

ECONOMIES OF SCALE AND MERGER EFFICIENCIES: EMPIRICAL EVIDENCE FROM THE CHILEAN PENSION FUNDS MARKET *

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Abstract

Over the last twenty years there has been a deep concentration process in the Pension Fund Manager (AFPs) industry in Chile (from 21 firms in 1994 to only 6 in 2012). A major concern with the concentration of this industry is that firms might be able to exercise market power. However, significant efficiency gains could result from this concentration process, especially if there are economies of scale present in the industry. The welfare effect of a merger is, therefore, ambiguous. In this paper we estimate the welfare implications of a merger between two medium-sized AFPs in Chile. For this purpose, we estimate the size of the economies of scale in this industry and use the results to simulate the merger using a simple imperfect competition model. The estimations, based on quarterly financial information for the last 8 years of the Chilean Pension Funds system, show robustly the presence of significant economies of scale in operating costs. The merger simulation indicates that despite the cost savings, the merger would induce a small price increase. This effect reduces consumer welfare, but aggregate welfare increases because of the efficiency gains from the economies of scale. Since aggregate elasticity in this industry is zero (because affiliation is compulsory), the price increase does not generate any efficiency loss.

Keywords: Mergers, Economies of Scale, Merger Simulation Models, Pension Funds

JEL Classification: C33, D43, G23, L11, L13, L41

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1. Introduction

Over the past decade, the financial services industry has been experiencing a concentration process across the globe (Cetorelli, et. al, 2007; De Nicoló, et. al, 2003; Gelos and Roldós, 2004; Rhoades, 1996). One of the main concerns associated with the concentration of this industry has to do with the possibility of being able to exercise market power. As a result, antitrust authorities in several countries have demanded a profound efficiency analysis of each merger when concentration indexes are above the minimum thresholds required by merger guidelines.

The main goal of this paper is to evaluate the welfare implications of a merger between two medium-sized Pension Fund Managers (AFP) in Chile, which was approved in 2007 by the Antitrust Tribunal (*Tribunal de Defensa de la Libre Competencia*). In order to do this, we first estimate the size of economies of scale in the industry and use this information to simulate the merger using an imperfect competition model. Finally, we estimate its welfare effects. The net effect of the merger depends on the relative strength of two opposing forces: on one hand, there are fewer firms in the market (which softens competition) and on the other, the new and larger competitor may have lower costs and behave more aggressively (which strengthens competition).

The estimations, based on quarterly financial information for the last 8 years of the Chilean Pension Funds system, show robustly that there are relevant scale economies in operating costs. Among the different components of these costs, economies of scale are larger for administrative personnel and sales force expenses while somewhat smaller for marketing and administrative staff expenses.

Using these estimations, we simulate the welfare effects of the merger. Merger simulation models allow us to weigh the two opposing forces mentioned earlier. The first is the productive efficiency gain given by a new larger competitor who behaves more aggressively, strengthening competition, and the second, that competition is softened because of the reduced number of firms. The merging firm has a clear incentive to increase prices as its affiliates have fewer alternatives to switch to. We conclude that these effects cancel each other out and that the approved merger would induce a small price increase, hence reducing consumers' welfare. Aggregate welfare, on the other hand, would increase because of the scale

economies. Given that the aggregate elasticity in this industry is zero or very small (since affiliation to one AFP is compulsory), the price increase induces no efficiency loss.

To the best of our knowledge, this is the first paper that analyzes a merger in the financial intermediary sector using a merger simulation model. However, in the last decade there has been a growing literature that studies and assesses mergers with this tool. Merger simulation models have been used to study important cases in the United States and Europe.¹

In most cases, merger simulation models were useful to help decide whether to reject, accept, or accept with remedies, the proposed merger. However, the empirical evidence that simulation models yield is only a part of the antitrust analysis. Complementary economic analysis, such as econometrics and qualitative assessment, are also relevant to decide whether a proposed merger may substantially lessen competition.

The paper is structured as follows: Section 2 describes the history and evolution of the pension system in Chile over the last three decades. Section 3 describes the data and presents empirical estimations of scale economies in this industry. In section 4, a standard model of merger simulation is solved and the welfare effects are computed. Finally, section 5 contains our concluding remarks.

2. Market Description

A fully funded social security system has been operating in Chile since 1981. Specific investment firms, known as pension fund managers (AFPs hereafter), collect mandatory savings, which are approximately 10% of the worker's wage (up to a limit of US\$2,700), manage workers' individual accounts, and invest their accumulated funds in financial assets. Workers must choose only one AFP, but can switch among them at any time they deem convenient. Since 2002, AFPs manage

¹ For example, the Continental Baking's acquisition of Interstate Bakeries, Kimberly-Clark's acquisition of Scott Paper, Staples' merge with Office Depot in the 90's, and Evanston Northwestern Healthcare's acquisition of Highland Park more recently in the United States. The European Commission also used it in Volvo and Scania's merger, Lagardère, Natexis, and VUP's merger, the Dutch energy utility company, Nuon's, acquisition of Reliant Energy Europe, TomTom's acquisition of Tele Atlas NV, Navteq's acquisition by Nokia, and Unilever's acquisition of some businesses of the Sara Lee Corporation. See details in Ivaldi and Bervoben (2005), Hausman and Leonard (2005), Neven and Albæk (2008), and Budzinski and Ruhmer (2010).

five risk-differentiated investment portfolios, and workers can freely distribute their funds among them. Regulatory provisions induce AFPs to hold similar investment portfolios² and, as a consequence, they mainly compete on the fees charged to workers.³ To some extent, competition is also based on advertising successful past investments and quality of complementary services such as the on-line provision of quarterly statements and certificates or additional savings management services.

The Chilean social security system has been an important source of national savings, which has helped sustain a high economic growth rate over the past two decades. The accumulated funds in the year 2010 amounted to 79% of the GDP. The system has also helped to develop and deepen the Chilean capital market. The fast-growing impact of the pension system on the capital market required several regulatory modifications to be made mainly related to both foreign asset investment limits and single firm ownership limits.

The industry had seen an important increase on the total number of firms during the first decade, followed by a sharp increase in concentration due to a wave of mergers and acquisitions in the second half of the nineties. Figure 2.1 shows the evolution of the total number of firms and the industry concentration. The Herfindahl-Hirschman Index (HHI) in this market has risen from 13% in the mid-nineties to 22% over the last decade.⁴ In the same period, the number of firms dropped from 21 in 1994 to only 6 in 2006.

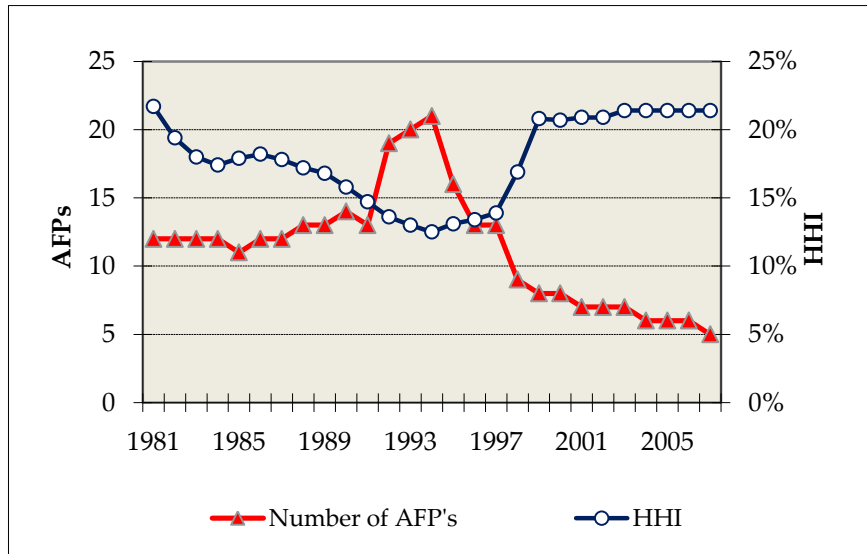
Figure 2.2 clearly illustrates the important number of mergers and acquisitions that took place and it also shows the stability of market shares (measured in terms of working affiliates) after the wave of mergers. The latter is relevant for our merger simulation, since we use information from April of 2007 for our calibration.

² As noted by Raddatz and Schmukler (2011) for Chile, Kominek (2006) for Poland.

³ AFPs are allowed to charge fees only to working affiliates (retired and unemployed workers are exempted).

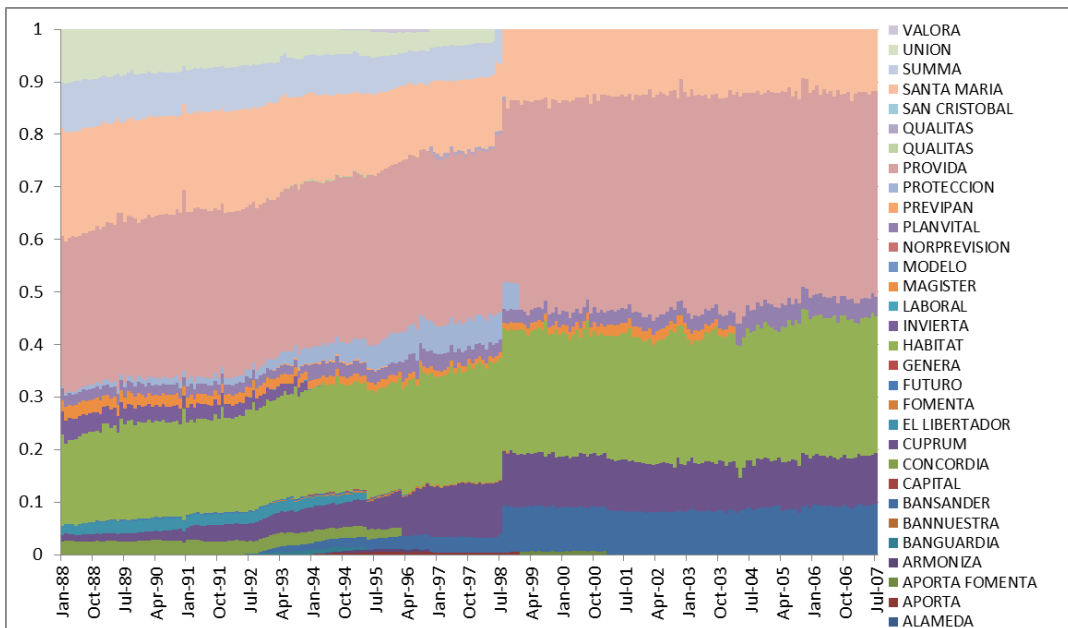
⁴ Following an important change in the regulation of the industry's structure, a new firm entered the market in 2010 after winning an auction (organized by the government) for the right to manage the funds of 200,000 workers entering the market (2% of the total number of active affiliates at that time).

Figure 2.1: Market Concentration



Source: Own calculations based on Pensions Supervisory Authority data.

Figures 2.2: Evolution of Market Shares (% of working affiliates)



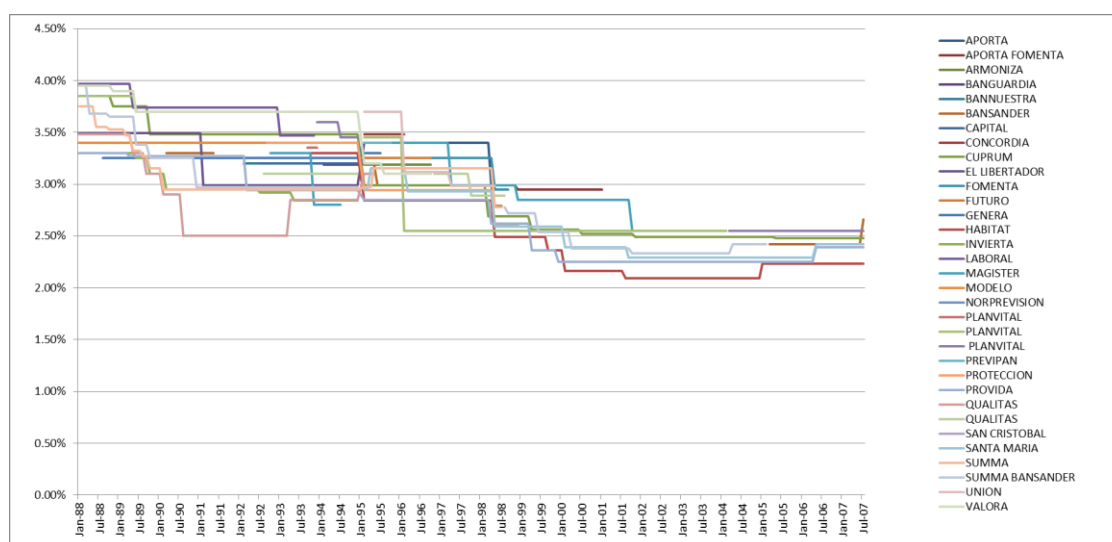
Source: Own calculations based on Pensions Supervisory Authority data.

An AFP provides a package of services to its active affiliates which mainly consists of collecting monthly social security contributions directly from the employers, managing the funds, providing insurance for not work related accidents or sicknesses (known as disability and survivor insurance, SIS) which may result in

permanent disabilities or death, and also providing periodical information about the funds' return to the affiliates. For their services, AFPs charge a fee that, by law, cannot be related to the funds but only to the monthly contribution. By the time of the merger we analyze in 2007, this fee consisted of a monthly fixed charge plus a percentage of the worker's monthly taxable income.

Figure 2.3 shows the evolution of the percentage fees charged by all AFPs; it is clear to see how these decreased over the 20 years previous to the merger and their stability since the year 2000.⁵

Figure 2.3: Evolution of Percentage Fees

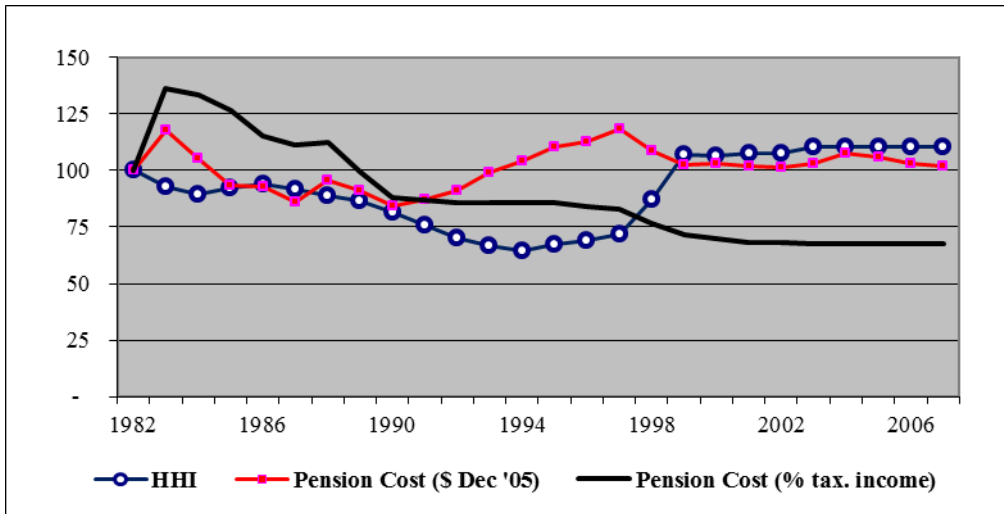


Source: Own calculations based on Pensions Supervisory Authority data.

In addition, together with the HHI, Figure 2.4 shows the evolution of the average fee charged by AFPs in both constant Chilean pesos and as a percentage of the taxable income. This figure shows how the average fee, measured as a percentage of taxable income of the system, has steadily decreased despite the increasing concentration observed since 1994. In fact, the Pearson correlation coefficient between the HHI and the percentage fee is negative (-0.29), although not statistically significant.

⁵ AFPs' fixed fees during this period followed, in real terms, a similar decreasing pattern. In any case, they represented a small fraction of total fees (about 13% in April 2007).

Figure 2.4: Price Evolution and Market Concentration



Source: Own calculations based on Pensions Supervisory Authority data.

This negative correlation certainly does not imply any causality. To be able to assess the impact of a horizontal merger on the fees, it is necessary to analyze in detail the cost structure of the industry, the potential economies of scale, and the degree of competition among firms.

3. Analysis of Economies of Scale

3.1 The Cost Structure of the AFPs Industry

The total cost of a pension fund manager depends mainly on the number of active affiliates (i.e., employed workers). As mentioned earlier, AFPs collect their monthly contribution to the fund, send out personalized information on a quarterly basis, provide them with the SIS insurance, and manage and invest their funds. Other customers of AFPs are unemployed or retired affiliates who did not previously choose to buy and receive a perpetuity (an annuity that continues until the person has passed away) from a life insurance company.

Table 1 shows the cost structure for the whole industry in 1990, 2000, and 2005 (in constant Ch\$ of 2005). During this period there has been an important decrease in total operating costs, which is consistent with the existence of important scale economies and the wave of mergers observed between 1994 and 2000.

After the merger wave between 2000 and 2005, the increase in operating

costs is mainly explained by the increase in the cost of the SIS, although it is important to note that the administrative expenses also increased significantly.

Based on annual data for the period between 1989 and 2005, Figure 3 shows how the relative importance of each component of the operational costs has changed. An interesting detail, evident in the figure, is how effective the regulatory reform of 1997 was to reduce the rapidly growing expenditures on sales force and advertising.⁶

Table 3.1: Operating Costs (in constant MMCh\$ of 2005)

Operating Expenses	1990	2000	2005
Personnel Salaries	97,226	63,628	47,526
Sale Force Salaries	49,587	40,547	32,918
Board of Directors Salaries	1,301	1,101	884
Advertisements and Marketing Expenses	10,712	3,852	4,936
IT Expenses	15,596	4,954	5,824
Administrative Staff Expenses	70,354	36,015	43,717
Depreciation	9,117	5,782	4,599
Repayments	495	957	1,799
Disability and Survivors Insurance	193,862	112,358	154,432
Miscellaneous	1,953	2,670	4,012
Total Expenses	450,605	271,864	300,647

Source: Pensions Supervisory Authority.

Except for the period between 1995 and 1998, the largest component of the operating costs has been the SIS. It has become increasingly more important since 1997, most probably because there are no scale economies on the insurance and if there are any at all, they are undoubtedly very small.

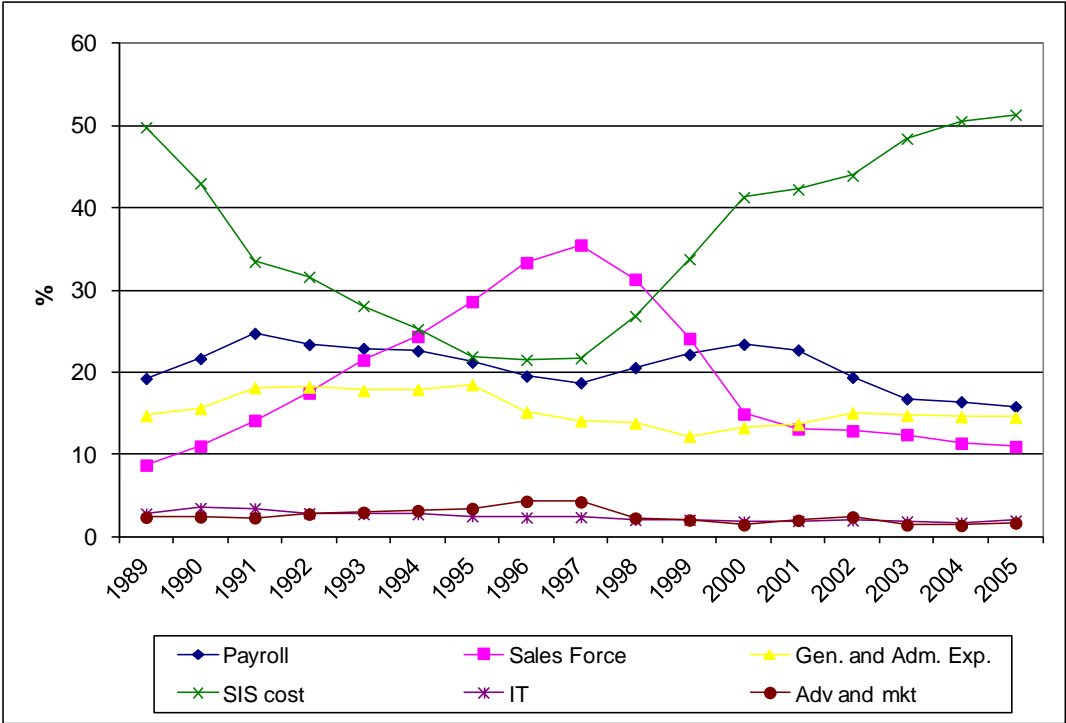
Other relevant expenses include general payroll, sales force and administrative expenses, which represent 18.2%, 12.1%, and 14.5% respectively, of the total expenses over the period 2000-2005.

A relevant share of administrative expenses is fixed per affiliate, which implies that scale economies in terms of number of affiliates are limited. There are, however, some scale economies in the volume of funds managed since most of the

⁶ It did so by imposing switching costs to affiliates (e.g., after the reform they had to 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).

associated relevant costs are fixed. Variable costs associated to fund 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 Valdés (2005), fund management variable costs are around just 0.02% of total fund management costs. Fixed costs include salaries of finance experts, legal counseling, and subscription to specialized financial services as real-time data and market analysis, to name just a few. All of these costs increase with the *number* of different investment portfolios, but not with their *volume*. It can also be observed that the 2002 reform, where five different and mandatory funds were introduced, had an important impact on the fund management expenses.

Figure 3.1: Operating Costs Structure 1989-2005 (main components)



Source: Own calculations based on Pensions Supervisory Authority data.

There are several other regulations that affect the portfolio compositions and also have an impact on fund management costs. Some regulations are independent of the actual size of the fund. An example of this is that there are specific bounds on the relative importance that different financial instruments may have on each of the 5 portfolios AFPs hold. Other regulations impose costs that do depend on the AFP size. This includes, for example, the constraint on the maximum

share that an AFP may have of any firm, which imposes higher costs on larger AFPs. On the other hand, the regulation that punishes AFPs whose return deviates too much from the system average imposes a larger burden on the smaller AFPs since they have a lower impact on this average.

Finally, there is a relevant fraction of operational expenses aimed at recruiting new affiliates and preventing current affiliates from switching to other AFPs. The larger components in this case are sales force payments (which consist of a fixed salary plus a variable component), marketing expenses, and branch offices along with their related expenses. Sales force personnel include not only salesmen, but also “keepers”, whose goal is to avoid current affiliates from switching to another AFP. According to the general manager of one of the AFPs we have interviewed, a single “keeper” is necessary for every three thousand affiliates who belong to the same geographic area and have a salary above a certain threshold (about US\$1,300). The scale economies on these expenses are related to advertising expenses and the training and supervising efforts of the sales force.

3.2 Empirical Findings

The previous discussion on the cost structure of the industry shows that the presence of scale economies, in general and in administrative expenses, should be related to the number of affiliates and also to the volume of managed funds. There is some empirical evidence on the latter for the U.S., as Baumol et al. (1990) find that the cost-asset elasticity is between 0,423 and 0,871. For developing countries, the evidence is scarce. In the case of Chile, there are only two studies providing some indirect evidence of economies of scale in this industry.

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 results show that the ‘per affiliate’ expense for the smallest AFP (8,371 affiliates) is 5.8 times higher than for the largest AFP (935.661 affiliates). Considering that there are no obvious differences in the quality of services offered among AFPs, it is possible to interpret this result as indirect evidence of relevant economies of scale. Marinovic and Valdés (2004), using monthly financial data from 1993 to 2002, estimate different cost functions for small and large AFPs (they define 200,000 affiliates as the threshold). These authors find evidence of a decreasing

marginal cost for large AFPs and an increasing marginal cost for the small ones.

The results of these two papers are consistent with the existence of economies of scale in the pension fund market in Chile. However, for the purpose of evaluating the likely effects of a merger on welfare, it is relevant to estimate the magnitude of these economies of scale and also the marginal cost function.

Economies of Scale

The total costs of AFPs depend mostly on the number of affiliated workers, who receive the services of money collection, fund management, and information services. However, the different operating cost components that are necessary to provide these services are affected heterogeneously by the number of workers who are affiliated and the total amount of 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 should be present mainly in administrative costs and sales effort. Additionally, there are some potential economies of scale in the amount of funds managed, mainly related to administrative and regulatory costs (Arrau and Chumacero, 1998).

To be able to assess the effects of a merger, it is of key importance to estimate the magnitude of these economies of scale. To do this, we estimate the cost function of the industry using quarterly panel data for the period between 2000 and 2007, which contains detailed financial information for each AFP.

Table 3.2 shows the summary statistics of the data used in the estimation, which was collected from the regulator (Pensions Supervisory Authority).

Table 3.2: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Total Affiliates	1,027,301	898,124.1	25,728	3,246,434
Working Affiliates	445,069	369,015.6	18,117	1,424,187
Managed Funds	4.10E+07	4.09E+07	1.05 E+06	1.83E+08
Saving Accounts	202,438.5	181,345.9	11,645	870,178
Operating Expenses	1.05E+07	6.85E+06	1.04 E+06	3.28E+07
Marketing Expenses	179,396.9	142,933.6	36.14176	780,920.8
Sales Force Expenses	1,280,677	637,145.4	190,836.6	2,850,250
Adm. Personnel Expenses	1,899,796	1,471,787	185,580.4	6,978,686

Source: Pensions Supervisory Authority, Chile.

The variables Total Affiliates and Working Affiliates are in terms of number of people. The variables Managed Funds, Operating Expenses, Marketing Expenses, Sales Force Expenses, and Administrative Personnel Expenses are all in millions of Chilean pesos of 2007. The variable Saving Accounts is the total number of saving accounts managed by each AFP.

The empirical analysis consists of estimating the parameters of a cost function using several linear and non-linear specifications. All cost functions were estimated with fixed effects estimators and robust standard errors. The regressions also include quarterly and yearly dummies to control for different time effects. In general, the estimation results are quite satisfactory; all explanatory variables are statistically significant at a 95% confidence level and the explanatory power of the regressions is quite high for panel data with an R² ranging from 0.28 and 0.44.

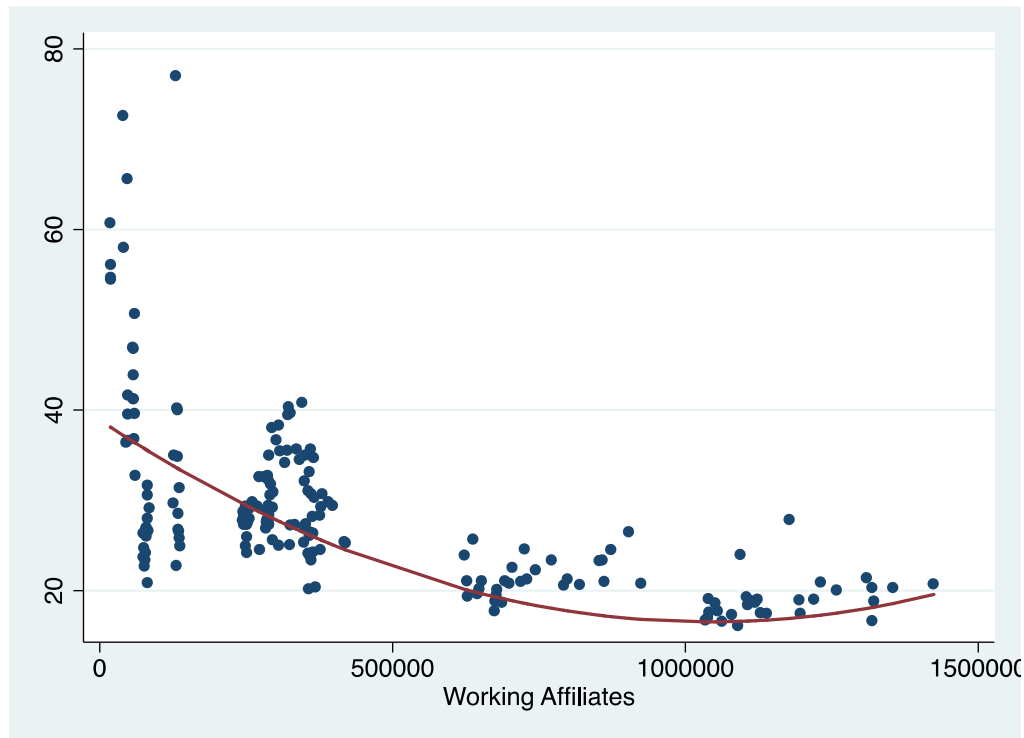
The results show significant economies of scale in operating costs both for the number of workers and also for the total number of affiliates (those who are working plus those unemployed and retired). The main empirical finding is that, keeping everything else constant, an increase of 1,000 active workers in an AFP reduces its average costs between approximately Ch\$16.3 and Ch\$42.4 per quarter. The regressions for operating expenses, using linear and quadratic specifications, are reported in Table 3.3. Figure 3.2 shows a scatterplot of the data used in the Working Affiliates estimations and the estimated average operational expenses function that results from non-linear specification.

Table 3.3: Average Operational Expenses

Dependent Variable	<i>Operational Expenses</i>		<i>Operational Expenses</i>	
	<i>Total Affiliates</i>		<i>Working Affiliates</i>	
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

Source: Own estimations.

Figure 3.1: Estimated Average Operational Cost Function



Source: Own estimations.

The estimations of the average cost functions of administrative personnel, general and administrative expenses, sales force, and advertising and marketing expenses show similar results. All variables are significant at 95% and have an R^2 ranging from 0.34 to 0.56, but effects are lower in magnitude. An increase of 1,000 active workers is associated with a reduction on the average total administrative costs between Ch\$3.8 and Ch\$10.8 per quarter and decreases the average administrative wage costs between Ch\$2.1 and Ch\$7.3 per quarter. The results also 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 of the results are robust to the inclusion of the monthly average accumulated pension funds of the workers in each AFP and the number of saving accounts.⁷ These results are presented in Tables 3.4 to 3.7.

⁷ Additional results are reported in the Appendix. 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.

Table 3.4: Average Administrative Personnel Expenses

Dependent Variable	<i>Adm. Personnel Expenses</i>		<i>Adm. Personnel Expenses</i>	
	<i>Total Affiliates</i>		<i>Working Affiliates</i>	
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

Source: Own estimations.

Table 3.5: Average General and Administrative Expenses

Dependent Variable	<i>Gen Adm. Expenses</i>		<i>Gen Adm. Expenses</i>	
	<i>Total Affiliates</i>		<i>Working Affiliates</i>	
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

Source: Own estimations.

Table 3.6: Average Sales Force Expenses

Dependent Variable	<i>Sales Force Expenses</i>		<i>Sales Force Expenses</i>	
	<i>Total Affiliates</i>		<i>Working Affiliates</i>	
Constant	3.154831	4.312939	6.513635	8.241916
T. Affiliates	-1.06e-6	-3.8e-6		
T. Affiliates ²		2.49e-13		
W. Affiliates			-4.85e-6	-1.44e-5
W. Affiliates ²				7.58e-12
Observations	194	194	194	194
F	99.74	51.899	173.86	176.81
R ²	0.3521	0.5160	0.5066	0.6493

Source: Own estimations.

Table 3.7: Average Advertising and Marketing Expenses

Dependent Variable	Marketing Expenses		Marketing Expenses	
	Total Affiliates		Working Affiliates	
Constant	0.4189542	0.451242	0.7898171	0.6687961
T. Affiliates	-1.35e-7	-2.12e-7		
T. Affiliates ²		2.49e-14		
W. Affiliates			-5.16e-7	1.54e-7
W. Affiliates ²				-5.13e-13
Observations	194	194	194	194
F	79.67	21.995	66.87	78.089
R ²	0.1832	0.1872	0.1526	0.44985

Source: Own estimations.

Marginal Costs

The evidence of economies of scale in operating costs and several of its components implies that, at least in some range, marginal costs are decreasing. It is particularly relevant to estimate its magnitude since it is an input for the merger simulation. For this purpose, we estimate the total operating expenses function controlling for the number of working affiliates along with its square and cube, the number of saving accounts and the total of managed funds. All the regressions include year and quarterly dummies and AFP fixed effects. Table 3.8 presents the results.

Table 3.8: Total Operating Expenses

	(1)	(2)	(3)
Working Affiliates	28.373 (4.198)	28.234 (3.394)	26.799 (4.395)
Working Affiliates ²	-0.0000178 (0.0000071)	-0.0000205 (0.0000059)	-0.0000193 (0.0000074)
Working Affiliates ³	7.61E-12 (3.3E-12)	9.43E-12 (2.97E-12)	8.81E-12 (3.52E-12)
Saving Accounts			1.942 (1.171)
Managed Funds		0.0217 (0.0053)	0.0222 (0.0066)
Constant	4.21E+08 (1.72E+08)	3.39E+08 (1.60E+08)	5.98E+07 (2.58E+08)
Observations	194	194	194
R ²	0.9481	0.9567	0.9521
F	76.23	79.27	78.17

Source: Own estimations.

The results of the estimation are consistent with previous results on scale economies and show a decreasing marginal cost of up to 700,000 working affiliates. Evaluated at the sample mean, the marginal cost is Ch\$14.85 and an increase of 1,000 working affiliates would reduce this cost in Ch\$15. The estimated marginal cost function implies that a merger between two AFPs, with 400,000 working affiliates each, would reduce the marginal cost in approximately 18%.

4. Merger Simulations

The use of merger simulation models (MSM) has increased significantly over the past two decades by antitrust authorities in order to evaluate the welfare effects of proposed mergers.⁸ These models provide a rigorous and consistent method to weigh the two opposing effects that are typically present in all mergers: efficiency gains associated to scale economies, which favor mergers, and consumer surplus losses associated to unilateral effects, which disfavor mergers.⁹

Succinctly, a merger simulation can be described as a three-step process: 1) A model of competition (e.g., a Bertrand model) and a demand system functional form are assumed; 2) from the market data available (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 obtained; and finally, 3) assuming that 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 this 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 are simply assumed).

Beyond the reliability of the parameters and assumptions made for the

⁸ See the early contributions of Hausman, Leonard, and Zona (1994), Werden and Froeb (1994), Werden (1997). See Budzinski and Ruhmer (2010) for a survey both on the different merger simulation models and on their use by European and American antitrust authorities to evaluate potential mergers.

⁹ 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.

simulation, it is important to mention that the merger simulation exercise focuses exclusively on short run incentives. Non-merging firms are allowed to modify their prices in the near future, but other long run reactions such as repositioning or possible entry of new firms are not included in the analysis.

4.1 Observed Data and Calibration Process

From administrative data, we have reliable information about prices and market shares for all firms. From our previous estimations, we also have information about the marginal cost function. As shown in Section 2, during the nineties there was an important wave of mergers that was accompanied by a significant decrease of average fees. However, in the five to seven years prior to the merger, we can observe that both market shares and fees were quite stable. Therefore, for our calibration exercise we use information from April of 2007, the last available data previous to the consultation made to the antitrust tribunal.

Table 4.1 presents information on total number of working affiliates, average taxable income of working affiliates, market share, and price for each AFP.

Table 4.1: Basic Market Information (April 2007)

	Working Affiliates	Av. Taxable Income (*)	Market Share	Price (**)
1_Santa María	496,202	344,888	11.54%	2.55
2_Bansander	391,005	436,900	12.01%	2.66
3_Cuprum	397,726	647,860	16.89%	2.48
4_Habitat	1,100,369	370,328	24.95%	2.32
5_Plan Vital	154,609	283,009	3.23%	2.79
6_Provida	1,645,336	301,947	31.38%	2.39

(*) Chilean Pesos per month (532Ch\$ ≈ 1US\$, April 2007).

(**) As a percentage of taxable income.

Since we assume a Bertrand competition model and each firm is assumed to provide a single service,¹⁰ the first order condition for each firm can be written as

¹⁰ AFPs provide a number of mandatory and highly regulated services, which are paid altogether by the monthly fee that an active worker pays.

$\partial \Pi_i(\mathbf{p}) / \partial p_i = q_i(\mathbf{p}) + (p_i - c_i) \partial q_i(\mathbf{p}) / \partial p_i = 0$.¹¹ 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 can pursue two different approaches 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. This means that if a firm raises its price, clients who leave and choose to move to other firms will do it in proportion to their market shares. For example, if firm j has double the market share that k , individuals who abandon firm i because of a price increase will move in such a way that firm j will receive twice as many affiliates as firm k . Therefore, the ratio of market shares between firms j and k will not be affected by the price increase of firm i .

With the additional information about market shares and the 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 have 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.

The second approach would imply estimating marginal costs for each AFP and, based on the first-order condition, calculate the value of all own-price elasticities. With these values, the fact that the aggregate price elasticity for the industry is zero and the assumption of proportionality, cross elasticities could be inferred as well.

This second approach, however, has some difficulties. Our estimations of the total cost function are very robust when they are evaluated at close-to-average sized AFPs, as it is expected when using a point estimate from a regression, but they are less robust for the largest and the smallest AFPs. Moreover, for several estimations, the marginal cost of the largest AFP exceeds the price they charge, which is

¹¹ 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.

inconsistent with profit maximization.¹²

Consequently, we decide to pursue the first approach. From our previous section estimation of total costs we deduce the marginal cost for the closest-to-the-average AFP. The marginal cost equation that can be deduced from the total cost estimation (Table 3.7, column 3) is $Cmg(q)=26.8-2\cdot q\cdot 1.9E-05+3\cdot q^2\cdot 8.81E-12$. These figures are in thousands of Chilean pesos, based on quarterly information, and q represents the number of working affiliates. Evaluated at the 2007 size of the AFP Santa María (the closest-to-the-average AFP), the marginal cost for the firm would be 14.15 thousand Ch\$ per quarter, which represents 1.37% of the taxable income for the average working affiliate of this firm (i.e., about 54% of the price it charged). From the first order condition and using the information on marginal cost, price, and market share, the own-price elasticity of AFP Santa María is found to be -2.16.

Once we take into account the value of the own-price elasticity of Santa María, the aggregate elasticity of zero, the information on prices and market shares, and the assumption of a proportional AIDS model, all elasticities can be deduced. Table 4.2 presents this information, (recall that cross-price elasticities of substitution of any two goods with respect to a third are identical).

Table 4.2: Elasticities

	Own-price	Cross-price
1_Santa María	-2.16	0.28
2_Bansander	-2.15	0.29
3_Cuprum	-2.03	0.41
4_Habitat	-1.83	0.61
5_Plan Vital	-2.36	0.08
6_Provida	-1.68	0.77

There is one additional element to be defined before the merger simulations can be performed and it has to do with the efficiency gains that a merger is supposed to involve. The merge of two-firms could, in principle, affect both fixed costs (because all fixed costs would be duplicated and can therefore be eliminated) and

¹² This is not surprising, as the estimator of marginal cost is a conditional mean and the data points for the largest AFP are far away from the sample mean. Identifying the marginal cost for the largest AFP would require a separate, though simultaneous, estimation for each AFP. Such an exercise requires a larger dataset than the one available to obtain estimators with reasonable precision.

marginal costs (because of the larger scale). Of course, for the pricing decision, the second effect is the relevant one, but the fixed costs savings must also be considered when evaluating total welfare effects of the merger.

According to the total cost function used in the calibration, the pre-merger marginal costs for Bansander and Santa María were 15.75 and 14.16 thousands of Chilean pesos per quarter respectively (which represent 1.20% and 1.37% of the quarterly average taxable income). Post-merger marginal cost, according to the same estimation, would be 13.36 thousands of Ch\$ per quarter, which would represent a 1.02% and 1.29% of their average quarterly taxable income (for Bansander and Santa María respectively). The estimated marginal cost savings can therefore be calculated as 15.2% for Bansander, and 5.6% for Santa María.

4.2 Results¹³

Benchmark Case

The benchmark is defined by the elasticities described in Table 4.2, the assumption of a PCAIDS demand, and the assumption on marginal cost savings based on our total cost estimations (i.e., 15.2% for Bansander and 5.6% for Santa María). The main results obtained under these assumptions are presented in Table 4.3. It shows the pre and post-merger market shares, the price change, and the variation in profit for each AFP.¹⁴

¹³ All merger simulations were computed with the SimMerger Lite program.

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 4.3: Merger simulation – Base Scenario

	Mkt Share		Price	Mg. Cost	Profits
	Pre-Merger	Post-Merger	% Change	% Change	% Change
Santa Maria	11,5%	10,1%	7,1%	-5,6%	6,9%
Bansander	12,0%	12,7%	-0,9%	-15,2%	22,6%
Cuprum	16,9%	17,1%	1,1%	0,0%	3,4%
Habitat	24,9%	25,2%	1,2%	0,0%	3,2%
Plan Vital	3,2%	3,3%	1,0%	0,0%	3,8%
Provida	31,4%	31,6%	1,2%	0,0%	2,9%
Average			1,63%	-3,01%	5,79%

$$\text{Marginal Cost (th.Ch}\$, \text{ per quarter)} = 26.8 - 2 \times 1.93\text{E-}05 \times \text{Num.Cot.} + 3 \times 8.81\text{E-}12 \times (\text{Num.Cot.})^2$$

In the benchmark scenario, the merger is marginally detrimental for consumers. The sign of the change in consumers' welfare is equal to *minus* the sign of the average price change; in the above scenario prices rise 1.63%. As for producers, the merger is naturally beneficial for the merging firms and given that, on average, these firms increase their prices, in the post-merger scenario it is also beneficial for the non-merging firms to increase their prices. Obviously, aggregate profits for the industry increase.

It is important to note that the last column of Table 4.3 reports the change in profit for each firm excluding any fixed-cost savings; it therefore provides a conservative measure of the profit increase for the merging firms.

In terms of aggregate welfare, if the same weight were given to consumer and producer surplus, the merger would be welfare improving. The reason is simple and it is that the merger involves cost savings and also because the total quantities are not affected by higher prices since the aggregate elasticity is zero.¹⁵ Naturally, if a larger weight is given to consumer surplus then the merger could decrease the total welfare.

Sensitivity Analysis

There are at least two dimensions in which a sensitivity analysis may be performed; first, we have estimations for the total cost function and can use the parameter estimations to construct a confidence interval for the marginal cost reductions.

¹⁵ This is a simplifying assumption of our merger simulation exercise, but we consider it is valid for small price changes since affiliation to an AFP is compulsory. For a large price increase, however, some workers could quit the labor market.

Second, we can assume different values for the own-price elasticity of the AFP we chose as anchor to compute the rest of the elasticities (Santa María in our case).¹⁶

Based on our total cost estimation (Table 7.3, column 3), the variance-covariance matrix of the estimators, and the size of the merging firms, we can build confidence intervals on the marginal cost savings. Table 4.4 presents the relevant figures for 90% and 95% confidence intervals both in thousands of Chilean pesos (per quarter) and as a percentage of average taxable income.

Table 4.4: Merger simulation – Cost-Saving Scenarios

	Pessimistic Scenarios		Base Scenario	Optimistic Scenarios	
	95%	90%	mean	90%	95%
Santa María (th. Ch\$)	-0.573	-0.371	0.796	1.963	2.166
Bansander (th. Ch\$)	0.261	0.576	2.390	4.204	4.519
Santa María (% of tax. income)	-4.1%	-2.6%	5.6%	13.9%	15.3%
Bansander (% of tax. income)	1.7%	3.7%	15.2%	26.7%	28.7%

Tables 4.5 and 4.6 present the results for the 90% interval in two alternative scenarios: the “optimistic” one, in which the marginal cost savings are 13.9% and 26.7% for Santa María and Bansander respectively; and the “pessimistic” one, where the marginal cost saving for Bansander is only 3.7% and the marginal cost increases 2.6% for Santa María.¹⁷

Table 4.5: Merger simulation –Optimistic Marginal Cost Saving Scenario

	Mkt Share		Price	Mg. Cost	Profits
	Pre-Merger	Post-Merger	% Change	% Change	% Change
Santa Maria	11,5%	11,0%	-2,8%	-13,9%	4,8%
Bansander	12,0%	15,0%	-13,1%	-26,7%	28,1%
Cuprum	16,9%	16,3%	-3,3%	0,0%	-10,0%
Habitat	24,9%	24,2%	-3,5%	0,0%	-9,3%
Plan Vital	3,2%	3,1%	-3,0%	0,0%	-11,1%
Provida	31,4%	30,5%	-3,7%	0,0%	-8,6%
Average			-4,68%	-5,83%	-3,44%

¹⁶ If we could deduce the complete substitution elasticity matrix from our empirical estimations, we could also simulate the merger assuming different demand functions. However, since we assume a PCAIDS demand function to deduce all elasticities, we cannot assume a different demand form for the merger simulation.

¹⁷ The tables summarizing the results for the 95% confidence interval are relegated to the appendix. The figures, naturally, are not that different from those presented in Tables 4.5 and 4.6.

In the “optimistic” scenario, cost savings are large enough so that they more than offset the incentive of the merging firms to increase their post-merger prices. Both merging firms reduce their prices and, as a consequence of the competitive interaction, the non-merging firms reduce their prices as well. In terms of welfare, consumers are better off after the merge since prices are lower; it is evident that the new firm increases its aggregate profits and non-merging firms are worse-off since they face a more aggressive competitor and are induced to reduce their prices, ending up with smaller market shares as a result of this.

Table 4.6 presents the result for the “pessimistic” scenario, where one of the firms would face a 2.6% marginal cost increase (Santa María), and the other one a reduction of 3.7% (Bansander). In this scenario there is a small cost reduction and a relatively large price increase. Therefore, in terms of welfare, the merging firms benefit because of the cost reduction and the higher prices; non-merging firms also benefit since they increase prices less than the merging ones do and gain market share. Logically, consumers are worse-off because of the price increase. Aggregate welfare increases since costs are reduced and total quantity is unaffected.

Table 4.6: Merger simulation – Pessimistic marginal cost saving scenario

	Mkt Share		Price	Mg. Cost	Profits
	Pre-Merger	Post-Merger	% Change	% Change	% Change
Bansander	11,5%	9,4%	16,6%	2,6%	7,9%
Cuprum	12,0%	11,0%	10,9%	-3,7%	17,3%
Habitat	16,9%	17,7%	4,9%	0,0%	15,2%
Planvital	24,9%	26,0%	5,2%	0,0%	14,0%
Provida	3,2%	3,4%	4,5%	0,0%	17,0%
Santa Maria	31,4%	32,5%	5,5%	0,0%	13,0%
Average			7,32%	-0,19%	13,69%

To complement the sensitivity analysis on cost savings, it is possible to compute the critical level of savings that would be necessary for the merger to produce no change in the average price. The value of the compensating marginal cost reduction (CMCR) is 13.5%, assuming that the percentage marginal cost reduction is identical for both merging firms. Alternatively, if we assume the same level of marginal cost for both firms, this should be equal \$12,952 thousands of Chilean pesos per quarter in order to produce no change whatsoever in the average price of the industry (in the post-merger scenario). In our base scenario, the level of marginal

cost for the merged firms is \$13,357 thousands of Chilean pesos per quarter.

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 other reference 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 consistent with our estimations.¹⁸

A different set of merger simulations can be performed considering alternative values for the own-price elasticity of one AFP and different cost-saving scenarios. Recall that from a single own-price elasticity, the fact that aggregate elasticity is zero, and the proportionality assumption, the whole elasticity of substitution matrix can be construed.

Table 4.7 presents the predicted average price change after the merger for each combination of own-price elasticity for Santa María and marginal cost reduction (assumed to be equal for both merging AFPs).¹⁹ The table also includes the marginal cost of Santa María implied by each of the assumed elasticities.

This table shows that, as expected, the results are sensitive to changes in the values of own-price elasticity. The results are intuitive: first, since the price is given, as the elasticity decreases in magnitude, the smaller the marginal cost is and therefore, the larger is the pre-merger market power of firms. Thus, the merger is more likely to generate a price increase as the own-price elasticity becomes smaller, all other things constant. On the other hand, the effect of the marginal cost reduction is straightforward: the larger it is, the smaller the price increase (or the larger the

¹⁸ Their estimated marginal cost function is $3.36-2.114E-06 \cdot q$. This equation is for monthly marginal cost and excludes the cost of the disability insurance, which accounts for about 50% of what workers contribute to AFPs. Once we adjust for this term, the marginal cost saving for the merging firms implied by this equation are 16% and 13% for Bansander and Santa María respectively. These figures are a somewhat more “optimistic” than our base scenario.

¹⁹ The chosen values of the own-price elasticity for the sensitivity analysis correspond to a 20% and 10% above and below the elasticity of the base scenario (-2.16).

price decrease) will be.

**Table 4.7: Merger simulation Sensitivity Analysis
(PCAIDS – Own price elasticity and marginal cost saving)**

Own-price elasticity (Santa María)		Implied average marginal cost	Implied average own-price elasticities	Marginal cost reduction for merging firms				
				0	5%	10%	15%	20%
				-1.73	1.075	-1.63	17.7%	13.9%
-1.94	1.239	-1.83	11.0%	7.8%	4.5%	1.0%	-2.7%	
-2.16	1.370	-2.03	7.7%	4.9%	2.0%	-1.0%	-4.2%	
-2.38	1.477	-2.24	5.8%	3.3%	0.7%	-2.1%	-4.9%	
-2.59	1.567	-2.44	4.6%	2.3%	-0.1%	-2.6%	-5.3%	

5. Conclusions

In a market characterized by scale economies, it is theoretically possible that a merger that creates market power will be pro-competitive. Empirically this depends on the magnitude of the economies of scale, which might more than compensate the increase in market power (Williamson, 1969).

In this paper we have empirically studied the possibility of this occurring in the market for pension fund managers in Chile. More specifically, we analyze the merger between two medium-sized AFPs (Santa María and Bansander) in order to estimate its welfare effects. This merger was the last in a concentration process in this industry which began in the mid-nineties when there were twenty-one AFPs. By the end of the year 2000 there were only seven; after the aforementioned merger was approved there were only five remaining.

The estimation of a cost function consistently shows significant economies of scale in this industry, even though they are not homogeneous in all of their components. They are larger in magnitude for personnel and sales force expenses, and smaller for marketing and administrative staff expenses. Evaluated at the mean of the sample (445 thousands working affiliates, which roughly coincides with the size of one of the merging firms), the average total operating costs would decrease in Ch\$24 per thousand working affiliates per quarter. If two AFPs (of 400 thousand working affiliates each) merge, their average cost would decrease in Ch\$7,000 per quarter which is about 26% of the average total operating expenses.

The simulation of the merger, considering not only the new post-merger marginal cost level but also the demand side and the degree of competition in the market, shows that the cost savings would not be passed on to consumers. The benchmark result gives evidence that the merged firm has an incentive to slightly increase their prices, which would lead to an industry average price increase of 1.6%. This effect reduces consumer welfare, but aggregate welfare on the other hand, increases because of the efficiency gains from the economies of scale. Since aggregate elasticity in this industry is zero (because affiliation is compulsory), the price increase does not generate any efficiency loss.

Ideally, the cost savings estimations and the post-merger changes estimated could be compared to the actual changes. Unfortunately, the pension system underwent an important reform in 2008, which makes it unfeasible to identify the effects of the merger.

Future research could use the wave of mergers that took place in the nineties to identify the marginal cost savings associated to mergers between AFPs of different sizes. Additionally, it could be used to validate the prediction of different merger simulation models.

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