	1%	0%	2%	1%	84%	62%	10%	9%
E	1%	0%	1%	1%	4%	2%	1%	1%

Source: SAFP, 2007.
Note: 1-age group: men and women up to 35 year old; 2-age group: men from 36 to 55 years and women from 36 to 50 years; 3-age group: men from 56 years and women from 51 and pensioners. The default option is shaded.

[5] Economics Department of the Universidad de Chile, 2004.

III. Methodology

Hypothesis to be tested

Based on the prior literature on behavioural economics and, specifically, on the effect of prior performance on investment fund choice, I will examine the following hypothesis:

- *H1*: Pension fund members increase their asset allocations in the best performing choices and decrease in the worst performing choices.
- *H2*: Pension fund members will make different investment fund decisions based on the time scale of prior performance.

The first hypothesis indicates that the decisions of participants in aggregate are caused mainly by the returns on different types of investment choice. Although prior research shows that past investment performance is generally not useful in predicting future returns, pension funds members continue to place emphasis on this information in their investment decisions.

Hypothesis *H2* explores the likely impact of varying the time scale on the investment fund choice of pension members. In order to deal with this question, the time horizon considerd for each pension fund will be either, last month, last 12 months, or performance since the inception of the system.

Hypothesis 1: The impact of past returns on pension members' decisions

Under this hypothesis, I analyze how participants behave in the aggregate given the choices they are offered. This hypothesis examines two issues:

- The importance of fund returns, participant contributions and transfers in the proportion of assets invested in a particular fund.
- Participants' reaction to return in aggregate.

(a) The importance of fund returns, participant contributions and transfers in the proportion of assets invested in a particular fund.

The proportion of assets invested by members in each pension fund (A_{it}) can change from the beginning to the end of the period (month, quarter, year), as a consequence of two different sources:

- the investment returns on different funds,
- the contributions of the employee (and/or the employer) and inter-fund transfers.

The purpose of this section is to measure how great the change in investment weights is from these two different sources. I will examine each separately as well as a combination of transfers and contributions. These are combined because these changes, unlike changes due to return, are under the controlers participants and fund managers. -]TJ0 -1.6995 TD0.0005 Tc0.0009 Tw[(The extent)7.8(...)-5.8(...)-2.2(e magnitude of the c

T_{it} = the dollar amount rs *i* between time *t* and *t +1*,

R_{it} = the investment return from unrealized and realized capital gains and dividends on fund *i* from time *t* to *t +1*,

X_{it} = the fraction of total assets invested in fund *i* at time *t* ,

In order to examine the change in weight in the fund *i* as a consequence of the return in the fund *i* between time *t* and *t +1*, I will assume that the change in assets invested in the fund *i* are consequence only of the capital gains and dividends on fund *i*. Thus, the total assets in the fund *i* at time t+1 would be,

(1) $$A_{it+1}^{R} = A_{it}(1+R_{it})$$

And the change in weight in the fund *i* from t to t+1 due to investment return (ΔX_{it}^{R}) would be:

(2) $$\Delta X_{it}^{R} = \frac{A_{it}(1+R_{it})}{\sum_{j=1}^{N} A_{jt}(1+R_{jt})} - \frac{A_{it}}{\sum_{j=1}^{N} A_{jt}}$$

where the first expression in the right side represents the weight in the fund *i* at time *t+1* and the second expression, the weight in the fund *i* at time *t. N* is the total number of investment choices (or funds) face by the individual.

In the same way, it is possible to analyse the change in the proportion of asset invested in the fund *i* due to contributions and inter-funds transfer (ΔX_{it}^{C+T}). In an analogous way, I will calculate that the total amount of asset invested in the fund *i* came only from contributions and transfers.

(3) $$A_{it+1}^{C+T} = A_{it} + C_{it} + T_{it}$$

Then,

(4) $$\Delta X_{it}^{C+T} = \frac{A_{it} + C_{it} + T_{it}}{\sum_{j=1}^{N} (A_{it} + C_{it} + T_{it})} - \frac{A_{it}}{\sum_{j=1}^{N} A_{jt}}$$

Following the results of equations (2) and (4), I will be able to determine whether investment returns or contributions and inter-fund transfers are more important in determining the change in allocation of plan members.

(b) Participants' reaction to return in the aggregate.

Once established the influence of investment returns or contributions and inter-fund transfers in determining changes in aggregate members allocation, I examine whether participants in aggregate change their allocations in a way that accentuates or decreases the change in allocation due to returns over the same period. By focusing on the changes in allocation made by participants due to contributions and transfers compared to the change in allocation due to returns during the same period of time, I will assess whether participants in aggregate change their allocations to those pension funds with high returns, thereby amplifying the impact of returns on relative investment weights.

The methodological approach is to pool cross-sectional time series. This technique incorporates both the cross-sectional effect of the independent variables on fertility as well as the time-series effects within nations. The critical assumption of pooled cross-sectional times series models is that of pooling. That is, all units are characterized by the same regression equation at all points in time:

$$y_{it} = x_{it}'\beta_i + \varepsilon_{it}, \qquad i = 1,.....,N; t = 1,.....,T$$

where y_{it} and x_{it} are observations for the ith unit at time t and β is a vector of coefficients. ε_{it} is the residual with the usual properties (mean 0, uncorrelated with itself, uncorrelated with x, and homoscedastic).

In order to examine the relation between prior performance and pension fund choice, I will use two variables: changes in investment proportions due to contributions and transfers, ΔX_{it}^{C+T}, and changes due to returns, ΔX_{it}^{R}. To measure the relationship between the change in weight due to contributions and transfer and the change in weights due to returns, the following regression can be performed for each pension fund.

(5) $$\Delta X_{it}^{C+T} = \alpha_i + \beta_i \Delta X_{it}^{R} + \varepsilon_{it}$$

The results of this regression will indicate whether member in aggregate use contributions and transfer to accentuate the change in weights caused by returns.

Hypothesis 2: Pension fund members will make different investment fund decisions based on the time scale of prior performance.

Following the same framework used for assessing the H1, I will examine whether different formats of the fund's prior performance affect investment fund choice. Thus, the equation (5) can be modified using three different measures of investment performance: last month, last 12 months, or performance since the inception of the system.

Using the performance achieved by the pension fund during the last month, the modified equation (5) is:

(5a) $$\Delta X_{it}^{C+T} = \alpha_i + \beta_i \Delta X_{it(-1)}^{R} + \varepsilon_{it}$$

where $\Delta X_{it(-1)}^{R}$ is the change in asset allocation due to last month performance.

In an analogous manner,

(5b) $$\Delta X_{it}^{C+T} = \alpha_i + \beta_i \Delta X_{it(-12)}^{R} + \varepsilon_{it}$$

(5c) $$\Delta X_{it}^{C+T} = \alpha_i + \beta_i \Delta X_{it(0)}^{R} + \varepsilon_{it}$$

where $\Delta X_{it(-12)}^{R}$ and $\Delta X_{it(0)}^{R}$ is the change in asset allocation due to last 12-month performance and performance since the inception of the system respectively.

These equations will allow assessing whether members have different perception of the return associated with the fund performance depending on the past performance formats and whether members in aggregate change their allocations based on the performance of last month, last 12 months, or since the inception of the system.

Finally, it is also possible to summarize the three different formats of the fund's prior performance in one simple equation:

(6) $$\Delta X_{it}^{C+T} = \alpha_i + \beta_i \Delta X_{it(-1)}^{R} + \gamma_i \Delta X_{it(-12)}^{R} + \psi_i \Delta X_{it(0)}^{R} + \varepsilon_{it}$$

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