

# **¿Are there economies of scale in the pension fund managers industry? A semi parametric approach**

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Preliminary draft. Do not quote  
Comments Welcome

## **Abstract**

It has been widely accepted that reforms to pension schemes have led to improvements in the financial viability of the systems. Nevertheless, at the same time it has been recognized that charges of pension fund managers (PFM) are very high, implying high mark ups for PFM and lower expected pensions for the participants of the pension plans. The presence of economies of scale has been suggested as one main reason for the observed high charges. The presence or not of economies of scale is highly important to surveillance authorities since it can lead to different regulatory actions aiming at lowering charges. In this paper we argue that previous studies that have found economies of scale were based on cost curves that were empirically misspecified. We estimate a semi parametric cost curve which allows us to conclude that if there exist economies of scale, minimum efficient scales are very low, equivalent to three percent of the market share. Our results are consistent with the recent experience in Mexico in which small PFM are entering the market.

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## 1. Introduction

In the last decade, many countries have conducted reforms of their pension systems, switching from a defined benefit scheme to a defined contribution system with private firms competing for the administration of the funds. It has been accepted that these reforms may lead to positive macroeconomic effects. For example, Corbo and Schmidt-Hebbel (2003) for the case of Chile show that the pension reform in Chile has contributed to the rate of growth observed in that economy. In Mexico, a study of the World Bank (2004) estimates that the explicit debt of the pension system (in 2050) was reduced from almost 95 per cent of GDP to 45 per cent, and it has been suggested that the investments of the assets under management has helped to reduce interest rates in the country.

However, there is also evidence that competition has not been as strong as thought and that the charges of the Pension Fund Managers (PFM) are high. These high charges may reduce in the long run the replacement rates and thus the benefits of the workers affiliated to the system. In addition, in countries like Mexico where there is a minimum guaranteed pension, low replacement rates may have a negative impact on the fiscal position of governments.

Two main reasons have been given to explain the high charges and the concentration of the industry. On the demand side, it is said that the elasticity of demand is very low due to a lack of interest of the consumers for a product that is very similar between firms (perhaps because of regulation), that they are obliged to buy, and that they will actually use many years from now. Several studies has demonstrated that consumers change their PFM mainly because of marketing policies of the firms and not in response to lower charges or better rates of return.<sup>2</sup>

On the supply side, it is said that the industry is characterized by the presence of economies of scale which produces a concentration of the industry in few firms. The presence or not of economies of scale is highly important to surveillance authorities since it can lead to different regulatory actions aiming at lowering charges. Previous work has

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<sup>2</sup> See Melendez (2004) for the case of Mexico, Berstein y Ruiz (2003) for the case of Chile

found the presence of economies of scale, Garcia and Rodriguez (2003) and Melendez (2004) for the case of Mexico, and Apella and Marceira (2004) for the case of Argentina.

But by carefully analyzing the methodology used in those papers and evidence of Mexico, where new small firms have entered the market, in the last two years, there may be some doubts in these findings. This study will investigate the presence of economies of scale in the PFM for the case of Mexico estimating a more flexible form of the cost function and not imposing it as in the studies just mentioned. Using monthly data from May 1997 to May 2004 of Mexican PFM we estimate a semi parametric model.

The results show that even if the average cost curve presents an L shape, the minimum efficient scale is reached with approximately 3,000 millions of pesos or with 800,000 affiliates. These numbers are well below those found in the studies of García y Rodriguez and Melendez. With our results practically all firms in Mexico has reached the minimum efficient scale.

The presence or not of economies of scale is very important for public policy decisions. If there are economies of scale, few PFM should exist and charges should be regulated as proposed by Melendez (2004). If there are not economies of scale, new firms could enter the market and compete to attract costumers from other PFM. In this case, the authorities should work to make easier for consumer to transfer their account to any PFM they want, and to improve the decision making process of the workers through more and better information and to eliminate any barrier to entry that may exist (Aguilera 2004) or to establish some auction mechanism as has been proposed for Chile (Valdes Prieto 2004).

The paper is organized as follows. The next section presents a brief description of the Mexican System and reviews the papers that have analyzed the presence of economies of scale for the case of Mexico. The third section presents the methodology and the results. Finally, we have the conclusions and policy recommendations.

## **2. Brief description of the system and previous studies**

### *2.1 Description of the system*

In 1997, following the experience of other countries in Latin America, the Mexican pension system for the workers of the private sector companies was reformed. A defined benefit scheme was substituted by a defined contributions one with a solidarity element in the form of a minimum guaranteed pension. The management of the individual accounts was contracted out to private PFM. The reform had, among others, the following objectives: i) to improve the financial viability of the system; ii) to increase the long term savings rate of the economy; and iii) to make the system more actuarially fair, that is, to better link benefits and contributions. This higher link should produce higher replacements rates for those workers who opt for a longer participation in the labor markets. See Sales et al. (1997) for a more comprehensive explanation of the reform.

Today, there are 33 millions of workers affiliated to the system, even though approximately only 40 percent are active workers. The assets of the system are 482.2 billions of pesos. It can be said that after 7 years of the reform, the system has reached positive results in several macroeconomic variables: the assets under management (AUM) are now equivalent to 6.3% of the GDP, the explicit debt of the pension system in 2050 was reduced from almost 95 to 45 per cent of the PIB (World Bank, 2004), and it has been suggested that the investments of (AUM) has helped to reduce interest rates in the country.

Unfortunately the systems is too young for being evaluated in microeconomic terms, any comparison of replacement rates between the old system and the new systems should be based on several assumptions. However, the system has been criticized because it is said that the charges for the account management are very high and are, thus, reducing the expected benefits.

Table 1  
Evolution of the system

|  | 1998       | 1999       | 2000       | 2001       | 2002       | 2003       | 2004       |
|--|------------|------------|------------|------------|------------|------------|------------|
| Assets under Management <sup>(1) (2)</sup>     |            | 142.73     | 198.15     | 287.47     | 355.58     | 424.13     | 482.20     |
| AUM/GDP <sup>(2)</sup>                         |            | 2.4%       | 3%         | 4.3%       | 5.2%       | 5.8%       | 6.3%       |
| Affiliates <sup>(2)</sup>                      | 13,827,674 | 15,594,503 | 17,844,956 | 26,518,534 | 29,421,202 | 31,398,282 | 33,316,492 |
| Number of PFM                                  | 17         | 14         | 13         | 13         | 12         | 12         | 13         |
| HHI <sup>(2)</sup>                             | 11.00      | 11.05      | 11.04      | 9.97       | 10.66      | 11.10      | 10.60      |
| Market share of the biggest one <sup>(2)</sup> | 16.1       | 15.91      | 16.07      | 14.10      | 17.91      | 17.87      | 17.48      |
| Average charge <sup>(3) (2)</sup>              | 1.47       | 1.55       | 1.68       | 1.78       | 1.75       | 1.64       | 1.56       |

*Notes: (1) Billions of Pesos of 2004 (2) Data for December (3) Five years equivalent charge  
Source: [www.consar.gob.mx](http://www.consar.gob.mx) and [www.banxico.org.mx](http://www.banxico.org.mx)*

There exists evidence that charges in Mexico are very high.<sup>3</sup> Melendez (2004) argues that the charges made by Mexican pension fund managers (PFM) are higher than what it would have cost the IMSS, the public agency responsible for managing the pensions in the former defined benefit system, to handle the pension insurance. Aguilera (2004) shows that several Mexican PFM are the most expensive ones in a comparison among Mexico, Chile, Colombia and Peru. Finally, it is well known that the Mexican PFM are among the most profitable companies in Mexico<sup>4</sup>. Because of this, many public voices have appeared. In the Congress, some believe that charges should be regulated, as in the case of Colombia, where a maximum charge exists. Others argue that the State should have its own PFM with very low charges to increase competition.

From a theoretical perspective, high prices can be explained by demand side or supply side factors or both. Demand side factors are associated to the inelasticity of demand associated to the fact that people are not interested in a product they are forced to buy and which will be consumed in a distant future. Rodriguez and Garcia (2003) and Melendez (2004) have found that the affiliates' decision to move their account to a different PFM is highly associated to the sales efforts of the PFM, and less associated to the charges or the

<sup>3</sup> There is also evidence of high charges for the case of Chile.

<sup>4</sup> See "Las 500 empresas de México", *Expansión Review*.

rates of returns (even though, as Melendez shows, the importance of these two last factors have increased over time).

Supply side factors are related to the presence of economies of scale which leads to a concentration of the industry in few firms, thus softening competition. The presence of economies of scale has been found by Garcia and Rodriguez (2003) and Melendez (2004) as we will see in detail in the next subsection.

Table 1 shows how the number of firms in the industry decreased over time. In 1999 there existed 17 PFM, but after some mergers, (See Table 2), the number of PFM decreased to 12 in 2003. At the same time, the market share of the biggest one increased from 15.9 to 17.5 (see Table 1).<sup>5</sup>

Table 2  
History of mergers

| Seller           | Date of purchase | AUM     | Market share | Buyer              | Market share before the purchase | Market share after the purchase |
|------------------|------------------|---------|--------------|--------------------|----------------------------------|---------------------------------|
| Previnter        | May 1998         | 305.6   | 2.3%         | Profuturo GNP      | 11.9%                            | 14.1                            |
| Génesis          | July 1998        | 141.0   | 0.9%         | Santander Mexicano | 13.6%                            | 14.5%                           |
| Atlántico Promex | September 1998   | 78.0    | 0.6%         | Principal          | 2.18%                            | 2.19%                           |
| Capitaliza       | September 1998   | 31.3    | 0.2%         | Inbursa            | 2.3%                             | 2.7%                            |
| Garante          | February 2002    | 2,220.1 | 8.3%         | Banamex            | 10.1%                            | 18.5%                           |
| Zurich           | April 2003       | 801.5   | 2.9%         | Principal          | 4.9%                             | 7.7%                            |
| Tepeyac          | August 2003      | 935.0   | 3.2%         | Principal          | 7.5%                             | 10.7%                           |

Source: [www.consar.gob.mx](http://www.consar.gob.mx)

Nevertheless, there are some recent changes in this trend. Since 2003, some new small PFM have entered the market, which does not fit with the idea that there are economies of scale (See Table 3). Together with the entry of new PFM, we observe a decrease in the HHI and in the charges as can be seen in Table 1.

<sup>5</sup> There exists an upper limit to the market share on affiliates equal to 20%. Nevertheless, CONSAR, the surveillance authority, can allow any PFM to have a higher market share upon request.

Table 3  
New entrants to the market

| New PFM  | Date of entry     | Market share as of<br>March 2005 |
|----------|-------------------|----------------------------------|
| Azteca   | March 17, 2003    | 2.5%                             |
| Actinver | April 7, 2003     | 2.3%                             |
| IXE      | June 30, 2004     | 0.6%                             |
| Metlife  | February 1, 2005  | N.A.                             |
| InverCap | February 24, 2005 | N.A.                             |

Source: [www.consar.gob.mx](http://www.consar.gob.mx)

Thus, there seems to be an agreement in the literature that charges are very high and that demand size factors can explain part of this outcome. But the entrance of new small firms puts some doubts on the existence of economies of scale.

The presence or not of economies of scale is very important for regulatory actions. If there are economies of scale, few PFM should exist and charges should be regulated as proposed by Melendez (2004). If there are not economies of scale, in the presence of high returns of the incumbent firms (because of high charges), new firms could enter the market and compete to attract costumers from other PFM. In this scenario, the authorities should work to liberalize the transfer procedures (allowing the workers to transfer their account between PFM more often and in an easier way), to improve the decision making process of the workers through more and better information and to eliminate any barrier to entry that may exist (Aguilera 2004) or to establish some auction mechanism as has been proposed for Chile (Valdes Prieto 2004).

## 2.2 Previous studies

As mentioned before, there are two studies that estimate a cost curve of the PFM industry for Mexico, Garcia and Rodriguez (2003) and Melendez (2004). Both of them conclude that there are economies of scale.<sup>6</sup> However, we believe the papers are empirically misspecified and thus their conclusion should be questioned.

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<sup>6</sup> As mentioned in the introduction, similar results have been found for other countries. See for example Apella and Marceira (2004) for the case of Argentina.

Garcia and Rodriguez (2003) estimate a function in which total cost (the dependent variable) is equal to fixed costs (estimated as the constant of the regression) plus the number of affiliates in a quadratic fashion. They also include the number of “traspasos”<sup>7</sup> and the excess rate of return as control variables. This cost function was also used by Chisari et al (1998). The use of a quadratic cost function, directly estimated or using a transformed translog function, can only have one turning point, hence the typical U-shape of the average cost curve. But as Humphrey and Vale (2004) have said, imposing the quadratic cost function “can in many cases be considered an artifact”. This reason is enough to question the results of the authors and to look for some new specifications form. Melendez (2004) also points out other limitations of the estimation of Garcia and Rodriguez, including the fact that the prices of the inputs were not included in the cost function.

Table 4  
Summary of previous studies

| Author                      | Cost function  | Other control variables  | Sample                | Variable of production: affiliates or AUM | Minimum point of variable cost if affiliates         | Minimum point of variable cost if AUM  |
|-----------------------------|--|--|-----------------------|---|--|--|
| García and Rodríguez (2003) | Linear in fixed cost and quadratic in the production level | Number of “Traspasos” and excess rate of return (from the mean)  | Bimonthly II/98-VI/02 | Affiliates                                | 1,081,000  | Not estimated  |
| Melendez (2004)             | Translog multiproduct                                      | Prices of inputs, number of “traspasos”, marketing weight in cost, net return (from charges), dummy for relation to a bank. In linear, quadratic and with several interactions | Quarterly IV/98-II/03 | Affiliates and AUM                        | 1,050,000 <sup>(1)</sup><br>1,150,000 <sup>(2)</sup> | 180 billions of pesos of 2004 <sup>(1)</sup><br>250 billions of pesos of 2004 <sup>(2)</sup> |

*Notes: (1) For PFM that do not belong to a financial conglomerate, (2) For PFM that belong to a financial conglomerate*

*Source: Garcia and Rodriguez (2003) and Melendez (2004)*

<sup>7</sup> “Traspasos” means persons that move into a PFM from other PFM

Melendez (2004) estimates a translog multi-product function. This function has been widely used to estimate cost functions of financial institutions, especially banks.<sup>8</sup> Recent studies have pointed out the limitations of this functional form when the financial institutions have different sizes and product mix, and have stressed the need to use more flexible cost functions in empirical estimations. Since the translog cost function was originally developed as a local approximation to some unknown “true” underlying cost function, the argument follows, when extrapolating the local approximation to global data, the translog function may behave poorly when the global behavior of the approximated function differs from its local behavior.

The literature on economies of scale in the banking industry has found different results depending on the choice of the range of bank size. McAllister and Manaus (1993) show this situation is a consequence of the use of the translog function.<sup>9</sup> They prove that while the translog gives the usually U-shaped average cost curve, the Kernel, Fourier and Spline estimations gives, as the translog cost function, increasing returns to scale for small banks, but contrary to the translog estimates, constant return to scale for large banks. Humphrey and Vale (2004) show that when they used the translog cost function for the Norwegian banking industry, the translog form effectively yield an L-shaped average cost curve while the linear spline and the fourier forms give an M-shaped curve. In fact, McAllister and Manaus (1993) concludes that “the globally fitted translog cost function systematically misrepresents cost for certain types of banks, resulting in a specification bias that contributes substantially to the traditional conclusion of decreasing returns to scale among banks above the midpoint of the size range studied” (pp. 390).

The problems of the translog function that McAllister found in the banking system can be present in the estimation of Melendez. In the sample the different PFM are of very different size. Bancomer, the biggest PFM in his sample has 58.9 billions of pesos of AUM and 2.6 millions of affiliates, Capitaliza, the smallest one in the sample, had 182 thousands pesos in AUM and only 61 thousands of affiliates. Notice then, as we can see in Table 4,

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<sup>8</sup> See for example Berger and Humphrey (1991) and Noulas et al (1990). Bernt (1990) y Green (2003) offer review of the translog function.

<sup>9</sup> Other reason is that the fact the studies ignored the financial capital, an important input required for the intermediation process.

that Melendez found that the minimum point of the average cost curve, if measured as affiliates equals approximately 1 million fifty thousands accounts for PFM with out a bank (and 1 million one hundred fifty thousand for PFM with a bank). The average number of affiliates in the sample of the author is 1,022,000 affiliates for PFM without a bank and 1,540,000 for PFM with a bank. That is, Melendez results check with the conclusion pointed out by McAllister that the minimum efficient scale will be close to the average of the size range studied.

Also, we question the use of a multiproduct approach for PFM. In banks is clear that they have two business lines: consumer loans and business loans (which are very different in terms of number of clients and average loan per client) which represents in the estimation of cost curves for banking two outputs. Thus for banks it makes sense to estimate a multiproduct approach using AUM, and not number of clients, as done for example by Humphrey and Vale (2004). PFM in Mexico while they perform at least two activities: account management and investments, they only make profits from the charges to affiliates for the account management, using a multiproduct function does not make a lot of sense if, for the second product the PFM is producing does not get any kind of revenue.

Finally, it seems weird to us the lowest point of the average cost curve when measured as AUM in the estimation of Melendez equals approximately 17.4 billions of dollars (195 billions of pesos of 2004) given the fact several studies for the banking industry in the United States, an industry with higher fixed costs, concludes that the minimum point is reached between 500 millions to 10 billions in assets (see for example, Noulas et al, 1990; and McAllister and Manaus, 1993). Moreover, Turner and Beller's (1989) study of pension funds in United States found economies of scale until funds reach 75 millions in assets; thereafter, administrative cost as a proportion of assets remain constant.

### **3. Empirical analysis**

The potential bias associated to the translog, or any other quadratic estimate of the cost function, and the importance of the confirmation or not of economies of scale for

regulatory reasons oblige us to re estimate a cost function for the Mexican PFM with a flexible form. We use a kernel regression technique which comes “closest to the goal of letting the data speak for themselves” (McAllister and Manaus, 1993 pp. 395), even though we recognize that as time passes, our estimates should be redone in order to get larger samples needed in this type of techniques to get more accurate results.

### 3.1 A semi parametric model of cost function

Let define a semi parametric model of the cost function as follows:

$$TC_{it} = f(Y_{it}) + \alpha_1 w_t + \alpha_2 r_t + \alpha_3 salesmen_{it} + \delta D + \varepsilon_{it} \quad (1)$$

We impose the normalization  $E[\varepsilon | z]=0$ , where  $z$  represents the regressors. The variable TC includes the administrative, operating and sales cost, the depreciation and the amortization and the opportunity cost of the invested capital (calculated as the invested capital times the weighted cost of the sources of financing).  $w$ , and the variable  $r$  are the prices of labor and capital respectively. We include the number of salesmen and one dummy variable if the PFM belongs to a financial conglomerate<sup>10</sup>. Previous studies have pointed out that PFM that belong to a financial conglomerate have lower cost (see for example Melendez, 2004). The number of salesmen is included to account for the fact the sales cost can change the shape of the cost function (Melendez, 2004; Braberman, Chisari and Quesada, 1999).

The variable  $Y$  represents the level of production, which can be the number of affiliates or the balance in the pension accounts of each PFM. For example, Rodriguez and Garcia (2003) use affiliates, while Melendez uses AUM and affiliates. The choice of the relevant variable to measure the production level is not innocuous. In theory, it is possible to find no economies of scale in terms of affiliates but economies of scale in terms of AUM. If most of the variable cost is driven by the number of affiliates, performing the estimation using AUM, which grow at the rate of return for each affiliate and the net

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<sup>10</sup> Financial conglomerate is defined as a conglomerate that includes a bank with or with out other financial institutions, i.e., insurance companies, fund managers, etc.

contributions<sup>11</sup>, can lead to an scenario in which the cost per affiliate is constant but the cost per dollar administered is declining over time, thus leading to the conclusion that there are economies of scale. We can have some insight on which variable is the correct one from analyzing the cost structure of the PFM. As can be seen in Table 5, most of the operating cost, which as of today accounts for 68 per cent of total cost, is a function of the affiliate and not of the account's balance. On the other hand, not all affiliates are the same, they differ in the account balance and in their wages (and thus their contributions), different PFM focus in different segments of the market, and using AUM will be using the same logic as in the banking sector. We estimate both models.

Table 5  
Descriptive analysis of the cost structure of the PFM

|  | Type of cost |                              |
|--|--------------|------------------------------|
|  | Fixed        | Variable                     |
|  |              | Per account    Per operation |
| Administrative cost (wages, utilities)       | ✓            |                              |
| Operating cost                               |              |                              |
| Services for IA management                   |              | ✓                            |
| Processing of information                    |              | ✓                            |
| Certification of allocation                  |              | ✓                            |
| Certification of record                      |              | ✓                            |
| Transfer process                             |              | ✓                            |
| Withdrawing from IA                          |              | ✓                            |
| Changes in the information provided          |              | ✓                            |
| Called received in the call center           |              | ✓                            |
| Call services                                | ✓            | ✓                            |
| Other operation                              | ✓            | ✓                            |
| Sales (sales commissions, promotions and ad) | ✓            | ✓                            |
| Other  | ✓            | ✓                            |
| Depreciation and amortization                | ✓            |                              |

*Note: IA, means individual account*

*Source: Bylaws of the system*

We estimate the model in three steps: first we estimate the coefficients  $\alpha$ , then we estimate  $\delta$  and finally we estimate the function  $f$ . For the first stage, note that we can get consistent estimates of  $\alpha$  for each of the two groups of PFM (those that do not belong to a financial conglomerate and those that belong to a financial conglomerate) using the non parametric procedure described by Robinson (1998). We perform kernel regressions of

<sup>11</sup> Net of charges

$TC_{it}$  and  $X_{it}$  on  $Y_{it}$ , and then we regress the residuals on the residuals. The estimate  $\hat{\alpha}$  that we use is the weighted average of each  $\alpha$ , computing separated estimations for each category, where the weights are given by the simple size (see Chevalier and Ellison, 1997).

In the second step we follow Chevalier and Ellison (1997). For the subsample of the PFM that belong to a financial conglomerate, we perform a kernel regression of  $TC_{it} - \hat{\alpha}X_{it}$  on  $Y_{it}$ . If we define this variable as  $\hat{g}^1$ , and  $\hat{g}^0$  represents the kernel regression for the subsample of the PFM that does not belong to a financial conglomerate, it is possible to calculate consistent estimates of  $\delta$  using these two functions. For example, the easiest way to do it is by calculating  $\hat{\delta} = \hat{g}^1(x_0) - \hat{g}^0(x_0)$  for any point  $x_0$ .

Finally to get the estimate  $\hat{f}$  of the function  $f$  we perform a kernel regression of  $\hat{y} = CT_{it} - \hat{\alpha}X_{it} - \hat{\delta}^1$  on  $Y_{it}$ . In this and all kernel regressions we use the kernel Epanechnikov with a window width of 1. The standard errors were estimated by bootstrapping the estimated residuals.

### 3.2 Data

We use monthly data for each PFM that has operated in Mexico. Data comes from the web page of CONSAR, the surveillance authority in Mexico. Data from wages comes from manufacturer sector published by Secretaria del Trabajo y Previsión Social (Minister of Labor); for the cost of capital we use the CAPM<sup>12</sup>:

$$r_{it} = rf_t + \beta_i (rm_t - rf_t) \quad (2)$$

where:

$r$  represents the cost of capital

$rf$  is the risk free rate. It was approximated by 28 days Cetes

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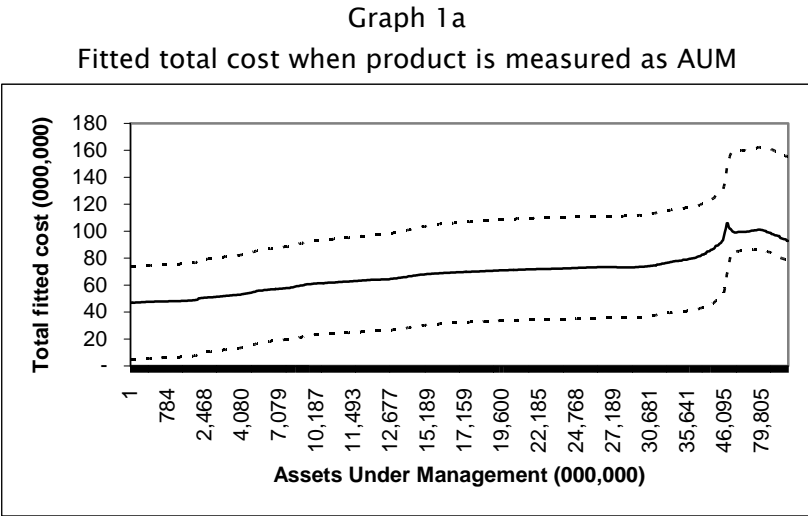
<sup>12</sup> PFM in Mexico are not allowed to issue debt

$rm$  is the monthly market return, approximated by the rate of grow of the price index of the Mexican Stock Exchange. As we will see for some of the months of the sample the price of capital was negative, a point that must be reviewed in new draft of the paper.

The sample goes from May of 1997 to May of 2004. All variables were indexed to pesos of 2004 using the Consumer Price Index. The total number of observations is 693.

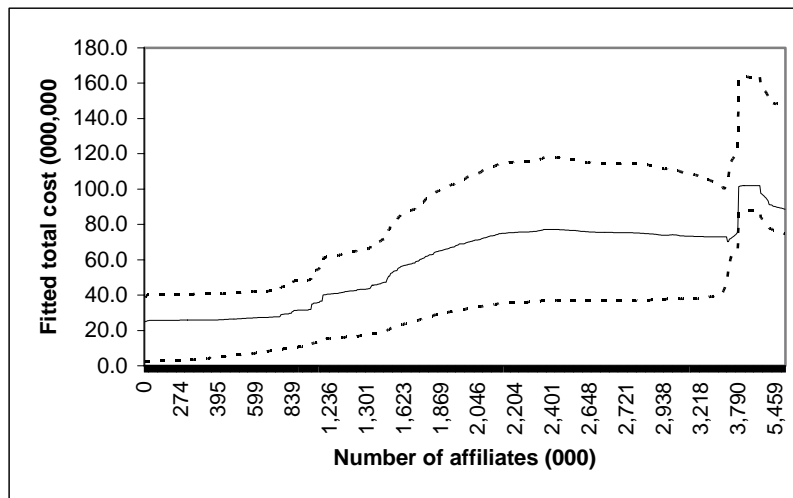
3.3 Findings

We begin by describing the shape of the estimated curve  $\hat{f}$ . In Graph 1a, we present the function  $\hat{f}$  and the 95 per cent confidence interval when AUM were taken as the production variable. As it can be seen, the function  $\hat{f}$  shows a positive slope, but almost constant, which give us and idea of constant marginal cost with AUM.



Graph 1b shows the function  $\hat{f}$  when affiliates are taken as the production variable. As we can see, the behavior of the function is not as smooth as in the previous case. The graph shows a jump around one million affiliates but then the slope goes down again.

Graph 1b  
Fitted total cost when product is measured as affiliates

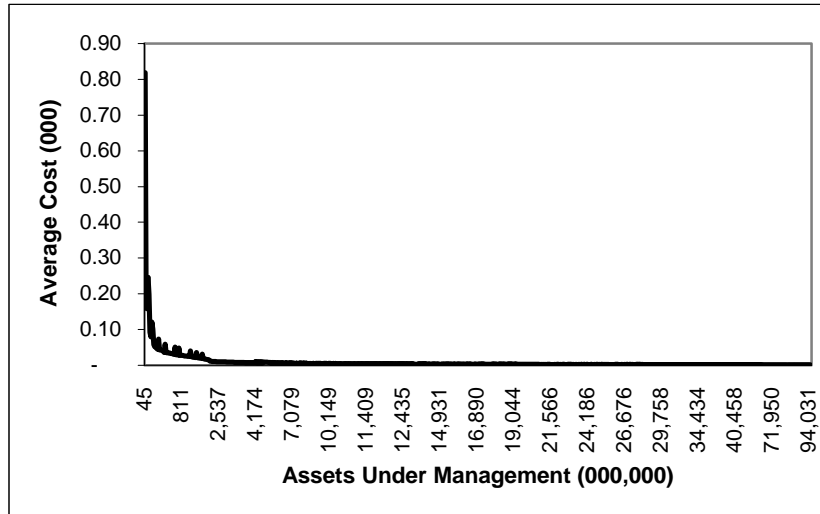


To have a clearer idea of the presence of economies of scale, in Graph 2 we present our calculation of the average cost curve.<sup>13</sup> As we can observe, there seems to be economies of scale but they are exhausted quickly. In terms of AUM, the estimates display constant returns to scale for PFM larger than 3 billions of pesos of 2004 (or approximately 270 millions of US dollars). If measured by affiliates, the estimates display increasing returns to scale up to values of 800 thousands affiliates and constant returns to scale for larger PFM.

<sup>13</sup> To calculate the average cost curve the regressors were fixed to the mean of the sample

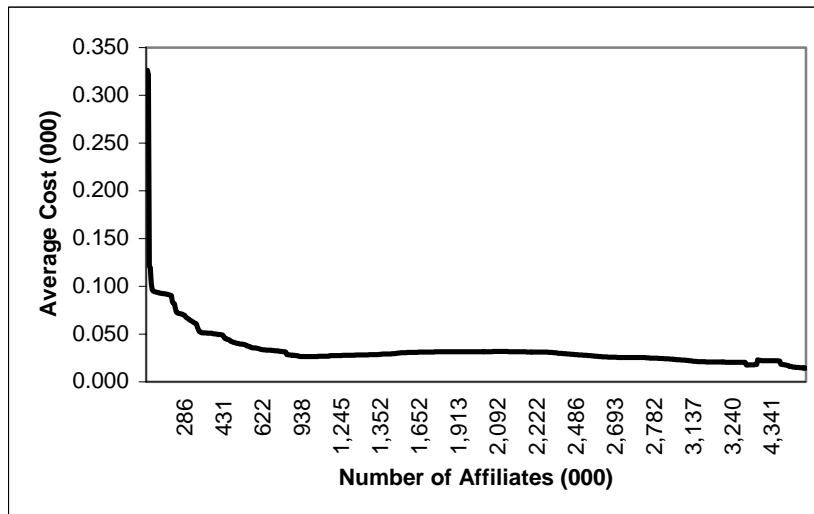
Graph 2a

Average fitted total cost curve when product is measured as AUM



Graph 2b

Average fitted total cost curve when product is measured as affiliates



The results based on number of affiliates as the production variable are slightly different from those of Garcia and Rodriguez (2003) and Melendez (2004). When the estimation is done as affiliates, we found an L shape with a minimum efficient scale approximately equal to 800,000 affiliates. Garcia and Rodriguez found the minimum cost

of the average cost curve equal to 1,081,000. Melendez on the other hand, finds a U shape for PFM that does not belong to a financial conglomerate which reaches its minimum around 1,050,000 affiliates and an L Shape (slightly upward for big PFM) average cost curve for PFM that do not belong to a financial conglomerate which reaches its minimum around 1,150,000 affiliates.

However, the results based on AUM contrast sharply with the translog estimates of Melendez (2004). Melendez also found a L shape average cost curve but with a minimum efficient scale around 184 billions of pesos of 2004, and 250 billions of pesos for PFM that do not belong to a financial conglomerate and for PFM that belong to a financial conglomerate respectively. Under Melendez estimates, none of the PFM has reached the efficient point. Under our estimates the minimum efficient scales is around 3,000 millions of pesos and only the smallest PFM have not reached this point. With approximately 2-3 per cent of the market share, a PFM can reach the efficiency point, either as measured as affiliates or measured as AUM. See Table 6.

Table 6  
Number of affiliates and AUM per PFM as of May 2004

|                    | Affiliates | Market share | AUM (Millions<br>of pesos) | Market share |
|--------------------|------------|--------------|----------------------------|--------------|
| Banamex            | 5,709,971  | 17.8         | 95,163                     | 22.6%        |
| Bancomer           | 4,327,804  | 13.5         | 88,182                     | 20.9%        |
| Profuturo GNP      | 3,234,742  | 10.1         | 43,077                     | 10.2%        |
| ING                | 3,213,254  | 10.0         | 39,514                     | 9.4%         |
| Santander Mexicano | 3,209,312  | 10.0         | 36,601                     | 8.7%         |
| Inbursa            | 2,844,629  | 8.9          | 31,991                     | 7.6%         |
| XXI                | 2,675,789  | 8.4          | 27,189                     | 6.5%         |
| Banorte Generali   | 2,245,025  | 7.0          | 26,931                     | 6.4%         |
| Principal          | 2,242,882  | 7.0          | 17,859                     | 4.2%         |
| HSBC               | 1,247,128  | 3.9          | 12,677                     | 3.0%         |
| Azteca             | 574,580    | 1.8          | 1,220                      | 0.3%         |
| Actinver           | 506,626    | 1.6          | 808                        | 0.2%         |

Source: [www.consar.gob.mx](http://www.consar.gob.mx)

Our estimates are more in line with that found for the pension industry in US, see the result of Turner and Beller's (1989) above, and are consistent with the fact that new small PFM are entering the market.

Let now analyze the control variables. The estimated coefficients are presented in Table 7. When AUM are used as production and we analyze firms that do not belong to a financial institution, the coefficient of wages is negative but not statistically significant. Cost of capital is positive but not different from zero, and the coefficient of salesmen is positive and statistically different from zero. When we analyze firms that belong to financial group, the coefficient of wages is also negative but statistically significant at the 5% level. Cost of capital is positive and the coefficient of salesmen is now negative.

When affiliates are used as production and we analyze firms that do not belong to a financial institution we observe that all coefficients are positive but none statistically significant. In the case of firms that are part of a financial group, all coefficients are now negative but again not statistically different from zero. These negative coefficients have to be discussed in a next draft.

Table 7a  
Estimated coefficients and standard error when AUM are used a production

|   | Coefficient | Std. Error | t-Statistic | Probability | R-Squared | Observations |
|---|-------------|------------|-------------|-------------|-----------|--------------|
| Do not belong to a financial conglomerate |             |            |             |             |           |              |
| Alpha 1 (wages)                           | -1002.5370  | 1701.3430  | -0.5893     | 0.5561      | 0.00110   | 316          |
| Alpha 2 (cost of capital)                 | 660.3612    | 1670.6000  | 0.3953      | 0.6929      | 0.00050   | 316          |
| Alpha 3 (salesmen)                        | 12.2383     | 7.1018     | 1.7233      | 0.0858      | 0.00934   | 316          |
| Belong to a financial conglomerate        |             |            |             |             |           |              |
| Alpha 1 (wages)                           | -3195.2040  | 1621.0500  | -1.9711     | 0.0494      | 0.01023   | 377          |
| Alpha 2 (cost of capital)                 | 1364.7730   | 1524.9620  | 0.8950      | 0.3714      | 0.00213   | 377          |
| Alpha 3 (salesmen)                        | -0.5322     | 3.7725     | -0.1411     | 0.8879      | 0.00005   | 377          |

Table 7b

Estimated coefficients and standard error when affiliates are used a production

|   | Coefficient | Std. Error | t-Statistic | Probability | R-Squared | Observations |
|---|-------------|------------|-------------|-------------|-----------|--------------|
| Do not belong to a financial conglomerate |             |            |             |             |           |              |
| Alpha 1 (wages)                           | 0.01493     | 0.05904    | 0.25288     | 0.80050     | -0.00039  | 316          |
| Alpha 2 (cost of capital)                 | 0.01493     | 0.05903    | 0.25296     | 0.80050     | -0.00039  | 316          |
| Alpha 3 (salesmen)                        | 0.01612     | 0.06019    | 0.26777     | 0.78900     | -0.00036  | 316          |
| Belong to a financial conglomerate        |             |            |             |             |           |              |
| Alpha 1 (wages)                           | -0.00329    | 0.04881    | -0.06734    | 0.94630     | -0.00006  | 377          |
| Alpha 2 (cost of capital)                 | -0.00328    | 0.04880    | -0.06720    | 0.94650     | -0.00006  | 377          |
| Alpha 3 (salesmen)                        | -0.00458    | 0.04977    | -0.09205    | 0.92670     | -0.00005  | 377          |

#### 4. Conclusions and policy recommendations

This paper investigates the presence of economies of scale in the PFM in Mexico. We estimate a semi parametric model that allows a more flexible form of the cost function, contrary to previous studies that imposed the structure of it.

The results show that the minimum efficient scale is reached approximately with 3,000 millions of pesos or with 800,000 affiliates. These numbers are below those found in the studies of García and Rodríguez (2003) and Melendez (2004). With our results practically all firms in Mexico has reached the minimum efficient scale.

If our results are true, why we observed small firms were bought at early stages of the new system. The reason may be in the fact that demand is very inelastic and that it is difficult to grow by attracting new customers just with low charges or high rates of return. But then, has this situation changed over time? There is evidence that consumers are now more sensible to charges and rates of return, but the main change has been in how new affiliates are assigned to the firms. Due to regulatory changes, since 2002 the system now “assigns” the new accounts for workers that at the moment of the affiliation to the system do not choose a PFM to firms with the lowest charges. Thus, new firms entering the market are sure that they can reach the minimum efficient scale if they have the right prices and

they do not need to pursue a very aggressive marketing strategy to attract new customers. It is worth commenting that the marketing cost can be an important share of the total cost and that in this type of markets it can have characteristics of fixed cost (Braberman, Chisari and Quesada, 1999). This has been the strategy of Azteca, Actinver and IXE the newest firms. 97.3, 97.5 and 90.4 per cent of the affiliates of Actinver, IXE and Azteca respectively come from this “assignment of accounts”.

The existence or not of economies of scale is highly important to surveillance authorities since it can lead to different regulatory actions aiming at lowering charges. If there are no economies of scale, the proposition that in Mexico we should eliminate the ceiling that a firm cannot have more than 20% of the market and instead highly regulate the charges is less convincing. On the contrary, no economies of scale suggest that authorities should work harder to develop more sensible consumers and/or to regulate more directly the process of changing/choosing PFM. Several actions in this line have been suggested by Whitehouse (2000), Valdes Prieto (2004), and Aguilera (2004).

The results of this study should encourage more research on this topic. We believe that the estimation that have been done for the case of Chile and Argentina can be redone using more flexible specification of the cost structure (all of them were based on some modifications of quadratic cost functions).

## References

- [1] Aguilera, N. (2004) “A Note on Internacional Administrative Charges of Funded Pensions” in *Journal Seguridad Social* Number 251, 8-13
- [2] Apella, I and D. Maceira. “Economias de Escala y Barreras a la Entrada en el Mercado Argentino de AFJP”. Mimeo CEDES and Facultad de Ciencias Económicas, Universidad de Buenos Aires, 2004
- [3] Amemiya, Takeshi (1985). *Advanced Econometrics*, Harvard University Press, Cambridge, Massachusetts
- [4] Berger, A.N. and D.B. Humphrey (1991). “The dominance of inefficiencies over scale and product mix economies” en *Journal of Monetary Economics* 28, 117-148

- [5] Bernt, Ernst (1991). *The Practice of Econometrics: Classic and Contemporary*, Addison Wesley, Reading, Massachusetts
- [6] Berstein, S. and J.L. Ruiz. (2003). “Sensibilidad de la Demanda con Consumidores Desinformados: El Caso de las AFP en Chile. Mimeo, Superintendencia de AFP de Chile.
- [7] Braberman, Chisari, O., y L. Quesada (1999) “The Pension Fund Industry in Argentina: Cost, Commissions and Alternatives for Regulation” Document prepared for the 1999 Annual Meeting of LACEA.
- [8] Chevalier, J. and G. Ellison (1997) “Risk Taking by Mutual Funds as a Response to Incentives” in *Journal of Political Economy* Vol. 105, No. 6
- [9] Chisari, O., Valdes-Prieto, S., Quesada, L., Dal Bo, P. and M. Rossi (1998) “Opciones Esatratégicas en la Regulación de las AFJP-Modulo III. Costos, comisiones y Organización Industria del Regimen de Capitalización” *Superintendencia de Administradoras de Fondos de Jubilaciones y Pensiones.*
- [10] Corbo, V. and K. Schmidt-Hebbel.(2003). “Efectos Macroeconómicos de la Reforma de Pensiones en Chile,” in *Resultados y desafíos de las Reformas de Pensiones*, Federación Internacional de Administradoras de Fondos de Pensiones
- [11] Expansión (2004) “Las 500 empresas de México” en *Expansión*, Grupo Editorial Expansión, México, D.F.
- [12] Greene, W. (2003) “*Econometrics analysis*” fifth edition, Prentice Hall.
- [13] M. Garcia and T. Rodríguez (2003). *La Organización del Mercado de Ahorro para el Retiro Mexicano Durante su Etapa de Acumulación*”, Thesis ITAM, 2003
- [14] McAllister, P. and D. McManus (1993). “Resolving the Scale Efficiency Puzzle in Banking” en *Journal of Banking and Finance* 17, 389-405
- [15] Melendez, J. (2004) *La Industria de la Afore: “Un análisis de su Estructura y Recomendaciones de Política de Competencia y Regulación”*. Mimeo, IMSS
- [16] Noulas, A.G., S.C. Ray and S.M. Miller (1990). “Returns to Scale and Input Substitution for Large U.S. Banks” en *Journal of Money, Credit and Banking* 22, 94-108

- [17] Robinson, P.M. (1998) “Root N-Consistent Semiparametric Regression” In *Econometrica*, Vol. 56 No. 4
- [18] Sales, C., F. Solís and A. Villagomez (1997). “La Reforma al Sistema de Pensiones: el Caso Mexicano” in *Gaceta de Economía* año 2 num. 4,11-55
- [19] Turner, R and D. Beller (1989) *Trends in Pensions*. Department of Labor, Washington, D.C.
- [20] Valdes-Prieto, S. (2004) “Para Aumentar la Competencia entre las AFP” Mimeo, Instituto de Economía PUC
- [21] Whitehouse, E. (2000) “Administrative Charges for Funded Pensions: An International Comparison and Assessment”, Social Protection Discussion Paper Series, World Bank, ([www.worldbank.org/pensions](http://www.worldbank.org/pensions))