



WP/08/177

# IMF Working Paper

---

## Consumer Confusion: The Choice of AFORE in Mexico

*Roberto Calderón-Colín, Enrique E. Domínguez,  
and Moisés J. Schwartz*



**IMF Working Paper**

Monetary and Capital Markets

**Consumer Confusion: The Choice of AFORE<sup>1</sup> in Mexico**

**Prepared by Roberto Calderón-Colín, Enrique E. Domínguez,  
and Moisés J. Schwartz**

Authorized for distribution by Ceyla Pazarbasioglu

July 2008

**Abstract**

**This Working Paper should not be reported as representing the views of the IMF.**

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

This paper was prepared for the World Bank 4<sup>th</sup> Annual Contractual Savings Conference (Washington DC, April 2008) co-organized by Gregorio Impavido ([gimpavido@imf.org](mailto:gimpavido@imf.org)). The article shows that account transfers among pension administrators in Mexico barely respond to price or return considerations and in general has not improved the consumer's pension balance. Instead of strengthening competition through lower fees and higher returns for the consumer, AFORE switching has so far undermined the system and resulted in the destruction of value. Moreover, "noisy" evaluations of the product by the consumer tend to undermine the power of competition. Thus, an increased number of pension fund managers has not provided a more competitive environment. The theoretical framework allows for the estimation of "noise" and mark-ups in the AFORE industry. As the number of AFOREs increases, the mark-up diminishes at a very slow rate. This implies that more participants in the industry will hardly affect prices.

JEL Classification Numbers: C25, D43, G14, G23, H55, J26, J32, L11, L13, L15, L22.

Keywords: Key words: Pensions, defined contribution, individual accounts, competition, retirement savings, consumer choice, consumer confusion, noise distribution, mark-up.

Author's E-Mail Address: Roberto Calderón-Colín ([rcalderon@consar.gob.mx](mailto:rcalderon@consar.gob.mx)) is currently Planning Assistant General Director, Enrique Domínguez ([edominguez@consar.gob.mx](mailto:edominguez@consar.gob.mx)) is currently Planning Director and Moisés Schwartz ([mschwartz@consar.gob.mx](mailto:mschwartz@consar.gob.mx)) is currently President, all at the Mexican Pension Supervisory Authority (CONSAR). Moisés Schwartz was previously Executive Director for Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Mexico, Spain and Venezuela at the IMF.

---

<sup>1</sup> Pension Fund Manager.

Contents	Page
I. Introduction .....	3
II. The Choice of AFORE in Mexico .....	8
A. Inelasticity of Demand and Switching among Fund Managers.....	8
B. The Effectiveness of an Increase in Supply.....	21
III. Consumer's "Confusion" and "Noise" .....	26
A. Theoretical Framework .....	26
B. Statistical Analysis of Possible "Noise" Distributions .....	29
C. Mark-up Estimation in the AFORE Industry .....	35
IV. Empirical Study.....	39
A. Measurement of "Noise" and Consumer "Confusion".....	39
B. Econometric Framework to Measure "Confusion's " Relative Importance.....	41
C. Empirical Results.....	46
V. Concluding Remarks.....	49
Tables	
1. Regression Analysis 1.....	14
2. Regression Analysis 2.....	15
3. Gain/Loss in Balances for Hypothetical Cases of Workers that began accruing .....	22
4. Winners and Losers Due to Decreases in Fees .....	24
5. Changes in Balances Due to Decreases in Fees.....	25
6. Mark-up According to the Number of AFOREs .....	38
Figures	
1. Switches.....	9
2. Turnover Ratio for Mexico and Chile.....	10
3. Switches In 2006.....	17
4. Gain or Loss after Switching Workers' Estimated Balance at the Age of Retirement.....	18
5. Gain or Loss after Switching Workers' Estimated Balance after a Five-Year Period.....	19
6. Loss from not Switching to the to the "Optimal" AFORE Workers' Estimated Balance at the Age of Retirement .....	20
7. Loss from not Switching to the "Optimal" AFORE Workers' Estimated Balance after a Five-Year Period .....	20
8. "Noise Distribution" Percentage Loss in Pension Balances at Retirement Age Due to "Sub-Optimal" Choice of AFORE Fitted by the Normal and Weibull Distributions. ....	31
9. "Noise Distribution" Percentage Loss in Pension Balances After A Five-year Period Due to "Sub-Optimal" Choice of AFORE Fitted By The Normal and Weibull Distributions .....	33
References.....	51
Annexes	
I. The Model .....	51
II. Questionnaires .....	56

## I. INTRODUCTION

During the last twenty-five years, pension systems in Latin America have experienced a profound transformation by migrating from the so called pay-as-you-go system to defined contribution regimes based on individual accounts, where private entities manage and invest retirement funds. Pension system reform in Latin America came as a remedy to the financial insolvency of systems where active workers finance the pensions of retirees, with the expectation that their own pension will be financed by future generations. Moreover, reforms allowed the substitution of regimes associated with administrative inefficiencies, unequal benefits, evasion, increasing fiscal pressures and threats posed by population trends, for more efficient, fair and fully funded systems.<sup>2</sup>

As a result of the fiscal and debt crises of the eighties, pension systems in Latin America faced insolvency. The widespread evasion of social contributions, the decline in pension's reserves and the meager resources for retirement, made the prevailing regimes unfeasible. Moreover, insolvency in pension systems coincided with an important trend toward privatization, market liberalization and the development of domestic capital markets in the region.

Chile was the first country in Latin America to reform its pension system in 1981 and its influence on the rest of the region was noteworthy. The reform was followed by 11 countries, including Mexico.<sup>3</sup> Despite some differences, pension systems in most of Latin America are characterized by defined contribution regimes, with the distinctive feature that retirement funds are managed by the private sector.<sup>4</sup>

Empirical evidence leaves no doubt of the macroeconomic success of these reforms. Pension system reform has contributed to a decline in fiscal deficits, the increase of domestic savings and the development of financial markets.<sup>5</sup> Notwithstanding, some skepticism about the benefits of these individual capitalization schemes still prevails. In general, fees charged on the administered funds have been high, promotion and sales expenses seem excessive and competition among pension fund managers has not fully translated into benefits for consumers.<sup>6</sup> As a result, some countries have undertaken additional reforms while others opted for reversals of the initial reform.<sup>7</sup>

---

<sup>2</sup> Crabbe and Giral (2005), Holzmann and Hinz (2005) and Mesa-Lago (2005), among others.

<sup>3</sup> Peru, Colombia, Argentina, Uruguay, Mexico, Bolivia, El Salvador, Costa Rica and the Dominican Republic. Nicaragua and Ecuador approved the reform but it has not yet been implemented.

<sup>4</sup> Similar systems were adopted in some Central and Eastern European countries (Hungary, Kazakhstan, Poland, Latvia, Croatia, Bulgaria, Estonia and Macedonia).

<sup>5</sup> Crabbe and Giral (2005) and Mesa-Lago (2005), among others.

<sup>6</sup> Holzmann and Hinz (2005).

<sup>7</sup> Chile's reform proposal and recent amendments in Mexico aim to make the current system more efficient, while reform in Argentina is an example of policy reversal.

Given that individual capitalization systems were conceived from a macroeconomic perspective aimed at fiscal solvency, it does not come as a surprise that deficiencies associated to these systems have their source in microeconomic design. In a competitive market, private sector participation in pension fund management should result in benefits for the consumer through lower fees and an optimal combination of risk and return. Nonetheless, the empirical evidence of individual capitalization schemes has not been able to entirely satisfy this conjecture.<sup>8</sup> That is, competition among pension funds has not always translated into benefits for the consumer.

Individual capitalization systems are based on the interaction between the demand for the management of pension resources and its supply. The worker, which in this market is the consumer of the product, is asked to choose a pension fund administrator that manages his funds, provides him a return, offers other services and charges a price or fee. Private administrators are thus distinguished by the price they charge for the management of funds, the return and the services they provide to the consumer.<sup>9</sup>

In a system where pension funds are administered by the private sector, fund managers compete to sign in workers. As it happens in other product or service markets, one should expect that competition translates into benefits for the consumer. Thus, in case a pension manager charges a fee that exceeds the rest, or provides a poor service, workers would opt to transfer their funds to another pension fund that offers a more attractive combination of price, return and service. The reasoning behind this thesis rests on the assumption that workers react to changes in fees, return and the quality of service offered by pension fund managers. That is, pension systems with private sector management have the implicit assumption of active and well-informed consumers that constantly assess the management of such funds. This implies that the demand in this market has some degree of elasticity.

Nonetheless, several studies have revealed that individual capitalization schemes are characterized by an acute inelasticity of demand which implies that workers barely respond to changes in fees, return or service.<sup>10</sup> This lack of response by the consumer is associated to the reduced concern and involvement of workers with their pension. Several reasons lay behind this diminished partaking. One is the lack of interest due to workers' short term planning horizon. Hence, some degree of consumer "myopia" is evident in relation to their future retirement.<sup>11</sup> This is accentuated by the fact that pension fund resources are seen as compulsory savings mandated by law, which might undermine ownership from workers.

---

<sup>8</sup> Holzmann and Hinz (2005), Larrain Ríos (2005) and Vidal-Aragón de Olives and Taguas Coejo (2005), among others.

<sup>9</sup> Bernstein and Cabrita (2006).

<sup>10</sup> Bernstein and Micco (2002), Bernstein and Ruiz (2004), Marinovic and Valdés (2005), Cerda (2005) and the World Bank (1994).

<sup>11</sup> The World Bank (1994).

Another explanation relates to the fact that pension systems are complex and accessing and understanding the relevant information implies a relatively high cost for the consumer.<sup>12</sup>

The reduced involvement of the worker in the system and on his own pension account has two key implications. On one hand, the regulator is required to offset the lack of an active consumer and create the incentives to promote a competitive environment that is beneficial to the consumer. On the other, given the high inelasticity of demand, it has been observed that the selection of pension fund manager is primarily associated to the size of their sales force.<sup>13</sup> That is, as a result of the reduced elasticity of demand, consumers tend to remain with a pension fund manager unless, by the initiative of a sales agent, they undertake a specific action to switch to another pension fund. Therefore, instead of relying on price changes to attract consumers, pension fund administrators resort to compete in the number of sales agents to enroll a higher number of clients.<sup>14</sup> Evidence from Mexico suggests that workers' switching among pension funds has not imposed market discipline that would result in benefits for the consumer in terms of higher returns, lower fees and better service. Moreover, the lack of involvement of the consumer and the active partaking of salesmen in the switching process among pension funds has severely undermined the consumer's reliability on the system. Section II shows that switching between pension fund managers has not promoted market discipline and has in turn resulted in the destruction of value within the system.

Given that from the demand side the empirical evidence seems to suggest that the consumer's diminished involvement in the system impedes competition to foster market discipline, one could consider stimulating the supply of pension fund administrators as an alternative to lower costs and provide higher returns for workers. Nonetheless, evidence shows that this is also not the case. The Mexican experience during the last few years is blunt. From December 2002 to year end 2006, the number of pension fund managers in Mexico increased from 11 to 21 without generating important benefits to workers. Evidence is presented in the following section.

One could then question the reason a higher number of providers has not resulted in a competition that benefits the worker. In competitive markets, a higher number of participants results in firms establishing prices of their products close to the marginal cost, so that competition "protects" the consumer. However, in markets of complex goods or services, such as pension funds management, the consumer shows an imperfect grasp of the product, and is therefore not able to distinguish its features and attributes to make the right choice. Hence, "noisy" evaluations of the product by the consumer allow firms, even in industries

---

<sup>12</sup> Bernstein and Ruiz (2004).

<sup>13</sup> Bernstein and Cabrita (2007) show the dominant role of sales' forces in the switching between administrators. They also show that demand responds to prices and returns increases when sales' agents are considered in the switching process.

<sup>14</sup> Diamond (1971) and Klemperer (1995).

with a large number of players, to reach equilibrium prices with mark-ups. This undermines the power of competition to impose market discipline.

The purpose of this article is to demonstrate that the existence of “noise” in the AFORE (Mexican Pension Fund Manager) industry does not allow workers to adequately evaluate the features and attributes of the product or service. Thus, once consumers are not able to accurately interpret market signals, they tend to show some degree of “confusion.” This allows pension administrators to establish prices above those that would be observed in a market without “noise.” The analysis is based on the methodology of Gabaix and Laibson (2004) that illustrates that in markets with “noise,” a large number of firms has a weak effect on the level of mark-ups and that suppliers benefit from the complexity and the “noise” associated to the product they sell.

The above implies that efforts to reduce the level of “noise” and “confusion,” and increase the concern and awareness of the worker on his own pension account would result in a competition among pension fund managers that brings about increased benefits for the consumer. Consequently, efforts should focus on lowering the cost of accessing information so that consumers participate more actively in the system and have the proper information to choose the best product or service.

The article is organized as follows: the next section explores the AFORE choice in Mexico. Demand sensitivity is analyzed as well as the role played by sales agents in the switching process among administrators. The way that switching regulation has affected the volume of shifting among pension funds is also studied. The direction of the totality of the observed pension funds account switches during 2006 is analyzed, and the evidence confirms that the vast majority of the transfers among AFOREs does not respond to price, return or service considerations. Moreover, the analysis corroborates that most of the observed shifting has not resulted in benefits to the worker and that the choice of AFORE by Mexican workers has not been optimal.

The effect of an increase in the supply of pension fund managers on the consumer is also examined. During the last five years the number of AFOREs in Mexico increased from 11 to 21. Hence, one would expect that a larger number of firms strengthened competition and thus resulted in lower prices and higher returns for the consumer. With the aim to analyze the end result of new participants on workers’ pensions, several exercises are presented. It is then concluded that in general, the entrance of new participants to the industry has not favored the consumer.

Section III presents a theoretical framework developed by Gabaix and Laibson (2004) that shows that, as opposed to what happens in markets where competition drives firms to establish prices close to marginal cost, this does not take place when consumers can not clearly evaluate the product features. In these cases, even in a competitive market characterized by a large number of players, firms are able to establish mark-ups. The model shows that in markets with “noise,” in which consumers are “confused,” a larger number of firms might not reduce mark-ups significantly. Moreover, using the statistical distribution of the “noise,” the model allows for the estimation of the mark-up in the industry. The



theoretical framework lets us put forward the hypothesis that the AFORE industry is characterized by consumers that are subject to some degree of “confusion.” Hence, using information of the observed pension account transfers between AFOREs during 2006 we define the “noise” to which consumers are exposed in the market as the difference in the pension account balance that each worker would have obtained in a specific period of time had he chosen the optimal AFORE according to his own idiosyncratic features, and that of the account balance that he would obtain as a result of having chosen the AFORE to which he transferred his resources in 2006. Once “noise” has been defined, we proceed to determine its statistical distribution, the industry mark-up, and the way in which the mark-up is affected by the number of firms in the industry.

In Section IV we quantify the relative importance of consumer “confusion” in the AFORE choice and estimate the “noise” in the industry. For these exercises we use data of the account transfers between AFOREs that took place in 2006 as well as information resulting from surveys. The analysis concludes that the AFORE market is typified by the presence of “noise.” Therefore, policies aimed at the elimination of “noise” and consumer “confusion,” will result in a market in which competition among administrators benefits the consumer.

The last section offers a set of concluding remarks. The relevance for consumers to access clear information in order to make a more informed decision on their AFORE is underscored. The 2007 amendments to the Savings for Retirement System Law in Mexico aim precisely to this end. The new Law will result in a system in which the information to choose AFORE is simple, straightforward and thus less confusing. This should in turn result in a more competitive and efficient market.

## II. THE CHOICE OF AFORE IN MEXICO

### A. Inelasticity of Demand and Switching among Fund Managers

Several studies analyze demand inelasticity in individual capitalization pension systems. Since Chile was the first country to implement this system in 1981, it is not surprising that most of these studies analyze such case. In general terms, these studies point out that the demand for Private Pension Fund Managers (AFP) is barely responsive to changes in variables such as price, return or to the quality of services provided. Berstein and Cabrita (2007) use individual data to analyze AFP's demand to estimate the probability that a worker elects another pension fund manager. Results confirm the significance of AFP sales agents and indicate that, despite the fact that price and return demand elasticity is relatively low; it increases considerably when associated to a sales agent involvement.<sup>15</sup>

There are few studies concerning AFORE demand inelasticity in Mexico. Meléndez Barrón (2004) estimates AFORE demand functions and finds out that neither fees nor returns explain affiliation and that the latter depends mainly on variables related to commercial activity and promotion. Armenta (2007) analyzes the determinants of losing workers to another AFORE and finds that between 2000 and 2006 AFORE demand is somewhat sensitive to changes in the flow fee, and is less affected by changes in the asset fee.<sup>16</sup> Moreover, some of the findings reveal that the probability of switching among AFOREs and the consumers' reaction to higher fees respond to sales agents' partaking.

In a competitive environment with perfect information, the transfer of workers' accounts among AFOREs should exert discipline on the market. That is, given price, return and service differences among AFOREs, one would expect that consumers exercise their right to move their resources to pension funds that offer a better combination in relation to these three variables. Nonetheless, the demand inelasticity that characterizes these systems and the consumers' inability to differentiate the product, have caused that the direction and volume of switches among pension fund managers respond mainly to their sales force. Thus, fund managers increase their market share through a greater number of sales agents that try to convince workers to switch.<sup>17</sup>

Figure 1 shows the number of switches and the turnover rate between 1999 and 2006 for the Mexican case. Account transfers among AFOREs have increased considerably during the last years, with 3.8 million cases in 2006. The increase in the transfer numbers is due essentially to modifications in regulations that were implemented in 2002, whose main objective was

---

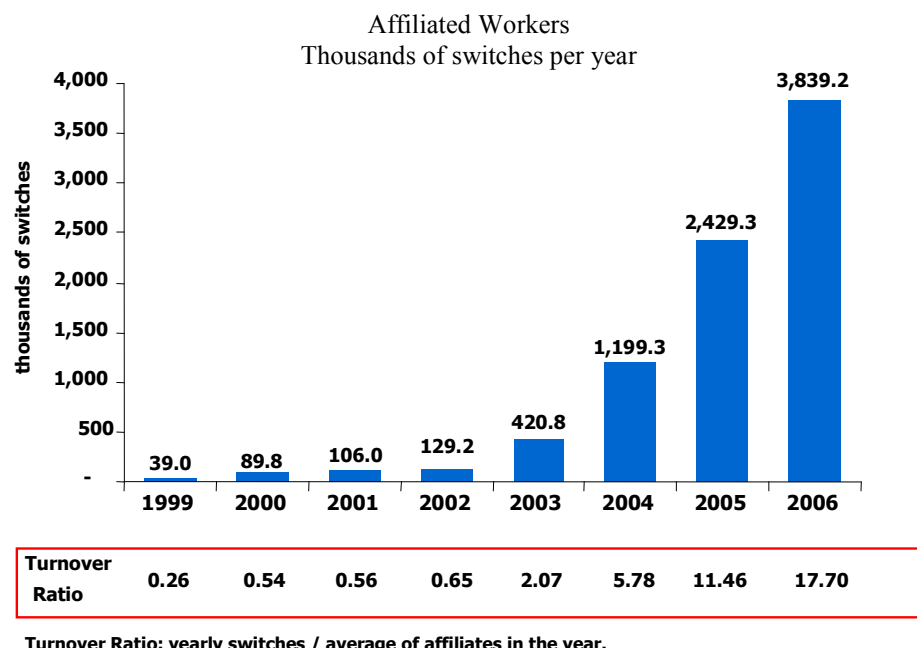
<sup>15</sup> Berstein and Ruiz (2004) and Berstein and Micco (2002) find similar results. Marinovic and Valdés (2005) estimate the effective long term price elasticity of demand and conclude that it is inelastic. Cerda (2005) finds that the affiliate exit rate from an AFP responds to return and market share considerations.

<sup>16</sup> This is related to the fact that regulation favored, through a higher probability to receive accounts, those AFOREs that charged a relatively low flow fee.

<sup>17</sup> This has caused that in some countries regulation impedes sales agents to provide "gifts" to workers.

precisely to favor account mobility among fund managers. That is, after having a system that during its first years of operation made it difficult to switch to another AFORE, the system evolved into one in which mobility among pension fund managers is enhanced by regulation and is thus made simple. As a result, the turnover rate increased to 17.7 percent in 2006, which means that close to 18 percent of the enlisted workers, switched their account to another pension fund in only one year. Even when compared to other countries that have similar pension schemes, this rate is remarkably high.

Figure 1. Switches



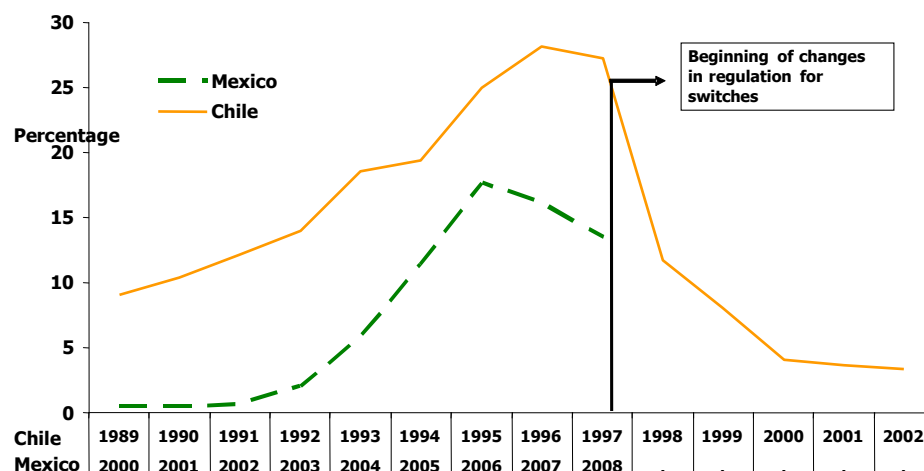
Source: CONSAR.

Figure 2 compares Mexico and Chile's turnover rate. As can be seen, the Mexican experience is similar to the Chilean case up to 1997, when the latter introduced regulatory changes with the aim to reduce the "transfer's war" among pension funds.<sup>18</sup> As a result of the amendments to the Savings for Retirement System Law that took place in 2007, a significant decline in Mexico's turnover rate should also be expected.<sup>19</sup>

<sup>18</sup> See Bernstein and Micco (2002).

<sup>19</sup> In relation to switching, amendments to the Law establish that transfers will be allowed only once a year, and before that, just one additional time and only if the transfer is to an AFORE with a higher net return.

Figure 2. Turnover Ratio for Mexico and Chile



Turnover Ratio: yearly switches / average of affiliates in the year. For Mexico, the data for 2008 considers the annualized ratio for the January-February period. For Chile, the turnover ratio is the number of switches / total affiliates.

Source: CONSAR with data of SAFP (Chile).

As pointed out previously, in a competitive market with informed and active consumers, flexibility in the switching process is expected to improve the terms and conditions for the worker. Nonetheless, in a market characterized by high demand inelasticity, the easing of barriers to shift among pension funds resulted in a significant increase in the number of sales agents, in high promotion costs and in harmful practices, all of which aimed at increasing the market share of AFOREs.<sup>20</sup>

In order to determine the model that explains the dynamics of transfers and best fits the Mexican case, several models –basically used for Chile– were considered. These models have shown that individual capitalization schemes are characterized by an acute inelasticity of demand which implies that workers do not respond as expected to changes in fees, return or service. In general, studies are based on two different approaches: those that use aggregated information; and those that rely on micro data, which allows to control for workers' individual attributes.

Considering the first approach, Berstein and Micco (2002) take into account fees, expected returns and marketing expenditure as switches' determinants. Berstein and Ruiz (2004) use fees and returns and analyze whether changes in these variables affect the elasticity of demand. In turn, Valdés and Marinovic (2005) use a "brand loyalty" model which assumes that higher income workers are better informed to choose pension fund managers, although

<sup>20</sup> During 2006, AFOREs promotion expenses accounted for 45% of their total expenses.

they find that demand elasticity decreases due to regulatory changes. Their analysis also considers fees and returns as explanatory variables. Finally, Cerda (2005) includes additional variables such as pension fund market shares and a return ranking to explain the elasticity of demand.

Referring to the second approach, Berstein and Cabrita (2007) use individual data and include variables such as age, account balance, income, employer and size of the pension fund manager, in addition to prices, a return ranking, as well as a variable that estimates how often a worker could be visited by a salesmen in order to explain transfers among pension funds.

There are several reasons these variables have been considered important in explaining the behavior of pension fund demand or transfers among pension managers. For example, the demand for pension fund managers is strongly related to the account balance at retirement. Since fees and returns are the most important variables to determine this balance, it should be expected that in a competitive market these variables play an important role in the choice of AFORE. However, according to some empirical studies this is not necessarily the case. Berstein and Ruiz (2004) consider this is due to the lack of information that prevails among workers.

Given the power that agents have to convince workers, empirically, salesmen represent the most important variable to explain transfers. Salesmen can approach workers and provide elements that support multiple reasons to switch their pension fund manager. In addition, in some countries the presence of gifts linked to switches has been notorious, motivating changes in legislation.<sup>21</sup>

Marketing expenditure has also been included by Berstein and Marinovic (2002) as an explanatory variable of demand elasticity, since it captures the impact of advertisement and the sales' effort of pension fund managers. In addition, Cerda (2005) considers that including variables that incorporate the worker's perception of a pension fund manager is relevant. Hence, the author includes indicators such as return rankings and market share.

For the Mexican case, a panel data with monthly aggregated data was generated. The main objective is to find the determinants of switches among pension fund managers from January 1999 to December 2006. We analyze the relationship between the number of account switches by AFORE and variables mentioned previously using Ordinary Least Squares (OLS).<sup>22</sup> Several econometric models were designed including variables such as: asset and flow fees, returns, equivalent fee ranking, marketing expenditure, the number of sales agents, regulatory changes, market share, and the fact that some AFOREs might belong to a financial or insurance group. These variables consider different features of the AFORE industry. First,

---

<sup>21</sup> See Valdés (2005).

<sup>22</sup> A *Pooled* OLS model is used assuming that the expected value of the product of the error and the independent variable is zero and that the variance-covariance matrix has a defined range,  $K$ .

AFOREs' expenditure -both on marketing and on sales agents- is introduced.<sup>23</sup> For the expected rates of return between the originating and the destination AFORE, a historical moving average of the last thirty-six months is used. Prices of the industry are considered both separately and compounded in a ranking index.

For almost every variable in the model, descriptive patterns changed from September 2002 to December 2006, after main amendments to regulation were implemented to favor mobility among fund managers. A Chow Test verified the presence of a structural change<sup>24</sup> prompting to divide the sample into two periods: from January 1999 to September 2002; and from October 2002 to December 2006.

For the first period, flow and asset fees are considered, while for the second period a ranking index is introduced.<sup>25</sup> Furthermore, since belonging to a financial or insurance group could generate economies of scale for some AFOREs and thus, provide them with more power to attract workers, dummy variables that capture this effect are introduced. Dummies that take into consideration AFORE's size are also incorporated. With the purpose of showing the main regulatory changes that led to additional flexibility in the switching process, dummy variables that capture such modifications are also included.<sup>26</sup>

A group of regressions are presented, from simpler to more complex models, in order to verify the robustness of each variable and to avoid the omission of relevant variables. The models are estimated with the AFOREs that participated in the industry.<sup>27</sup>

Several models are estimated for each period. For the first one, January 1999 to September 2002, regressions identify the relationship between the number of transfers received by the AFOREs and important features of the industry. During the first years of the new pension system, marketing expenditure was an important determinant of the industry's behavior. At this point, attributes such as size and participation within a financial group or insurance company were also relevant to shape the market.

---

<sup>23</sup> We lagged both variables in order to mitigate endogeneity problems and expressed them in logarithms.

<sup>24</sup> The Chow Test objective was to verify the null hypothesis that the coefficient vectors are the same in both periods.

<sup>25</sup> The ranking index is a measure that encompasses the prices that are charged in the AFORE industry (flow and asset fees). Given that the price ranking was not published until 2005, we decided to estimate the model considering both fees separately.

<sup>26</sup> Regulatory changes: in July 2002 the switching process time was reduced from 3 months to 13 days. The process initiates in the AFORE that receives the customer while the AFORE that loses the customer validates the worker's signature; in May 2003 the entity that manages the system's data base verifies signatures; in June 2004 the AFORE that loses the customer stops taking part in the switching process.

<sup>27</sup> Two AFOREs that showed considerable higher correlation between sales agents and marketing expenditure were left out from the sample in order to avoid collinearity problems.

During this period, as depicted in *Regression Analysis 1*, marketing expenditure is significant at 1 per cent in models M1 and M2, while for M3, it is not. This variable is crucial to explain transfers between AFOREs and shows that during the first years of the industry, marketing expenditure played an important role in attracting workers. As for sales agents, its significance level varies depending on whether the model controls for the size of the AFORE and on the inclusion of other explanatory variables. At this point, sales agents are not key in explaining transfers, being significant only in M2.

For the first period, transfers respond to changes in prices, particularly to the asset fee, while the flow fee is important in M1 and M3, but not in M2. On the other hand, nominal returns are not significant in M2 and M3, and when they are significant in M1, its sign is not the expected one. This may be due either to the lack of information of workers during the selection of AFORE or to some misunderstanding of the information provided.

The size of the AFORE is significant when considered. In these cases, it captures some of the effect of sales agents. Finally, results confirm that an AFORE that is part of a financial group might have an extra advantage in gaining workers, perhaps due to considerations on its technical expertise in the design of retirement plans or portfolios or simply because of economies of scale.

In sum, marketing expenditure, the number of sales agents or size of the AFORE and being part of a financial group play an important part in explaining switches during the first period, while the effect of prices is not clear cut: asset fees are statistically significant most of the time and flow fees are significant to a lesser extent. Returns are not relevant in the analysis.

For the second period, October 2002 to December 2006, the models are expanded to control for changes in regulation that provided more flexibility to the switching process. It is thus possible to confirm the importance of changes in regulation, as well as the effect of sales agents on the escalation of switches after October 2002.

On January 2005, regulation allowed workers to transfer their accounts among pension funds before completing a year in an AFORE, as long as the funds were transferred to a pension fund that had a lower one-year Equivalent Fee.<sup>28</sup> As a result, a worker could transfer its account several times in a year provided that he moved his funds to an AFORE with a lower Equivalent Fee. Hence, it is expected that the AFOREs ranking in the comparative Equivalent Fee table became an important element determining the direction of switches, since pension funds with a relatively low Equivalent Fee were able to attract affiliates that had barely stayed with a previous fund. Thus, a variable that captures the AFORE ranking in the Equivalent Fee Table was also included.

---

<sup>28</sup> The one-year Equivalent Fee is an indicator that groups, under the assumptions that describe an average worker in the system, the various fees charged by an AFORE.

Table 1. Regression Analysis 1  
(First Period: January 1999–September 2002)

$\ln(TR)$	M1	M2	M3
$\ln(\text{Marketing Expenditure}(-1))$	<b>0.1212</b> 0.0438	<b>0.2602</b> 0.0492	<b>0.0664<sup>c/</sup></b> 0.0436
$\ln(\text{Salesmen}(-1))$	<b>0.0959<sup>c/</sup></b> 0.1181	<b>0.8438</b> 0.1338	<b>0.0420<sup>c/</sup></b> 0.1299
<i>Flow_Fee</i>	<b>-13.3629</b> 1.8447	<b>-0.2840<sup>c/</sup></b> 1.5404	<b>-15.5929</b> 1.8420
<i>Asset_Fee</i>	<b>-0.1279<sup>b/</sup></b> 0.0731	<b>-0.3483</b> 0.0882	<b>-0.1976</b> 0.0731
<i>Nom_Return</i>	<b>-6.9041<sup>a/</sup></b> 3.2841	<b>1.9336<sup>c/</sup></b> 4.1475	<b>-0.7916<sup>c/</sup></b> 3.3901
<i>Financial Group</i>		<b>0.7736</b> 0.1817	<b>0.7472</b> 0.1481
<i>Insurance Group</i>		<b>0.4677<sup>a/</sup></b> 0.2039	<b>0.2608<sup>c/</sup></b> 0.1673
<i>Large Size AFORE</i>	<b>2.8548</b> 0.2600		<b>2.8446</b> 0.2504
<i>C</i>	<b>23.6150</b> 3.8474	<b>-3.0105<sup>c/</sup></b> 3.9416	<b>19.9669</b> 3.7971
<b>R<sup>2</sup></b>	<b>0.6748</b>	<b>0.5539</b>	<b>0.7046</b>
<b>Adjusted R<sup>2</sup> -</b>	<b>0.6671</b>	<b>0.5416</b>	<b>0.6953</b>

Where:  
 $\ln(\text{Marketing Expenditure}(-1))$  = Total weighted expenditure in marketing in the receiving AFORE lagged one period.  
 $\ln(\text{Salesmen}(-1))$  = Natural logarithm of the number of sales agents in the receiving AFORE lagged one period.  
*Nom\_Return* = Nominal return.  
*C* = Constant.  
<sup>a/</sup> Significant at 5%.  
<sup>b/</sup> Significant at 10%.  
<sup>c/</sup> It is not significant.  
Standard errors are below the coefficients.

Source: Retirement Saving System Database.

An important difference between the models for the first and the second time period is the relevance of marketing expenditure. During the first period, in which the industry was shaping itself, this variable was fundamental in determining switches, whilst, in the second period, it is not significant at all. In contrast, the number of sales agents appears to be highly important in every model despite the variables considered.

As shown in *Regression Analysis 2*, prices lose their relevance as determinants of transfers. The position of the AFORE according to the Equivalent Fee Table is statistically significant only at 5 percent. The asset and flow fees also lose their relevance in explaining switches among pension fund managers, and their coefficients are lower than the ones obtained for the number of sales agents, which in this period—once regulation was amended to stimulate transfers—become the key determinants of transfers. The results confirm the importance of sales agents in the switching process and the fact that an adverse position in the fee table limits the ability of AFOREs to attract affiliates.

As in the first period, nominal returns seem to have no effect on switches. Returns are significant but the sign is not correct.

Regulatory changes during the second period were a catalyst for switches, specifically, those that took place between May 2003 and July 2005. Furthermore, belonging to a financial group continues to be important in determining switches, while being part of an insurance group loses all its relevance. The size of the AFORE remains significant, implying that a



larger share of the market, and hence its presence as a financial service provider contributes to attract more accounts.

Table 2. Regression Analysis 2  
(Second Period: October 2002–December 2006)

<i>ln(TR)</i>	M1	M2	M3	M4	M5	M6
<i>ln(Marketing Expenditure(-1))</i>	<b>0.0028<sup>c/</sup></b> 0.0250	<b>0.0286<sup>c/</sup></b> 0.0251	<b>0.0174<sup>c/</sup></b> 0.0148	<b>0.0040<sup>c/</sup></b> 0.0150	<b>0.0051<sup>c/</sup></b> 0.0165	<b>0.0032<sup>c/</sup></b> 0.0171
<i>ln(Salesmen(-1))</i>	<b>0.6641</b> 0.0635	<b>0.5627</b> 0.0641	<b>0.4481</b> 0.0437	<b>0.3800</b> 0.0489	<b>0.3709</b> 0.0481	<b>0.3443</b> 0.0497
<i>Ranking</i>	<b>0.0053<sup>a/</sup></b> 0.0022		<b>-0.0032<sup>a/</sup></b> 0.0015		<b>-0.0035<sup>a/</sup></b> 0.0016	
<i>Flow_Fee</i>		<b>3.1722</b> 0.5285		<b>0.5928<sup>b/</sup></b> 0.3261		<b>0.3838<sup>c/</sup></b> 0.4122
<i>Asset_Fee</i>		<b>0.0987<sup>b/</sup></b> 0.0543		<b>0.0154<sup>c/</sup></b> 0.0371		<b>0.0400<sup>c/</sup></b> 0.0371
<i>Nom_Return</i>	<b>-3.1148</b> 1.0039	<b>-3.0569</b> 0.9738	<b>-1.7274<sup>a/</sup></b> 0.6775	<b>-1.7017<sup>a/</sup></b> 0.6787	<b>-2.0903</b> 0.6737	<b>-2.1170</b> 0.6764
<i>Rc0503</i>			<b>1.7539</b> 0.0993	<b>1.7130</b> 0.1002	<b>1.7457</b> 0.0984	<b>1.6965</b> 0.1008
<i>Rc0705</i>			<b>1.0312</b> 0.0735	<b>1.0378</b> 0.0737	<b>1.0829</b> 0.0765	<b>1.0521</b> 0.0781
<i>Financial Group</i>			<b>0.4214</b> 0.0780	<b>0.3097</b> 0.0750	<b>0.3094</b> 0.0828	<b>0.2548</b> 0.0799
<i>Insurance Group</i>			<b>0.1995<sup>a/</sup></b> 0.0808	<b>0.0445<sup>c/</sup></b> 0.0871	<b>0.0932<sup>c/</sup></b> 0.0840	<b>-0.0008<sup>c/</sup></b> 0.0866
<i>Medium Size AFORE</i>	<b>-1.0678</b> 0.2028	<b>-1.6320</b> 0.2175			<b>0.0700<sup>c/</sup></b> 0.1479	<b>-0.1392<sup>c/</sup></b> 0.1727
<i>Large Size AFORE</i>	<b>-0.7585</b> 0.2188	<b>-1.5260</b> 0.2521			<b>0.4130<sup>a/</sup></b> 0.1671	<b>0.1873<sup>c/</sup></b> 0.2056
<i>C</i>	<b>7.8016</b> 1.0975	<b>5.8360</b> 1.1226	<b>5.4045</b> 0.7547	<b>5.2212</b> 0.7669	<b>6.2232</b> 0.7655	<b>6.0897</b> 0.8023
<i>R<sup>2</sup></i>	<b>0.2358</b>	<b>0.2805</b>	<b>0.6616</b>	<b>0.6610</b>	<b>0.6739</b>	<b>0.6720</b>
<i>Adjusted R<sup>2</sup></i>	<b>0.2271</b>	<b>0.2709</b>	<b>0.6565</b>	<b>0.6552</b>	<b>0.6677</b>	<b>0.6652</b>

Where:

*ln(Marketing Expenditure(-1))* = Total weighted expenditure in marketing in the receiving AFORE lagged one period.

*ln(Salesmen (-1))* = Natural logarithm of the number of sales agents in the receiving AFORE lagged one period.

*Ranking* = Ranking of the Equivalent Fee over balance during 1 year.

*Nom\_Return* = Nominal return.

*Rc0503* = May 2003 Regulatory Change.

*Rc 0604* = June 2004 Regulatory Change.

*Rc 0705* = July 2005 Regulatory Change.

*C* = Constant.

<sup>a/</sup> Significant at 5%.

<sup>b/</sup> Significant at 10%.

<sup>c/</sup> It is not significant.

Standard errors are below the coefficients.

Source: Retirement Saving System Database.

Finally, models M5 and M6, which include most of the variables, explain switches in 66.7 and 66.5 percent, respectively. In general, switches among pension fund managers are explained mainly by sales agents' activity, AFORE size and whether they belong or not to a financial group.

Notwithstanding, it can also be useful to assess whether the objective of switching has been met and has in fact led to position the workers' assets in a more convenient AFORE. Armenta (2007) considers the account transfers that took place from 1998 to 2006 and analyzes if the receiving AFORE charges a higher or lower fee than the one were the funds

came from. Armenta analyzes separately the cases of the flow and asset fee and finds out that through the years, the share of account shifts toward fund managers that charge a higher fee has increased.<sup>29</sup> Consequently, during 2006, 41.8 percent of transfers took place to AFOREs with higher flow fees and 42.3 percent to those with higher asset fees. With regard to returns, Armenta finds out that the percentage of shifts to AFOREs with lower returns increased from 32.9 percent in 1998 to 52.7 percent in 2006.

Armenta's analysis suggests that a significant portion of pension account transfers has not been beneficial for affiliates. However, in Armenta's study returns are considered independently from each of the two fees, hence the analysis offers a partial view of the switching process. An alternative option to analyze the merit of the observed account transfers is to integrate the flow and asset fees into a single indicator, such as the Equivalent Fee, and then compare returns and fees in both the AFORE that received the account and the one that yielded it.

Figure 3 shows in four quadrants the 3.8 million account shifts that took place during 2006. Quadrant I includes all the account switches that took place during 2006 for which both the return and the Equivalent Fee of the receiving AFORE are more favorable for the worker (22.3 percent). On the other hand, quadrant III shows all account shifts for which return is lower and the fee is higher in the AFORE that received the transfer. Hence, all the workers that shifted their accounts and appear in quadrant III ended in a worse off situation (39.9 percent). Since quadrants II and IV present a negative and a positive element, it is not possible to determine whether workers that fell in these quadrants improved or worsened their individual situation. Quadrant II includes switches to AFOREs with a higher return and a higher fee (24.2 percent), while quadrant IV includes shifts to fund managers with a lower return and a lower fee (13.6 percent). As shown in Figure 3, it does not seem that the direction of account transfers among AFOREs responds to return or fee considerations.<sup>30</sup>

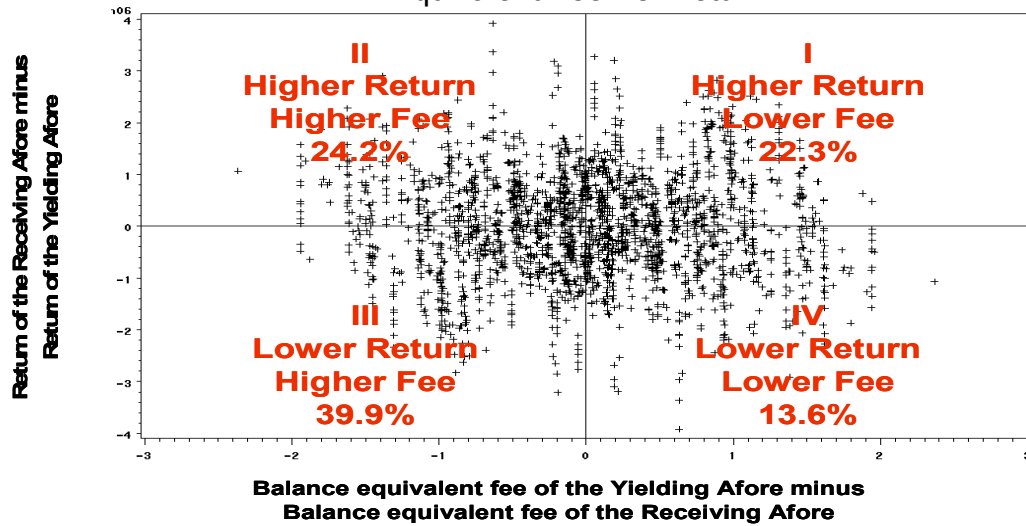
As previously set forth, the Equivalent Fee integrates into a single indicator, both flow and asset fees. However, in order to do so, the indicator rests on the assumption that workers' features and characteristics resemble those of the average worker of the system. Nonetheless, the particular case of each worker is unique, and is thus different than that of the average worker considered in the estimation of the Equivalent Fee. Therefore, due to the specific circumstances of each worker, the flow fee may be more relevant than the asset fee or vice versa.<sup>31</sup>

<sup>29</sup> Up to March 2008, regulation in Mexico allowed AFOREs to charge two different fees. The flow fee is a percentage of the funds that are deposited in the worker's account and the asset or stock fee is charged on the assets under management. As of March 2008, AFOREs can only charge the asset fee.

<sup>30</sup> Figure 3 is a snapshot of transfers' distribution in 2006. By no means one can assume that the observed fees and returns will prevail in the future. Nonetheless, the analysis suggests that most of the transfers are not driven by fee or return concerns.

<sup>31</sup> For example, young workers with less time in the system should be more sensitive to the flow fee than to the asset fee. On the other hand, workers close to retirement, with a significant balance in their accounts, should be more responsive to changes in the stock fee than to those in the flow fee.

Figure 3. Switches In 2006  
Equivalent Fee Vs. Return



**•In 2006, 3.87 million workers switched their accounts.**

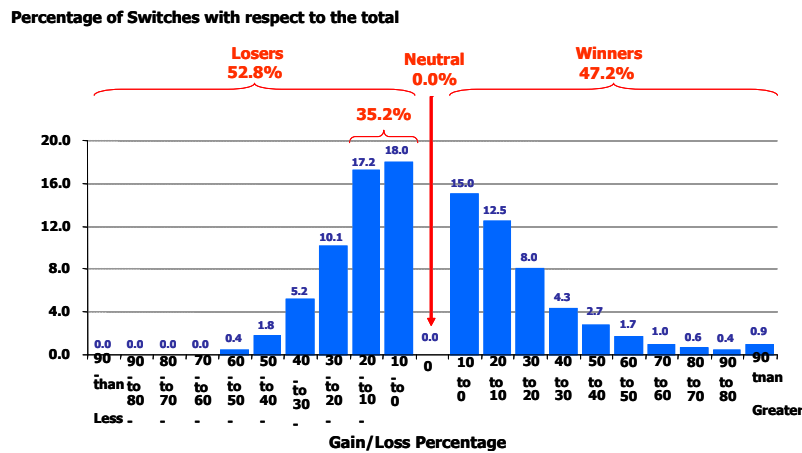
Source: CONSAR

In order to obtain more precise results of the impact of switching accounts among AFOREs on the pension that workers will receive at retirement, we proceeded to estimate the effect of switching over the future pension of all workers that transferred their account to another AFORE during 2006, taking into consideration the specific characteristics of each one of the workers. These characteristics include age, years in the system, balance in the worker's account, frequency of contributions and wage. In addition, the observed returns and the prevailing fee structures of both the receiving and the yielding AFOREs were considered.<sup>32</sup>

The analysis shows that for 52.8 percent of the observed account transfers in 2006, the referred transfer will result in a lower pension. On the other hand, 47.2 percent of the workers that shifted their resources to another pension manager will receive a higher pension. Figure 4 also shows the gain or loss of resources as a result of switching. For example, 18.0 percent of workers lose up to 10 percent of their assets by transferring their account to another AFORE, 35.2 percent lose up to 20 percent by changing fund manager, etc.

<sup>32</sup> For analysis purposes, we assume that the prevailing fee structures, the announced loyalty discounts and the observed returns of AFOREs, remain unchanged until each of the workers considered reaches retirement.

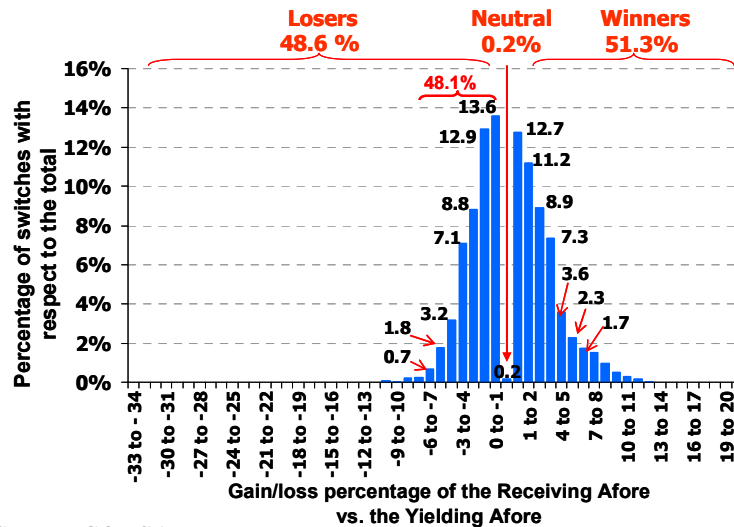
Figure 4. Gain or Loss after Switching Workers' Estimated Balance at the Age of Retirement  
(Percentage)  
Receiving AFORE vs. Yielding AFORE



Source: CONSAR.

The same exercise was done for a five-year period, taking into consideration the Mexican AFORE “turn-over” ratio. In this case, 48.6 per cent of the workers lose by switching their AFORE while 51.3 of them have a larger balance in their account after a five-year period. As in the previous exercise, a significant portion of the balance in the workers’ account is lost as a result of having chosen another AFORE. For example, 48.1 percent of workers lose up to 7 percent of their assets. Given that the time period considered is shorter than in the previous exercise, losses are also lower.

Figure 5. Gain or Loss after Switching Workers' Estimated Balance after a Five-Year Period  
(Percentage)  
Receiving AFORE vs. Yielding AFORE

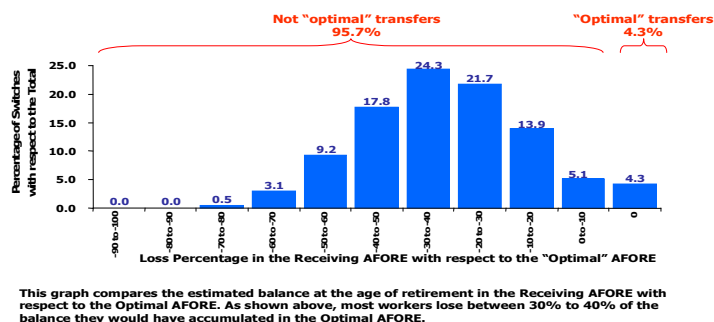


Source: CONSAR.

A similar and more illustrative exercise consists in comparing the assets that the worker would receive at retirement, in case he decided to stay in the AFORE he chose when switching during 2006, to the amount he would receive had he transferred to the “optimal” AFORE according to his individual characteristics (i.e. age, wage, account balance, etc.). CONSAR’s web page, through the so called SAR calculator, allows people to carry out an exercise to determine the most convenient or “optimal” AFORE, according to their specific individual characteristics. Even if the rational choice of an AFORE by a consumer may take into consideration factors such as brand, service quality and return and price expectations, which are not included in the SAR calculator exercise, for the purpose of our analysis we will consider the result of the SAR calculator exercise as “optimal” for an informed worker that makes his decision by considering his own specific case as well as the observed fees and returns of all AFOREs. Hence, the exercise compares for each of the 3.8 million account switches that took place in 2006, taking into consideration the individual characteristics of each worker, the balance of his account at retirement in the AFORE he decided to switch to, against the balance he would receive had he chosen the “optimal” fund manager suggested by the SAR calculator.

Figure 6 shows that 95.7 percent of the account shifts that took place during 2006 were not optimal, since the fund manager selected by the workers will bring about a lower pension than the one they would get had they chosen the “optimal” AFORE, according to the SAR calculator.

Figure 6. Loss from not Switching to the “Optimal” AFORE Workers’ Estimated Balance at the Age of Retirement (Percentage)  
Receiving AFORE vs. Yielding AFORE

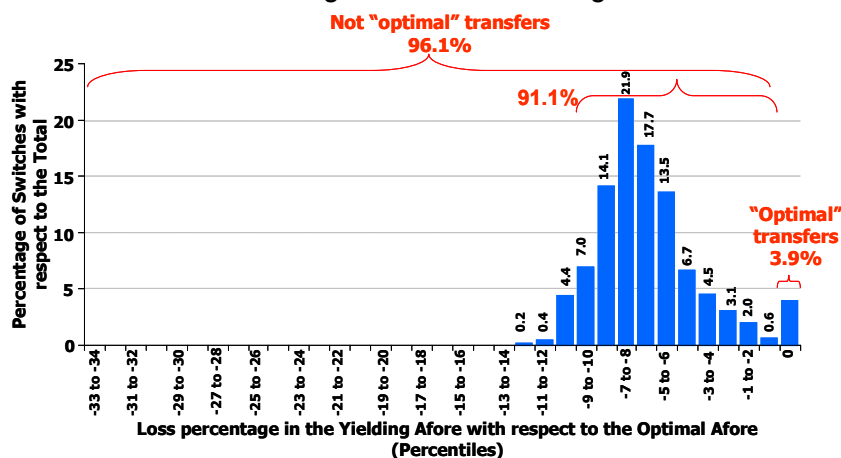


Source: CONSAR.

The analysis shows that, for example, 24.3 percent of the workers will record a 30 to 40 percent loss in their balance at retirement, compared to the balance they would receive had they selected the “optimal” fund manager. Likewise, the balance in the individual accounts at retirement will be 40 to 50 percent lower for 17.8 percent of the workers, when compared to the assets they would obtain had they opted for the “optimal” choice when selecting AFORE in 2006.

The exercise was also done for a five-year period. In this case, 96.1 percent of workers made a “sub-optimal” transfer, while only 3.9 per cent made an “optimal” decision. As in the previous exercise, a relevant share of the balance in the workers’ accounts is lost as a result of “sub-optimal” switching. That is, 91.1 percent of workers forego up to 10 percent of their balance by not selecting the “optimal” AFORE.

Figure 7. Loss from not Switching to the “Optimal” AFORE Workers’ Estimated Balance after a Five-Year Period (Percentage)  
Receiving AFORE vs. Yielding AFORE



Source: CONSAR.

Even if these exercises rest on the extreme assumption that the AFOREs fee structure and returns remain constant up to the retirement age of the worker or after a five-year period, the analysis shows that pension account transfers would not result in a better outcome for most of the workers. That is, evidence indicates that switches among AFOREs have not been the result of informed decisions, and that transfers respond to factors other than price and return. Furthermore, it is clear that an inadequate choice of fund manager has a relevant and, thus, non negligible effect on the workers' future pension.

### **B. The Effectiveness of an Increase in Supply**

Given that the consumer's lack of involvement in the system has hindered competition among AFOREs to render significant benefits to workers, one could envisage that a policy aimed at increasing the number of pension fund managers would result in higher competition, which would in turn contribute to the reduction of fees and enhance returns for the workers' benefit. Since 2002, and with the aim of fostering competition through a larger number of AFOREs in the system, the regulatory authority in Mexico assigns those workers that enter the labor market but do not choose AFORE, to those funds that charge a comparatively lower Equivalent Fee.<sup>33</sup> In an extreme case, one could imagine a situation in which fund managers start operations with a relatively low fee structure and hence benefit from the allotment of workers that do not select AFORE. From December 2002 to December 2006 the number of AFOREs increased from 11 to 21.

Contrary to expectations, the higher number of market participants, has not brought improved competition nor it has added value to the industry. For example, some services provided by the new participants are delivered only to registered workers, but not to those who have been assigned.<sup>34</sup> Furthermore, in many cases the number of services provided by the new fund managers and their quality is lower than those offered by AFOREs that have been in the industry for a longer period of time.<sup>35</sup> One would expect that new participants, in an attempt to differentiate themselves from the existing competitors and hence gain market share, would offer new and attractive services to the consumer. Nonetheless, the reduced involvement of workers with respect to their pension has not stimulated new participants to foster more competitive conditions that would result in benefits for the consumer.<sup>36</sup> Supposedly,

---

<sup>33</sup> The fee indicator that determined the allotment of workers (Equivalent Fee) changed through the years. The most recent indicator rested heavily on the level of the flow fee and less on the asset fee. The different weight of the two fees in the indicator resulted in AFOREs making significant reductions in their flow fees and important increases in their asset fees. This mixture of fee movements was reflected in a decline in the fee indicator. As of March 2008, the allotment of workers that do not choose AFORE takes place according to a net return indicator.

<sup>34</sup> Those AFOREs with assigned workers are expected to formally register the referred workers. Once the worker is registered, he is officially affiliated to the system. Only registered workers get the services offered by the AFORE, such as receiving their account statement. New AFOREs manage the funds of 12% of the workers in the system. However, given the high percentage of the assigned workers in comparison to the total registered population, only 4% of workers in the new AFOREs are able to benefit from the services offered.

<sup>35</sup> Such as personal services, return, management quality, etc.

facilitating the transfer of accounts among AFOREs should have increased the demand's response to fees and returns, while a sizable number of participants in the market was expected to promote a more effective competition that would bring along increased benefits to workers. The evidence seems to contradict both conjectures.

In order to assess the effect of a higher number of pension fund managers on the consumer, the following exercise was carried out: balances up to December 2006 were estimated for hypothetical cases of workers with different wage levels for each one of the AFOREs that shaped the industry when the new system started operations in 1997. That is, for the pension fund managers that began the system of individual accounts (original AFOREs) we added contributions according to the hypothetical wage cases and observed returns, while observed fees were deducted.<sup>37</sup> On the other hand, balances were projected assuming that each type of worker transferred his account to each one of the AFOREs that began operations as of 2003.<sup>38</sup> The comparison between the two estimated balances is revealing.

Table 3. Gain/Loss in Balances for Hypothetical Cases of Workers that began accruing benefits at the start of the system and switched to New AFOREs  
(Balances for 2006)

Hypothetical Case: Workers that earn three minimum wages

New AFORE	Original AFORE									
	Afore 18	Afore 12	Afore 7	Afore 16	Afore 3	Afore 20	Afore 21	Afore 17	Afore 8	Afore 1
Afore 5	-1.8%	3.2%	3.6%	2.8%	4.0%	0.9%	1.0%	-1.8%	1.8%	-1.4%
Afore 2	-2.8%	-0.4%	0.1%	-0.7%	2.6%	-1.3%	-1.7%	-4.3%	-2.1%	-2.1%
Afore 4	-3.8%	-2.4%	-2.1%	-2.1%	2.1%	-3.0%	-2.8%	-5.4%	-3.5%	-2.6%
Afore 13	-2.8%	-2.8%	-2.3%	-2.3%	-0.6%	-2.6%	-2.7%	-3.3%	-3.1%	-2.3%
Afore 10	-5.6%	-0.9%	-0.4%	-1.1%	0.0%	-3.0%	-2.9%	-5.5%	-2.1%	-5.2%
Afore 15	0.2%	1.5%	2.1%	0.8%	4.7%	0.5%	0.8%	-1.4%	0.1%	0.7%
Afore 11	-0.1%	-0.1%	0.4%	0.4%	2.1%	0.1%	0.0%	-0.7%	-0.5%	0.4%
Afore 9	4.5%	10.0%	10.0%	8.9%	12.2%	7.6%	7.7%	4.1%	7.3%	6.0%
Afore 6	-3.1%	2.8%	2.9%	2.0%	4.6%	0.5%	0.5%	-2.9%	0.4%	-1.4%
Afore 14	-1.4%	3.8%	3.8%	2.7%	5.9%	1.5%	1.6%	-1.8%	1.3%	0.0%
Afore 19	-0.4%	-0.4%	0.1%	0.0%	1.8%	-0.2%	-0.3%	-1.0%	-0.8%	0.1%

Source: CONSAR.

In general terms, despite the fact that the number of AFOREs increased from 11 to 21 from December 2002 to December 2006, transferring the hypothetical balance of a worker from

<sup>36</sup> Those AFOREs that started operations around 2002 recovered their investment in only 20 months. Such a short period of time compares negatively with that of a worker that enters the system. Given the anticipated charge that the flow fee represented, it took workers more than 40 months to get positive net returns in their account.

<sup>37</sup> Projections were done for workers earning 1, 3, 5, 10, 15 and 20 minimum wages, assuming that they entered the labor force in July 1997 and contributed to the system during the whole period.

<sup>38</sup> It is assumed that an account transfer from an original AFORE takes place at the time the new AFORE starts operations.



one of the founding AFOREs to one of the new ones, does not provide an additional benefit to the system since the difference in the two projected balances is close to zero.<sup>39</sup>

With the exception of only one new AFORE, number 9, where a gain in the 2006 balance is obtained regardless the AFORE the account is transferred from, the rest of the results are mixed. For example, transferring resources from AFORE 3 to AFORE 5 implies a 4.0 percent gain, while shifting an account from AFORE 18 to AFORE 5 entails a 1.8 percent loss in the 2006 balance. Moreover, most of the workers that transferred their resources out of AFOREs 17 and 18 to any new AFORE registered a smaller balance in their account.<sup>40</sup>

One of the most commonly used arguments to emphasize the added benefit of the new AFOREs is their effect on competition and fees. With the intent to analyze the end result of a higher number of competitors on fees and on workers' account balances, we proceeded to project the existing balances in December 2002 to December 2006, of those workers that had their pension account in one of the original AFOREs and still kept their funds with the same pension fund manager in December 2006.<sup>41</sup> Individual contributions and observed returns were added to the existing balances in 2002, and fees were deducted according to the prevailing fee structure in 2002. That is, given that the objective is to analyze the effect of the larger number of providers on fees, which in turn are translated into workers' account balances, the comparison between the observed balances in 2006 and those that would have been obtained in case no new AFOREs had entered the market, which are captured by the assumption that the prevailing fee structure in 2002 would have been kept unchanged until December 2006, gives us an idea of the contribution of new participants to the consumer's benefit.

The comparison of individual accounts' balances for December 2006 shows that for 46.9 percent of workers that did not switch AFORE, the observed fees from December 2002 to December 2006 resulted in the same (21.9 percent) or lower (25.0 percent) balance than the one that would have resulted in case the fee structure in place in December 2002 had been maintained until December 2006. That is, only for 53.1 percent of workers, the entrance of new AFOREs implied a higher balance in their accounts than the one that would have resulted with the unaltered December 2002 fee structure. Furthermore, the observed balance of all the accounts of workers that remained in the same AFORE from 2002 to 2006 is only 0.39 percent higher than the balance that would have been obtained had the fee structure in effect in 2002 remained unchanged. That is, evidence does not seem to support the fact that a higher number of participants has played a role in improving the consumer's condition.

---

<sup>39</sup> Weighted average of assets managed by each AFORE.

<sup>40</sup> Results presented are for workers earning 3 minimum wages. Similar results were obtained for workers earning 1, 5, 10, 15 and 20 minimum wages.

<sup>41</sup> The number of workers that appears in the same AFORE in December 2002 and in December 2006 is 20,089,241. This does not imply that workers stayed in the same AFORE during the whole period, which would have given us a more precise result.

Table 4. Winners and Losers Due to Decreases in Fees<sup>1</sup>

AFORE	Members 2002 - 2006	Winners given Decreases in Fees from the Total of Workers	Losers given Decreases in Fees from the Total of Workers	Workers with neither Gain nor Loss given Decreases in Fees	% Winners	% Losers	% Neutral
Afore 1	1,354,223	0	0	1,354,223	0.0	0.0	100.0
Afore 7	1,867,457	1,844,140	0	23,317	98.8	0.0	1.2
Afore 8	2,200,851	2,181,804	0	19,047	99.1	0.0	0.9
Afore 3	1,409,788	1,073,829	299,544	36,415	76.2	21.2	2.6
Afore 12	3,188,693	1,030,566	2,141,378	16,749	32.3	67.2	0.5
Afore 17	1,945,696	1,928,935	0	16,761	99.1	0.0	0.9
Afore 20	1,814,252	540,910	0	1,273,342	29.8	0.0	70.2
Afore 18	3,817,356	1,193,993	2,577,057	46,306	31.3	67.5	1.2
Afore 16	880,741	871,915	1,018	7,808	99.0	0.1	0.9
Afore 21	1,610,184	0	0	1,610,184	0.0	0.0	100.0
<b>Total</b>	<b>20,089,241</b>	<b>10,666,092</b>	<b>5,018,997</b>	<b>4,404,152</b>	<b>53.1</b>	<b>25.0</b>	<b>21.9</b>

<sup>1/</sup> Workers that stayed in the original AFOREs from 2002 to 2006.

Source: CONSAR.

Table 5. Change in Balances due to Decreases in Fees

<b>AFORE</b>	<b>Members 2002 - 2006</b>	<b>Current Balance 2006</b>	<b>Projected Balance 2006</b>	<b>Total Loss or Gain</b>
<b>Afore 1</b>	1,354,223	31,729	31,729	0.0%
<b>Afore 7</b>	1,867,457	25,213	24,719	2.0%
<b>Afore 8</b>	2,200,851	32,074	31,682	1.2%
<b>Afore 3</b>	1,409,788	35,020	34,620	1.2%
<b>Afore 12</b>	3,188,693	87,640	87,594	0.1%
<b>Afore 17</b>	1,945,696	36,668	36,431	0.7%
<b>Afore 20</b>	1,814,252	28,474	28,405	0.2%
<b>Afore 18</b>	3,817,356	101,414	101,544	-0.1%
<b>Afore 16</b>	880,741	10,762	10,712	0.5%
<b>Afore 21</b>	1,610,184	12,101	12,101	0.0%
<b>Total</b>	<b>20,089,241</b>	<b>401,095</b>	<b>399,537</b>	<b>0.39%</b>
1/ Workers that stayed in the original AFOREs from 2002 to 2006.				
Quantities in millions of Pesos.				

Source: CONSAR.

### III. CONSUMER'S "CONFUSION" AND "NOISE"

#### A. Theoretical Framework

Evidence shown in Section II confirms the demand for AFOREs low response to variables such as price and returns. In addition, the previous exercises illustrate that a greater number of AFOREs has not been translated into more competitive conditions for the benefit of workers. This section presents a theoretical framework that demonstrates that the existence of "noise" in the AFORE industry does not allow workers to correctly assess the characteristics of a specific good or service. Hence, given that consumers are not able to understand market's signals correctly, they show some "confusion" in their choice of AFORE. Contrary to what happens in markets where "noise" is not present and where competition "protects" the consumer, the existence of "confusion," even in highly competitive markets, allows suppliers, AFOREs in this case, to charge prices above their marginal cost.

The analysis is based on Gabaix and Laibson (2004), who show that in markets where consumers make product assessments affected by "noise," the disciplinary effect of competition is diminished. That is, since suppliers benefit from the complexity and the "noise" associated to the product they sell, a higher number of suppliers has a weak effect on the industry's mark-up.

Luce (1959) and McFadden (1981) analyze consumers' choice decisions in this type of markets using random utility models.<sup>42</sup> Within this framework, we use an application from Gabaix and Laibson (2004) and analyze the choice of AFORE when consumers are "confused."

#### The Model

##### *Consumers*

Consumers in this model are those workers that must choose an AFORE from a total of  $N$  possibilities. For consumer  $a$ , the service provided by AFORE  $i$  has complexity  $\sigma_i$ , value  $v_i$  and price  $p_i$ . However, workers can not observe directly  $\sigma_i$ ,  $v_i$  or  $p_i$ . Consumer  $a$  is only able to observe a utility signal  $U_{ia}$  from the services offered by each AFORE without being able to determine its individual components. Thus, the utility function is described as:

$$\begin{aligned} U_{ia} &= v_i - (p_i - \sigma_i \varepsilon_{ia}) \\ \varepsilon_{ia} &\approx F(0,1)_{iid} \end{aligned} \tag{1}$$

The term,  $\sigma_i \varepsilon_{ia}$  is constituted by two variables.  $\sigma_i$ , characterizes the complexity of each AFORE's good or service and,  $\varepsilon_{ia}$ , models the "noise" faced by consumer  $a$  when choosing the service of AFORE  $i$ . Likewise, we assume  $\varepsilon_{ia}$  with zero mean, unitary variance,  $f$  density

---

<sup>42</sup> For a detailed analysis see Anderson, de Palma and Thisse (1992).

function and an  $F$  cumulative distribution function that it is identically and independently distributed.

The previous assumptions imply that the true expected value of the service at the moment of selecting an AFORE is not known by the consumer. This may be due to several reasons. For example, advertisement campaigns create “noise” or the genuine price for the service might be difficult to understand for the consumer. Since the worker can only observe a utility signal  $U_{ia}$  for the service offered by an AFORE and is not able to unravel the constituent parts of the utility function, we assume that the worker chooses the AFORE with the highest signal value.

### ***Firms***

Each AFORE selects a price structure,  $p_i$ , and the level of complexity,  $\sigma_i$  for the service provided. Similarly, we assume that the complexity of the service directly influences its intrinsic valuation. Hence, valuation will be a function of the referred complexity,  $v_i = v(\sigma_i)$ . Moreover, the chosen  $\sigma_i$ , directly influences the “noise” perceived by workers.

Within the context of the AFORE market, we analyze the optimal choice of prices and service complexity through profit,  $\pi_i$ , maximization. From (2), AFOREs choose the control variables,  $p_i$  and  $\sigma_i$ :

$$\max_{p_i, \sigma_i} \pi_i = (p_i - c)D(p_i, \sigma_i) \quad (2)$$

where  $c$  is the marginal production cost and  $D(p_i, \sigma_i)$  the demand function for an AFORE.<sup>43</sup> Given that workers choose the service of AFORE  $i$  if that firm offers the highest value signal  $U_{ia}$ , then,  $D(p_i, \sigma_i)$  is equal to the probability that a consumer selects the good that offers the highest utility signal. Thus, workers will only demand AFORE  $i$  services if  $U_{ia}$  is strictly greater than the utility provided by any other AFORE, for example, AFORE  $j$ .

In order to solve (2), we define a new variable,  $x_i$ , which captures the valuation surplus a worker earns from choosing AFORE  $i$  as opposed to  $n - 1$  competitors.<sup>44</sup> Using this change of variable, we express prices as:

$$p_i(x_i, \sigma_i) = v(\sigma_i) - x_i - [v(\sigma) - p] \quad (3)$$

Substituting prices in (2) we obtain the new maximization problem:

---

<sup>43</sup> Annex I presents the solution to the model.

<sup>44</sup> Variable  $x_i$  is defined as:

$$x_i = v(\sigma_i) - p_i - [v(\sigma) - p] \quad (1a)$$

Notice that in the new maximization problem workers have to solve for  $x_i$  and  $\sigma_i$ .

$$\max_{x_i, \sigma_i} (v(\sigma_i) - x_i - [v(\sigma) - p] - c) D(x_i, \sigma_i) \quad (4)$$

Once the maximization problem has been formulated, AFOREs will obtain the mark-up,  $p - c$ , and the complexity of the service they provide,  $\sigma_i$ . To obtain these results, it is necessary to find the First Order Conditions with respect to  $x_i$  and  $\sigma_i$ :<sup>45</sup>

$$x_i : F_{x_i} (v(\sigma_i) - x_i - [v(\sigma) - p] - c) \cdot D(x_i, \sigma_i) + F_{x_i} (x_i, \sigma_i) \cdot (p_i - c) = 0 \quad (5)$$

$$\sigma_i : v'(\sigma_i) \cdot D(x_i, \sigma_i) + (p_i - c) \cdot F_{\sigma_i} (x_i, \sigma_i) = 0 \quad (6)$$

Once the First Order Conditions are obtained, we solve the equilibrium assuming that each AFORE charges the same price and expresses the demand as a function of the maximum “noise” value generated by any other AFORE different to AFORE  $i$ .<sup>46</sup> From (5) and (6) and from the definition of the maximum “noise,” we define the mark-up and service complexity and obtain the following expressions:

$$(p - c) = \frac{1}{n \cdot E[f(M_{n-1})]} \sigma \quad (7)$$

$$\sigma^* = v^{-1} \left( - \frac{E[f(M_{n-1}) \cdot M_{n-1}]}{E[f(M_{n-1})]} \right) \quad (8)$$

From (7) we observe that the mark-up is inversely proportional to the number of AFOREs in the industry and to the expected value of any density function evaluated at  $M_{n-1}$ . On the other hand, the mark-up is directly proportional to the complexity imposed by the AFOREs in the market,  $\sigma$ .

Intuitively, from (8) we derive a marginal rate of substitution between the market’s “noise” and the gain in value for workers. That is, as market “noise” increases, workers’ benefits decrease. These results, shown in Gabaix and Laibson (2004), generalize those obtained by

---

<sup>45</sup> To denote First Order Conditions we use the following notation:

$$\frac{\partial D(x_1, \dots, x_n)}{\partial x_i} = F_{x_i} (x_1, \dots, x_n) \quad (2a)$$

<sup>46</sup> To define the maximum “noise” value we use the following expression:

$$M_{n-1} = \max_{j \in \{1, \dots, n\}, j \neq i} \varepsilon_j \quad (3a)$$

Perloff and Salop (1985) who are able to derive the mark-up,  $p - c$ , but not the value of complexity,  $\sigma^*$ .

Equations (7) and (8) show that to evaluate the mark-up and the complexity of the product it is possible to use different “noise” distributions. Hence, mark-up results may vary according to the selected distribution.

Recall that  $M_{n-1}$  is the highest of any “noise” realizations from any AFORE other than the AFORE  $i$  and that, on average, there is a  $1/n$  probability to find a higher value than the maximum realization of “noise.” This suggests that we can define  $A_n \equiv \bar{F}^{-1}(1/n)$  and be sure that  $A_n$  is close to  $M_{n-1}$ .<sup>47</sup> Using  $A_n$  instead of  $M_{n-1}$ , allows us to obtain simpler equations to evaluate the mark-up and the service complexity. Thus, we derive the following equations:

$$(p - c) = \frac{1}{n \cdot f(A_n)} \sigma \quad (9)$$

$$\sigma^* = v^{-1}(-A_n) \quad (10)$$

According to Gabaix and Laibson (2004), (9) and (10) can be directly applied to the Normal, Gumbel, Exponential and Log-Normal distributions. In order to evaluate any other type of distribution it would be required to adjust each equation by the constant  $\Gamma(2 + \xi)$ .<sup>48</sup>

Given the above, for any type of distribution, the following expressions can be used:<sup>49</sup>

$$(p - c) = \frac{1}{n \cdot f(A_n) \cdot \Gamma(2 + \xi)} \sigma \quad (11)$$

$$\sigma^* = v^{-1}\left(-\frac{A_n}{\Gamma(2 + \min(\xi, 0))}\right) \quad (12)$$

$A_n$ ,  $\Gamma(z)$  and  $\xi$ , allow us to estimate (11) and (12) and thus the mark-up that exists in the AFORE industry for any kind of “noise” distribution. This implies that it is necessary to identify the “noise” distribution, which is what we aim to do next.

## B. Statistical Analysis of Possible “Noise” Distributions

Section II analyzed the switching process among AFOREs in 2006 and compared workers’ AFORE selection with the “optimal” choice according to their specific characteristics.<sup>50</sup>

<sup>47</sup> Refer to Annex I to see how  $A_n$  is derived.

<sup>48</sup> To see how this constant is obtained see Gabaix and Laibson (2004).

<sup>49</sup> To understand these equations, recall that  $P(\varepsilon \geq A_n) = 1/n$ ,  $\Gamma(z) = \int_0^\infty t^{z-1} e^{-t} dt$  is the Gamma distribution and  $\xi$  is the index that describes the distribution tail fatness. See Gabaix and Laibson (2004).

Based on this comparison, it was possible to determine the loss in each worker's pension balance at a specific moment in time, such as retirement, as a result of not choosing the "optimal" AFORE. Hence, using information of the observed pension account transfers between AFOREs during 2006 we define the "noise" to which consumers are exposed in the market, as the difference in the pension account balance that each worker would have obtained in a specific period of time had he chosen the "optimal" AFORE according to his own idiosyncratic features, and that of the account balance that he would obtain as a result of having chosen the AFORE to which he transferred his resources in 2006. That is, the existence of "noise" "confuses" consumers and prevents them from choosing the "optimal" AFORE.

The objective of this section is to characterize the AFORE industry's "noise" distribution function. As shown in the previous section, the existence and magnitude of mark-ups depends mainly on how the "noise" in the industry is distributed. Equilibrium mark-ups are proportional to "noise," thus higher "noise" levels lead to higher "confusion" and hence favor the presence of mark-ups. Once the "noise" distribution is determined, it is possible to analyze the way in which the number of AFOREs in the market affects the industry mark-up.

In order to derive the "noise" distribution in the AFORE industry, we use a time horizon related to each worker's retirement age. The time period considered allows us to compute the maximum percentage loss in a worker's pension balance when choosing an AFORE sub-optimally.<sup>51</sup>

### ***"Confusion" in worker's sub-optimal AFORE choice***

The following graph shows the "noise" distribution, that is, the way in which the pension balance loss that workers would have recorded for not choosing their AFORE "optimally" is distributed. Although losses vary according to worker's specific characteristics, all workers that transferred their account in 2006 would have had higher pension balances at retirement had they opted for their pension fund manager "optimally."

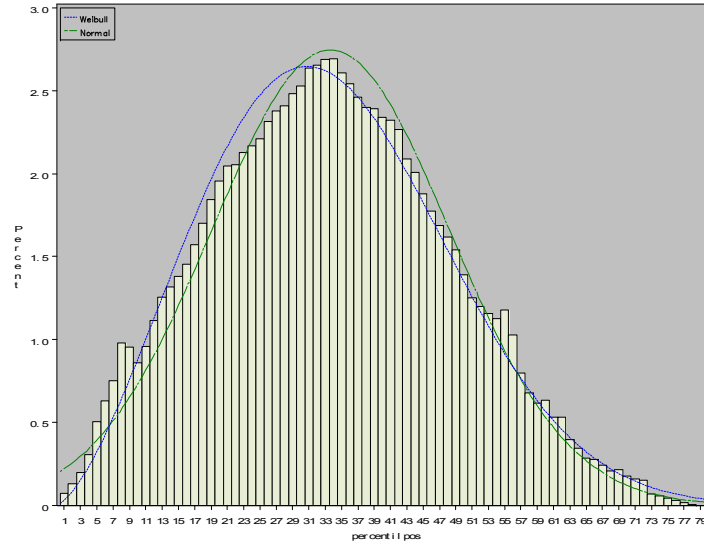
---

<sup>50</sup> As mentioned in section II, the "optimal" AFORE for each worker was obtained through the SAR calculator exercise. This calculator can be found in CONSAR's webpage. Even though the exercise makes some important assumptions, it provides the "optimal" AFORE choice for an informed worker that makes his decision based solely on current information.

<sup>51</sup> Given that evaluating pension balances' loss until the age of retirement relies on the assumption that once a consumer opts to switch to a specific AFORE he remains in that AFORE until retirement, the exercise was also implemented for a five-year period. This shorter time horizon reflects the Mexican AFORE "turn-over" ratio. As it will be seen, for the two time horizons considered, results do not differ.



Figure 8. “Noise Distribution” Percentage Loss in Pension Balances at Retirement Age due to “Sub-Optimal” Choice of AFORE Fitted by the Normal and Weibull Distributions



With the purpose of fitting the “noise” relative frequency histogram and determine its distribution, several goodness-of-fit<sup>52</sup> tests were performed<sup>53</sup> for the Gamma, Log-Normal, Normal and Weibull functions.<sup>54</sup>

<sup>52</sup> To characterize the “noise” distribution we did the following:

1. We defined the hypothesis test:
  - a.  $H_0: F_0(X) = F(X)$
  - b.  $H_A: F_0(X) \neq F(X)$
2. We evaluated the hypothesis test and decided either to reject or not to reject using the statistics of each of the following goodness-of-fit tests for several significance levels,  $\alpha = 10, 5$  y 1 percent:
  - a. Kolmogorov – Smirnov.
  - b. Cramer von Mises.
  - c. Anderson – Darling (Log – Normal, Normal and Gamma).

<sup>53</sup> The model developed by Gabaix and Laibson (2004) can be generalized to any distribution according to the fatness of its tails. Due to the above and the distribution we found for the market’s “noise,” we decided to evaluate those functions with medium fatness tails (Gamma, Log-Normal, Normal and Weibull). Thus, we left out distributions with no tails or relatively fat tails such as the Uniform and Power Law distributions, respectively.

<sup>54</sup> In order to estimate the three Weibull parameters we used the Maximum Likelihood method. The function is such that:

$$f(\theta; \alpha, \sigma) = \left(\frac{\alpha}{\sigma}\right) \cdot \left(\frac{\theta}{\sigma}\right)^{(\alpha-1)} \cdot e^{-\left(\frac{\theta}{\sigma}\right)^\alpha} \quad (4a)$$

(continued)

The results show that the null hypothesis is rejected for the four functions. However, the empirical fit of both, the Normal and Weibull distributions, to the “noise” distribution is almost perfect.<sup>55</sup> Moreover, considering the fit by quintiles, we see that the differences between the observed and estimated functions are minimal both for the Normal and Weibull distributions.<sup>56</sup>

---

The parameters are:

1. Lower Threshold =  $\theta$ .
2. Scale =  $\sigma$ .
3. Form =  $\alpha$ .

<sup>55</sup> The following table summarizes the results obtained from the goodness-of-fit tests using the Normal and Weibull distributions.

Goodness-of-fit Tests Results			
Function	Test	Statistic	<i>p</i> - Value
Normal	Kolmogorov- Smirnov	0.03	0.010
	Cramer von Mises	565.13	0.005
	Anderson - Darling	4,346.84	0.005
Weibull	Cramer von Mises	484.10	0.010
	Anderson - Darling	3,448.27	0.010
In every case the statistic is greater than the critical value for $\alpha = 10, 5$ and 1 percent. This means that in every case we reject $H_0$ .			

---

<sup>56</sup> Differences by quintiles are minimal for both distributions:

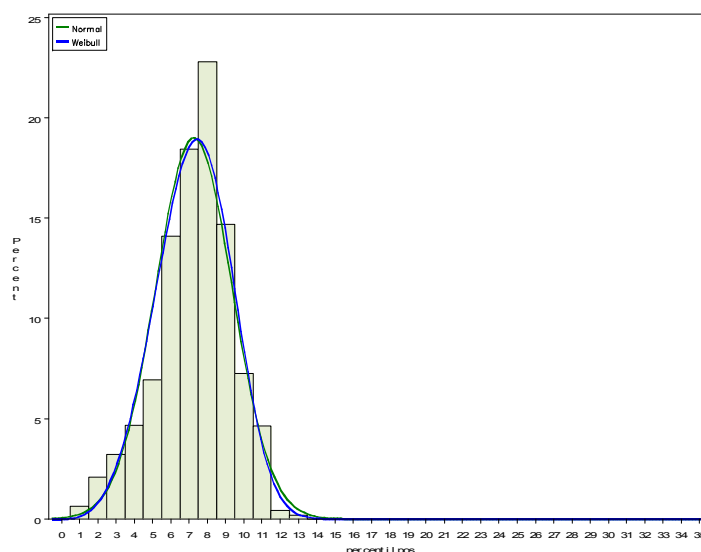
Differences by Quintile between the Observed and Estimated Function		
1	5.15	-0.93
5	0.24	-1.44
10	-1.03	-1.29
25	-0.85	0.07
50	-0.65	0.31
75	0.55	0.76
90	0.73	-0.06
95	0.45	-1.00
99	0.55	-2.17

---

Empirically, the fitting result of both distributions differs in very small numbers by quintile. Given this result and in order to apply the model described in the previous section, we use both distributions to evaluate the mark-up's range.

The exercise is repeated taking into consideration the Mexican AFORE “turn-over” ratio which is around five years. The following graph shows the “noise” distribution considering losses in a five-year period as a result of not choosing the “optimal” AFORE. Although losses are not as high as in the previous exercise that computes balances at the age of retirement, all workers register smaller pension balances in a five-year period as a result of choosing their AFORE “sub-optimally.”

Figure 9. “Noise Distribution” Percentage Loss in Pension Balances After A Five-year Period Due to “Sub-Optimal” Choice of AFORE Fitted By The Normal and Weibull Distributions



As previously done, we fit the “noise” relative frequency histogram and determine its distribution through several goodness-of-fit tests for the Gamma, Log-Normal, Normal and Weibull distributions. As in the previous exercise that computes losses up to retirement, the results show that the null hypothesis is rejected for the four distribution functions. However, the empirical fit of both, the Normal and Weibull distributions, to the “noise” distribution seems adequate.<sup>57</sup>

<sup>57</sup> The following Table summarizes the results obtained from the goodness-of-fit tests using the Normal and Weibull distributions.

Goodness-of-fit Tests Results			
Function	Test	Statistic	<i>p</i> - Value
Normal	Kolmogorov- Smirnov	0.14	0.010
	Cramer von Mises	9,773.75	0.005
	Anderson - Darling	52,149.45	0.005
Weibull	Cramer von Mises	7,942.99	0.010

(continued)

As in the previous exercise, once we consider the fit by quintiles, we see that the differences between the observed and estimated functions are minimal both for the Normal and Weibull distributions. Given these results, we use both functions to evaluate the mark-up range that exists in the AFORE industry.<sup>58</sup>

### ***Analysis according to Worker's Contributions to their Pension Account, Wage and Gender***

When considering the total number of account transfers among AFOREs during 2006 in order to derive the “noise” distribution function, one could argue that worker’s heterogeneity might influence the results obtained. Therefore, in order to verify that the results in the previous section are robust, we divided the whole population that switched their accounts during 2006 according to some of their idiosyncratic features. That is, variables such as wage level, worker’s contributions to their account and gender, can be important to define workers’ behavior and their AFORE selection.

The population was divided according to the number of contributions to a worker’s pension account, wage level and gender.<sup>59</sup> As a result, we obtained twenty sub-groups for men and

Anderson - Darling	41,012.56	0.010
In every case the statistic is greater than the critical value for $\alpha = 10, 5$ and 1 percent. This means that in every case we reject $H_0$ .		

<sup>58</sup> Differences by quintiles are minimal for both distributions:

#### **Differences by Quintile between the Observed and Estimated Function**

Empirically, the fitting result of both distributions differs in very small numbers by quintile. Given this result and in order to apply the model described in the previous section, we use both distributions to evaluate the mark-up’s range.

<sup>59</sup> We derive the groups according to the following table:

(continued)

twenty sub-groups for women; for each group, we carried out goodness-of-fit tests similar to those practiced for the whole population. Results for the Normal and Weibull distributions were obtained for each of the men and women sub-groups. Out of eighty estimations, we noticed that each sub-group presents similar results to those obtained for the entire population.<sup>60</sup>

Given that dividing the sample by worker's contributions, wage and gender did not produce results that differ from those obtained previously, we now proceed to estimate the industry's mark-up using the Normal and Weibull distributions.<sup>61</sup>

### C. Mark-up Estimation in the AFORE Industry

Taking into consideration the previous statistical analysis, this section studies the cases in which the industry's "noise" is Normal and Weibull distributed. In addition, an exercise that shows the way in which the industry mark-up varies as the number of competitors increases is presented. Moreover, the analysis allows comparing, according to the selected "noise"

---

Groups according to Worker's Contributions, Wage and Gender				
Percentage of Worker's Contributions				
Minimum Wage	0 - 25	25 - 50	50 - 75	75 - 100
0 - 3	1	2	3	4
3 - 5	5	6	7	8
5 - 7	9	10	11	12
7 - 10	13	14	15	16
+ 10	17	18	19	20

---

<sup>60</sup> From all the results, there are some cases in which the null hypothesis is not rejected. However, these cases are specific to a small group based on workers' contribution to their account. From a total of 80 cases, just in 6 of them  $H_0$  is not rejected; besides, the size of these 6 samples is significantly lower than the other 74. Due to the above, the phenomenon of not rejecting the null hypothesis could be associated to the number of observations of each sample (See Canavos C. George, p. 365). This means that for a given significance level  $\alpha$  and an alternative hypothesis  $H_1$ , the probability of not rejecting  $H_0$  given it is false, could diminish as the number of observations,  $N$ , increases. If this is the case, the power of the test will converge to 1 as  $N$  grows to infinity. Thus, this result would imply that for samples with many observations the null hypothesis will be rejected given the fact that it is very difficult to specify an  $H_0$  which might be similar to the true distribution.

<sup>61</sup> Paradoxically, in every case, the null hypothesis is rejected; however, systematically, the graphs seem to be distributed as a Normal or a Weibull distribution. On the other hand, we know that differences in worker's contributions, wage and gender do not modify the "noise" distribution functional form, although the distribution shows three visible modes. In order to understand why this is the case, we proceeded to divide the distribution according to AFORE and worker's switching date. Once we did this grouping, we noticed that the modes were generated by the number of sales agents of each AFORE, which reflects each AFORE's market strategy.

distribution, the speed at which price converges to the marginal cost when the number of suppliers in the industry increases.<sup>62</sup>

With the aim of studying the way the number of firms affects prices in the industry, the equilibrium mark-up obtained for the two “noise” distributions analyzed is used. As mentioned in the previous section, both distributions have medium fatness tails but, when compared, the Weibull distribution shows thinner tails than the Normal distribution. This implies that the mark-up estimated using the Normal distribution will converge to zero at a lower rate than when the Weibull distribution is used. However, both distributions imply that competition has only a slight effect on the industry’s mark-up.

To estimate variations in mark-ups we use the following functions, which are closed forms for each distribution:

$$f_{Weibull}(\varepsilon) = \alpha \cdot (-\varepsilon)^{\alpha-1} e^{(-\varepsilon)^\alpha} \quad (13)$$

$$f_{Normal}(\varepsilon) = \frac{1}{\sqrt{2\pi}} e^{-\varepsilon^2/2} \quad (14)$$

Let us recall from equations (9) and (10) in section 3.1.2 that the basic requirement to obtain the mark-up is a density function denoted by  $f(A_n)$ . Since any function can be used, we propose  $h(t)$  such that:

$$h(t) \equiv f(A_n) \quad (15)$$

and, from Annex I we use:

$$A_n \equiv \bar{F}^{-1}\left(\frac{1}{n}\right) \quad (16)$$

in addition to the specific index  $\xi$ , that measures the tails’ fatness of the distribution.

The estimates for each of these equations and  $\xi$ , are computed by Gabaix and Laibson (2004) and shown in the following table:

---

<sup>62</sup> Based on the goodness-of-fit tests, there is not enough evidence to use either the Normal or Weibull distributions to estimate the AFORE industry’s mark-up. However, given the close fit by quintile in the distribution functions and the dubious rejection of the null hypothesis given the number of observations of each sample, we use both the Normal and Weibull functions to estimate the mark-up.

**Estimates for Normal and Weibull Elements**

Distribution	$A_n \equiv \bar{F}^{-1}\left(\frac{1}{n}\right)$	$h(t) \equiv f\left(\bar{F}^{-1}(t)\right)$	$\xi$
Weibull	$-n^{-1/\alpha} + o\left(n^{-1/\alpha}\right)$	$\approx \alpha \cdot t^{1-\frac{1}{\alpha}}$	$-1/\alpha$
Normal	$\approx \sqrt{2 \ln n}$	$\approx t \sqrt{2 \ln \frac{1}{t}}$	0

Once the expressions for each distribution are estimated, the mark-up's closed form equation for the AFORE industry is obtained. Based on Gabaix and Laibson (2004), the results are:

For  $\alpha \geq 1$ , the Weibull is expressed as:

$$p - c = \frac{1}{\alpha \cdot \Gamma(2 - 1/\alpha)} \cdot \frac{n^{1-\frac{1}{\alpha}}}{n-1} \cdot \sigma \approx \frac{1}{\alpha \cdot \Gamma(2 - 1/\alpha)} \cdot n^{-\frac{1}{\alpha}} \cdot \sigma \quad (17)$$

and the Normal as:

$$p - c \approx \frac{1}{\sqrt{2 \ln n}} \cdot \sigma \quad (18)$$

Both distributions have medium fatness tails; however, the Weibull distribution has thinner ones. Thus, if the number of AFOREs increases, the difference between price and marginal cost will decrease at a faster rate with the Weibull distribution than with the Normal distribution.

Excluding extreme cases such as the Uniform and Power Law functions, all distributions imply that if there is “noise” in the market, there will always exist an industry's mark-up. Nevertheless, the “noise” distribution actually considered will determine the speed at which the price converges to the marginal cost as the number of firms in the industry increases. Thus, if the “noise” is distributed as a Normal, the mark-up,  $p - c$ , is proportional to  $1/\sqrt{\ln n}$ .<sup>63</sup> This implies that more AFOREs will force the mark-up down, albeit at a very slow rate.

To prove the above we performed an exercise with 21 AFOREs and normalized the mark-up in  $n = 21$  to 1. This allowed us to estimate the mark-up as the number of competitors increases in multiples of 10. The exercise shows that even in a highly competitive industry, for instance, an industry with 1,000,000 AFOREs, there would still be a 47 percent mark-up, as opposed to the prevailing mark-up when there are 21 AFOREs in the market. On the other

<sup>63</sup> See Gabaix and Laibson (2004).

hand, if the “noise” is distributed as a Weibull, then the industry’s mark-up will decrease faster as the number of firms increases.

Table 6. Mark-up According to the Number of AFOREs<sup>64</sup>

Number of Firms	Mark-up with “noise” Weibull for $\alpha = 1$	Mark-up with “noise” Normal
21	1	1
100	0.21	0.81
1,000	0.021	0.66
10,000	0.0021	0.58
100,000	0.00021	0.51
1,000,000	0.000021	0.47

However, as pointed out in section III .b, the Normal distribution shows a better fit by quintiles to the observed “noise” distribution than the Weibull distribution. This means that, even if the number of AFOREs increases, the convergence of price to marginal cost will be very slow.<sup>65</sup> In contrast to the classical Cournot model where the mark-up is proportional to  $1/n$ , and where more firms imply a faster rate of convergence between price and marginal cost, in an industry with “noise,” likewise the AFORE market, the convergence rate will be slow, at a rate of  $1/\sqrt{\ln n}$ .

Thus, we can conclude that a policy aimed at increasing the number of AFOREs will not necessarily bring prices down. Policy efforts should thus mainly focus on reducing the prevailing “noise” in the industry through better and straightforward information.

<sup>64</sup> This exercise, far from showing the true mark-up in Mexico’s AFORE industry, tries to give an idea the way mark-ups would decrease as the number of participants increase. It is important to highlight that given the “noise” distribution, new participants in the industry might only have a marginal impact on the consumer’s situation.

<sup>65</sup> By quintile, when adding the proportional differences, we observe that the Normal distribution fits the “noise” distribution in 65 percent, while the Weibull distribution fits it in only 56 percent.



## IV. EMPIRICAL STUDY

### A. Measurement of “Noise” and Consumer “Confusion”

In the previous section we defined the “noise” distribution that workers face when choosing an AFORE to administer their retirement fund. Additionally, the industry’s mark-up reduction, as the number of competitors’ increases was estimated. The next step is to prove the existence of consumer “confusion” and estimate the “noise” that obstructs consumers from choosing an AFORE that improves their situation.

According to Gabaix and Laibson (2004), it is possible to estimate the effects of “confusion” through the use of “random educational treatments,” such as the ones implemented by Duflo and Sáez (2003) and Choi *et al* (2004). The methodology used in these studies entails dividing a random sample of people in two groups (treatment and control). People in the *treatment* group receive information that allows them to take an “informed decision” regarding an action they must take. On the other hand, the *control* group takes the action without receiving previous information. For example, Duflo and Sáez (2003) and Choi *et al* (2004) analyze the selection of investment funds made by individuals that are asked to allocate their hypothetical wealth among different funds. The first group (treatment group) receives information on the fees charged by the funds, while the second group (the control group) must assign their wealth among different funds without getting information on the fees. That is, both groups have *ex ante* the same utility functions, but they present different levels of financial knowledge or sophistication *ex post*.

We will assume that people in the *treatment* group become financially *sophisticated* as a result of the educational input they receive prior to be asked to make a decision. Hence, their choice will be an informed decision. On the other hand, individuals in the *control* group, who lack information, will be considered *naïve* in financial terms and would therefore be exposed to “noise” in their assessments as well as in their final decision. Thus, both *sophisticates* and *naïves* have the same underlying objective function, but enjoy different sets of information at the time they are expected to decide.

According to Gabaix and Laibson (2004), it is possible to determine the existence of “confusion” in an industry by comparing the market shares of *sophisticates* and *naïves*. That is, when a product has a high level of complexity, it would be expected to attract more *naïves* than *sophisticates*, since *naïves* are confused and are not able to assess correctly the good’s attributes. Hence, both groups’ market shares can be used as demand vectors indicators, where:

$(D_i^S)_{i=1,\dots,n}$  is the *Sophisticates* Demand and represents the share of assets that is invested in fund  $i$ .

$(D_i^N)_{i=1,\dots,n}$  is the *Naïves* Demand and represents the share of assets that is invested in fund  $i$ .

The existence of “confusion” by the *naives* can be determined by comparing the demand vectors and measuring their correlation.<sup>66</sup> For example, in the case of perfect correlation between the *sophisticates* and the *naives*’ demand vectors, both types of consumers would follow the same consumption pattern, thus, the existence of “confusion” by the *naives* can be ruled out. On the contrary, if there is no correlation whatsoever among the vectors, one would infer total “confusion” by the *naives*, since these consumers are exposed to “noise” in the market, which hinders their ability to choose the way *sophisticates* do. Consequently, the level of correlation among both vectors allows us to determine the level of “confusion” in the industry.

---

<sup>66</sup> The exercise attempts only to find out if there is some evidence of “confusion” in the market. For this purpose statistical correlation seems sufficient. Hence, there is no need to establish causality or to suggest a specific model.

## B. Econometric Framework to Measure “Confusion’s” Relative Importance

According to McFadden (1981) it is possible to define a conventional econometric model if a probability set from which a choice can be made is determined.<sup>67</sup> The attributes of this set should include the population demand distribution, which in turn should be derived from the maximization of individual preferences. Thus, one can find a function that aggregates individual preferences and meets the features of the election set.

Usually, a family of utility functions that allows the aggregation of preferences and meets the characteristics of a choice set are additively separable. Gabaix and Laibson (2004) assume that a *sophisticated* consumer has the following additive utility function:

$$U_{ia}^S = v_i + H^S(T_{ia}) \quad (19)$$

Where  $U$  is the utility function,  $a$  identifies the consumers and  $i$  the goods. Superscript  $S$  indicates that we refer to a *sophisticated* consumer and  $v_i$  is the value that the consumer grants to good  $i$ .  $H^S$  specifies that the utility function depends on the idiosyncratic preferences of the *sophisticated* consumer,  $T_{ia}$ .

On the other hand, the *naive* consumer is not able to observe his true utility, but rather observes utility signals that are affected by the presence of “noise.”

$$U_{ia}^N = v_i + H^N(T_{ia}, N_{ia}) \quad (20)$$

Where superscript  $N$  denotes that we refer to the utility function of a *naive* consumer and  $H^N$  indicates that the utility function depends on the idiosyncratic preferences of the consumer  $T_{ia}$  and on the “noise” that obstructs the proper assessment of the good,  $N_{ia}$ .

In case there is no “noise,” then there will be no “confusion” and the utility function of the *naive* will be equal to that of the *sophisticated*:

$$H^S(T_{ia}) = H^N(T_{ia}, N_{ia} \equiv 0) \quad (21)$$

For a *sophisticated* or *naive* consumer, the choice of a good or a service, in this case an AFORE, will take place when the probability of the utility that is derived from the

---

<sup>67</sup> A system of probabilistic choice is a set formed by the following elements:

$$PCS = \{I, Z, \xi, B, S, P\} \quad (5a)$$

Where,

$I$  = Alternatives that the consumer may choose.

$Z$  = Alternatives’ attributes.

$\xi$  = Mathematical function that assigns attributes to each alternative.

$B$  = Mathematical space where alternatives are located.

$S$  = Characteristics of individuals.

$P$  = Mathematical function that assigns alternatives according to the characteristics of the individuals. Results are within the closed real space  $[0,1]$ , and hence are defined as a probability.

consumption of a good, for example  $i$ , is higher than the maximum utility that other goods, for example  $j$ , could generate.<sup>68</sup> In this case, the market shares for good  $i$  are given by:

$$D_i^\tau = P(U_{ia}^\tau > \max_{i \neq j} U_{ja}^\tau) \text{ for } \tau = S, N. \quad (22)$$

Where  $\tau$  applies to both type of consumers, *sophisticates* and *naives*. In the case of *sophisticated* consumers, we assume that idiosyncratic preferences are captured by the following variation source:

$$T_{ia} = \sigma_T u_{ia} \quad (23)$$

The idiosyncratic preferences of *sophisticated* consumers,  $T_{ia}$ , depend on the variation in the preferences indicated by the term  $\sigma_T$ . On the other hand, for *naive* consumers, the “noise” or “confusion” is captured by a source of variation that depends on two variables:

$$N_{ia} = (\sigma_N \varepsilon_{ia}, \sigma_i \eta_{ia}) \quad (24)$$

Where  $\sigma_N$  captures the effect of general “confusion” in the industry and  $\sigma_i$  the effect of specific “confusion” for good  $i$ .  $\varepsilon_{ia}$ ,  $\eta_{ia}$  and  $u_{ia}$  are independent random variables that depict noise behavior and are distributed as a standard normal. In order to obtain the demand function for each individual, we can use Roy’s Lemma,<sup>69</sup> which assures that each individual’s demand generates the maximum possible utility.<sup>70</sup>

Given that the functions are additively separable, once the individual choice is obtained, it is possible to aggregate preferences and express each part of the aggregated function. The non-observable part of the utility function can be expressed as a function that may be distributed

---

<sup>68</sup> This is possible since the utility functions of both *sophisticates* and *naives* are additively separable, and their utility can be maximized. See McFadden (1981).

<sup>69</sup> Roy’s Lemma: The utility  $U(x, y, p_x, p_y)$  is maximized subject to a budget constraint  $p_x x + p_y y \leq I$  and  $d = D(I, x, y, p_x, p_y; U)$  is obtained, if the following is satisfied:

$$D(I, x, y, p_x, p_y; U) = - \frac{\partial V / \partial p_\tau}{\partial V / \partial I} \text{ for } \tau = x, y \quad (6a)$$

Where  $V$  denotes the indirect utility function and  $I$  individual’s income.

<sup>70</sup> Once the demand equations and the utility maximization are defined, the individual demand function is derived from the indirect utility function.

in several ways.<sup>71</sup> Following Gabaix and Laibson (2004) we use the Gumbel distribution, since it facilitates the estimation of demand.<sup>72</sup> With this in mind, we suggest the following function to describe the *naives*' "confusion."

$$H^N(T_{ia}, N_{ia}) = \sqrt{\sigma_T^2 + \sigma_N^2} G\left(\frac{\sigma_T u_{ia} + \sigma_N \varepsilon_{ia}}{\sqrt{\sigma_T^2 + \sigma_N^2}}\right) + \sigma_i \eta_{ia} \quad (25)$$

In this case, as in discrete choice models used in industrial organization literature, the choice is not among two options, but from a basket which includes several choice options.<sup>73</sup> Each option has a probability to be chosen, which is exactly what is assessed.

Given that  $\sigma_N^2$ ,  $\sigma_N \varepsilon_{ia}$  y  $\sigma_i \eta_{ia}$  are equal to zero for *sophisticated* consumers, we propose to define disturbances to preferences as:

$$H^S(T_{ia}) = \sigma_T G(u_{ia}) \quad (26)$$

where  $G(u_{ia})$  has a Gumbel distribution.

According to McFadden (1981), once a function that describes the behavior of the non-observable part of the utility function is found, and that we are able to maximize individually and to add the preferences, it is indeed possible to define distribution and density functions.

---

<sup>71</sup> McFadden (1981) uses the Weibull distribution, Nevo (2001) and Gabaix and Laibson (2004) use the Gumbel distribution.

<sup>72</sup> The suggested function  $G(s)$  is Gumbel distributed:

$G(s) = -\ln \ln 1/\Phi(s)$  where  $\Phi$  is the cumulative distribution function of the Gaussian standard distribution. The Gumbel function is defined as:

$$Gumbel(x) = e^{-e^{-x}} \quad (7a)$$

Thus, if the Gumbel function is evaluated in the proposed function  $G(s)$  we obtain:

$$G(s) = -\ln \ln \frac{1}{\Phi(s)} \text{ where } -x = \frac{1}{\Phi(s)} \quad (8a)$$

Hence, we have:

$$G(s) = \frac{1}{\Phi(s)} \quad (9a)$$

<sup>73</sup> McFadden (1981), Goldberg (1995), Berry, Levinsohn and Pakes (1995) and Nevo (2001).

Like Gabaix and Laibson (2004), we can suggest the following demand function for *sophisticated* consumers. This expression is a variation of the logit model used in discrete choice models.

$$D_i^S = \frac{\exp(\lambda^S v_i)}{\sum_{j=1}^n \exp(\lambda^S v_j)} \quad \text{where} \quad \lambda^S = \frac{1}{\sigma_T} \quad (27)$$

and  $\lambda^S$  indicates the inverse of *sophisticated* consumers' market share dispersion.

On the other hand, the *naive* consumers demand function is given by:

$$D_i^N = E \left[ \frac{\exp(\lambda^N v_i + \lambda^N \sigma_i \eta_{ia'})}{\sum_{j=1}^n \exp(\lambda^N v_j + \lambda^N \sigma_j \eta_{ja'})} \right] \quad \text{where} \quad \lambda^N = \frac{1}{\sqrt{\sigma_T^2 + \sigma_N^2}} \quad (28)$$

and  $\lambda^N$  indicates the inverse of *naive* consumers' market share dispersion.

In the limit, when all goods have small market shares, we have the following equivalence:<sup>74</sup>

$$\frac{D_i^N}{D_i^S} \approx \frac{\exp(\lambda^N v_i + \lambda^N \sigma_i^2 / 2)}{\sum_{j=1}^n \exp(\lambda^N v_j + (\lambda^N)^2 \sigma_j^2 / 2)} \quad (29)$$

For the case in which  $\sigma_i = 0$ , and given that  $\lambda^N = \frac{1}{\sqrt{\sigma_T^2 + \sigma_N^2}}$  is smaller than  $\lambda^S = \frac{1}{\sigma_T}$ , the *naive*'s market shares will be more disperse.

Following McFadden (1981), a set of probabilistic choice is analogous to a demand system portrayed into a conventional econometric model if the demand structure and the error distribution are specified. In our case, given that the workers have several choice options and there is an error distribution, we can propose an econometric framework to estimate the

<sup>74</sup> In order to solve the model we need to assume that as  $n \rightarrow \infty$ , there is a constant value,  $M$ , such that for all  $i$ ,  $\text{var}(e^{\lambda^N v_i}) < M < \infty$ . We know that this is not the case in the AFORE industry given different market shares. However, it is necessary to define a similar value in order to bound our variance given the Mexican AFORE industry's features. Finding this value is beyond the scope of this paper, so we will assume that the variance is bounded and follow Gabaix and Laibson (2004) to estimate, to some extent, the "noise" in the industry.

dispersion that exists among *naive* and *sophisticated* consumers when choosing an AFORE, as a function of the market share of each type of consumers.<sup>75</sup>

Hence, with the aim to measure the extent of “confusion” in the market, the following regression, that considers the *sophisticated* consumers market share in the determination of the *naive* consumers market share, can be estimated:<sup>76</sup>

$$\ln D_i^N = \alpha + \beta \ln D_i^S + r_i \quad (30)$$

where  $\alpha$  is the constant and  $r_i$  the error term.

Given that we started with the choice of an AFORE from a probabilistic set and the demand structure and error distribution were specified, it was then possible to define this conventional econometric model. Assuming that all goods have small market shares in the limit, that variance is bounded by a constant value and  $\sigma_i$  has low covariance with  $v_i$ , the resulting  $\beta$  coefficient will simply express the relationship of the dispersion with which *naive* and *sophisticated* workers choose an AFORE. Thus, the resulting coefficient is:

$$\beta = \frac{\sigma_T}{\sqrt{\sigma_T^2 + \sigma_N^2}} \quad (31)$$

Since we assume that *naive* workers turn into *sophisticates* as they acquire more information and they gradually understand the way the market reacts, we expect dispersion to decline, hence, that the  $\beta$  coefficient is lower than 1. We can express  $\beta$  as a ratio between  $\lambda^N$  and  $\lambda^S$  and see how much dispersion exists for the *Control* group in excess of the *Treatment* group.

On the other hand, we can proxy the general level of “noise” in the market by:

$$\frac{\sigma_N}{\sigma_T} = \sqrt{\beta^{-2} - 1} \quad (32)$$

Intuitively, we notice that the “noise” is a ratio that shows how each type of worker, *naive* or *sophisticated* chooses an AFORE, respectively. As the dispersion is reduced,  $\beta^2$  increases and the ratio between  $\sigma_N$  and  $\sigma_T$  tends to zero. When “noise” is not present, both types of workers will choose in the same way and market shares of AFOREs will tend to change.

Finally, it is also possible to approximate the specific level of “noise” for good  $i$  by estimating the following equation:

---

<sup>75</sup> For further details on the equation, refer to Gabaix and Laibson (2004). The advantage of this equation relies only in letting us approximate the industry’s “noise.”

<sup>76</sup> This equation is derived from the distribution equations; see Gabaix and Laibson (2004).

$$\frac{\sigma_i^2 - \sigma_j^2}{\sigma_T^2} = 2 \frac{r_i}{\beta^2} \quad (33)$$

Hence, the existence of “noise” in the AFOREs market can be verified as long as *sophisticated* and *naive* consumers have the same objective function and they can be identified *ex-ante*, which is done in the following section.

### C. Empirical Results

The identification of *sophisticated* and *naive* consumers for a specific good or service is not an easy task. As mentioned previously, some authors have resorted to field experiments and to the use of random educational treatments.<sup>77</sup> In order to verify the existence of consumer “confusion” when workers select an AFORE, observed information on the choice of AFORE in 2006 is used in the next section.

#### Presence of “Confusion:” Correlation between *Sophisticates* and *Naives* in Account Switches during 2006

Using information on the totality of account transfers during 2006, the market share for each AFORE was obtained. We assume that this vector represents the demand of *naive* workers. This assumption is based on the fact that the choice of the optimal AFORE for each individual is not easy and that the number of account transfers in the year was such that rarely could those switches result from an informed decision.

On the other hand, we use information from the SAR calculator exercise presented in Section II, where the “optimal” choice of AFORE for each worker, according to his specific circumstances, was considered. With this information, a new market share vector is produced. Given that for the SAR calculator exercise workers have clear and precise information regarding their own situation, we assume their decision represents the “optimal” AFORE choice. Thus, the resulting vector corresponds to the demand of the *sophisticated* consumers. Consequently, we have two demands, one for *sophisticated* consumers and another for *naives*. Given that consumers differ only in their financial sophistication and thus in their ability to maximize preferences, the condition that the objective function of all workers has the same distribution is satisfied.

In order to determine the existence of worker’s “confusion” in the choice of AFORE, the correlation among both vectors is estimated. *Sophisticated* consumers make optimal choices while “confused” workers are expected to choose in an environment affected by “noise.” Therefore, in the case of perfect correlation between *sophisticated* and *naive* demand vectors ( $\rho = 1$ ), we would conclude that no “confusion” is present and that the AFORE selection is optimal. Conversely, if the correlation among the two vectors is zero ( $\rho = 0$ ), there is perfect “confusion” and the “noise” tends to infinitum. The observed correlation between the *naive*

---

<sup>77</sup> Duflo and Sáez (2003) and Choi *et al* (2004).



and *sophisticated* consumers is 0.60, which can be interpreted as evidence of 40 percent “confusion” in the market.

### Quantification of “Noise:” Econometric Framework

According to the previous section, in order to quantify the “noise” through an econometric framework, we estimated regression (30). Considering the market conditions in the AFORE industry and the estimated correlation coefficient, we expect a  $\beta$  coefficient lower than 1, which implies the existence of general “noise.” As  $\beta$  gets closer to 1, “confusion” tends to disappear, and the choices of “confused” workers become similar to the optimal choices of the *sophisticates*. The results are:

$$\ln D_i^N = 2.62 + 0.35 \ln D_i^S + r_i \quad (34)$$

The value of  $\beta$  is used to obtain the level of general “noise” in the market, based on (32):

$$\frac{\sigma_N}{\sigma_T} = \sqrt{\beta^{-2} - 1} \quad (35)$$

Thus, the general “noise” is equal to  $\frac{\sigma_N}{\sigma_T} = 2.629$

Since *sophisticated* consumers are able to choose an AFORE without the influence of “noise,” while *naive* consumers are not, the ratio  $\sigma_N/\sigma_T$  measures the error of *naive* consumers in the choice of AFORE. This allows us to obtain an estimate of “noise” and confirms the hypothesis that *naive* consumers are “confused” by the presence of “noise,” which hinders their ability to properly assess and optimally choose AFORE.

Eliminating the “noise” in the industry does not seem to be an easy task and, as shown previously, a higher number of AFORES does not necessarily lead to a more effective competition. Given the “noise” distribution in the AFORE industry, more competitors has only a marginal effect on the mark-ups charged in the industry.

Given that resorting to the so called SAR calculator for the “optimal” AFORE recommendation may not be available for all workers, since access is limited by the use of the internet or telephone and the precise and individual information requirements, we proceeded to carry out surveys as the ones suggested by Duflo and Sáez (2003) and Choi *et al* (2004).

### Presence of “Confusion:” Surveys

The previous exercises highlight the difference between consumers that are well informed and those that are not. In order to have some empirical results, two surveys providing different sets of information were designed. In the first one, basic information on AFORES’ fees and returns was presented in a similar format to that shown to workers in the switching

application. In the second survey, information with respect to fees, returns and an additional explanation of these concepts was also presented. Thus, the second survey incorporates additional information that should contribute to help individuals make a more informed choice.<sup>78</sup>

Six hundred persons were randomly surveyed in different regions of Mexico City, including high, middle and low income participants, applying each survey to half of the sample. Based on the results, two vectors with the AFOREs market shares were generated. Hence, the two vectors can be interpreted as the AFORE demand of the *control group* consumers, that have access only to basic information, and the AFORE demand of the *treatment group*, which in addition, have more complete information on returns and prices, and hence could be considered as *sophisticated* consumers. Conversely, the *control group* could be considered as *naïve* since the lack of information may hinder its ability to choose correctly.

The resulting market share vectors have a 0.87 correlation, which would seem to suggest that there is little “confusion” in the AFORE choice. The relatively high correlation among the two vectors can be understood as evidence that indicates that when individuals take a few moments to analyze the information presented, they are able to choose optimally even when no additional explanations are presented.<sup>79</sup> It might also be the case that the surveys are not identifying correctly *treatment* and *control* groups, so basically, workers are not as different in the two groups as they may appear and their distributions are closely related. Furthermore, this could also be an outcome of the small differences in both questionnaires.

However, we know now that most of the workers do not take time to analyze fees and return tables when opting to switch AFORE. There is evidence that in many cases, sales agents approach workers with a set of arguments in order to convince them to transfer their account. Moreover, even when the worker is required to sign the fees and returns comparative table in force, workers do not pay attention to the figures in the table.<sup>80</sup>

Despite the above, the surveys’ results are encouraging. Rather than indicating that there is no “confusion” in the choice of AFORE, the results show that when consumers are able to analyze, even briefly, the information presented, or this information is explained to them without the pressure exerted by sales agents, workers are able to choose satisfactorily.

---

<sup>78</sup> Surveys are presented in Annex II.

<sup>79</sup> This is based on the fact that most of the individuals opted (even in the first survey) for AFOREs with a relative higher return or lower fee.

<sup>80</sup> It has been observed that the switching process has not been exempt from irregularities. Thus, a number of account transfers that apparently comply with regulations may not, in the end, reflect the worker’s own will.

## V. CONCLUDING REMARKS

Individual capitalization pension systems in Latin America were conceived from a macroeconomic perspective aimed at facing the challenges associated with the pay-as-you-go systems. Empirical evidence from these regimes is clear cut in terms of their macroeconomic success. Individual capitalization schemes have contributed to a decline of fiscal deficits, the increase in domestic savings and financial markets development.

Individual accounts systems have the implicit assumption of active and well-informed consumers regarding their retirement savings, which in general has not been the case. Well-informed consumers tend to respond swiftly to price variations or to changes in the quality of service. Hence, under the assumption of informed workers, pension fund managers that do not provide a proper service or charge a fee that exceeds that of the rest, will simply witness their customers opting out to another competitor. However, empirical evidence seems to suggest that individual capitalization systems are characterized by a marked demand inelasticity. This implies that the worker's choice of pension fund administrator does not respond, as expected, to changes in fees or returns.

In a competitive market, competition among firms to enlist workers should result in benefits for the consumer. That is, reduced fees, an optimal combination between risk and return, as well as good service. However, individual capitalization schemes have not yet been able to completely satisfy this conjecture. The article presents evidence for the case of Mexico and shows that account transfers among pension administrators barely respond to price or return considerations and that AFORE switching has most of the time not improved the consumer's situation. Moreover, the analysis suggests that Mexican workers have not chosen their AFORE in an optimal manner. Even when the main purpose of allowing account shifting among pension fund managers is to promote market discipline for the worker's best, empirical evidence indicates that instead of strengthening competition through lower fees and higher returns for the consumer, AFORE switching has so far undermined the system and resulted in the destruction of value. There is no doubt that the possibility of switching from one AFORE to another represents a market discipline device that needs to be preserved. Nevertheless, the active partaking of salesmen in the switching process, in conjunction with a diminished involvement of the worker in his pension account, has severely damaged the system. Moreover, allowing workers a virtually unlimited number of account transfers among pension administrators has turned out to be counterproductive.<sup>81</sup>

The article also demonstrates that a larger number of AFOREs in Mexico has not provided a more competitive environment. In general, the addition of 10 new administrators since 2003 has not favored the consumer. In competitive markets, a sizable number of firms results in prices relatively close to marginal cost. That is, competition "protects" the consumer. Nonetheless, in markets of complex goods or services, such as pension funds, the consumer

---

<sup>81</sup> The new Savings for Retirement System Law establishes that as of March 2008 workers can only switch AFORE once a year, and only once more in such period, if the switching is to an AFORE that offers a higher net of fee return.

barely understands the product or service he acquires. As a result, the consumer can not easily distinguish the main attributes or features of the product to make an appropriate decision. Hence, “noisy” evaluations of the product by the consumer tend to undermine the power of competition. This allows firms, even in highly competitive markets characterized by a large number of players, to reach equilibrium prices with mark-ups.

The article confirms the existence of “noise” in the AFORE industry. As a result, consumers show “confusion” and are not able to accurately interpret market signals and thus evaluate the attributes of the product or service they obtain when choosing AFORE. The study indicates that in markets with “noise,” an ample number of competitors may not significantly reduce mark-ups and suppliers tend to benefit from the complexity and “noise” associated to their product. Utilizing the statistical distribution of the “noise,” the theoretical framework allows for the estimation of the mark-up in the AFORE industry. In addition, the model indicates that when the number of AFOREs increases, the mark-up diminishes at a very slow rate. This implies that more participants in the industry will hardly affect prices.

All of the above allows us to conclude that the regulator’s effort should mainly be addressed to the reduction of the industry’s “noise.” That is, policies such as the recent modifications to the Savings for Retirement System Law, that aim toward a transparent system in which information is simple, readily available for the consumer and facilitates his decision-making process, represent significant steps in the elimination of “noise” and “confusion” of the worker. A market without “noise,” in which the worker becomes an active and well-informed consumer when choosing AFORE, will eventually strengthen competition among pension funds for the benefit of the consumer.

## Annex I. THE MODEL<sup>82</sup>

### Consumers

Consumers in this model are those workers that must choose an AFORE from a total of  $N$  possibilities. For consumer  $a$ , the service provided by AFORE  $i$  has complexity  $\sigma_i$ , value  $v_i$  and price  $p_i$ . However, workers can not observe directly  $\sigma_i$ ,  $v_i$  or  $p_i$ . Consumer  $a$  is only able to observe a utility signal  $U_{ia}$  from the services offered by each AFORE without being able to determine its individual components. Thus, the utility function is described as:

$$\begin{aligned} U_{ia} &= v_i - (p_i - \sigma_i \varepsilon_{ia}) \\ \varepsilon_{ia} &\approx F(0,1)_{iid} \end{aligned} \quad (C1)$$

The term,  $\sigma_i \varepsilon_{ia}$  is constituted by two variables.  $\sigma_i$ , characterizes the complexity of each AFORE's good or service and,  $\varepsilon_{ia}$ , models the “noise” faced by consumer  $a$  when choosing the service of AFORE  $i$ . Likewise, we assume  $\varepsilon_{ia}$  with zero mean, unitary variance,  $f$  density function and an  $F$  cumulative distribution function that it is identically and independently distributed.

### Firms

Firms in this model are those AFOREs that maximize profits by choosing optimally both prices and service complexity.

$$\max_{p_i, \sigma_i} \pi_i = (p_i - c) D(p_i, \sigma_i) \quad (A1)$$

Where  $c$  is the marginal production cost and  $D(p_i, \sigma_i)$  the demand function for an AFORE. Given that workers choose the service of AFORE  $i$  if that particular firm offers the highest value signal  $U_{ia}$ , then,  $D(p_i, \sigma_i)$  is equal to the probability that a consumer selects the good that offers the highest utility signal.

Thus, workers will only demand AFORE  $i$  services if  $U_{ia}$  is strictly greater than the utility provided by any other AFORE, for example, AFORE  $j$ :

$$\begin{aligned} D(p_i, \sigma_i) &= P\left( v(\sigma_i) - p_i + \sigma_i \varepsilon_{ia} > \max_{i \neq j} v(\sigma) - p + \sigma \varepsilon_{ja} \right) \\ &= P\left( v(\sigma_i) - p_i - [v(\sigma) - p] + \sigma_i \varepsilon_{ia} > \max_{i \neq j} \sigma \varepsilon_{ja} \right) \end{aligned} \quad (A2)$$

In order to solve (A1) and (A2), we define a new variable,  $x_i$ , which captures the valuation surplus a worker earns from choosing AFORE  $i$  as opposed to  $n - 1$  competitors.

---

<sup>82</sup> Gabaix and Laibson (2004).

$$x_i = v(\sigma_i) - p_i - [v(\sigma) - p] \quad (\text{A3})$$

$$p_i(x_i, \sigma_i) = v(\sigma_i) - x_i - [v(\sigma) - p] \quad (\text{A4})$$

Substituting prices into (A1) we obtain the new maximization problem:

$$\max_{x_i, \sigma_i} (v(\sigma_i) - x_i - [v(\sigma) - p] - c) \cdot D(x_i, \sigma_i) \quad (\text{A5})$$

To simplify notation and further calculations, we suppress the consumer's specific subscript,  $a$ . Thus,  $U_i = U_{ia}$  and  $\varepsilon_i = \varepsilon_{ia}$ . Hence, the new demand function,  $D(x_i, \sigma_i)$ , will be a function of  $x$ .

Once the maximization problem has been formulated, AFOREs will obtain the mark-up,  $p - c$ , and the complexity of the service they provide,  $\sigma_i$ . To obtain these results, we derive the First Order Conditions with respect to  $x_i$  and  $\sigma_i$ :

$$x_i : F_{x_i} (v(\sigma_i) - x_i - [v(\sigma) - p] - c) \cdot D(x_i, \sigma_i) + F_{x_i} (x_i, \sigma_i) \cdot (p_i - c) = 0 \quad (\text{A6})$$

$$\sigma_i : v'(\sigma_i) \cdot D(x_i, \sigma_i) + (p_i - c) \cdot F_{\sigma_i} (x_i, \sigma_i) = 0 \quad (\text{A7})$$

In order to obtain the equilibrium, we assume that all AFOREs charge the same price in the industry. Thus, in a certain way, we are solving the model *a la* Bertrand.<sup>83</sup>

From (A2) we solve for  $D(x_i, \sigma_i)$ :

$$D(x_i, \sigma_i) \equiv P \left( x_i + \sigma_i \varepsilon_i > \max_{i \neq j} \sigma_j \varepsilon_j \right) \quad (\text{A8})$$

Next, we define the maximum “noise” value generated by any other AFORE than AFORE  $i$  as:

$$M_{n-1} = \max_{j \in \{1, \dots, n\}, j \neq i} \varepsilon_j \quad (\text{A9})$$

Then, if we substitute (A9) in (A8) we obtain:

$$D(x, \sigma_i) = P \left( \varepsilon_i > \frac{-x + \sigma_i M_{n-1}}{\sigma_i} \right) \quad (\text{A10})$$

We evaluate (A10) in  $\bar{F} = 1 - F(\cdot)$ , where  $F(\cdot)$  is the cumulative distribution function and express it as a statistical expectation:

---

<sup>83</sup> We use the assumption of identical prices in order to obtain the theoretical equilibrium. In Section III, prices adjust due to other characteristics of the model, such as the “noise” distribution and the myopic behavior of the consumer.

$$D(x, \sigma_i) = P\left(\varepsilon_i > \frac{-x + \sigma M_{n-1}}{\sigma_i}\right) = E\left(\bar{F}\left(\frac{-x + \sigma M_{n-1}}{\sigma_i}\right)\right) \quad (\text{A11})$$

This formulation emphasizes the property that the demand for AFORE  $i$  services is driven by the right-hand tail properties of  $\bar{F}$ .

To derive the properties of the Bertrand Symmetric Equilibrium, we evaluate the demand,  $D(x_i, \sigma_i)$ , and the partial derivatives at the points  $(x_i, \sigma_i) = (0, \sigma)$ ,<sup>84</sup> that is, where workers should not obtain any surplus and the service complexity is constant for all AFOREs.

$$F_x(0, \sigma) = \frac{1}{\sigma} E(f(M_{n-1})) = \frac{1}{\sigma} E(f(M_{n-1})) \quad (\text{A12})$$

$$F_\sigma(0, \sigma) = E\left(f(M_{n-1}) \cdot \left(\frac{-\sigma M_{n-1}}{\sigma^2}\right)\right) = \frac{1}{\sigma} E(f(M_{n-1})M_{n-1}) \quad (\text{A13})$$

Once the partial derivatives have been obtained and evaluated, we recall demand is the probability of achieving the maximum surplus:

$$D(x, \sigma_i) = P\left(\varepsilon_i > \frac{-x + \sigma M_{n-1}}{\sigma_i}\right) \quad (\text{A14})$$

If we evaluate at the points  $(x_i, \sigma_i) = (0, \sigma)$  we have that:

$$D(0, \sigma) = E \int_x^n M_{n-1} dy = P(M_{n-1} < \varepsilon_i) = P\left(\max_{j \in \{1, \dots, n\}, j \neq i} \varepsilon_j < \varepsilon_i\right) = \frac{1}{n} \quad (\text{A15})$$

From (A15) we observe that  $D(0, \sigma)$  is the probability of receiving the highest gain in value,  $U_i$ , given that the worker chose AFORE  $i$  services with respect to those provided by the other  $n - 1$  competitors. That is, the probability of selecting the AFORE that offers the highest surplus is  $1/n$ , which is the demand's value.

Given these results, we substitute (A12) and (A15) in the mark-up's First Order Conditions (F.O.C.s) to obtain:

$$(p - c) = \frac{1}{n \cdot E[f(M_{n-1})]} \sigma \quad (\text{A16})$$

---

<sup>84</sup> To denote First Order Conditions we use the following notation:

$$\frac{\partial D(x_1, \dots, x_n)}{\partial x_i} = F_{x_i}(x_1, \dots, x_n) \quad (2a)$$

And, we also substitute (A12) and (A13) in the complexity's F.O.C.s:

$$\sigma^* = v^{-1} \left( - \frac{E[f(M_{n-1}) \cdot M_{n-1}]}{E[f(M_{n-1})]} \right) \quad (\text{A17})$$

This suggests that we can evaluate this probability at the distribution function and define  $A_n \equiv \bar{F}^{-1}(1/n)$ . Now, we can be sure that  $A_n$  is close to  $M_{n-1}$ .

We know that  $\bar{F}(M_{n-1})$  is  $1/n$ , so we can rewrite this expression as  $\bar{F}(M_{n-1}) = u/n$  for a random variable  $u$  close to 1. Thus, to analyze  $u$ 's behavior around a neighborhood close to 1 and characterize the value of  $M_{n-1}$  we use a first order Taylor's expansion.

Therefore, expanding  $M_{n-1} = \bar{F}^{-1}(u/n)$  around 1, we obtain the following:

$$M_{n-1} = \bar{F}^{-1}\left(\frac{u}{n}\right) = \bar{F}^{-1}\left(\frac{1}{n}\right) + \left(\bar{F}^{-1}\right)'\left(\frac{1}{n}\right) \frac{u-1}{n} \quad (\text{A18})$$

Substituting  $A_n \equiv \bar{F}^{-1}(1/n)$  in (A18) we obtain:

$$M_{n-1} = A_n - \left( \frac{1}{f(A_n)} \right) \frac{u-1}{n} \quad (\text{A19})$$

From (A19), we find that  $M_{n-1}$  has the same dispersion as  $(1/f(A_n))(u-1/n)$ , which implies that any variation in  $M_{n-1}$  will be proportional to  $1/[nf(A_n)]$ . Thus, considering that firms establish their mark-ups proportional to  $M_{n-1}$  dispersion, we can conclude that they are proportional to  $1/[nf(A_n)]$ .

If we use this factor we can express the mark-up (A16) and the service complexity (A17) in a simpler way:

$$(p - c) = \frac{1}{n \cdot f(A_n)} \sigma \quad (\text{A20})$$

$$\sigma^* = v^{-1}(-A_n) \quad (\text{A21})$$

We can now solve the mark-up (A20) and the service complexity (A21) for the Normal, Gumbel, Exponential and Log-Normal distributions.



For any other type of distribution it is necessary to adjust each equation by the constant  $\Gamma(2 + \xi)^{85}$  and use the following equations:<sup>86</sup>

$$(p - c) = \frac{1}{n \cdot f(A_n) \cdot \Gamma(2 + \xi)} \sigma \quad (\text{A22})$$

$$\sigma^* = v^{-1} \left( - \frac{A_n}{\Gamma(2 + \min(\xi, 0))} \right) \quad (\text{A23})$$

$A_n$ ,  $\Gamma(z)$  and  $\xi$ , allow us to estimate (A22) and (A23) and thus the mark-up that exists in the AFORE industry for any kind of “noise” distribution.

---

<sup>85</sup> To see how this constant is obtained see Gabaix and Laibson (2004).

<sup>86</sup> To understand these equations, recall that  $P(\varepsilon \geq A_n) = 1/n$ ,  $\Gamma(z) = \int_0^\infty t^{z-1} e^{-t} dt$  is the Gamma distribution and  $\xi$  is the index that describes the distribution tail fatness. See Gabaix and Laibson (2004).

## Annex II. QUESTIONNAIRES

### Questionnaire I

The following tables show the fees charged and returns given by different AFOREs. Please indicate in which AFORE you would like your contributions to the Saving System to be deposited.

#### Fees

AFORE	Annual Balance Fee (1 year)
Afore 1	1.48%
Afore 2	1.51%
Afore 3	1.53%
Afore 4	1.65%
Afore 5	1.80%
Afore 6	1.83%
Afore 7	1.85%
Afore 8	1.88%
Afore 9	1.91%
Afore 10	1.95%
Afore 11	1.97%
Afore 12	1.98%
Afore 13	2.15%
Afore 14	2.16%
Afore 15	2.21%
Afore 16	2.29%
Afore 17	2.36%
Afore 18	2.36%
Afore 19	2.66%
Afore 20	2.94%
Afore 21	3.48%
Average	2.09%

#### Return Comparison <sup>1</sup>

AFORE	Annual Balance Fee (1 year)
Afore 9	14.42%
Afore 17	13.44%
Afore 18	12.98%
Afore 14	12.32%
Afore 15	12.14%
Afore 8	12.05%
Afore 1	11.84%
Afore 20	11.57%
Afore 21	11.54%
Afore 16	11.19%
Afore 6	11.14%
Afore 5	10.95%
Afore 7	10.90%
Afore 12	10.86%
Afore 2	10.78%
Afore 10	10.32%
Afore 3	9.11%
Afore 4	N.D.
Afore 13	N.D.
Afore 11	N.D.
Afore 19	N.D.
Average	11.62%

Average annual returns before fees obtained by Siefore Básica 1 and Siefore Básica 2 during the last 3 years.

Data as of May 31, 2007.

**SELECTED AFORE:** \_\_\_\_\_

## Questionnaire II

The future savings you will accumulate in your AFORE depend on:

- **Mandatory contributions** (of employer, government and worker) that are made bimonthly by law.
- **Fees** (price). These are the charges that your AFORE makes for offering the service of managing your pension savings account. Each AFORE charges a different fee. The lower the fees you are charged by your AFORE, the higher the resources you will have in the future. The Fee is only an indicator that tries to reflect the different charges made by the AFOREs. However, this indicator is an exercise that applies only for an average worker under certain assumptions of initial balance, contribution and years of work and thus, it does not necessarily reflect the case of workers with individual characteristics different than those assumed.
- **Returns** (yield) that your AFORE generates by investing your money. Each AFORE gives a different return. Your savings are invested from the first moment in which a contribution is made, up to the moment in which they are withdrawn when you have reached the retirement age established by Law. This is with the aim to generate the higher possible amount of interests. The higher returns your AFORE generates, the more resources you will have in the future.

The following tables show the Fee that is an indicator that tries to express the different charges made by the AFOREs, as well as the returns given by them. Please indicate in which AFORE you would like your contributions to the Saving System to be deposited.

**Fees**

<b>AFORE</b>	<b>Annual Balance Fee (1 year)</b>
Afore 1	1.48%
Afore 2	1.51%
Afore 3	1.53%
Afore 4	1.65%
Afore 5	1.80%
Afore 6	1.83%
Afore 7	1.85%
Afore 8	1.88%
Afore 9	1.91%
Afore 10	1.95%
Afore 11	1.97%
Afore 12	1.98%
Afore 13	2.15%
Afore 14	2.16%
Afore 15	2.21%
Afore 16	2.29%
Afore 17	2.36%
Afore 18	2.36%
Afore 19	2.66%
Afore 20	2.94%
Afore 21	3.48%
<b>Average</b>	<b>2.09%</b>

**Return Comparison <sup>1</sup>**

<b>AFORE</b>	<b>Annual Balance Fee (1 year)</b>
Afore 9	14.42%
Afore 17	13.44%
Afore 18	12.98%
Afore 14	12.32%
Afore 15	12.14%
Afore 8	12.05%
Afore 1	11.84%
Afore 20	11.57%
Afore 21	11.54%
Afore 16	11.19%
Afore 6	11.14%
Afore 5	10.95%
Afore 7	10.90%
Afore 12	10.86%
Afore 2	10.78%
Afore 10	10.32%
Afore 3	9.11%
Afore 4	N.D.
Afore 13	N.D.
Afore 11	N.D.
Afore 19	N.D.
<b>Average</b>	<b>11.62%</b>

Average annual returns before fees obtained by Siefore Básica 1 and Siefore Básica 2 during the last 3 years.

Data as of May 31, 2007.

**SELECTED AFORE:** \_\_\_\_\_

## References

- Anderson, S., A. de Palma, and J.F. Thisse, 1992, "*Discrete Choice Theory of Product Differentiation*," (Cambridge, Massachusetts: MIT Press).
- Armenta, A., 2007, "Determinantes de los traspasos de los trabajadores en las Administradoras del sistema de pensiones en México: 2000 – 2006." B.A. Thesis, ITAM (August).
- Berdejo, M. et. al., 2006, "Mecanismos para incentivar la competencia en los sistemas de pensiones basados en capitalización individual," Working Paper, No. 1 (July).
- Berstein, S., and C. Cabrita, 2006, "Determinantes de la elección de AFP en Chile: nueva evidencia a partir de datos individuales," Chilean Pension Fund Supervisory Authority, Working Paper 19, (December).
- \_\_\_\_\_ and J. Ruiz, 2005, "Sensibilidad de la demanda de los consumidores desinformados: el caso de las AFP en Chile," Chilean Pension Fund Supervisory Authority, Working Paper 4 (April).
- \_\_\_\_\_ and A. Micco, 2005, "Rol de los vendedores en la industria de las AFP: un marco teórico," Chilean Pension Fund Supervisory Authority, Working Paper 6 (May).
- \_\_\_\_\_, 2002, "Turnover and regulation: The Chilean pension fund industry," Banco Central de Chile, Working Paper 180, (September).
- \_\_\_\_\_, 2001, "Price competition and turnover: The Chilean pension fund industry," LACEA Conference (May).
- Berry, S., J. Levinsohn, and A. Pakes, 1995, "Automobile Prices in Market Equilibrium," *Econometrica*, Vol. 63, No. 4, July, pp. 841–890.
- Cerda, R., 2005, "Movilidad en la cartera de cotizantes por AFP: la importancia de ser primero en rentabilidad," Economics Department, Catholic University of Chile, Working Paper 309 (April).
- Choi, J., X. Gabaix, D. Laibson, and B. Madrian, 2004, "Measuring Noise," Harvard, *mimeo*.
- Crabbe, A. C., 2005, "A Quarter Century of Pension Reform in Latin America and the Caribbean: Lessons Learned and Next Steps," (Washington: Inter-American Development Bank).
- Diamond, P. A., 1971, "A model of price adjustment," *Journal of Economic Theory*, *Elsevier*, Vol. 3(2), pp. 156–168 (June).

- Duflo, E., and E. Saez, 2003, “The Role of Information and Social Interactions in Retirement Plan Decisions: Evidence from a Randomized Experiment,” *Quarterly Journal of Economics*, Vol. 118 (3).
- Gabaix, X., and D. Laibson, 2004, “Competition and Consumer Confusion,” *Working Paper*, (Harvard, Massachusetts: National Bureau of Economic Research).
- \_\_\_\_\_, Laibson, and H. Li, 2005, “Extreme Value Theory and the Effects of *Competition* on Profits,” Working Paper, (Harvard, Massachusetts: National Bureau of Economic Research).
- Goldberg, P., 1995, “Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry,” *Econometrica*, pp. 891–951 (July).
- Greene, H. W., 2000, *Econometric Analysis*, Prentice Hall, New Jersey.
- Holzmann, R., and R. Hinz, 2005, “Old-Age Income Support in the 21<sup>st</sup> Century: An International Perspective on Pension Systems and Reform,” The World Bank, Washington, D. C.
- Larraín Ríos, G., 2005, “Chile, fértil provincia,” (Santiago, Chile, Random-House Mondadori editors).
- Luce, R. D., 1959, *Individual Choice Behavior*, New York: John Wiley.
- Marinovic, I., and S. Valdés, 2005, “La demanda de las AFP chilenas: 1993 – 2002,” Working Paper presented at the Economic Society, Santiago, Chile.
- McFadden, D., 1981, “Econometric Models of Probabilistic Choice,” in C. Manski and D. McFadden, eds., *Structural analysis of discrete data*, (Cambridge, Massachusetts: MIT Press) pp. 198–272,.
- Meléndez, J., 2004, “La industria de las Afores: análisis de su estructura y recomendaciones de *política* de competencia y regulación,” Economic Competitiveness in Mexico, Chapter VIII, Mexico.
- Mesa-Lago, C., 2002, “Myth and Reality of Pension Reform: The Latin American Experience.” *World Development* 30(8): pp. 1309–1321.
- Nevo, A., 2001, “Measuring Market Power in the Ready-to-Eat Cereal Industry,” *Econometrica*, 69(2), pp. 307–342.
- Perloff, J. M., and S. C. Salop, 1985, “Equilibrium with Product Differentiation,” *The Review of Economic Studies*, Vol. 52, No. 1 (January), pp. 107–120.

Taguas Coejo, D., and A. Vidal-Aragón de Olives, 2005, “Hoja de ruta para la reforma de los sistemas de pensiones en América Latina,” Working Paper 01/05, Study Services BBVA, Madrid.

Valdés P. S., 2005, “Para aumentar la competencia entre las AFP,” *Public Studies*, Chile (May).

Wooldridge, M. J., 2002, *Econometric Analysis of Cross Section and Panel Data*, (Cambridge, Massachusetts: MIT Press).

World Bank, 1994, *Averting the Old-Age Crisis: Policies to Protect the Old and Promote Growth*, (New York: Oxford University Press).