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Resumen

Este artículo presenta un modelo de competencia con productos diferenciados y costos de búsqueda. En este modelo las firmas cobran un precio por sobre sus costos marginales. Este margen positivo constituye un incentivo a robar clientes de firmas competidoras. Con este objeto, las firmas contratan agentes de venta que contactan personalmente a los consumidores para cambiarlos de una firma a otra, e incluso ofrecen recompensas a quienes aceptan cambiarse. Estos premios o recompensas pueden ser interpretados como una rebaja al precio para clientes de la competencia, lo que sería una forma de discriminación de precios en este contexto. El modelo se aplica a la industria chilena de administradoras de fondos de pensiones. En 1995 había mas de un agente de ventas por cada doscientos clientes con una rotación entre administradoras de más de un 50 por ciento. Esta alta rotación estaba asociada a elevados costos, y las autoridades reaccionaron imponiendo restricciones a los cambios de administradora en el año 1997. La sección empírica de este artículo analiza el rol de los agentes de venta en esta industria y los efectos de las restricciones implementadas en 1997.

Abstract

We study price competition in a model with differentiated products and searching costs. In this model firms charge a price above marginal costs. This positive mark-up gives firms incentive to steal consumers from their rivals. For this purpose, firms hire sales agents that contact customers personally to switch them from one firm to another and offer rewards to the switchers. These rewards can be interpreted as a price cut to rival's customers, which is a form of price discrimination in this model. This model is applied to the Chilean pension funds industry. In 1995 there was more than one sales agent per two hundred customers with a turnover between Pension Fund Administrators of more than 50 percent. This high turnover was associated with large costs, and the authorities reacted by imposing restrictions to switching by the end of 1997. The empirical section of the paper attempts to analyze the role of sales agents in this industry and the impact of such restrictions.

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1 Introduction

Direct advertisement and telemarketing are practices commonly used in many industries. This is usually the case with subscription goods, like long distance telephone service, life insurance, cable TV, credit cards, and pension fund administration. In general, these are all products where once you choose a brand you stay with it unless you take a specific action that has some costs to switch to another one, so there are searching or switching costs in these industries. It seems that in this environment firms have chosen to compete by directly contacting potential customers in person, by telephone or by mail.

We study a model in which firms can compete in price and use sales agents, and there are searching costs. In equilibrium, searching costs or product differentiation allow firms to charge a price above marginal costs. This positive mark-up gives firms incentive to steal consumers from their rivals. For this purpose, firms hire sales agents that contact customers personally to switch them from one firm to another and offer rewards to the switchers (price-cuts or bribes). This is a way of price discriminating in this model.

This model is applied to the Chilean pension funds industry. In this case, we observe a strong correlation between the number of sales agents hired and turnover. In 1995 there was more than one sales agent per two hundred customers with a turnover between Pension Fund Administrators of more than 50 percent per year. During this year, sales agent wages accounted for more than 35 percent of firms' total costs. The empirical evidence shown in this paper supports the fact that sales agents increase turnover. Moreover, our results suggest that sales agents reduce the sensitivity of consumers to product characteristics, which implies that sales agents not only reduce searching costs, but also induce switching through gifts (bribes) or some other mechanism.

The next section reviews the related literature. Then in Section 3 we solve a differentiated products' model and study the welfare effects of the existence of sales agents and bribes. Section 4 presents some empirical evidence for the Chilean pension industry. Section 5 gives our conclusions.

2 Literature Review

The model developed in this paper can be thought of as an extension of either Klemperer (1995) or Diamond (1971).[1] In the former paper, assuming an homogenous good, Klemperer shows that a sufficiently large switching cost induces firms to charge the monopoly price and induces costumers to buy from the same firms that they did in the past. Similar results can be found based on Diamond (1971).[2] In this paper, consumers are uncertain about prices and must compare the cost of searching further with the expected gain from finding a better price. Under the assumptions of both papers, the unique equilibrium is: all firms charge the monopoly price and no customer pays the searching or switching cost, and therefore there is no consumer turnover.

Chen (1997) extends Klemperer's model by allowing product differentiation and consumer poaching. In his model, in equilibrium discounts are offered to all newcomers through a different price. Extensions to Chen (1997) can be found in Shaffer and Zhang (2000), where demand is generalized by allowing customers to differ in terms of loyalty. This model results in discounts offered to loyal consumers instead of newcomers. Another extension is presented in Taylor (2000), in which there are multiple periods and random switching costs. Chen's results hold in this last model.

In an alternative setup Fundenberg and Tirole (2000) study the case of differentiated products and customer poaching. They analyze two polar cases: consumer preferences are fixed or independent over time, where price discrimination in the second period is based on information about preferences

[1] The model is an extension of example 0) in Klemperer (1995).

[2] For more recent research on the same issues, see Levine and Lippman (1995) and Stahl (1996).

that consumers reveal in the first period. They find that if preferences are fixed, consumer poaching results in inefficient switching. However, with independent preferences over time, there is no basis for price discrimination in the second period, so there is no efficiency problem in this case.

The differentiated goods model presented in this paper considers a case between the two extreme situations considered by Fundenberg and Tirole in terms of preferences. We assume there are both horizontal and vertical differentiations, where the latter is uncertain and changes over time. We also consider the existence of switching costs and that the discounts to newcomers can be done through sales agents. Under this setup, sales agents produce some efficiency gain in the sense that they reduce searching costs, but at the same time the existence of positive mark-ups induces the firms to have too many sales agents and bribes (stealing effect), which implies inefficient switching as well.

In our setup, even though firms can charge different prices across customers, in equilibrium firms charge the same price to all customers and only discriminate through gifts (price-cuts or bribes) to consumers visited by sales agents. Firms take advantage of sales agent technology to steal customers from their rivals.

3 A Model with Searching/Switching Costs and Sales Agents

In order to study the effect of sales agents in a market with searching and/or switching cost we must have a model with two characteristics: (1) a dynamics set up with at least two periods; (2) a technology that allows sales agents to either reduce searching/switching costs or/and to discriminate between visited customers and the others. Product differentiation is not required to analyze sales agents; however, when there is product differentiation, turnover induced by sales agents may improve welfare. This is not the case for homogeneous goods.

In this section we describe a two period duopoly model with differentiated products, searching/switching costs and sales agents. Products are different in two ways. On the one hand, firms have different characteristics like location and services, which are treated as elements of horizontal differentiation and analyzed using a Hotelling approach. On the other hand, we will assume an element of vertical differentiation which is subject to uncertainty. Ex-ante, both firms have the same expected product quality, however some information about quality is revealed during the second period (horizontal differentiation appears), after prices are set but before customers choose. This can be the case of mutual funds or pension funds in which firms get uncertain rates of return on their investments and information about expected return is revealed over time.

The two firms a and b are located at the two extremes of product characteristic. Consumers are distributed uniformly between the two firms with a fixed density equal to 1. At the beginning of period 1, all consumers seek to maximize the discounted sum of their expected one-period-utility (u). Each period consumers derive gross surplus R which is a function of product quality, and they incur in a "transportation cost" of t per unit of distance from the firm, where t represents the sensitivity of consumers to horizontal product characteristics. The expected one-period-utility is:

$$E(u_{ij}) = E(R_j) + td_{i,j} \tag{1}$$

where E, i and j represent the expected operator, the consumer, and the firm, respectively. $d_{i,j}$ is the distance between firm j and consumer i in the product characteristic space. R_j is the gross surplus of being with firm j. For simplicity we assume that in the first period both firms have the same gross surplus, and in the second period, after some information about product quality is revealed, the expected gross surplus can be either $R+\Delta R/2$ in case the firm has a high expected quality and $R-\Delta R/2$ if otherwise. Both states of nature have the same probability (1/2). For mutual or pension funds ΔR stands for the difference in expected rates of return.

At the beginning of the second period, a fraction σ_a of consumers have already purchased from firm a and thus they have a switching cost (θ_{SC}) to buy from firm b in the current period, and due to some searching costs only a fraction s of customers will re-evaluate their product choice in the second period, while the others will buy from the same firm without any cost-benefit analysis. Similarly, the complementary fraction σ_b of consumers have bought from firm b in the past, and they have a switching cost to buy from a as well as a searching cost.

Each period, prices are chosen simultaneously and non-cooperatively by firms before transactions take place. Firms are forced to have a single price for all customers each period. Both firms face the same marginal cost equal to 0.

In the second period, after prices are set, sales agents have the ability to reduce the switching costs and to eliminate the searching cost of the customers they visit. Moreover, they can offer a price discount (B) to induce the switch (price discrimination).[3] These agents are hired by the firms and paid a wage w. Firms decide the number of sales agents for the second period and at the same time they fix their prices. The probability (l_b) that an old customer of firm a receives a sales agent from firm b in the second period is given by: [4]

[3] We assume that the one price-policy is not enforceable when the transaction take place directly between the customer and the sales agent.

[4] Following Tirole (1989), this equation assumes that sales agents are sent randomly to workers in the other firm. So if there are $(M\sigma_a^o)$ workers in the rival firm, each of them has a probability $1/(M\sigma_a^o)$ of receiving a given sales agents. Defining A_b, as the total number of sales agents sent by firm b to customers in firm a, workers' probability of not getting a sales agents at all is:

$1 - l = (1 - \frac{1}{M\sigma_a^o})^{A_b} \approx e^{-\frac{A_b}{M\sigma_a^o}}$

Therefore, the cost that a fraction l of workers in firm, a receives at least one sales agent is:

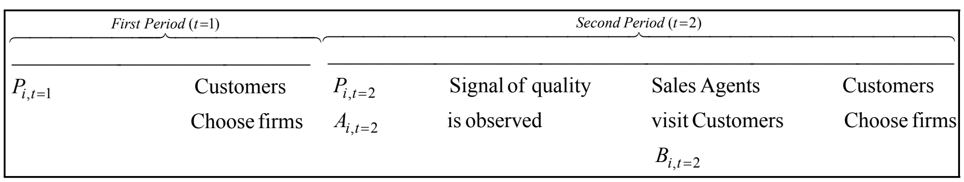
$wA_b = -wM\sigma_a^o \ln(1 - l)$.

$$l_b = 1 - \exp\left(\frac{-A_b}{\sigma_a}\right) \tag{2}$$

where A_b is the number of sales agents that firm b has per worker in the system.

Figure 1 shows the time line of events in the model. At the beginning of $t = 1$ firms set prices for the first period and then customers choose firms (products). At the beginning of $t = 2$ firms set prices and the number of sales agents for the second period, then just after the signal about firms' quality is revealed, sales agents visit customers, who decide to stay or to switch at the end of the period.

$Figure$ 1 : The Time Line of Events in the Model



The next sections solves for the symmetric Subgame Perfect Nash equilibrium of the model. The lack of sales agents and the symmetry between firms imply that, for any symmetric first-period-price, firms will end up having the same market shares, and customers will be in the firm that better fits their tastes in terms of the firms' horizontal characteristics at the end of the first period. This result allows us to mainly focus on the analysis of the second period.

To stress the role of sales agents in the model, in particular how they allow firms to discriminate between customers, section 3.1 initially solves the model for the case of a homogeneous product. In this case, consumers are

In the model M and the number of visit per sales agents are normalized to 1.

not sensitive to horizontal product characteristics ($t = 0$) and firms' products have the same expected quality in both periods ($\Delta R = 0$). Section 3.2 solves for the case of differentiated products.

3.1 Homogeneous Products

This section solves for the equilibrium price and the level of sales agents in a two-period duopoly market, in which products are homogeneous and consumers have both switching (θ_{SC}) and searching costs ($1 - s$). The main conclusion of this section is that, in equilibrium, it is possible to have consumer turnover in the second period (with symmetric cross-flows) even though firms provide homogeneous goods and charge the same price. In this case all turnover is inefficient (neither consumer surplus nor firms' profits are increased), and it is completely induced by discrimination between current and potential customers. Sales agents' wages and switching costs paid dissipate the firms' monopolistic rent.

At the end of the first period, no matter which is the equilibrium price, half of the consumers purchase from firm a and half from b. For any given second-period prices P_a and P_b, a consumer who decides to re-evaluate his/her choice and is not visited by a sales agent will switch from firm a to firm b in the second period if and only if:[5]

$$R - P_b - \theta_{SC} > R - P_a \tag{3}$$

The same condition for a consumer who is visited by a sales agent is:

$$R - P_b - \theta'_{SC} + B_a > R - P_a \tag{4}$$

where θ'_{SC} accounts for the switching cost faced by a consumer who received

[5] For simplicity, in the paper we do not allow firms to charge a different price to all rival customers. In our setup, it is easy to prove that although firms were allowed to charge different prices to current and potential customers, in all equilibria in which these prices are charged they are the same.

a sales agent ($\theta'_{SC} < \theta_{SC}$), and B_a is the price discount offered by sales agents to induce the switch from firm a to b.

Given these conditions, and assuming that firms cannot induce switches by cutting equilibrium-prices to all customers at a profit, and that sales agents may induce switches through gifts, firms' profit in the second period are:

$$\Pi_a(P, l, B) = \frac{1}{2}(1 - l_b)P_a + l_a(P_a - B_a)\frac{1}{2} - w\frac{1}{2}\ln\left(\tfrac{1}{1-l_a}\right) \tag{5}$$

where w represents sales agents' wage ($< \theta_{SC}$). The first term is the second period income that come from customers choosing firm a in both periods. The second term is the income generated from customers stolen from firm b using a price discount. The last term is the wage of sales agents.

Firms maximize their second period profits in two steps: first they choose simultaneously the price and the number of sales agents, and then the price discount they would like to offer through sales agents to induce a switch (given their rivals' price).

Proposition 1 *If $(R - c) < \theta_{SC}$,[6,7,8] the symmetric Nash equilibrium in price discounts, prices and sales agents is:*

$$B_h^* = P_j - P_h + \theta'_{SC} \quad \textit{for } j = a, b \textit{ and } h = a, b \tag{6}$$

$$P_a^* = P_b^* = R \tag{7}$$

[6] The necessary condition is: $\left\{ \begin{array}{c} \frac{R-c-\theta'_{SC}-w}{w} - \ln(\frac{R-c-\theta'_{SC}}{w}) - (1 - \frac{w}{R-c-\theta'_{SC}})\frac{\theta_{SC}}{w} \geq \\ s\frac{(R-c)}{w} - (1+s)\frac{\theta_{SC}}{w} \end{array} \right\}$.

[7] Alternatively, we can assume a searching cost a la Diamond (71). In his model, Diamond assumes that customers have to incur a fixed cost to see the other firms' prices. Under this assumption, the unique equilibrium is: all firms charge the reservation price (R) and no customer pays the cost to monitor the other firms' prices. In this case, the equilibrium with sales agents is the same as in the case described in the text.

[8] Under this condition, proposition 1 holds as a Nash Equilibrium even though firms are allowed to charge a second price to newcomers (Fudenber and Tirole 1999).

$$A_h^* = \begin{cases} \frac{1}{2}\ln\left(\frac{R-c-\theta_{SC}^{'}}{w}\right) & if \quad w < R-c-\theta_{SC}^{'} \\ 0 & otherwise \end{cases} \quad for\ h = a, b \tag{8}$$

Proof. Straight forward from firms' profit function. ■

The equilibrium number of sales agents implies:

$$(1-l^*) = \begin{cases} \frac{w}{R-c-\theta_{SC}^{'}} & if \quad w < R-c-\theta_{SC}^{'} \\ 0 & otherwise \end{cases} \tag{9}$$

Firms choose the monopoly price (R) and hire sales agents as a function of markup charged to new customers $\left(\frac{R-c-\theta_{SC}^{'}}{w}\right)$. In equilibrium, all firms' new customers are stolen by sales agents who offer a discount to visited customers ($B = \theta_{SC}^{'}$). In equilibrium cross flows exist even though the good is homogeneous and firms charge the same price. Customer turnover is:

$$Turnover = l^* \tag{10}$$

Turnover is composed of customer flows from firm a to firm b ($1/2\ l^*$) and from firm b to firm a ($1/2\ l^*$). All turnover is induced by sales agents who allow firms to price discriminate between current customers (high price: R) and rival customers (low price to induce them to switch: $R - \theta_{SC}^{'}$). In equilibrium there is turnover without net flows between firms (i.e. without a change in market shares).

Appendix A solves this model assuming a long horizon (T periods, where T tends to infinity). We find that, as in the previous case, firms charge the monopoly price (in all periods) and the number of sales agents is increasing in the mark-up charged to new consumers. In the steady state, firms' market shares only depend on their relative marginal costs, which in Appendix A are assumed to be different from each other. The higher the relative marginal cost, the lower the market share. Once firms reach the steady state shares, there are no net flows anymore, but there is still turnover.

Finally, it is important to stress again that with a homogeneous good, all turnover is inefficient from a social point of view. There is no social gain from switching a customer from one firm to another (homogeneous good), but there is a cost. Sales agents and switching costs paid dissipate some of the monopoly rents. If possible, firms would like to commit to have no sales agents at all, but that is not sustainable in equilibrium. In the Pareto optimal case there will be neither sales agents nor turnover.

3.2 Differentiated Products

In this subsection we relax the assumption of homogeneous good and allow horizontal and vertical differentiation ($\Delta R > 0$ and $t > 0$), however for simplicity we only allow for searching costs ($0 < s < 1$ and $\theta_{SC} = 0$).

In the previous subsection all turnover is inefficient. However, when there is product differentiation, turnover induced by sales agents may be welfare improving. A change in product characteristics, or consumers' tastes, might induce switching; nevertheless, the existence of searching costs can prevent part or all of this switching from happening. To highlight this point, we first assume that sales agents cannot offer price discount ($B = 0$) and they only make customers re-evaluate with probability one their first period choices. Afterwards, we will solve a model in which sales agents are allowed to offer price discounts to convince customers to switch. In both cases there is excess turnover compared to the social optimum.

As in the case of homogeneous goods, at the end of the first period, half of the consumers purchased from firm a. In this case, customers are in the firm that better fits their tastes in terms of product horizontal characteristics. Therefore, in the second period, firms maximize the following expected profit function:

$$E\left(\Pi_a\left(P,l\right)\right) = \frac{1}{2}P_a\left(\frac{1}{2} + \left((1-l_a)s + l_a\right)\frac{\Delta R - (P_a - P_b)}{2t}\right) \tag{11}$$

$$+\frac{1}{2}P_a\left(\frac{1}{2} - \left((1-l_b)s + l_b\right)\frac{\Delta R + (P_a - P_b)}{2t}\right)$$

$$-\frac{w}{2}\ln\left(\frac{1}{1-l_a}\right) \tag{12}$$

The first term in equation [11] is firm a's income when it is the expected high quality firm multiplied by the probability of being in this state of the nature (1/2). The second term is the income in the case where the firm is the expected low quality and finally the last term is the sales agents' wages.

Proposition 2 *Under the previous assumptions ($B = 0$), the symmetric Nash equilibrium in prices is: $P^* = \frac{t}{l^*(1-s)+s}$ if l^* is positive and $P^* = \frac{t}{s}$ if otherwise.*

Proof. Follows from the first order conditions for the following maximization problem:

$$\underset{P_a}{Max}\frac{1}{2}P_a\left(\frac{1}{2} + \left((1-l_a)s + l_a\right)\frac{\Delta R - (P_a - P_b)}{2t}\right) +$$
$$\frac{1}{2}P_a\left(\frac{1}{2} - \left((1-l_b)s + l_b\right)\frac{\Delta R + (P_a - P_b)}{2t}\right) - \frac{w}{2}\ln\left(\frac{1}{1-l_a}\right)$$

FOC and symmetry:

$$\frac{d\left(E\left(\Pi_a\left(P,l\right)\right)\right)}{dP_a} = \frac{1}{2t}\left(sP_al_a - P_al_a - sP_a\right) + \frac{1}{2} = 0,$$

the solution is: $\begin{cases} \left\{\frac{t}{l_a(1-s)+s}\right\} & \text{if} \quad l_a\left(s-1\right) \neq s \\ \emptyset & \text{if} \quad l_a\left(s-1\right) = s \end{cases}$

As s is between $[0,1]$ and l_a is between $[0,1]$ $l_a\left(s-1\right)$ is always different from s, so the unique equilibrium in prices is given by:

$$P_a = \frac{t}{l_a(1-s)+s}$$

■

As is usual in this type of models, the equilibrium prices will be higher when the transportation cost t is higher. However, notice that if $0 < s < 1$ and $0 < l < 1$, the price is even higher than the transportation cost. In this model, the existence of searching costs is giving the firms additional market power, which implies higher mark-ups than in the traditional Hotelling model. On the other hand, the presence of sales agents reduces the effects of this additional source of market power, lowering the price. In the extreme cases where there are no searching costs, $s = 1$, or all consumers are visited by a sales agent, $l = 1$, we go back to the Hotelling model, where $P = t$. If there are no sales agents the price will go up to $\frac{t}{s}$. A higher s is related to lower searching costs, recall that s is the proportion of consumers that re-evaluate their decision without being visited by a sales agent. If there are no searching costs, everyone should be re-evaluating this decision.

Proposition 3 *Under the previous assumptions ($B = 0$), the symmetric Nash equilibrium for sales agents gives us the following proportion of consumers visited by sales agents: $l^* = 1 - \frac{2wt}{P^*(1-s)\Delta R}$, if positive and 0 otherwise. Considering the equilibrium prices this proportion is: $l^* = 1 - \frac{1}{(1-s)\left(1+\frac{\Delta R}{2w}\right)}$ if positive and 0 if otherwise.*

Proof. Follows from the first order conditions for the following maximization problem.

$$\underset{l_a}{Max}\frac{1}{2}P_a\left(\frac{1}{2}+((1-l_a)s+l_a)\frac{\Delta R-(P_a-P_b)}{2t}\right)+$$
$$\frac{1}{2}P_a\left(\frac{1}{2}-((1-l_b)s+l_b)\frac{\Delta R+(P_a-P_b)}{2t}\right)-\frac{w}{2}\ln(\frac{1}{1-l_a})$$

FOC and symmetry:

$$\frac{d\left(E\left(\Pi_a\left(P,l\right)\right)\right)}{dl_a}=\frac{w}{2l_a-2}+\frac{1}{4t}\left(\Delta Rst\frac{1}{sl_a-l_a-s}-\Delta Rt\frac{1}{sl_a-l_a-s}\right)=0,$$

$$\text{therefore, the solution is: }\left\{\begin{array}{ccc}\left\{1-\frac{1}{(1-s)\left(1+\frac{\Delta R}{2w}\right)}\right\} & \text{if} & s\neq 1\\ \emptyset & \text{if} & s=1\wedge 2sw\neq\Delta R\left(1-s\right)\end{array}\right.$$

■

We observe that the proportion of consumers reached by sales agents will be lower if wages that the firm has to pay them are higher. Notice that if there are no searching costs, $s=1$, the equilibrium number of sales agents is zero.

3.2.1 Model with sales agents offering price discount

In this section, we allow sales agents to offer price-discounts to visited customers ($B>0$). The results imply that, in this context, turnover is higher than before and that in equilibrium, even if there are no searching costs there is a positive number of sales agents. The intuition for this result is that the presence of positive mark-ups makes it profitable for firms to steal customers from competitors, inducing firms to hire sales agents to offer price-discount to visited consumers to switch.

Sales agents visit customers after the signal about firms quality is revealed, therefore the price-discount offered will depend on the quality of the firms they represent.

In the second period, firms maximize the following profit function:

$$\Pi_a(P,l,B) = \frac{P_a}{2}\left(\frac{1}{2} + (1-l_a)s\frac{\Delta R-(P_a-P_b)}{2t} - l_b\frac{-\Delta R+(P_a-P_b)+B_{ba}}{2t}\right) \quad (13)$$
$$+ \tfrac{P_a-B_{aa}}{2}l_a\left(\tfrac{\Delta R-(P_a-P_b)+B_{aa}}{2t}\right)$$
$$+ \frac{P_a}{2}\left(\frac{1}{2} - (1-l_b)s\frac{\Delta R+(P_a-P_b)}{2t} - l_b\frac{\Delta R+(P_a-P_b)+B_{bb}}{2t}\right)$$
$$+ \tfrac{P_a-B_{ab}}{2}l_a\tfrac{-\Delta R-(P_a-P_b)+B_{ab}}{2t}$$
$$- \frac{w}{2}\ln(\tfrac{1}{1-l_a})$$

where B_{ij} is the price discount offered by firm i when j is the high expected quality firm, for $i = a, b$ and $j = a, b$.

Proposition 4 *Assuming* $\{t > \Delta R\}$,[9] *the Nash equilibrium in price discounts is:* $B_{aa} = P_a - \frac{\Delta R+P_b}{2}$, $B_{ab} = P_a + \frac{\Delta R-P_b}{2}$, $B_{bb} = P_b - \frac{\Delta R+P_a}{2}$, $B_{ba} = P_b + \frac{\Delta R-P_a}{2}$.

Proof. This result comes from the first order conditions for profit maximization with respect to B_{ij}, for $i = a, b$ and $j = a, b$. ■

Price discounts offered by sales agents depend on fixed prices and they are higher if the firm is the one with low expected quality (return).

Replacing the equilibrium levels for bribes, we have the following profit function:

$$\Pi_a(P,l) = \tfrac{P_a}{2t}\left(1 + (1-l_a)s\tfrac{\Delta R-(P_a-P_b)}{2t} - (1-l_b)s\tfrac{\Delta R+(P_a-P_b)}{2t} - l_b\tfrac{P_a}{2t}\right) \quad (14)$$
$$+ \frac{l_a}{t}\left(\left(\tfrac{\Delta R+P_b}{4}\right)^2 + \left(\tfrac{-\Delta R+P_b}{4}\right)^2\right)$$

Proposition 5 *Under the previous assumptions, the symmetric subgame perfect Nash equilibrium in prices is:* $P^* = \frac{t}{l^*(1-s)+s}$.

[9] The sufficient condition is $\frac{t}{l^*(1-s)+s} > \Delta R$.

Proof. Follows from the first order conditions as in the previous proofs. ■

Equilibrium prices expressed as a function of the equilibrium level of l, are the same in the previous model, following the same intuition as before.

Proposition 6 *Under the previous assumptions, the symmetric subgame perfect Nash equilibrium for sales agents gives us the following probability of being visited by a sales agent:* $l^* = 1 - \frac{2wt}{(1-s)\Delta RP^* + \frac{1}{2}(\Delta R - P^*)^2}$, *if positive and* 0 *if otherwise.*

Proof. Follows from the first order conditions as in the previous proofs. ■

In this setup it can be easily shown that the equilibrium number of sales agents is higher than in the case with no price discounts. To see the proof notice that the equation for the equilibrium level of l is similar to the one in the previous model, but includes an additional positive term in the denominator, which makes l higher than before.[10]

There are two interesting extreme cases to analyze. The first is a situation where there are no searching costs ($s = 1$). In this case, the probability of being visited by a sales agent is: $l^* = 1 - \frac{4wt}{(\Delta R - t)^2}$, if positive. Recall that in the previous model, with no searching costs, there were no sales agents hired because all customers re-evaluate their choice in the second period. The second interesting case is a situation where no expected differences are expected in product quality in the second period ($\Delta R = 0$). In this case, although there is no change in firms relative-characteristics between the first and the second period, firms may still have incentives to hire sales agents. This is because they can steal customers using price discounts ($l^* = 1 - \frac{4wt}{P^{*2}}$).

[10]**Proof.** Without loss of generality, assume $\Delta R = 1$ and $a = (1 - P^*)^2$. From the equilibrium with bribes and without bribes we have:

$1 - l_B = 2t\frac{w}{(s + l_B(1-s))a + t(1-s)}(s + l_B(1-s))$

$1 - l_{NB} = 2\frac{w}{1-s}(s + l_{NB}(1-s))$

Comparing these two equations we have that if $l_B \leq l_{NB}$ then $1 - l_B \leq 1 - l_{NB}$, which is a contradiction. So it must be that $l_B > l_{NB}$. ■

Recall that in the previous model, in this case there were no sales agents hired because all customers were already in the firm that better suited their tastes at the beginning of the second period.

In the case where sales agents may offer price discounts, their role is not only to induce switching by reducing searching costs, but also to steal customers away from rivals by using gifts (prices discounts). Given this new instrument, firms have higher incentives to hire sales agents.

3.2.2 Social Planner and Equilibrium Comparison

An interesting benchmark for the subgame perfect Nash equilibrium is the constrained Pareto optimal solution. This solution is obtained by maximizing the gains from switches from the low to the high-expected-return firm, minus the sales agents cost.[11] The social planner is restricted to use the same technology as competitive firms; in other words, the social planner has specific sales agents for each type of switch (from a to b and from b to a). These sales agents are chosen before the state of the nature is realized. If firm a has the higher expected rate of return, the social planner only switches customers from firm b to a, and for whom it is convenient to switch according to their preferences (These are the ones between $[1/2, 1/2 + \Delta R/2t]$).

The social planner maximization problem is as follows:[12]

$$\begin{aligned} Max \qquad SB = {} & \frac{1}{2} l_a (1-s) \int_0^{\Delta R/2t} (\Delta R - tx)\, dx + \frac{w}{2} \ln(1 - l_a) \\ & + \frac{1}{2} l_b (1-s) \int_0^{\Delta R/2t} (\Delta R - tx)\, dx + \frac{w}{2} \ln(1 - l_b) \end{aligned} \tag{15}$$

therefore, from the FOC we have:

$$l_i^{SP} = \begin{cases} 1 - \frac{8wt}{3(1-s)(\Delta R)^2} & \text{if positive} \\ 0 & \end{cases} \qquad i = a, b \tag{16}$$

[11] It is worth noting to note that the fee level does not affect the social surplus because in any case all the market is covered (In Chile, pension fund saving is mandatory).

[12] This corresponds to the change of social benefit due to sales agents.

The constrained Pareto optimal number of sales agents ($2A(l^{SP})$) is smaller than the one in the subgame perfect Nash equilibrium in which sales agents are not allowed to offer price discounts ($2A(l^{NB})$),[13] and therefore to the one in the case in which sales agents are allowed to offer price discounts ($2A(l^{B})$). [14]

Turnover, under the subgame perfect Nash equilibrium in which sales agents are not allowed to offer discount ($Turnover^{NB}$) is the sum of the efficient turnover, the first two terms in eq.17, plus the excess turnover induced by a higher number of sales agents than the social optimum level, the last term.

$$Turnover^{NB} = \frac{\Delta R}{4t}\left(s + l^{SP}(1-s) + (l^{NB} - l^{SP})(1-s)\right) \tag{17}$$

In the case where sales agents are allowed to bribe consumers (offer discounts), turnover is even higher and it can be expressed as the sum of three terms: i) the constrained Pareto optimal, ii) the excess turnover generated by a higher number of sales agents than the social optimum, and iii) the completely inefficient switching from the high to the low expected return firm, last term in eq. 18. Notice that each of the previous terms is positive.

$$\begin{aligned} Turnover^{B} &= \frac{1}{2}\left(\frac{\Delta R}{2t}\left(s + l^{B}(1-s)\right) + \frac{l^{B}}{2}\frac{\Delta R}{t}\left(\tfrac{t/\Delta R}{l^{B}(1-s)+s} - 1\right)\right) \\ &= \frac{\Delta R}{4t}\left(s + l^{SP}(1-s) + (l^{B} - l^{SP})(1-s) + l^{B}\left(\tfrac{t/\Delta R}{l^{B}(1-s)+s} - 1\right)\right) \end{aligned} \tag{18}$$

[13]**Proof.** $l^{SP} < l^{NB}$: We have assumed for an interior solution that $\frac{t}{\Delta R} > 1 \Rightarrow \frac{1}{2w+1} < t \Rightarrow 2\frac{1}{2w+4} < \frac{8}{3}t \Rightarrow \frac{w}{(1-s)}2\frac{1}{2w+1} < \frac{w}{(1-s)}\frac{8}{3}t \Rightarrow 1 - \frac{w}{(1-s)}2\frac{1}{2w+1} > 1 - \frac{w}{(1-s)}\frac{8}{3}t$ ■

[14]**Proof.** $l^{SP} < l^{B}$: We have assumed for an interior solution that $\frac{t}{\Delta R} > 1 \Rightarrow \frac{t/\Delta R}{l(1-s)+s} > 1 \Rightarrow 4\frac{t/\Delta R}{l(1-s)+s} > 3 \Rightarrow 4\frac{t/\Delta R}{l(1-s)+s} + \frac{2}{(1-s)\Delta R^2}(\Delta R - \frac{t}{l(1-s)+s})^2 > 3 \iff \frac{4tw}{2(1-s)\Delta R\frac{t}{l(1-s)+s} + (\Delta R - \frac{t}{l(1-s)+s})^2} < \frac{8wt}{3(1-s)}$
$\iff 1 - \frac{4tw}{2(1-s)\Delta R\frac{t}{l(1-s)+s} + (\Delta R - \frac{t}{l(1-s)+s})^2} > 1 - \frac{8wt}{3(1-s)}$ ■

4 Application to the Chilean Pension System

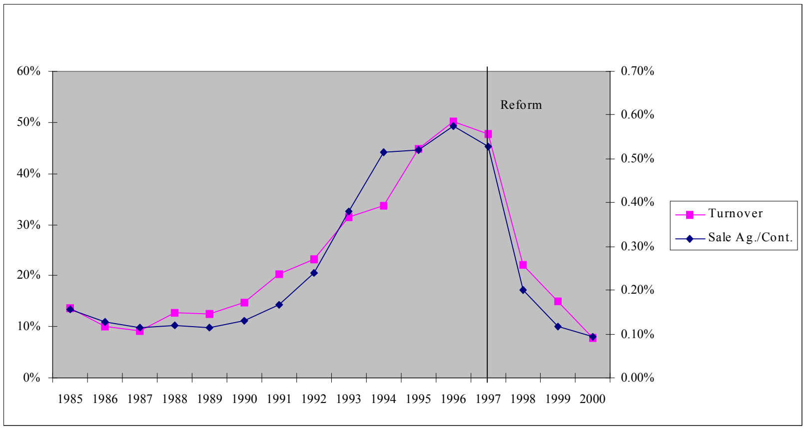
4.1 The Chilean Pension Fund Industry

In recent years many countries have experimented with reforms of their social security systems. In general we observe a switch from Pay As You Go (PAYG) systems to Fully Funded (FF) ones with individual accounts. At the same time, the management of these retirement funds has been given to private firms instead of staying with the government. This change has led to the development of a new industry in these countries. This new industry has certain distinct features, and the countries that have implemented a Pension Fund Reform are still looking for the appropriate regulation to ensure efficient service.

A feature that has remained is the compulsory nature of the contributions. In Chile, workers contribute 10% of their taxable income to the Pension Fund of their choice, and are allowed to switch providers as desired. However, until 1988 regulations required workers to physically go to an agency of the PFA (Pension Fund Administrator) in order to transfer the Fund to this PFA. So it was not easy for a worker to transfer their funds to some other manager, even with sales agents.

In 1988, Chile eliminated the provision actually walking in to the manager's agency to request a transfer. From that year on the number of transfers increased significantly, the turnover went up to almost 50% in 1996. In the early eighties, there were fewer than 2 sales agents for every 1,000 contributors, and in 1996 there were more than 6 sales agents for every 1,000 contributors (See Figure 2). This also implied a significant increase in the costs of servicing the workers.

Figure 2 : Turnover and Sales Agents[15]



Source : Superintendencia de Administradoras de Fondos de Pensiones. Chile.

In fact, sales agents began giving out gifts (bribes) to contributors to encourage them to transfer their funds, and commercialization expenses gradually become an important part of the total expenses for the Pension Fund managers. For instance, the so called "Chilean system" has been criticized for its high administrative costs.[16,17] The largest share of this burden is accounted by advertising and promotion efforts. In 1995 the number of sales agents exceeded one per two hundred workers and their wages amounted to around 33 percent of total costs.[18,19]According to some estimates, administrative costs may be reducing retirement benefits by as much as 20 percent[20].

[16]James et al (1998) and Diamond (1999) discuss the administrative costs for different types of pension systems.

[17]AIOS (1999) shows administrative costs for the seven Latin-American countries that have a funded system with individual accounts.

[18]E.James, G.Ferrier, James Smalhout, D.Vittas (1998) shows that marketing costs are around 50% of total costs in the last years (1995-1998).

[19]Marketing costs are around 50 percent of total costs in the seven Latin-American countries with funded pension system with individual accounts. See AIOS (1999).

[20]E.James, G.Ferrier, James Smalhout, D.Vittas (1998). NBER Conference on Social Security Dec. 4, 1998.

A recent amendment to the regulation implied additional paperwork to process a transfer.[21] The main purpose of this measure was to lower commercialization expenses and limit transfers. In fact, the number of sales agents dropped from 17,448 in 1997 to 6,434 in 1998, a drop of 63%. The number of transfers also dropped from 1,574,189 to 696,164, a 55% decrease in the same period. Nevertheless, commercialization expenses dropped by only 23%. This might be because now every transfer is more valuable for the PFA.

According to the above models, sales agents have two roles to play in this market. On the one hand, they might be reducing the switching costs by giving information to consumers about product characteristics that are valuable. On the other, they might be inducing inefficient switching through bribes, thereby increasing the administrative cost of the system. This section provides some empirical evidence about these two roles for sales agents and the effects of the 1997 reform over customer turnover.

4.2 Empirical Framework and Results

Our empirical framework is derived from the two period model with differentiated products presented in section 3.2. As in standard multichoice models, we assume that the consumer one-period-utility is a function of firms characteristics plus an idiosyncratic valuation which is distributed with a type I extreme value distribution:

$$\begin{aligned} u^i_{j,t} &= \alpha_a Adv_{j,t} + \alpha_s Serv_{j,t} + \alpha_F F^i_{j,t} + \alpha_R R^i_{j,t} + \epsilon_{i,j} & (19) \\ &= \delta^i_{j,t} + \epsilon^i_j & (20) \end{aligned}$$

where i, j and t are the customer, the firm and the period, respectively. In addition, Adv, $Serv$, F and R represent firm j advertising, service, fee and

[21] Upon the change in regulation, in addition to the affiliate's signature, sales agents require a copy of both customer ID and the last statement of his/her PFA to formalize the switch. See Circular NU 998, Superintendencia de Administradoras de Fondos de Pensiones.

expected return, respectively. The fee is equal to a fixed fee plus a variable fee multiplied by customer i's wage. The expected return is equal to the firm j expected return multiplied by the amount that i has in his/her individual account. Finally, ϵ is the idiosyncratic valuation.

Following section 3.2, we assume that at the beginning of period t_0, all customers are in the firms that better suits their tastes. Between t_0 and t firms characteristic change and sales agents visit customers. These two facts induce switches among customers.

Let there be only two firms, without sales agents and focus only in a group of customers with similar wages and funds in their accounts. In this case the net flow between firm h and firm j equals:

$$\begin{aligned} NF^i_{hj,t} &= M^i_t \; s \; (sh^i_{j,t} - sh^i_{j,to}) && (21) \\ &= M^i_t \; s \; \left(\frac{\exp(\delta^i_{j,t})}{\exp(\delta^i_{h,t}) + \exp(\delta^i_{j,t})} - \frac{\exp(\delta^i_{j,to})}{\exp(\delta^i_{h,to}) + \exp(\delta^i_{j,to})} \right) \\ &\approxeq M^i_t \; s \; sh^i_{h,to} sh^i_{j,to} \left(\Delta\delta^i_{j,t} - \Delta\delta^i_{h,t} \right) && (22) \end{aligned}$$

where sh^i_j is the share of type i customers in firm j. M^i is the number of type i customers in the market. Δ represents the change between t_0 and t. The net flow of type i customers from h to j is composed by clients that are now willing to be in firm j and chose h at t_0 (the last term in equation [21]). Due to searching costs only a fraction s of these consumers re-evaluate their choice in t. Using a first-order Taylor expansion we obtain equation [22].

Including sales agents that eliminate searching costs and could offer some type of incentive to switch (price cut:) to whom they visit, the net flow becomes:

$$\begin{aligned} NF^i_{hj,t} \approxeq\; & M^i_t sh^i_{h,to} sh^i_{j,to} \; s \; \left(\Delta\delta^i_{j,t} - \Delta\delta^i_{h,t} \right) (1 - l_{j,t} - l_{h,t}) && (23) \\ & + M^i_t sh^i_{h,to} sh^i_{j,to} \left(\Delta\delta^i_{j,t} - \Delta\delta^i_{h,t} + B^i_{j,t} \right) l_{j,t} \\ & - M^i_t sh^i_{h,to} sh^i_{j,to} \left(\Delta\delta^i_{h,t} - \Delta\delta^i_{j,t} + B^i_{h,t} \right) l_{h,t} \end{aligned}$$

$$= M_t^i sh_{h,to}^i sh_{j,to}^i \left\{ \left(s + (1-s)(l_{j,t} + l_{h,t}) \right) \left(\Delta\delta_{j,t}^i - \Delta\delta_{h,t}^i\right) + l_{j,t} B_{j,t}^i - l_{h,t} B_{h,t}^i \right\} \tag{24}$$

where l_j is the probability that a customer from firm h receives a sales agent from firm j. B_j^i is the gift or price cut offered by sales agents from j to induce customer i from h to switch. The first term in equation [23] represents the fraction of customers who switch by themselves. This percentage is higher, the lower the searching cost and the number of sales agents. The second and third terms represent customers who switch after they have received a sales agent from firms j and h, respectively. Sales agents change flows' sensitivity to changes in firms' characteristic $(\Delta\delta_{j,t}^i - \Delta\delta_{h,t}^i)$, this effect is larger the higher the probability to be contacted by a sales agents $(l_{j,t} + l_{h,t})$ and the higher the searching costs $(1 - s)$. If sales agents give information about firms' characteristics, the effect should be an increase in sensitivity to these characteristics. However, sales agents may offer price cuts (B) which may be a function of relative fees and returns, reducing flows' sensitivity to changes in firms characteristics. This is something that we will test in this section.

For simplicity, we assume that sales agents go randomly to any customer in the market. Using a first order Taylor approximation we have that the probability that a sales agents from j meets a customer from h is:

$$l_j \approxeq \alpha_A \frac{A_j}{M} \tag{25}$$

where A_j represents firm j's sales agents, M the total number of customers in the market and α_A the number of visit per sales agents.

Finally, to compute the observed net flows between h and j we add up the different types of customers in the market. Therefore the observed net flow between h and j divided by the total number of customers in the market is:

$$\frac{NF_{hj,t}}{M_t} \approxeq \sum_i \phi_t^i sh_{h,to}^i sh_{j,to}^i \left\{ (s + (1-s)(l_{j,t}+l_{h,t})) \left(\Delta\delta_{j,t}^i - \Delta\delta_{h,t}^i \right) + l_{j,t} B_{j,t}^i - l_{h,t} B_{h,t}^i \right\} \tag{26}$$

where ϕ_t^i is the fraction of customers that are type i in the whole market. From equation [26] we obtain our empirical model:

$$\begin{aligned} \frac{NF_{hj,t}}{M_t} \approxeq \; & \beta_a \widetilde{Adv}_{hj,t} + \beta_s \widetilde{Serv}_{hj,t} + \beta_F \widetilde{F}_{hj,t}^i + \beta_R \widetilde{R}_{hj,t}^i \\ & + \beta_{sa,a} \widetilde{SaAdv}_{hj,t} + \beta_{sa,s} \widetilde{SaServ}_{hj,t} + \beta_{sa,F} \widetilde{SaF}_{hj,t}^{\,i} + \\ & \beta_{sa,R} \widetilde{SaR}_{hj,t}^{\,i} + \beta_{sa} \widetilde{DA}_{hj,t} \end{aligned} \tag{27}$$

where

$\widetilde{Adv}_{j,t} := \sum_i \phi_t^i sh_{h,to}^i sh_{j,to}^i \left(\Delta Adv_{j,t} - \Delta Adv_{h,t} \right)$

$\widetilde{SaAdv}_{j,t} := \sum_i \phi_t^i sh_{h,to}^i sh_{j,to}^i \left(\Delta Adv_{j,t} - \Delta Adv_{h,t} \right) \left(\frac{A_{j,t}}{M} - \frac{A_{h,t}}{M} \right)$

$\widetilde{DA}_{hj,t} := \sum_i \phi_t^i sh_{h,to}^i sh_{j,to}^i \left(\frac{A_{j,t}}{M} - \frac{A_{h,t}}{M} \right)$

$\beta_a := s \ \alpha_a$

$\beta_{sa,a} := \alpha_A \ (1-s) \ \alpha_a$

$\beta_{sa} := \alpha_A B$

Equation [27] assumes that all sales agents offer the same gift (B), but actually it may be a function of firms' characteristics (or changes thereof). In this case, the variables that interact sales agents and changes in firms characteristics ($\beta_{sa,*}$) would reflect both: i) the reduction in searching costs and ii) the size of the gifts offered by sales agents. These two effects have opposite signs. For an increase in expected return, the reduction in searching costs implies that the interacted term has to be positive, but after this improvement sales agents may offer a smaller gifts to induce a switch implying a negative sign for the same term.

Our empirical set up assumes that workers' choice in t_0 is fully driven by a change in PFAs' characteristics during this period. In reality this is not true because some might have been in the wrong (not preferred) PFA for some months because of searching costs. Besides, some customers switch to a less preferred firm after being visited by a sales agent, who could have offered them a gift. Therefore, they might want to move back to the preferred PFA as soon as they can. To control for the former fact, our variables in t_0 are the simple average of the previous 12 months. Implicitly we are assuming that a customer in PFA j in t_0 re-evaluates his/her choice according to firms characteristics for the previous 12 month period.

$Table 1 : Summary\ Statistics$

	Whole Sample (obs=1750)				Pre-Reform (obs=1020)		Post-Reform (obs=442)	
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Mean	Std. Dev.
PFAs	10.53	2.56	8	15	13	1.55	8.14	0.38
Contributors in the System	2968428	173010	2682297	3275529	2845276	99979.06	3108091	69531.49
Gross Flows	1958	3607	0	29811	2271	4296	1936	2511
Sales Agents	1111	947	31	3747	1297	1052	672	499
Advertisement (ln) 1	-1.36	1.39	-5.11	0.51	-1.56	1.44	-1.04	1.30
Service (ln) 1	-1.46	0.72	-3.05	-0.15	-1.58	0.74	-1.24	0.66
Fees	7.18	0.55	5.60	9.73	7.36	0.46	6.76	0.54
Return	0.003	0.005	-0.007	0.015	0.003	0.004	0.004	0.007
Net Flows (Absolute Value)	563	1103	0	12801	694	1334	462	671
Net Flows	0.0	1239	-12801	12801	0.0	1503	0.0	815
Net Flows / Cot.	0.0	0.00043	-0.00453	0.00453	0.0	0.00053	0.0	0.00026
Dif. in sales agents (j-h) 4	0.0	0.00000	-0.00005	0.00005	0.0	0.00001	0.0	0.00001
Rel. Change in Advertising 1	0.0	0.00560	-0.07247	0.07247	0.0	0.00276	0.0	0.01016
Rel. Change in Service 1	0.0	0.00170	-0.01249	0.01249	0.0	0.00114	0.0	0.00252
Rel. Change in Returns	0.0	0.01801	-0.14709	0.14709	0.0	0.01150	0.0	0.02979
Rel. Change in Fees	0.0	0.00294	-0.03191	0.03191	0.0	0.00134	0.0	0.00473
Rel. Change in Fees * wage	0.0	1.054	-10.84037	10.84037	0.0	0.422	0.0	1.696

Note: The whole sample include 15 quarters and the pre-reform and post-reform periods include 6 and 7 quarters, respectively. September and December 1999 are considered as transition period. All mean values for difference variables are zero by construction, variables appear twice with different sign. Our estimations only use flows in one direction .
1 Advertising and Service expenditures are stock variables in hundreds of millions of 95$ (log). 2 Relatives changes in fees between PFAs are interacted with individual wages. 3 The variables are interacted with the sum of sales agents from PFA j and h divided by the total number of contributors in the system. 4 The diference in the number of sales agents in firm j and h are divided by the total amount of contributors in the system. 5 The post reform period does not include Dic. & Mach 1997. Absolute value of t-statistics in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.
as transition period. All mean values for difference variables are zero

Table 1 shows the summary statistics of the variables used in equation 27 as well as the level values of net and gross flows, advertisement (log), services (log), fees, expected returns and sales agents. We compute this summary statistic for the whole sample and for the pre and post-reform periods. As showed by table 1 and figure 3, gross flows are high across the whole sample, but in particular in the pre-reform period. The same is true for the number of sales agents. In the case of advertising and services expenditures, although table 1 shows no fall in the mean value, the large reduction in the number of PFAs in the system (from 13 to 8) implies that the total expenditure in these items decreased after the reform. Finally, a small fall in the average fee after the reform.

Figure 3 : Total Net Inflow, Gross Inflow and Probability of Sales Agents Visit

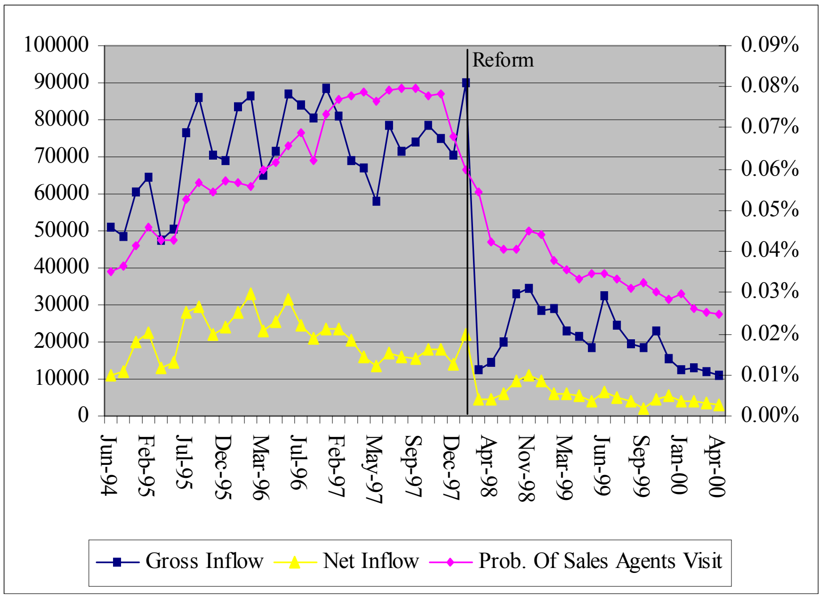


Table 2a shows equation [27] estimated coefficient using the whole period (since Dec.95 until Dec.99). The first column uses OLS and the second column shows results when we instrument the level of sales agents with their values four months before. Given that fees are fixed by law six months in advance, we took them as exogenous. Table 2b presents the same regressions dividing the sample in pre and post-reform periods.

Table2a

	(1)	(2)
Rel. Change in Advertising 1	**0.023**	**0.026**
	(0.014)*	(0.015)*
Rel. Change in IT 1	**-0.000**	**-0.002**
	(0.029)	(0.027)
Rel. Change in Returns	**0.009**	**0.007**
	(0.003)***	(0.003)**
Rel. Change in Fees	**-0.107**	**-0.097**
	(0.032)***	(0.032)***
Rel. Change in Fees	**0.000**	**0.000**
*** Individual Wages** 2	(0.000)	(0.000)
Rel. Change in Advertising	**-10.993**	**-15.029**
*** Sales Agents h and j** 3	(17.149)	(17.799)
Rel. Change in IT	**3.155**	**3.382**
*** Sales Agents h and j**	(31.114)	(31.677)
Rel. Change in Returns	**-9.178**	**-7.399**
*** Sales Agents h and j**	(3.527)***	(3.863)*
Rel. Change in Fees	**90.245**	**82.366**
*** Sales Agents h and j**	(24.079)***	(24.251)***
Dif. in sales agents (j-h) 4	**101.138**	**86.723**
	(24.463)***	(44.272)*
Dif. in sales agents (j-h) in to 4	**-80.895**	**-70.087**
	(19.522)***	(33.641)**
Observations	887	875
Sample	All	All
IV	No	Yes
R-squared	0.26	-

1 Advertising and IT stocks are in hundreds of millions of 95$ (log). 2 Relatives changes in fees between PFAs are interacted with individual wages. 3 The variables are interacted with the sum of sales agents from PFA j and h divided by the total number of contributors in the system. 4 The diference in the number of sales agents in firm j and h are divided by the total amount of contributors in the system.
Robust standard errors in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.

Our results indicate that the net inflow of customers to a given PFA is positively correlated with sales agents, reduction in relative prices and higher relative returns. All these coefficients have the expected sign and are significant at a 5% level in most specifications. Expenditure in advertising and in services are not significant and in some specifications have not the expected sign. The evidence supports the claim that sales agents explain a large portion of the switching between PFAs even after controlling for the other characteristics. Net flows are also associated with changes on product characteristics, implying for example that firms that reduce their relative prices and/or increase their relative returns attract customers.

Results for the whole sample show that a relative increase in advertising expenditures increases the net flows to firm j. For the average firm and focusing only on customers that switch by their own will (first row), the direct effect of a 1% increase in firm $j\prime s$ advertising stock increases the net flow from

h to j in around 5 workers, almost a 1% increase in the average cross-firm flows (in absolute value). It is worth to note that our measure of change in relative advertising interacted with sales agents is negative (sixth row). Sales agents reduce the net flow's sensitivity to changes in advertising. After taking into account the effect of sales agents, a 1% increase in advertising boosts the net flow by only 2.5 workers. These results are not robust to different samples (see Table 2b). As for expenditures in services, Table 2 shows that it does not have a significant effect on cross flows, which might be reflecting a problem with our measure of service.

Table 2a shows that an increase in the relative change in firm $j\prime s$ expected returns increases the net flow from h to j. Focusing only on customers that switch by their own will (third row), a one basic point increase in the expected return increases the net flow in around 30 workers, a 5% increase in the average net flows (in absolute value). When the expected return variable is interacted with sales agents we obtain a negative coefficient (sixth row). Sales agents reduce the net flow sensitivity to expected return; in other words, the price cut or gift offered by sales agents take into account the relative change in expected returns: a decrease in expected return relative to the rival firm implies a higher price cut or gift. The net effect of one base point increase in the expected return boosts the net flow by 6 workers, less than the direct effect (30 workers). This result supports Proposition [4] in our model.

Table2b

	(1)	(2)	(3)	(4)
	Net Flows between PFAs divided by total Contributors in the System			
Rel. Change in Advertising [1]	**0.003**	**-0.033**	**0.044**	**-0.054**
	(0.079)	(0.013)**	(0.087)	(0.020)***
Rel. Change in IT [1]	**0.001**	**0.009**	**0.009**	**0.000**
	(0.148)	(0.019)	(0.160)	(0.037)
Rel. Change in Returns	**0.028**	**-0.002**	**0.029**	**-0.002**
	(0.011)**	(0.002)	(0.012)**	(0.004)
Rel. Change in Fees	**-0.244**	**0.030**	**-0.272**	**0.055**
	(0.108)**	(0.051)	(0.107)**	(0.068)
Rel. Change in Fees	**0.000**	**-0.000**	**0.000**	**-0.000**
*** Individual Wages** [2]	(0.000)***	(0.000)	(0.000)***	(0.000)
Rel. Change in Advertising	**-10.486**	**58.730**	**-30.639**	**100.084**
*** Sales Agents h and j** [3]	(45.875)	(21.911)***	(50.796)	(36.809)***
Rel. Change in IT	**17.756**	**-2.887**	**27.975**	**22.275**
*** Sales Agents h and j**	(102.028)	(29.557)	(117.575)	(56.891)
Rel. Change in Returns	**-21.035**	**9.107**	**-21.262**	**12.173**
*** Sales Agents h and j**	(7.203)***	(4.817)*	(7.553)***	(8.422)
Rel. Change in Fees	**139.249**	**15.843**	**136.368**	**33.840**
*** Sales Agents h and j**	(63.120)**	(53.340)	(69.223)**	(71.725)
Dif. in sales agents (j-h) [4]	**153.601**	**39.121**	**201.389**	**128.346**
	(34.206)***	(15.154)**	(60.417)***	(61.372)**
Dif. in sales agents (j-h) in to [4]	**-140.989**	**-21.483**	**-179.203**	**-74.369**
	(30.012)***	(10.074)**	(51.520)***	(35.272)**
Observations	522	221	510	221
Sample	Pre-reform	Post-reform [5]	Pre-reform	Post-reform [5]
IV	No	No	Yes	Yes
R-squared	0.50	0.19	-	-

1 Advertising and IT stocks are in hundreds of millions of 95$ (log). 2 Relatives changes in fees between PFAs are interacted with individual wages. 3 The variables are interacted with the sum of sales agents from PFA j and h divided by the total number of contributors in the system. 4 The diference in the number of sales agents in firm j and h are divided by the total amount of contributors in the system. 5 The post reform period does not include Dic. & Mach 1997. Absolute value of t-statistics in parentheses, * significant at 10%; ** significant at 5%; *** significant at 1%.

The fourth row shows that a relative increase in firm $j\prime s$ fee reduces net flows. The positive sign in the interacted term with individual' wages (row 5) shows that the marginal effect of the fee is decreasing with workers's wealth (proxied by their wages). Focusing only on customers that switch by their own will (rows 4 and 5), a 1% reduction in fees increase the net flow by around 100 workers. As in the case of expected return, sales agents reduce the net flow sensitivity to fees (row 9). Sales agents compensate through gifts the increase in relative fees to induce customers to switch. The whole effect in net flows of a 1% increase in fees is only 23 workers.

Focusing on sales agents (difference between the two PFAs), our results show that net flows are positively correlated with the number of sales agents. Using the whole sample, two additional sales agents imply an increase in net flows of one worker. Considering the large standard deviation of this variable (1300) we have that this is by far the most important determinant of cross flows between PFAs.

Our regressions also include the difference in sales agents in t_0. This term takes into account the fact that maybe some customers are in PFA h in t_0 because they received a sales agents from this PFA in the past. If sales agents induce shift through gifts or price cuts, a rational customer would be willing to switch to take advantage of the gifts and decide to come back to the original PFA later. If this was the case the sign should be negative as is apparent in our regressions. This is an additional evidence that sale agents offer gifts or price cuts to induce customers to switch.

Table 2b splits the sample between pre and post reform period. After the reforms, firms' characteristics loose most their predictive power on net flows. The goodness of fit drops from 50 percent in the pre-reform period to less than 20 percent after the reform (first and second column). The relative changes in fees and expected returns are significant at 1% in the pre-reform period but fall (in absolute values) to become not significantly different from zero after the reform. This is true for customers that switch for themselves (rows 3-5) as well as for the ones visited by sales agents (rows 6-7). The results for advertising and services are either insignificant or with unexpected signs.

The previous results show that the 1997 amendment to the regulation, which implied additional paperwork to be done in order to process a transfer and a reduction in sales agents effectiveness, reduced net flows sensitive to changes in firms characteristic. As expected, this reform seems to increase customers' searching/switching costs.

Summing up, our results show that net flows between PFAs are positively related to increases in expected returns and advertisement, and negative related to increases in relative fees. The interactions of sales agents with changes in firms' characteristics show that sales agents reduce flows sensitivity to returns and fees. As predicted by our model, after an increase in fees or a reduction in expected returns, gifts offered by sales agents increase to compensate the deterioration of PFA characteristics. The positive and large coefficient for sales agents show that sales agents by themselves are an important determinant of net cross flows (through gifts). The 1997 reform increased searching/switching costs and therefore reduced flows' sensitivity to any change in firms' characteristics, and moreover, it reduced the effectiveness of sales agents to induce switches through gifts.

Finally, using our empirical setup, it is easy to see that sales agents would be even more important in the case of gross flows. In this case the effect of sales agents from the two rival firms add up (they create in and outflows at the same time), this is not the case for changes in firms' characteristics because they only produce flows in one direction.

5 Conclusion

This paper provides a framework for the idea that sales agents promote switching among plans (turnover) even when it is not socially efficient, increasing the administrative cost of the system. The paper shows that equilibria with an excessive number of sales agents, and therefore excessive turnover, can arise. Either the presence of searching costs or some degree of product differentiation (e.g. expected return in the case of pension fund administrators) allows firms to charge a fee higher than their marginal cost. This positive markup creates for firms an incentive to steal customers away from their rivals (the stealing effect).

In the model, sales agents help firms to steal customers. Using gifts (bribes), sales agents are able to induce workers (customers) to switch from one firm to another. A bribe can imply that even a rational worker may switch from a high to a low quality product with the same marginal cost –a completely inefficient switch from a social point of view–. Firms are willing to pay these bribes because price is above marginal cost and therefore they still make profits with these new customers.

A comparison of the competitive equilibrium with the constrained Pareto optimal case shows that the competitive equilibrium has too many sales agents. This inefficiency comes from two causes. First, the stealing effect makes the private benefit from hiring an extra sales agent bigger than the social one. Therefore, the competitive equilibrium will allocate too many sales agents to this industry. Second, sales agents, through bribes, can induce flows from high to low quality product, in the case of the Chilean pension system from high to low expected return PFAs –a misallocation of financial resources-.

By applying this model to the Chilean pension system, we observe that welfare might be improved by imposing restrictions to switching, which in general might be thought of as an anti-competitive regulation. However, for this to be the case, these restrictions should only involve switching through sales agents; otherwise, overall switching or searching costs might be increased and welfare reduced.

Finally, the empirical evidence shown in this paper supports the fact that under measures that increase switching costs and reduce the efficiency of sales agents, the number of sales agents in this industry and turnover are reduced. However, there is no strong evidence in favor of more "efficient" switching between providers after the reform.

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A Homogeneous Products: Extension to Long horizon

This appendix studies the model introduced in section 3.1, now assuming a long horizon (T period, where T tends to infinity).

Proposition 7 *If condition A holds (described in the next subsection) or there is a positive searching cost, a SPNE is given by:*[22,23]

$$B_j^* = P_i - P_j + \theta'_{SC} \quad \forall t, j \tag{28}$$

$$P_i^* = R \quad \forall t, i \tag{29}$$

$$\lambda_i^* = \begin{cases} 1 - \frac{w}{R-c_j-\theta'_{SC}} \frac{1-\beta(1-\lambda_j^*-\lambda_i^*)}{1+\beta^2(1-\lambda_j^*-\lambda_j^*)\frac{\theta'_{SC}(1-\lambda_j^*)-W\ln(1-\lambda_j^*)}{R-c_j-\theta'_{SC}}} & if \quad \text{positive} \\ 0 & otherwise \end{cases} \tag{30}$$

where β represents the discount factor.

Proof. Follows from the first order conditions. ■

In this set up, the market share evolution is equal to:

$$\begin{aligned} \sigma_{a,t+1} &= (1-\lambda_b^*)\sigma_{a,t} + \lambda_{at}^*\sigma_{b,t} \\ &= \lambda_a^* + \sigma_a(1-\lambda_a^*-\lambda_b^*) \end{aligned} \tag{31}$$

In the steady state,[24] the market shares of firms are given by $\sigma_{a,SS} = \lambda_a^*/(\lambda_a^* + \lambda_b^*)$, and they only depend in firms marginal costs. The higher

[22]It is important to note that in this equilibrium customers have zero surplus in each period , no matter whether they swith or not. Consumer's value function to stay in the same PFA or to switch (with a sales agents) are equal at any time.

[23]In the case we assume a positive searching cost, this is the unique markov equilibrium.

[24]The steady state is computed imposing that there is not net flow between PFAs. In other words, is the equilibrium prices, sales agents and market shares for which $\lambda_{SS}^{B*}\sigma_{SS}^{A} = \lambda_{SS}^{B*}\sigma_{SS}^{A}$.

the relative marginal cost, the lower the market share. Once firms reach the steady state shares there are not net flows anymore, but there is still turnover.

Condition for the long horizon model

This appendix describes the technical condition required to have a markov SPNE in the long horizon model (Section 1.3.2), and proofs the uniqueness of this equilibrium in the case in which there is a positive searching cost.

Condition A

A sufficient condition to have the equilibrium described by equations [28-30] as a SPNE for any initial market share in the case there is no searching cost, ie. s=1, is:[25]

$$\theta_{SC} \geqslant (R - c_i) + (\beta V(\sigma_{i,o} = 1) - V(\sigma_{i,o} = 0)) \qquad \forall i = a, b \tag{32}$$

where $V(\sigma_{i,o})$ represents the value function of firm I if it has an initial market share equals to $\sigma_{i,o}$. After some algebra, and assuming the equilibrium described in the previous subsection, equation [32] can be rewritten as:

$$\begin{aligned} \theta_{SC} \quad \geqslant \quad & (R - c_i) + \frac{(R - c_i)\left(\beta(1 - \lambda_i^* - \lambda_j^*) - \lambda_i^*(\lambda_i^* + \lambda_j^*)\right)}{1 - \beta(1 - \lambda_i^* - \lambda_j^*)} \\ & + \frac{\theta'_{SC}\lambda_i^*(\lambda_i^* + (1+\beta)\lambda_j^*) - w\ln(1 - \lambda_i^*)(1 + \beta\lambda_j^*)}{1 - \beta(1 - \lambda_i^* - \lambda_j^*)} \end{aligned}$$

If this condition hold, equations [28-30] describe the equilibrium in the long horizon model whatever are the parameters in the model.

If $\theta'_{SC} = 0 \quad$ and $\quad w = (R - c_i)/2 \quad \forall i$, the previous condition becomes: $\frac{\theta_{SC}}{w} \geqslant 1 + \ln(2)(1 + \beta/2)$.

[25] We assumes that $R > c^I$, otherwise firms I would never produce in this market.

B Data

All the information comes from the Superintendencia de Fondos de Pensiones (SAFP). The data was taken for the period 1994-2000. SAFP not only collects PFA's monthly balance sheets but also has records of the number of contributors in each firm and the number of transfers between PFAs and constructs reports on returns and fees. In addition, twice a year (December and March),[26] the SAFP constructs distribution of contributors in each PFA in terms of wages earned and cumulated funds each year. We construct the distribution for June and September interpolating those pieces of information. With the available data we construct observations for each December, March, June and September since December 1995 until December 1999. The constructed variables are:

- Quarterly gross flow from PFA h to j: Sum of three months ahead gross flows from h to j. For March 1996 we use cross flows observed between May and July 1996. This is because the transfer process takes three months and a switch decided in March can be concretized only on June. We use three months average to reduce noise. Whenever there is a merge between two PFAs, we use the sum of the two firm flows as if they were just one.

- Variation in firms characteristics: Variations in firms characteristics are taken between the current month t and a one year moving average that ends a quarter before t . For example, March 1996 changes in PFA $j\prime s$ characteristics is the difference between data for that PFA in March 1996 and the average of the characteristic during January 1995 and December 1995.Whenever there is a merge between two PFAs, we estimate the past characteristics as the sum of both firms' characteristics for the case of advertisement and information system services and the weighted average for the case of fees and returns (using contributors as

[26] In 1999, the SAFP computed distributions in June instead of March.

a weight). We measure PFA's advertisement as a monthly stock variable with a depreciation rate of 50% per year (in 10^8 Sep95\$). Service is a stock variable constructed with expenditure in information technology (in 10^8 Sep95\$). Fee is calculated as the three-month ahead PFA fixed fee plus variable fee multiplied by worker wages (in 10^3 Sep95\$). Expected Return is computed as the last 12-month average rate of return informed by the SAFP multiplied by the amount of fund hold by the worker in the system (in 10^3 Sep95\$). Workers' wages and funds are taken from the distribution of customers in each PFA.

We use the previous variables to construct the relative changes in firms characteristics used in table [1]. We compute the relative changes as the change in PFA $j\prime s$ characteristic between to and t minus the same changes for PFA h. For advertisement and services we use the log change.

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