Economies of Scale and Merger Efficiencies: Empirical Evidence from the Chilean Pension Funds Market

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1. Introduction

The financial services industry has been experiencing a strong concentration process all over the world during the last decade (Cetorelli, et. al, 2007; De Nicoló, et. al, 2003; Gelos and Roldós, 2004; Rhoades, 1996). As usual, one of the main concerns associated to the concentration of the industry is related to the possibility of exercising market power. As a result, antitrust authorities in several countries have required an in depth analysis of the efficiencies of each merger when concentration indexes are above the minimum thresholds required by mergers guidelines.

The main goal of this paper is to evaluate the welfare implications of the merger of two medium Pension Fund Managers (AFP) in Chile that was approved in 2007 by the Antitrust Tribunal (*Tribunal de Defensa de la Libre Competencia*). To this end, we estimate the size of scale economies in this industry, we present a simple theoretical model of the competition in the industry and, based on this model, we simulate the merger.

Logically, the net effect of the merger depends on the relative strength of two opposing forces: on the one hand, there are fewer firms in the market (which softens competition) and, on the other hand, the new larger competitor may have lower costs and behave more aggressively (which strengthens competition). We first estimate the size of the scale economies and then rely on standard merger simulation techniques to evaluate the final effect of the merger.

Our estimations, based on quarterly financial information of the last 8 years of the Chilean Pension Funds system, show that there are relevant economies of scale on operatoinal costs. The results are robust to several econometric specifications and is robust whether we use the total number of affiliates or only "active" affiliates -i.e., we exclude retirees and dead affiliates. We find that scale economies are stronger for administrative and sales costs, and somewhat weaker (**but still significant**) for **gastos de comercialización y de personal administrativo.**

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With our estimations of scale economies, we perform several merger simulations under different assumptions about the underlying demand elasticities. We conclude that the approved merger was in fact welfare enhancing.

The rest of the paper is structured as follows. In the next section we provide a concise description of the pension system in Chile and its evolution in the last two decades. In Secton 3 we describe our data and present the results of our empirical estimations**. In Section 4 we present a standard model of imperfect competition and in Section 5 we perform the merger simulations.** In Section 6 we conclude.

2. Market Description

The social security system in Chile operates since 1982 as a fully-funded-system whose main characteristics are: mandatory savings (12% of the worker's wage up to a limit of 2,700 US$), each worker owns her fund, cannot dispose her money before retirement, and specific investment firms (AFPs) manage these funds using a portfolio of assets. As a result of regulatory provisions AFP's portfolios do not differ among themselves and competition is based mainly on the fee each AFP charges to the worker (although those AFP that obtain larger return on funds highly publicize the fact).[4] In some sense, the Chilean system resembles the American IRA system, because Chilean regulation allows competition among private companies that manage the individual savings accounts and because workers are free to choose among portfolio managers.

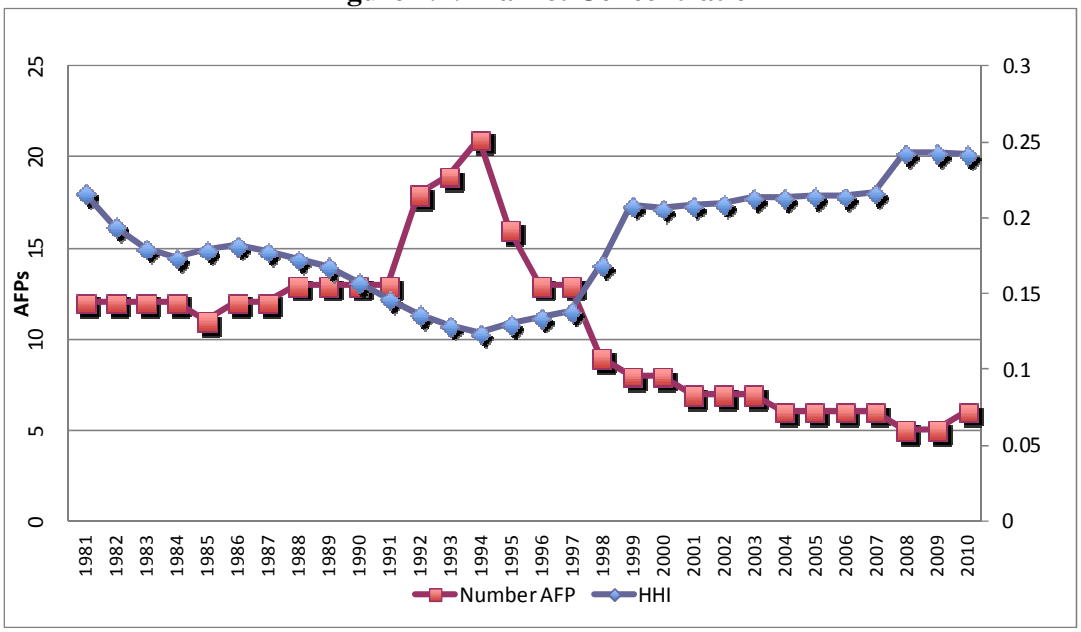
The Chilean social security system has been a very important source of savings, which has triggered a highly sustained rate of growth in the past two decades. Currently, accumulated funds represent around 60% of the GDP (**ojo, versión previa decía que en 2009 eran el 92,4% del PIB**). Since its reform in the early eighties, the pension system has imposed an important pressure over capital markets, helping their development and strengthening them. In addition, the private pension system requires a regulator's fast response to changes in market conditions, particularly by fixing the upper limits of different types of assets in the portfolio of the pension funds trusts.

In the last two decades, especially since 1994, the Chilean pension funds system increasingly concentrated. As shown in Figure 2.1, the Herfindahl-Hirshman Index in this market has risen from 13% during the 90s to 22% during the last decade while the number of firms has changed from 21 in 1994 to 6 in 2006 before the merger. The merger of two medium size firms that we analyze reduced this number to 5 firms in 2007. In 2010, a new firm entered the market after winning an auction (organized by the government) for the right to administrate the funds of 200,000 workers entering the

[4] To some extent, competition is also based on the perceived quality of complementary services such as the on-line provision of quarterly statements and certificates or additional savings management services.

market (the total number of active affiliates at that time was about 8.5 million).[5] The two largest funds increased their joint participation from 51% in 1994 to near 65% in 2010 and 2011.

Figure 2.1: Market Concentration

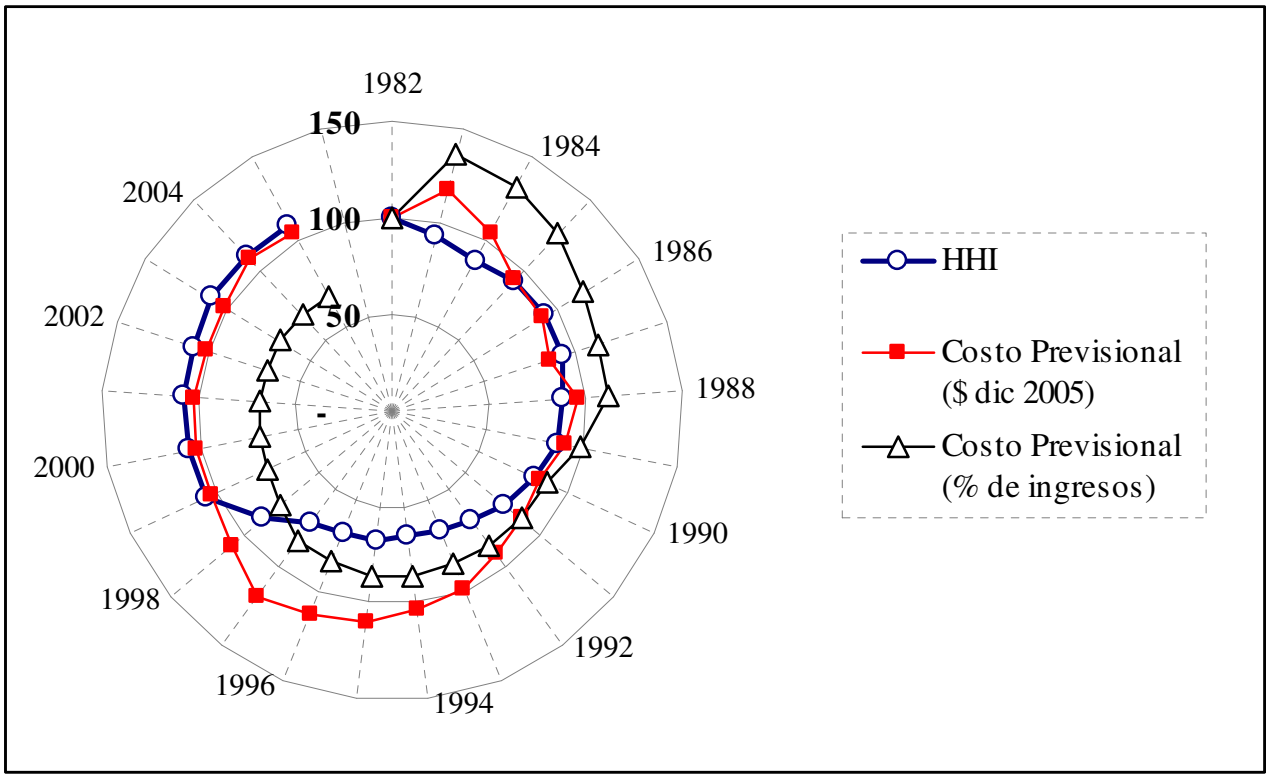


AFPs provide in fact a bundle of services to their active affiliates: they collect the monthly funds directly from the employers, manage the funds, provide insurance for accidents or sicknesses (not related to work) that result in permanent disabilities or death (*Seguro de Invalidez y Sobrevivencia*, SIS from now on), and regularly provide information about the funds' return to the affiliates. Additionally, they receive and manage additional and voluntary savings that accumulate in a special account (*ahorro previsional voluntario*). For their services, fund managers charge a fee that, by law, it is not related to the accumulated funds but to the monthly payment. By the time of the merger (2007 and 2008), it consisted of a monthly fixed charge plus a percentage of the worker's monthly taxable income. Explicitly, a fraction of this percentage financed the aforementioned insurance. To foster competition by simplifying the price structure, a reform in 2008 eliminated the fixed charge and it also forced all AFPs to charge the same rate for the SIS (the rate results from an auction that AFPs design and the government oversees).

Figure 2.2 portraits the evolution of the average fee charged by the AFPs in constant $ and as a percentage of the amount workers contribute to their funds. The figure shows how the cost of the system (as a percentage of worker's contribution) has steadily decreased despite the increasing concentration observed.

[5] The auction had several interesting characteristics that favoured potential entrants: it pooled a large number of workers (entering the market) who would not have the right to switch AFP for two years, it was a first-price sealed-bid auction, and existing AFPs, if they won offering a lower commission than the currently charged to its affiliates, had to charge the winning bid to all its affiliates. Additionally, if the winner is a new entrant, it had some temporal leeway in terms of the number of offices open to the public they must have.

Figure 2.2: Price Evolution and Market Concentration



3. Analysis of Economies of Scale

3.1 The cost structure of the AFPs Industry

Total cost of a pension fund manager (AFP) depends mainly on the number of active affiliates (i.e., employed wage workers). AFPs must collect their monthly contribution to the fund, send out information quarterly, provide them with the SIS insurance, and manage their funds. Other clients for the AFPs are unemployed affiliates and retirees affiliates who did not choose to buy an annuity from a life insurance company.

Table 3.1 and shows the cost structure for the whole industry in 1990, 2000, and 2005 (in constant Ch$ of 2005). In this period there has been an important decrease on total operating costs, which is consistent with the existence of important scale economies and the wave of mergers observed between 1994 and 2000. During this period all relevant operating costs significantly decreased.

Table 3.1: Operating Costs

Operating Expenses	1990	2000	2005
Payroll (Administrative Personnel)	97629	63628	47526
Sales Force	49587	40547	32918
Board of Director Compensations and Benefits	1301	1101	884
Advertising and Marketing Expenses	10712	3852	4936
IT Expenses	15596	4954	5824
General and Administrative Expenses	70354	36015	43717
Depreciation	9117	5782	4599
Amortization	495	957	1799
SIS Cost	193862	112358	154432
Other	1953	2670	4012
Total Operational Expenses	450605	271864	300647

Between 2000 and 2005, the increase on operating costs is mainly explained by the increase on the cost of the SIS although the administrative expenses also increased significantly.

Based on annual data for the period 1989-2005, Figure 3.1 shows how the relative importance of the different components of operating costs have changed. It is clear in this graph how effective was the regulatory reform of 1997 aimed at reducing the rapidly growing expenditures on sales force and advertising.[6]

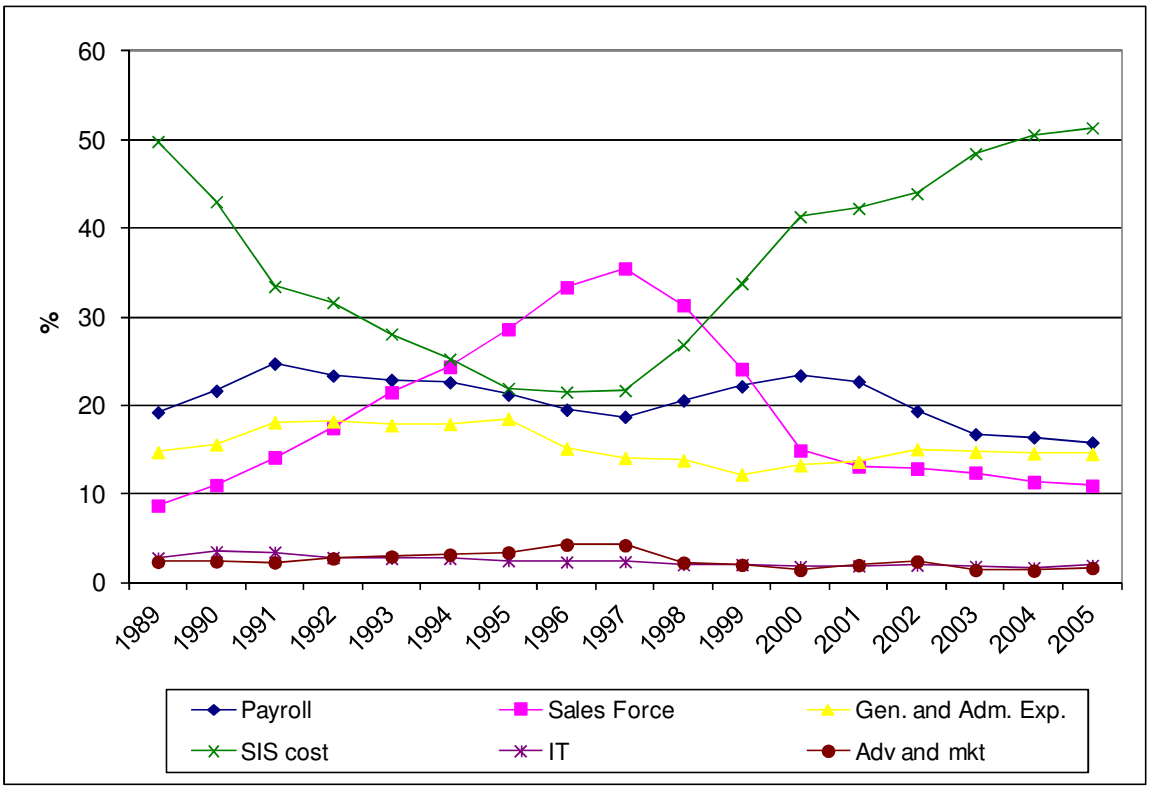
Except for the years 1995 to 1998, the main component of operating costs has been the SIS. Its importance has been increasing since 1997 and this could probably be explained by several reasons, one of them is that there are probably no scale economies on the insurance or they are very small.

The other relevant expenses have been the general payroll, sales force and administrative expenses that represented 18.2%, 12.1% and 14.5% of total expenses in the period 2000-2005.

A relevant share of administrative expenses is fixed per affiliate, so the scale economies in terms of the number of affiliates are limited. There are, however, some scale economies in terms of the volume of funds managed since most of the associated relevant costs are fixed. Variable costs associated to funds management are reduced to custody costs, brokers' fees (although AFPs may enjoy some quantity discounts on international transactions), and mandatory reserves (1% of the fund). According to Marinovic and Valdes (2005), fund management variable cost are about only 0,02% of total fund management costs. Fixed costs include salaries of experts in finance, legal counseling, subscription to specialized information sources, etc. These costs increase with the number of different funds managed, but not with their volume. The 2002 reform that introduced the mandatory five different funds certainly had an impact on the fund management expenses.

[6] It did so by imposing switching costs on affiliates (e.g., after the reform they had go to the office of their current AFP and sign a few papers to be able to switch AFP and the possibility of giving certain gifts to new affiliates - typically small appliances- was eliminated), and by increasing the costs of hiring sales agents (they had to attend a course and pass an exam, and all AFPs had to inform to the rest of the industry thirty days in advance that they were planning to hire a new sale agents and even who they will hire).

Figure 3.1: Operating costs structure 1989-2005 (main components)



There are also several regulations that have an impact on fund management costs. Some are independent of the size of the fund (e.g., percentage limits to the different kind of financial instruments in the different funds), but others as the constraint on the maximum share that an AFP may have of any firm imposes larger costs on larger AFPs. On the other hand, the regulation that the return of any fund of an AFP cannot be too low as compared to the average of the system imposes a larger burden on the small AFPs as they have a lower impact on this average.

Finally, a relevant share of operational expenses are those necessary to gain new affiliates and to keep the own affiliates. The larger components here are sale force payments (which consist of a fixed salary plus a variable component), marketing expenses, and branch offices and its related expenses. Sale force personnel include not only salesmen, but also "keepers" whose goal is to avoid that current affiliates switch to another AFP. According to one of the AFPs, one "keeper" is necessary for every three thousands affiliates of the same geographic area with a salary above a certain threshold (about US$1,300). The scale economies on these expenses are related to training and supervising efforts of the sale force and advertising expenses.

3.2 Empirical Findings

From the previous discussion, we conclude that scale economies on general and administrative expenses should be related to the number of affiliates, and also to the volumen of managed funds.

There is some evidence of the second type of economies for the US. Baumol et al. (1990) find empirically that the cost-assets elasticity are between 0,423 and 0,871. For developing countries, the

evidence is scarce. Donoso (1997) estimates the annual operating expenses minus the SIS cost, the sales force and marketing expenses per affiliate for 12 of the 13 AFPs in 1995 and 1996. The per affiliate expense for the smallest AFP (8,371 affiliates) turned out to be 5.8 times larger than for the largest AFP (935.661 affiliates). Given that there was no evidence of significant differences on the quality of services, this result is consistent with the existence of important scale economies. Marinovic and Valdés (2004), based on monthly financial data from 1993 to 2002 estimate two different cost functions for small and large AFPs (they define the threshold on 200,000 affiliates). They find evidence of decreasing marginal cost for the large AFPs and increasing marginal cost for the small ones. For the purpose of evaluating the likely effects of the merger on welfare, it is relevant to estimate the size of the scale economies and the marginal cost function.

Economies of Scale

Total costs of AFPs depend mostly on the number of workers affiliated to each AFP whom receive money collection, fund management, and information services. However, different operating cost components that are necessary to provide these services are affected differently by the number of workers affiliated and the amount of total funds managed. On average, the main costs of AFPs in decreasing order of magnitude are wages, sales force expenses, and administrative costs. Potential economies of scale depending on the number of workers affiliated are mostly related to some administrative costs and sales effort. Additionally, there are some potential economies of scale on the amount of funds managed mostly related to some administrative and regulatory costs (Arrau and Chumacero, 1998).

The empirical question then, to later assess the effects of a merger between two AFPs, is about the magnitude of economies of scale for each cost component. To estimate the scale economies in this market, we estimate the cost function of firms using a unique and very rich data set containing detailed information for each AFP. Different models and specifications robustly show an important degree of scale economies in the operating costs. The average cost of an AFP decreases as the number of affiliated workers increase. The results also show that scale economies are more important in managerial costs and sellers, and less important in marketing and administrative staff.

Specifically, using a panel of quarterly data from 2000 to 2007 collected from the regulator (Superintendencia de AFP) we estimate the parameters of a cost function using several linear and non-linear specifications. The cost functions were estimated with a fixed effects estimators and robust standard errors. The regressions include quarterly and yearly dummies to control for different time effects. The results of the estimation are quite satisfactory, all explanatory variables are statistically significant at the 95% confidence and the explanatory power of the regressions is quite high for panel data with an R^2 ranging from 0.28 and 0.44.

The results show significant economies of scale of operating costs both on the number of workers or on the total number of affiliates (those working and those unemployed or retirees). The main empirical finding is that, everything else constant, an increase in 1,000 active workers in an AFP reduces its average cost between Ch$16.3 and Ch$42.4 per quarter. The main results are reported on Table 3.2.

Table 3.2: Average Operational Expenses – Linear and quadratic specifications

Dependent Variable	$\frac{Operational\ Expenses}{\#\ Total\ Affiliates}$		$\frac{Operational\ Expenses}{\#\ Working\ Affiliates}$	
Constant	17.6636	21.6343	35.8458	40.5679
T. Affiliates	-0.0000041	-0.0000135		
T. Affiliates^2		3.06e-12		
W. Affiliates			-0.0000163	-0.0000424
W. Affiliates ^{2}				2.07e-11
Observations	194	194	194	194
F	82.76	57.889	108.08	75.249
R^2	0.2769	0.3774	0.3711	0.4407

The regressions on the average costs of administrative personnel, general and administrative expenses, sales force, and advertising and marketing expenses show similar results, with all variables significant at 95% and an R2 ranging from 0.34 to 0.56, but the effects are lower in magnitude. An increase of 1,000 active workers would, on average, reduce the average total administrative costs between Ch$3.8 and Ch$10.8 per quarter. On average, an increase in 1,000 active workers decreases the average administrative wages between Ch$2.1 and Ch$7.3 per quarter. Finally, the results show that an increase of 1,000 active workers would decrease the average sales effort expenses between Ch$4.9 and Ch$14.4 per quarter. All the results are robust if we use the total number of affiliates instead of working affiliates only and also to the inclusion as an independent variable of the average accumulated pensions funds of the workers in each AFP.[7] These results are summarized in Tables 3.3 to 3.6.

Table 3.3: Average Administrative Personnel Expenses– Linear and quadratic specifications

Dependent Variable	$\frac{Adm.\ Personnel\ Expenses}{\#\ Total\ Affiliates}$		$\frac{Adm.\ Personnel\ Expenses}{\#\ Working\ Affiliates}$	
Constant	2.876759	3.588949	5.831176	6.775706
T. Affiliates	-5.68e-07	-0.00000226		
T. Affiliates^2		5.50e-13		
W. Affiliates			-0.0000021	-0.00000731
W. Affiliates ^{2}				4.14e-12
Observations	194	194	194	194
F	41.56		43.19	
R^2	0.1553	0.2497	0.1364	0.1986

[7] Additional results are reported on the Appendix.

Table 3.4: Average General and Administrative Expenses – Linear and quadratic specifications

Dependent Variable	$\frac{Gen.\ Adm.\ Expenses}{\#\ Total\ \ Affiliates}$		$\frac{Gen.\ Adm.\ Expenses}{\#\ Working\ \ Affiliates}$	
Constant	2.832276	3.521512	6.163836	7.430543
T. Affiliates	-0.000000763	-0.0000024		
T. Affiliates^2		5.32e-13		
W. Affiliates			-0.00000375	-0.0000108
W. Affiliates ^{2}				5.56e-12
Observations	194	194	194	194
F	96.6		179.05	
R^2	0.3413	0.4491	0.4504	0.5645

Table 3.5: Average Sales Force Expenses – Linear and quadratic specifications

Variable Dependiente	$\frac{Gasto\ Ventas}{\#\ Afiliados}$		$\frac{Gasto\ Ventas}{\#\ Cotizantes}$	
Constante	3.154831	4.312939	6.513635	8.241916
Afiliados	-0.00000106	-0.0000038		
Afiliados^2		8.94e-13		
Cotizantes			-0.00000485	-0.0000144
Cotizantes^2				7.58e-12
Observaciones	194	194	194	194
F	99.74	51.899	173.86	176.81
R^2	0.3521	0.5160	0.5066	0.6493

Table 3.6: Average Advertising and Marketing Expenses – Linear and quadratic specifications

Variable Dependiente	$\frac{Gastos\ Comercialización}{\#\ Afiliados}$		$\frac{Gastos\ Comercialización}{\#\ Cotizantes}$	
Constante	0.4189542	0.451242	0.7898171	0.6687961
Afiliados	-0.000000135	-0.000000212		
Afiliados^2		2.49e-14		
Cotizantes			-0.000000516	0.000000154
Cotizantes^2				-5.31e-13
Observaciones	194	194	194	194
F	79.67	21.995	66.87	78.089
R^2	0.1832	0.1872	0.1526	0.44985

It is important to mention that our previous results could be potentially biased because of omitted variables (e.g., size of the funds managed, unobserved heterogeneity among AFPs, or unobserved temporary effects that affect industry's costs). As a robustness exercise, we estimated several additional models including average size of the managed funds, dummies for the different years and quarters, and we also run a panel regression with individual fixed effects to account for unobserved heterogeneity. The results consistently support the existence of scale economies both on the number of working affiliates and total affiliates.[8] When the volume of managed funds is included, the estimated reduction on average operational costs of increasing in 1,000 working affiliates is between Ch$16.2 and Ch$51.7.

[8] Quarterly dummies were never significantly different from zero and the other variables were unaffected by its presence, so we exclude them in the final specifications. Additionally, in the fixed effect estimation all non-linear effects on the number of working affiliates or total affiliates were not statistically different from zero.

Marginal Costs

In addition to the evidence on scale economies, it is worth exploring if there is evidence of decreasing marginal returns. We run several regressions of total operational expenses on several variables: the number of working affiliates (and its square), the total number of affiliates (and its square), and the total of managed funds. All the regressions include dummies for the years and quarters.[9] Table 3.7 summarizes the results.

Table 3.7: Total Operating Expenses

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	1207494	1172277	687146	769868	465541	1115110	-78678	492945
T. Affiliates	6.301867(**)	5.634141(**)			8.2117(**)	5.785785(**)		
T. Affiliates^2					-6.20E-07(**)	4.75E-08		
W. Affiliates			15.85194(**)	14.73454(**)			20.51175(**)	16.46818(**)
W. Affiliates ^{2}							-3.68E-06(**)	-1.28E-06
Man. Funds		0.0491095(**)		.0268298(**)		.0487741(**)		0.0243655
Observations	194	187	194	187	194	187	194	187
F	132	184	191	201	160	208	293	273
R^2	0.894	0.942	0.935	0.948	0.9	0.942	0.940	0.949
(**) 1% significance; (*) 5% significance.								

According to the regression on the number of working affiliates, marginal cost are between 14.7 and 17.2 thousands Ch$ per quarter (column 4 and column 7 –evaluating at the mean of 445 thousands working affiliates). We are particularly interested on this coefficient (rather than one on total affiliates) because is the relevant one for pricing decisions, since the AFPs do not charge any fees to unemployed affiliates.

The results on decreasing marginal costs are mixed coefficients on the square of the number of affiliates –columns 5 to 8- are negative (and they were also negative in other additional specifications), but it is not statistically different from zero in all specifications.

4. Merger Simulations

Merger simulation models (MSM) are increasingly used by antitrust authorities to evaluate the welfare effects of proposed mergers. These models provide a rigorous and consistent method to weigh two opposing effects that are typically present (or at least argued by the parties) in all mergers: efficiency gains associated to scale economies –which favor mergers– and consumer surplus losses associated to unilateral effects –which disfavor mergers.[10]

[9] On additional regressions we included AFP's individual effects. On these regressions the coefficients on number of total affiliates (or working affiliates) resulted non-significantly different from zero. Unfortunately, the low variability through time of the number of affiliates makes it impossible to capture the effect of scale and individual effects. Since our chief interest is on the scale, we excluded the individual effects from our regressions.

[10] Another argument to oppose mergers is the increased risk of coordinated effects (collusion) because of the reduced number of competitors. MSMs do not allow weighing this factor, as they assume firms behave competitively both before and after the merger.

Succinctly, a merger simulation can be described as a three step exercise: 1) A model of competition is assumed (e.g., a Bertrand model) and a demand system functional form is assumed, 2) from the market data available (e.g., typically market shares and prices and sometimes margins and/or marginal costs as well) and the first order conditions of the maximization problems of all firms, all parameters of the demand model (and marginal costs) are deduced, and 3) assuming the observed, estimated, and/or deduced parameters do not change, a post-merger equilibrium is computed and all relevant welfare changes calculated. Logically, the reliability of the exercise heavily rests on the accuracy of the assumptions and the parameters observed or estimated. For these reasons, it is also convenient to perform robustness analysis by using different demand functional forms and by assuming different values for those parameters that are noisily observed (or simply assumed).

Complete with references.

4.1 Observed Data and Calibration Process

From administrative data, we have reliable information about prices and market shares for all firms and, from our previous section estimations, we have also information about the marginal cost function. Figure 4.1 shows the evolution of the percentage fees charged by all AFPs in the decade previous to the merger.[11] Figure 4.2 illustrates the evolution of market shares in the same period (market share of a firm is defined not in terms of workers but in terms of received monthly contributions).

Figures 4.1 and 4.2.

As can be seen, these figures are quite stable thru time. For our calibration exercise, we use the information from april 2007, the last one previous to the consultation to the antitrust tribunal. Table 4.1 resumes this information and includes a calculation of marginal cost based on column (7) of Table 3.7 and number of working affiliates.

Table 4.1:

	Working Affiliates	Market Share	Price (*)	Marginal Cost (*)
Bansander	391005	12.01%	11.6	5.88
Cuprum	397726	16.89%	16.1	5.86
Habitat	1100369	24.95%	8.6	4.14
Planvital	154609	3.23%	7.9	6.46
Provida	1645336	31.38%	7.2	2.80
Santa Maria	496202	11.54%	8.8	5.62
(*) Thousands of Chilean Pesos (per month)				

Since we assume a Bertrand competition model and each firm is assumed to provide a single service,[12] the

[11] The percentage fee was, on average, about 0,87% of the total fees charged by the AFPs for the month of April (2007).

[12] AFPs provide in fact a number of services as mentioned in the introduction. We focus here exclusively on those related to compulsory pension fund. Although each AFP manages five different funds (A to E) that differ on the level of risk that the AFP might take, the funds do not differ much among the different AFPs because, by regulation, no AFP can risk to have too low a return as compared to the average of the whole system and the AFP charges the same fee for all funds.

first order condition for each firm can be written as $\partial \Pi_i(\mathbf{p}) / \partial p_I = q_i(\mathbf{p}) + (p_i - c_i) \partial q_i(\mathbf{p}) / \partial p_i = 0$.[13] This condition can also be written as $s_i + s_i \mu_i \varepsilon_{ii} = 0,$ where s_i is firm i's market share, μ_i is its markup and ε_{ii} is its own-price elasticity.

We could pursue two different avenues to calibrate our model. Following Epstein and Rubinfeld (2001), we can assume a "*Proportional Almost Ideal Demand System",* which amounts to assume an AIDS with the additional simplifying assumption of proportionality: if a firm raises its price, lost clients who choose to go to other firms do it in proportion to their market share. E.g., if before the price of firm i increases firm j doubles firm k, then when firm i increases its price firm j will receive twice as many workers as firm k; the ratio s_j/s_k will not be affected by the price increase of firm i.

With the additional assumption that the aggregate price elasticity for the industry is zero (by regulation all dependent workers must be affiliated to an AFP), we would require information (or to make an assumption) on one firm's own-price elasticity and market shares to be able to deduce the rest of the substitution elasticity matrix (Epstein and Rubinfeld, 2001) and all marginal costs.

In our case, however, we have information not only on market shares and the aggregate elasticity of the industry, but also on marginal costs. This, and the fact that each firm handles a single product, allows us to obtain all own-price elasticities for all firms from the first order conditions. With these values, the fact that the aggregate price elasticity for the industry is zero, and the assumption of proportionality, cross elasticities can be deduced as well.

Table 4.2 presents own-price elasticities on the first column and cross-price elasticities in the second one (recall cross-price elasticities of substitution of any two goods with respect to a third one are identical).

Table 4.2: Elasticities

	Own-price	Cross-price
Bansander	-2,02	0,28
Cuprum	-1,57	0,32
Habitat	-1,93	0,64
Planvital	-5,46	0,18
Provida	-1,63	0,75
Santa Maria	-2,77	0,36

To perform the merger simulation exercise we need to define two additional elements: a functional form for the demand system and the effect that the merger would have on marginal costs. According to our estimations form the previous section that we also used to deduce marginal costs, the merging firms Bansander and Santa María would have a post-merger marginal cost of 14 thousand pesos per quarter, which amounts to reductions of 21% and 17% respectively. We will therefore assume these savings and perform sensitivity analysis around these and other variables.

With respect to the demand functional form, we will present detailed results with a PCAIDS demand and aggregate results for a linear and for a constant elasticity demands.

[13] We implicitly assume that both pre and post-merger marginal cost are constant over the relevant range of production for the firms. The value of the marginal cost, however, is allowed to vary before and after the merger.

4.2 Results

Benchmark Case

Our benchmark is therefore defined by the elasticities and marginal costs described in Table 4.2 and the assumption of a PCAIDS demand. The main results obtained under these assumptions are presented in Table 4.3. It shows for each "brand" which is the pre and post-merger market shares, the price change and change in profits.

In the proposed scenario the merger is beneficial for consumers as all firms end up lowering their prices, it is also beneficial for the merging firms and, given that the merging firm reduces its prices, the non-merging firms logically end up with lower profits.

Table 4.3: Merger simulation – Base Scenario[14]

	Mkt Share		Price	Mg. Cost	Profits
	Pre-Merger	Post-Merger	% Change	% Change	% Change
Bansander	12,0%	14,1%	-11,0%	-20,7%	16,2%
Cuprum	16,9%	16,5%	-4,3%	0,0%	-9,1%
Habitat	24,9%	24,2%	-3,0%	0,0%	-8,5%
Planvital	3,2%	3,1%	-1,0%	0,0%	-10,2%
Provida	31,4%	30,7%	-3,5%	0,0%	-7,9%
Santa Maria	11,5%	11,5%	-3,2%	-17,1%	20,8%
Average			-4,58%	-5,75%	-3,33%
Average (Linear Demand Model)			-0,91%	-5,75%	3,27%
Average (Constant Elasticity Model)			-1,76%	-5,75%	2,51%
Base Scenario: Marginal Cost = 6,837 -2 x 1.23E-06 x Num.Cot.					

Sensitivity Analysis

There are several dimensions in which sensitivity analysis might be performed: demand curve functional forms, marginal cost reductions and values of elasticities. Since we observe prices, market shares and have estimated marginal costs to infer elasticities, the first obvious sensitivity analysis to perform is on the marginal cost savings.

Tables 4.4 and 4.5 present the results for two alternative scenarios: an optimistic one where the marginal cost savings are larger than the base case and a pessimistic one, where they are smaller. Both cost savings where calculated using the extreme values of the 95% confidence interval on the parameter that accompanies the square of the total number of active affiliates on the total cost regression.

[14] Note that the simulations were performed based on monthly figures while the regression analysis was based on quarterly data. This fact explains the difference between the marginal cost equation reported on this and the following tables and the original regression.

Table 4.4: Merger simulation – (Very) Optimistic marginal cost saving scenario

	Mkt Share		Price	Mg. Cost	Profits
	Pre-Merger	Post-Merger	% Change	% Change	% Change
Bansander	12,0%	16,0%	-33,8%	-34,2%	-17,7%
Cuprum	16,9%	14,9%	-26,4%	0,0%	-50,5%
Habitat	24,9%	22,6%	-24,9%	0,0%	-46,7%
Planvital	3,2%	2,4%	-7,2%	0,0%	-54,0%
Provida	31,4%	31,7%	-34,3%	0,0%	-41,8%
Santa Maria	11,5%	12,4%	-22,8%	-29,1%	-14,2%
Average			-28,11%	-11,98%	-40,78%
Average (Linear Demand Model)			-2,23%	-11,98%	2,54%
Average (Constant Elasticity Model)			-4,71%	-11,98%	-1,50%
Optimistic Scenario: Marginal Cost = 6,837 **- 2 x 1.85E-06** x Num.Cot.					

Table 4.5 shows that in the pessimistic scenario the merger would produce a negligible price increase of 0,69%.

Table 4.5: Merger simulation – Pessimistic marginal cost saving scenario

	Mkt Share		Price	Mg. Cost	Profits
	Pre-Merger	Post-Merger	% Change	% Change	% Change
Bansander	12,0%	12,6%	-1,1%	-9,4%	14,8%
Cuprum	16,9%	17,0%	1,0%	0,0%	2,3%
Habitat	24,9%	25,2%	0,5%	0,0%	2,2%
Planvital	3,2%	3,3%	0,2%	0,0%	2,6%
Provida	31,4%	31,6%	0,4%	0,0%	2,1%
Santa Maria	11,5%	10,3%	3,5%	-7,5%	16,7%
Average			0,69%	-2,21%	5,18%
Average (Linear Demand Model)			0,31%	-2,21%	4,08%
Average (Constant Elasticity Model)			0,84%	-2,21%	6,97%
Pessimistic Scenario: Marginal Cost = 6,837 **- 2 x 6.00E-07** x Num.Cot.					

To complement the sensitivity analysis on costs savings, it is possible to compute the critical level of savings that would be necessary for the merger to produce no price changes. The value of the compensating marginal cost reduction (CMPC) is in our case 9,8%.

A robustness check on our simulations could be performed if we had an additional source of information on marginal costs (e.g., accounting information) or on elasticities. In such a case we could double check our estimated marginal cost and or the implied elasticities with the ones from the external source. As far as we know, the only additional source is Marinovic and Valdés (2004). With monthly financial data from 1992 to 2002, they estimate two different total cost functions for "large" and "small" pension fund managers. Their results in terms of the level and slope of the marginal cost function for the large AFPs (defined as those

having more than 200,000 workers) are very consistent with our estimations.[15]

A complete different set of merger simulations can be performed if we disregard the information on marginal costs deduced from our previous section estimations and, instead, we assume a value for a single own-price elasticity. In that case, given that we lack information on individual elasticities, we could perform sensitivity analysis by assuming different values of one own-price elasticity and deduce the whole elasticity of substitution matrix. [16]

Table 4.5 presents the results of our simulations (in terms of average price changes) for different own-price elasticities of AFP Provida (the largest one) from -1.1 to -2.3 and marginal cost reductions from 0% to 20%. The table also includes the average marginal cost implied by each of the assumed elasticities.

Table 4.6: Merger simulation Sensitivity Analysis
(PCAIDS – Own price elasticity and marginal cost saving)

		Implied average marginal cost	Implied average own-price elasticities	Marginal cost reduction for merging firms				
				0	5%	10%	15%	20%
Own-price elasticity (Provida)	**-1.1**	2040	-1.34	52.3%	47.2%	41.8%	36.1%	30.1%
	-1.4	3700	-1.70	15.1%	11.6%	8.0%	4.1%	0.0%
	-1.7	4774	-2.06	7.5%	4.8%	2.0%	-0.9%	-4.0%
	-2	5525	-2.43	4.7%	2.4%	0.0%	-2.4%	-5.1%
	-2.3	6081	-2.79	3.4%	1.3%	-0.8%	-3.1%	-5.4%

This table shows how sensitive the results are to the own-price elasticity that we assume. For small values of the elasticity and given an observed price, the smaller is the marginal cost (deduced from the first order condition of the profit maximization problem) and, therefore, the larger the pre-merger market power of firms. The merger is, ceteris paribus, more likely to generate price increases the smaller the own-price elasticities are. The effect of the marginal cost reduction we assume is straightforward: the larger it is, the smaller the price increase (or the larger the price decrease).

5. Conclusions

We have analyzed the proposed (and eventually accepted) merger between two medium pension fund managers in Chile (Santa María and Bansander). This merger was the last one in a concentration process of this industry that began in the mid nineties when there were more than twenty administrators to only five when the merger was approved.

The empirical evidence presented in Section 3 is robust finding scale economies for this merger. Evaluated at the mean of the sample (which roughly coincides with the size of the two merging firms), average total operating expenses could decrease in Ch$16 per thousand working affiliates per quarter, which adds to

[15] Their estimated marginal cost function is 3.36-2x1.14E-06. The slope and the level of this function is very similar to ours once we consider the fact that we work with quarterly data and the fact that Marinovic and Valdés exclude the cost of the disability insurance, which accounts for about 50% of what workers contribute to AFPs and, we consider, represents a constant marginal cost for the AFPs.

[16] Recall that aggregate elasticity is zero and, using a PCAIDS specification, the whole elasticity of substitution matrix can be deduced from the aggregate elasticity and any own-price elasticity.

Ch$6,500 per quarter given the size of the merger (about 25% of the average total operating expenses).

The simulations performed is Section 4 do not provide results that clear as they are sensitive to the assumption made on the marginal cost reduction and the elasticities. For marginal costs of about Ch$16,500 per quarter –which imply average own-price elasticities of about 2–, a marginal cost reduction of 10% would be necessary to avoid a price increase. Some of our estimations predict even a larger marginal cost reduction, but the results are not that robust. Further research is required to obtain more precise estimations about the possible change that the merger may induce on marginal costs. In particular, the information on the wave of mergers occurred during the second half of the nineties should be exploited.

6. References

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7. Appendix