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# Advertising and Competition in Privatized Social Security: The Case of Mexico*


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## 1. Introduction

There is an increasing movement to give workers greater control over pensions, allowing them to personally manage their retirement investments. The recent trend away from pay-as-you-go social security programs towards fully-funded, individual-account systems is a prominent example. Privatization is promoted as a potential cure for the agency, efficiency and solvency problems of traditional pay-as-you-go pension schemes, based on the notion that the resulting competition among asset management firms for employees' retirement funds will provide incentives for efficiency (Feldstein 2005).

Several countries have instituted privatization programs in search of these efficiencies, starting with the prominent 1981 launch of the Chilean system. One of the largest systems to privatize, Mexico's, is the focus of our analysis. It launched its revamped program in 1997 with workers able to choose their account managers from among 17 firms, most of which were already well known in Mexico through their operations in the broader financial sector and, occasionally, other sectors of the economy as well.

Despite the presence of a seemingly large number of firms competing for workers' accounts, fees in the newly launched system were strikingly high compared to those for similarly-styled financial accounts, both in Mexico (but outside the social security system) and in other countries. A year after system inception the average asset-weighted load was 23 percent. That is, of every 100 pesos a Mexican worker contributed to the system, only 77 pesos were credited to his or her account. By way of comparison, maximum loads among U.S. mutual funds that actually have loads are around four percent, and most U.S. funds do not even charge loads. In addition to these loads, many of the Mexican fund managers charged an annual fee based on the balance in the worker's account. The asset-weighted average annual fee across the 17 firms was 0.63 percent. All told, a 100-peso deposit by a Mexican worker into an account that earned a five percent annual return and charged these average fee levels would be worth only a bit over 95 pesos after 5 years.

In this paper, we seek to understand the competitive forces behind this outcome. How could competition among so many firms, selling what is financially speaking a virtually homogenous product (regulations strictly limited the types of assets that workers' accounts could hold), end up with fees at these levels?

We begin by noting that recent research has documented that consumers appear to respond rather weakly to prices in markets for seemingly similar financial products, including credit cards, index funds, mortgages, and in privatized social security systems (respectively, Ausubel 1991; Hortacsu and Syverson 2004 and Choi et al. 2009; Hall and Woodward 2010; Duarte and Hastings 2009). While some of these studies rationalize price dispersion as arising from information frictions such as search costs (Hortacsu and Syverson 2004, Hall and Woodward 2010), others find that even when price information is provided to consumers, consumers often select based on brand name rather than price (Choi et al. 2009). Indeed there is growing field evidence that investors are often overly responsive to information framing and short-term incentives when selecting fund managers.[1]

Along with price competition (or the lack thereof), advertising has proved to be an important competitive component in markets for consumer financial products. The US mutual fund industry spends about $6 billion dollars annually on advertising, for example.[2] As to whether such advertising is socially beneficial or harmful, however, extant theoretical models do not provide a unified prediction. Advertising that 'informs' consumers can reduce frictions and intensify price competition, increasing consumer surplus through market expansion (Butters 1977; Grossman and Shapiro 1984). However, advertising that 'persuades' consumers to focus on brand name or 'complements' consumption with prestige can lower price competition as consumers focus on non-price attributes – real or perceived – when selecting products (Schmalensee 1976; Becker and Murphy 1993; Chioveanu 2008;). Understanding how investors react to advertising and how this affects management fees takes on new importance in the context of social security privatization, where mandatory participation limits any market expansion benefits of advertising.

This paper presents evidence on how advertising impacts competition and equilibrium prices in the context of a privatized pension market. We use detailed administrative data on fund manager choices and worker characteristics at the inception of Mexico's privatized social security system, where fund managers had to set prices (management fees) at the national level, but could select sales force levels by local geographic areas. We develop a model of fund

[1] See for example Duarte and Hastings 2009; Hastings and Mitchell 2010; Hastings 2011.

[2] See Cronqvist (2006), who also finds that US mutual fund flows respond positively to advertising and other information irrelevant to net returns.

manager choice, price and advertising competition (in terms of sales force deployment) to examine how exposure to advertising shaped demand, and what effect it had on overall management fees.

We allow advertising to influence both price sensitivity and brand loyalty in a flexible way, nesting the potentially informative and persuasive effects of advertising exposure in our demand model. We use arguably exogenous variation in individual-level management costs generated by system regulations and instrumental variables for local sales-force levels to estimate the parameters of our demand model, while allowing for a remarkable degree of preference heterogeneity across geographies and demographic groups.

Our demand estimates explain important patterns observable even in raw summary statistics. First, Mexican workers are largely price insensitive, with management fees playing a very limited role in their fund manager choices. This is especially true among lower-income segments of the population. Second, workers' exposure to a firm's sales force decreases price sensitivity and increases brand value of the advertising firm, explaining why high-price firms had large sales forces and large market shares in the aggregate data. In addition, and tying the first two findings together, we find that advertising's influence is most powerful on low-income individuals.

We quantify the effects of advertising on demand by simulating fund manager choices setting to zero the effect that asset management firms' sales forces have on investors' preferences. All else equal, we find that doing so more than doubles the price elasticity of demand. This results in a substantial drop in industry concentration (measured as the HHI), with smaller firms gaining market share over larger firms who deployed large sales forces. In addition, investors sort to lower-fee funds, leading to an overall reduction of 17% in total fees paid. As contributions to the pension accounts represent 6.5% of all formal sector wages and a primary source of retirement income particularly among less-educated workers,[3] a decrease in management costs of this size represents a non-trivial portion of GDP and wealth at retirement.

Given the price insensitivity of demand and the sensitivity of fund manager choice to sales force, we next explore two hypothetical policies, one each on the supply and demand side of the market. On the supply side, we simulate what would happen if the existing government-co-branded fund manager was required to charge a very low fee (akin to a discount mutual fund

[3] See Hastings (2011).

in the U.S.). Introducing a government or government-regulated competitor is an often suggested policy solution for increasing competition in social-safety-net markets such as health care and pensions. On the demand side, we examine the impact of increasing price sensitivity at different points in the distribution—for example, through financial literacy programs for low-education workers.

To explore these counterfactual policies, we must first model the market's supply side, incorporating regulatory uncertainty and tackling non-convexities in the firms' profit functions caused by price-inelastic segments of the population. We then use this model together with our demand estimates to simulate these counterfactual policies. We find that the supply-side intervention has little impact on average fees in isolation, and would have to be coupled with additional limits on advertising to have larger effects. The demand-side policy's effect size obviously depends on how much one assumes workers' price sensitivities would change, but realistic values imply some modest reductions in average fees. A combination of supply- and demand-side interventions has the largest effect, though one should be mindful in this and all these counterfactual analyses that actual implementation of such interventions could create its own unforeseen costs and consequences.

This paper contributes to the literature in the following ways. We estimate a model of price and advertising competition and conduct counterfactual simulations demonstrating how important advertising's impact can be on product preferences and price sensitivity in a social-safety-net market. While there are several prominent theoretical models of the mechanisms through which advertising could affect demand and price competition, there is little direct empirical testing of these models (Bagwell 2007). Our approach lets us do so by empirically distinguishing between the 'informative' versus 'persuasive' or 'complementary' effects of advertising.

Further, many papers studying the relationships between advertising and market prices (Benham 1972 and Milyo and Waldfogel 1999 are prominent examples) have had to infer advertising's impact on demand indirectly, from firm's pricing responses, and often using posted rather than transaction prices. This prevents formal tests of how exposure directly impacts individual decisions and precludes counterfactual simulations, both of which we engage in.

This paper also adds to the recent growth in empirical work that has added advertising as a strategic variable that can influence preferences for products or alter the perception of product attributes.[4] The closest research to our context is that on the pharmaceutical industry, where recent papers have used aggregate data on detailing (sales force directed at medical professionals) and prices to estimate models of competition to explain, for example, cross-country differences in detailing and prices (Chintagunta and Desiraju 2005). We add to this literature by using individuals' product choices and exposure to sales forces to estimate how advertising impacts preferences across socio-economic groups. Our setting shares with pharmaceuticals the potential policy importance of understanding how advertising regulation may or may not lead to efficiency and welfare gains in the provision of a key social safety net.

Finally, as privatization of once publically provided products grows, there is greater need to understand the interaction between policy, consumer behavior, and firm responses in shaping the outcomes under privatization. Treating prices as given, firms as passive actors, and consumers of all backgrounds as forward-looking, frictionless decision makers may mischaracterize the efficiency and distribution effects of privatization (Adams, Einav and Levin 2008; Duarte and Hastings 2009; Hastings and Washington 2010). We explicitly characterize the behaviors of both individuals and firms to determine the efficacy of various policy designs.

## 2. Background on Mexico's Privatized Social Security System

### *2.1 System Background*

Mexico instituted its current privatized social security system on July 1, 1997. The system established individual ownership over retirement account contributions, and was designed to reform the previous pay-as-you-go system in a way that would increase financial viability, reduce inequity, and increase the coverage and amount of pensions.[5] The government approved private investment managers, called Afores (Administradoras de Fondos para el Retiro - pronounced uh-FOR-ay) to manage the individual accounts and established CONSAR (*Comision Nacional del Sistema de Ahorro para el Retiro* [National Commission of the System

[4] Note that preferences and perceived attributes have equivalent representations in a random utility context when data on revealed choices, advertising and product characteristics are the only data available.

[5] Sinha (2003), PowerPoint presentation by CONSAR on "Modernization of the Mexican Pension System," New York, February, 2005.

of Savings for Retirement]) to oversee this new *Sistema de Ahorro para el Retiro* (SAR – System of Savings and Retirement).[6]

The privatization of the pension system was done effectively in two parts. First, in 1992, the government created private accounts for all pension holders in the system. Effectively, from this point forward, social security contributions were placed into a personal account rather than into the general pay-as-you-go tax revenue. All personal accounts were held by the Banco de México, which guaranteed account holders a two percent real rate of return on their social security savings. However, accounts were poorly managed, creating a multiplicity of accounts per worker and a poor success rate in linking actual deposits to individual accounts.[7] The government decided to move towards privately managed personal social security accounts and in 1997 president Ernesto Zedillo signed into law the current SAR, moving management of accounts from Banco de México to approved private fund managers called Afores.[8]

Firms that applied to be Afores needed to meet minimum capital requirements and have experience in the financial sector in Mexico. Potential Afores submitted business plans including fee schedules to CONSAR for approval to operate as an Afore in the market. Twenty-four firms submitted applications and business plans, and of those seventeen were approved to operate. Two of the rejected applicants entered the market several years later. One theme at the inception of the system was that there should be enough firms so that no one firm would have more than a 20 percent market share, ensuring price competition and efficiency. This maximum-market share target has not yet been broken. In addition, the government centralized back-office operations to reduce management costs. The government created a national monopolist "switch" to process all transactions, charging the Afores an annual subscription fee and a nominal fee per transaction.

On July 1, 1997, the new system officially began. Account holders as well as new workers had to choose one of the seventeen approved Afores to manage their existing SAR 92 account balances and their pension contributions going forward. If a worker did not choose any

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[6] Initial reforms introduced in 1992 created private SAR accounts for workers at a bank of her choice, concurrent with participation in the partially funded scheme. However, the scope of privatization was largely limited to administrative tasks, such as record keeping and account statement generation (Sinha [2003]), as all investment decisions were still made in a manner similar to the older system. The resources from SAR 92 can be transferred to individual accounts in the Afores if there are bank receipts that confirm that there were deposits regarding pension funds in those accounts.

[7] Sinha (2003).

[8] "Ley del Sar", articles 18, 19 and 20. See also "Ley del Sar", Section II.

Afore when the new system started, their pension account was to be turned over to a consolidated account ("Cuenta Concentradora") held by Banco de México for up to four years. If the worker still had not claimed their account at the end of the four year period, the account was to be assigned to an Afore by CONSAR.[9] In the first year, there were over 12 million workers who registered with an Afore, though only approximately 10 million of these had an account balance with the SAR 92 system.

### *2.2 Fees, Investment Structure, and Advertising*

Mandatory contributions to the retirement account come from three places: the worker contributes a mandatory 1.125% of her base salary, the employer contributes an additional 5.15%, and the government contributes 0.225% of the base salary, as well as a "social contribution" of 5.5% of the inflation-indexed Mexico City minimum wage (Sinha 2003).[10] The worker chooses the Afore that manages the funds in her account. At the inception of the system, each Afore was required to offer one specialized investment fund, called a *Siefore* (*Sociedades de Inversión Especializadas en Fondos para el Retiro*, pronounced See-FOR-ay). The initial Siefore was limited to Mexican government bonds and Mexican corporate bonds with at least AA- rating (up to 35% of assets), with a 10% cap on financial sector corporate bonds.[11] Thus Siefores were primarily composed of Mexican government bonds.

Afores charged management fees on both flows (load fee) and on assets under management (balance fee). The load fee was referred to as "the flow fee" because it was quoted as a percent of the worker's *salary* instead of as a percent of the contribution to the account. Hence a flow fee of 1% was actually a 15.4% load (1/6.5 = 0.154)! In 1997, flow fees ranged from 0 to 1.70% (i.e., a 0% to 26.1% load). In addition to the flow fee, firms charged balance

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[9] The allocation process took place on 01/01/2001. Subsequent allocations took place every two months. The assignment rules change periodically, but the unclaimed accounts never sum to a large enough amount of money to be effective in generating price competition. In fact, in 2006, the sum total of the value in all unclaimed accounts was less than 5% of assets under management (Duarte and Hastings 2009). For details on the assignment policy, see "Ley del Sar", articles 75 and 76, and Article 7$^{th}$ transitional. See also Press release BP_02082000 (Aug 2nd, 2000) and Circular Consar 07-13.s.

[10] In addition, another 5% of the worker's base salary is contributed to a housing account. The employer pay this contribution. See "Ley del ISSSTE", article 167 for details.

[11] In the mid-to-late 2000s, a series of reforms were introduced to loosen investment restrictions. The system moved from a 1-fund system to a 2-fund system and later to the current 5-fund system, where workers are moved by default from less and less risky funds over their life-cycle. For more discussion of investment reforms please see Duarte and Hastings (2010) and Hastings (2010). See also press release BP_003_01 (Oct 19th, 2001) for more details.

fees ranging from 0% to 4.75%. Importantly, the existence of these two separate fees implies that the relative cost ranking of Afores varies across individuals as their relative wage-to-balance ratio changes. In Mexico's context, where there is a strong informal sector and also a large public sector that has a separate pension system, workers of all income and education levels move in and out of employment in the formal private sector on a regular basis.[12] Thus, the relative wage to balance ratio depends on the 1) wage rate, 2) probability of working in the formal private sector, 3) balance at the system inception.

These three factors vary richly across workers within relatively fine demographic cells due to Mexico's fluid informal labor market and due to mistakes in accounting and management in the SAR 1992 system (which creates variation in the account balance at the inception of the system). For example, for a worker who contributed consistently under the 1992 system (and whose full account balance was retrievable in one account) and is currently employed in the informal sector, the cheapest Afore would be one with a zero balance fee, regardless of how high its flow fee is. Conversely, for a worker with high and steady contributions who did not have a 1992 account, the best Afore would be one with a low flow fee, even if it might have a high balance fee.

As stated earlier, workers who had a SAR 92 account were required to select an Afore by 2001 at the latest. If they did not, their account would be assigned to an Afore for them according to rules set forth by CONSAR. Overall, most account holders, representing 95% of assets under management, elected an Afore in the first year. To select an Afore, workers had to gain information on fees, project their future contributions, know their current SAR 92 balance, and perform a fairly complex calculation. The government provided no information on fees, did not advertise Afore characteristics or regulate communication or advertising by the Afores. Instead, the government made a directed decision to trust that competitive pressure would lead to competition for accounts with generous information provision and forward-looking choices by consumers. In other words, to compete for consumers it was assumed profit-maximizing firms would charge a low price and use advertizing to fully inform consumers about their low prices. Thus, advertising and recruitment was left almost entirely to the Afores, and complaints or questions were handled by CONTUSEF, the regulatory arm for the Mexican financial sector. Investors relied on Agentes Promotores (literal translation is promoting agents, i.e. sales force)

[12] Duarte and Hastings (2009), Hastings (2010).

and general advertisement campaigns through radio and television to gain information and make their Afore choice.[13]

Interestingly, in available examples of the campaigns, Afores did not appear to invest in informative advertising by disclosing or highlighting fees (Gabaix and Laibson 2006; Ellison 2005, 2006). Instead, they appealed to their Afore's experience, for example. If fees were mentioned at all, it appears that Afores combined the two fees in an undisclosed way that obfuscated the situation-dependency of relative Afore expense, and minimized the size of the fee through assumptions on tenure length and relative wage to balance ratios. Appendix 1 provides English translations of prominent television advertisements during the first year of the system.

To register for an Afore, workers had to contact an Afore, or they could instead have been contacted by a promoting agent at their home or place of work. Once they registered, however, it was difficult to switch. Although workers were technically allowed to switch fund managers at their discretion, the right to switch the account and all of the paperwork resided with the Afore they *currently belonged to*, not the one they wanted to switch to. Thus switching Afores was a long and difficult process until reforms in the early 2000s.[14]

Given this backdrop, many Afores hired sales agents to recruit accounts and spread their Afore's name in a one-time competition at the start of the system. Figure 1 shows the level of agentes in the market over time. It is clear that Afores acted to recruit account holders with an expectation to hold them going forward. Agente numbers dropped of substantially after the first two years of the system. As for the fraction of account holders who switched Afores during the first 5 years of the system: almost no one switched from the one they chose at the inception of the system. Switching really did not occur in meaningful levels until key reforms were passed to make switching possible, as mentioned earlier. After these reforms, switching started and there was a new wave of Afore entry into the system. But from the vantage point of regulations in place in 1997, Afores set fees for the foreseeable future and competed for customers using local

[13] See Duarte and Hastings (2009) for the impact of government mandated information on demand and prices in the Afore market during surrounding information reforms in 2004-2006. The government took important steps in later years to develop a mandate for information on fees and importantly required that this mandated information be placed in account statements and presented by Agentes to potential clients. See Hastings (2010) for the extent to which low-income and lower-educated workers rely on sales agents still for guidance in Afore choice.

[14] See Circular 28-5, July 2002. In the years following the switching reforms, several new Afores entered the market and the number of Agentes increased once more.

sales force and advertising. Indeed, as Figure 2 shows, fees were for the most part constant from 1997 up until the reforms in the early 2000s.

## 3. Data

We compile data from several sources to form a detailed picture of workers' characteristics, pension fund balances and contributions, fund administrator choices, and Afores' prices and deployments of sales agents across localities. We use administrative data, stripped of individual identifiers and provided under a confidentiality agreement with CONSAR, to construct measures of what workers ("investors") would have to pay each Afore in management costs if they chose to hold their pension fund with that Afore. Recall that these costs will differ across workers because of heterogeneity in their starting account balances, contribution rates, wages and ages. The data include each contribution made into each account on a bimonthly period from 1997 through 2007 for all workers in the system as well as their account balance (imported from the SAR 1992 system) at the start of the system. We construct local measures of sales force deployment and exposure by combining this data with information on workers' zip codes of residence (as of 2006) and the zip code of registry for each agente. The information on agentes is a registration panel that provides us with information on all registered agentes and the current Afore they represented each month from 1997-2007.

Before proceeding to a formal model of Afore demand, we can preview our findings in some basic summary statistics from the raw data. Table 1 shows Afores' flow and balance fees, market shares, and the size of their agente sales forces. Several patterns stand out. First, several Afores are dominated by other choices, meaning both their flow and balance fees are higher than both the flow and balance fees of at least one other Afore. For example, Santander charges a 1.70% flow fee (a 26% implied load on contributions) as well as a 1% balance fee, and is dominated at least by Banamex and Bancomer, which both charge the same high load fee but a zero balance fee. Those three firms' fees are dominated in turn by several firms who charge lower load fees and zero balance fees. It is clear from Table 1 that there was substantial price variation in this market even though the firms were all large, well-known institutions selling essentially homogenous investment products due to the tight regulations on portfolio composition

Despite this variation in fees, we can see that many of the highest-fee ('dominated') firms have the highest market shares. The three firms mentioned above, Santander, Banamex and Bancomer, had the three highest market shares at the inception. This is consistent with the classic brand value effect—these firms were perceived to have a product of high enough quality on non-price/non-return attributes to garner large market shares despite high fees. Looking at the final column of the table, we see that these high-fee-high-share firms are also those with high numbers of sales agents, suggesting that advertising had the effect of building brand value rather than increasing price sensitivity. In particular, Santander had the largest market share of all Afores, and also had the highest level of sales agents. Overall, the correlation between the market share garnered during the inception phase has correlation coefficient 0.78 with the number of agentes deployed.

We see a similar pattern emerge in summary statistics for the relative costs of the Afore each individual choose. To compute relative costs, we calculate the 10-year projected cost for each worker in a random 10% sample affiliates at the system inception using their actual contributions, wages, and initial balance recorded in the administrative data from 1997-2007, assuming that the Afore fees were held constant going forward. We then form an expected cost for each worker by averaging future costs in each year over workers with very similar baseline characteristics. This expected cost measure allows us to estimate worker sensitivity to fees free of measurement error bias associated with using actual realized costs. We use this measure of expected cost to calculate the ranking for each Afore for each individual (rank 1 to 17, with 1 being the least expensive Afore for a given individual), and the expected savings each person could have made if they switched from the Afore they actually chose to the cheapest Afore for them.[15] Thus we have two descriptive measures of how important management fees were in determining Afore choice.

Table 2 presents these statistics for each Afore. The first column gives the average rank of the Afore over people who chose that Afore. The second column gives the average rank of the Afore over all people in the system. If people were acting on their personal information to minimize costs, we would expect to see much lower values in column 1 than in column 2. This is not the case. Rather, the two columns closely resemble each other despite large variation in relative rank for most Afores across workers. Overall, the average rank is very high for Afores

[15] Appendix 2 describes the expected cost construction in detail.

with substantial market share such as Santander, Profuturo GNP, Banorte, and XXI (XXI is the Afore co-branded with the Mexican social security administration, IMSS), suggesting that investors' Afore choices were driven by factors other than the fees they would pay.

In addition, the overall lowest cost Afore, Inbursa (the financial arm of Telemex owned by Carlos Slim) has a very low market share despite its prominent name in Mexico. However, it clearly attracts substantially higher-wage workers. In fact, we find below that investors' price sensitivities increase with their wage, while at the same time their responsiveness to advertising decreases with their wage. The combination of Inbursa's observed market position and this estimate of investor demand hint that advertising in this market might act primarily on lower-income and less-educated workers, making them less sensitive to high fees. We explore this in further detail below.

Column 3 translates the relative rankings into a 'days of salary' measure. It shows the average number of days wages that could be saved if each of the Afore's clients switched instead to the Afore that was cheapest for them. These average days of wages are non-negligible, suggesting that demand may not be very price elastic and particularly for Afores with high levels of sales agents. Interestingly, one of the highest cost Afores on average is XXI (Twenty-one or Veinte-uno), the Afore that is co-branded with the Mexican social security system (this is reminiscent of findings for AARP co-branded Medicare Part D plans (Kling et al. 2009; Abaluck and Gruber, forthcoming). In addition, this Afore is particularly popular among women. Our demand estimation will allow both preferences for costs and for Afores to vary flexibly with demographic characteristics and municipality to separate out advertising's effect on brand value and price sensitivity from demographics.

## 4. Estimation of Demand

### *4.1. Demand Model*

To measure how advertising affects Afore choice, we start by estimating a random utility model of Afore demand, allowing the weights individuals place on brand and price to vary with localized exposure to Agente Promotores. Specifically, we assume that system affiliates choose an Afore to maximize their indirect utility given by the following equation:

$$u_{ij} = \lambda_i(a_{m,j}, \theta_i) C_{ij}\left(y_i, b_i, p_j\right) + \delta_{i,j}\left(a_{m,j}, \theta_i\right) + \varepsilon_{ij} \qquad (1)$$

so that the indirect utility *i* receives from having Afore *j* manage her account is a function of: 1) her sensitivity to management costs, $\lambda_i$, which is in turn a function of Afore *j*'s level of Agente Promotores in *i*'s municipality *m*, $a_{m,j}$, and individual *i*'s demographic characteristics, $\theta_i$; 2) her expected management costs $C_{ij}$ as a function of her expected formal labor sector income, $y_i$, her incoming SAR 92 balance, $b_i$, and the flow and balance fees set by Afore *j*, $p_j$; 3) a preference for Afore *j*, $\delta_{ij}$, which is a function again of local advertising and demographic characteristics of *i*; and 4) a random component, $\varepsilon_{ij}$, which is assumed to be distributed *iid* extreme value.

### *4.2. Demand Estimation*

We begin by estimating the parameters of the utility model given in (1). Note that we allow all parameters of the generic utility function to vary across individuals. To capture this preference heterogeneity among investors in a flexible yet still tractable manner, we estimate conditional logit models separately by demographic-geographic cells. We break the population into 32 demographic groups, categorized by age (of which there are four categories), gender, and wage quartile. These demographic groups are interacted with investors' municipality of residence (we explain why we choose municipalities as geographic markets below), giving us 3699 distinct cells and sets of estimated utility parameters $\lambda_i$ and $\delta_{i,j}$. So for each of the 3699 distinct cells, *c*, we estimate the following equation:

$$u_{ij} = (\alpha^c + \gamma^c w_i)C_{ij}\big(y_i, b_i, p_j\big) + \delta_j^c + \varepsilon_{ij} \qquad (2)$$

resulting in 3699 sets of parameter estimates for price sensitivity and brand loyalty. Note that within a cell, price sensitivity is allowed to vary linearly with individual *i's* current wage, so that price sensitivity varies with a measure of income within income quartile, age quartile, gender and municipality of residence.

Importantly, even though Afores set their prices at the national level, investors' estimated price (i.e., management fees) sensitivities $\lambda_i$ are identified separately from Afore brand preferences using the variation in effective prices observed by the individuals within a demographic-geographic cell. This variation arises because while the parameters of the investor-level price variable in our model (flow and balance fees) are set at the national level, the actual price faced by each worker varies smoothly according to her salary, age, account balance brought into the system, and the fraction of time she spends employed in the formal sector (versus the informal sector, unemployed, or out of the labor force). In addition, any unobservable demand component acting at the demographic-geographic cell level is absorbed by the estimated $\delta_{i,j}$, implying that our price sensitivity estimates are identified separately from any regional or demographic-group specific preferences for particular Afores.

We then use our estimates of the utility parameters $\lambda_i$ and $\delta_{c,j}$ to examine the impact of Afores' advertising/marketing efforts as measured in their use of agentes in each local market, *m*, on demand parameters of individuals in various demographic groups. Because agentes can be deployed strategically across metropolitan areas, we first estimate mean utility parameters by municipality and demographic cell, and then instrument for exposure to local sales force to recover the causal relationship between agentes and mean brand and price preferences within and across our geographic-demographic estimation cells. We estimate the following relationships in this manner:

$$\alpha_c = \alpha^0 + \tilde{\alpha}_c A_m + \sigma_{ij} \qquad (3)$$

$$\delta_{cj} = \delta_j^0 + \tilde{\delta}_c a_{j,c} + D_c + v_{c,j} \qquad (4)$$

$$a_{j,c} = a + \beta Z_{j,c} + \omega_{c,j}$$

where $A_m$ is a measure of total Agente concentration in municipality *m*, $a_{c,j}$ is the total concentration of Afore *j*'s agentes in municipality *m*, $D_c$ are dummies for estimation cells, and $Z_{j,m}$ are instruments for $a_{j,m}$ such that the error terms $\omega_{c,j}$ and $v_{c,j}$ are orthogonal. We will propose and test a handful of instruments when we estimate equation (4). Note that our structural equation in (1) and (2) implies that price preferences are not confounded by excluded factors correlated with agente concentration. We check and confirm this to be the case by showing that an IV approach does not meaningfully change the parameters of interest in (3) as it does in (4).

Table 3 presents summary statistics describing the demand estimates, presented as scale-free elasticities of demand with respect to management costs. Across all Afores, individuals in the lower quartile of the income distribution are substantially less elastic to management fees than their counterparts in the upper quartile of the income distribution.[16] However, if we look at the simple correlation between total sales force exposure and mean wages across municipalities,

[16] Note that because those in the upper quartile have more funds to manage, conditional on age and initial balance, their elasticity counts substantially more for the firm's price strategy.

we find that those in the upper quartile have 25% higher mean agente exposure than those in the lowest quartile. Thus a first-glance correlation between sales force exposure and demand elasticity may be misleading if sales force is endogenously deployed to higher-income markets.

Therefore, we use our cell-level demand estimates and an instrumental variables approach to measure how much of the variation in price sensitivity within and across demographic groups is due to sales force exposure. To begin, Table 4 shows the results of regressing our cell-level estimates of investors' price sensitivities $\lambda_i$ and Afore-specific brand effects $\delta_{i,j}$ on potential exposure to agentes Afore *j* has working in the market corresponding to the utility estimation cell.[17] We use the number of agentes for Afore *j* in a municipality *m* divided by the total number of SAR affiliates (workers) in municipality *m* (in thousands) as our estimate of exposure to sales force. Hence our measure is the number of sales agents per 1,000 potential clients in a given municipality (county).

Columns 1 and 2 of Table 4 show results from regressing $\lambda_i$ via OLS on measures of local sales force exposure (linear and quadratic polynomials in the number of agentes per worker in the market).[18] The positive and significant coefficient on sales force exposure in column 1 implies that as Afores step up marketing efforts, investors become less sensitive to fee differences across Afores. (A positive coefficient denotes less price sensitivity, because a negative value of $\lambda_i$ indicates investors get disutility from higher management costs.) A positive coefficient is not what one would expect if agentes merely served as information conduits that made it easier for investors to find the lowest-cost Afore. In that case, investors would become more sensitive to costs as agentes made it easier to find lower-price asset managers, and the

[17] We define geographic markets by Mexican municipality (roughly, a county) based on information we have about the geographic reach of agentes. Specifically, for all workers who switched Afores, we know the identity of the agente who handled the switch. We also know both the worker's and the agente's residence, so we can measure the typical distance between worker-agente pairs. We found, for example, that the probability of having a worker using an agente in their same zip code is close to the probability of matching with a random agente in the local market, suggesting this is far too narrow an area to consider a market. The same result holds true at a 4-digit zip code level. Matches become more systematic, however, at higher levels of aggregation. The probability of a worker matching with an agente from the same msunicipality (there are over 500 municipalities in Mexico) is 0.34. Probabilities are even higher, of course, at the 2-digit zip code level (of which there are 100), but this strikes us as too aggregate a market area to allow for the rich variation in demand parameters across demographics and markets that we want in our estimations.

[18] Note we use OLS because the model implies that unobserved Afore quality characteristics are already captured in each market's Afore fixed effects. However, if we do instrument for sales force exposure as we do when estimating brand preference parameters below, the relationship between price sensitivity $\lambda_i$ and sales force exposure is not statistically different from the results we discuss here.

number of agentes would instead be negatively correlated with $\lambda_i$. The sign of the coefficient is positive and the size is economically meaningful as well. The mean value for our sales-force exposure measure is 4.757 with a standard deviation of 2.504. Thus a one standard deviation increase in sales force exposure from its mean would decrease the price sensitivity parameter by 29%.[19] The results from the quadratic specification indicate this effect might fade at higher exposure levels, though the higher-order term is not statistically significant.

The results in columns 3 and 4 of Table 4 relate investors' brand preferences for Afore *j*, as captured in $\delta_{i,j}$, to exposure to Afore *j*'s agentes. The positive coefficient in column 3 indicates that greater saturation of an Afore's agentes in a municipality is associated with a significantly greater brand preference for that Afore—i.e., marketing efforts for a product are tied to demand. The negative quadratic term in column 4 implies the magnitude of this effect falls as agente density continues to rise, however. The increased number of observations in columns 3 and 4 relative to columns 1 and 2 is due to the fact that while there is only one price sensitivity coefficient per cell, there are separate brand preference parameters for each Afore-cell. Note that we include cell fixed effects in these brand preference regressions, so the relationship is identified off of variation in Afores' agente usage within markets.

Of course, advertising/marketing efforts are chosen by the Afores, and we might expect them to allocate agentes based on differences in demand across worker categories. This poses the standard endogenous attributes problem familiar in demand estimation, making causal inferences from the column 3 and 4 results difficult. To address this problem we estimate the contribution of sales force exposure to the brand preference parameters $\delta_{c,j}$ using instrumental variables. We use two sets of instruments that should affect Afores' choices of agente concentration within a municipality, but are arguably excluded from the demand for that Afore by a consumer, conditional on the current controls and within a given demographic cell.

The first instrument we use is the average fee/cost of Afore *j* for pension contributors in the same municipality but excluding those within the demographic cell we are studying. Because expenditure of agente effort should in theory concentrate in markets with high (potential) revenue, but agentes are deployed by geographic region and not by individual , the revenue potential of "neighboring" demographic cells may positively impact the level of agente exposure

[19] $\lambda_i$ falls from (= -6.06E-4 + 4.757*4.57E-5) to (=-6.06E-4 + (4.757+2.504)* 4.57E-5).

that an individual in demographic cell *c* receives, conditional on their own revenue potential for Afore *j*. This is effectively an advertising spillover: being located in a municipality where other workers are profitable to Afore *j*, controlling for one's own attractiveness to Afore *j*, will all else equal increase one's exposure to sales agents from Afore *j*. The second instrument we use is the average wage of pension contributors in the municipality, but again excluding those within the particular demographic cell of the observation. This is interacted with Afore fixed effects to get within demographic cell variation.

Table 5 shows the first-stage results of our instrumental variables approach—the relationship between the municipality-level concentration of agentes for each Afore and our two instruments. The first three columns present results for the "neighbors' revenues" instruments; the last three show the "neighbors' wages".

The instrument enters positively into the regression in all cases, consistent with a model in which a demographic group's exposure to agentes in their market grows with the potential revenue for an Afore or the average wage in other demographic groups in the same municipality. Note that all regressions include demographic-geographic cell fixed effects, so the positive relationship between the instruments and the number of agentes holds across Afores even within a narrow slice of the market. Thus the first stage is not merely driven by aggregate profitability shocks (e.g., a particular Afore is in high demand across all groups and hires a large number of agentes to handle this client base). Rather, when a particular demographic group happens to be in a market full of other groups that are idiosyncratically profitable for an Afore relative to other Afores, that demographic will be exposed a larger number of *that* Afore's agentes in that particular market, but this need not be true in other markets. The narrowness of our identification improves our confidence that broader common demand shocks are confounding our instrumental variables estimates.

We further examine the relationship between our instruments and sales force exposure by allowing for nonlinearities (shown in the second columns of the respective instruments' panels in Table 5) and allowing the relationship between agentes and potential revenues/wages to vary across Afores (the third columns of the panels). The basic patterns hold. The revenue instruments might have nonlinear effects, with a stronger marginal impact at higher revenue levels. Both instruments see notable differences across Afores in the magnitudes of their relationships to agente sales force deployment. However, the Afore-specific relationships, when taking into account the baseline relationship, are still positive in every case.

Instruments in hand, we next re-estimate the relationship between agente exposure and the Afore-specific brand preferences $\delta_{c,j}$. Table 6 presents five such specifications. Columns 1-3 use the instruments corresponding to the first-stage specifications shown in the first three columns (respectively) in Table 5. Column 4 uses the wage instrument allowing for Afore-specific effects (corresponding to the third column of that instrument panel in Table 5). Finally, column 5 uses the revenue instruments and allows the impact of agentes on brand value to vary with the average income level of the demographic cell.

The results are quantitatively and qualitatively similar to one another. Just as in the OLS results in columns 3 and 4 of Table 5, increases in an Afore's agente coverage strengthen investors' preferences for that Afore. The fact that the IV estimates are larger in magnitude than their OLS counterparts suggests that all else equal, Afores direct agentes to markets where investors tend to have weaker brand preferences for that Afore. This is consistent with a world where the marginal return to advertising/marketing is larger in markets where investors lack current awareness or inherent taste for an Afore than in markets where the Afore has largely already "won over" investors for one reason or another. The measured effect is sizable. The mean delta is approximately 3.2. An increase of one standard deviation in Afore *j*'s sales force concentration would be approximately 0.31, which would lead to a predicted increase in delta of 125% (=0.31*12.87/3.2), using the point estimate of 12.87 in Column (5). Thus advertising sales force contributed greatly to brand value at the expense of price sensitivity in this market. This is consistent with our motivating summary statistics in Table 1, which showed an overall correlation of 0.78 between total market share and sales force size.

In the final column of Table 6, which allows the impact of Afores' marketing efforts to vary across workers with different incomes, the worker wage coefficient is negative and significant. This indicates that, interestingly, while agentes overall shift investors' preferences to their associated Afore, the strength of their ability to do so declines for higher-income investors. This is consistent with survey findings from Hastings (2011); higher-income system affiliates are more likely to depend on their independent information sources such as CONSAR in choosing an Afore.

The results in Tables 4 and 6 are instructive about the fundamental nature of this product market. They reject the simplest product structure one might imagine for a market with observable outcomes such as this; namely, that Afores are essentially perfect substitutes (because they all offer very similar portfolios), but search frictions support some management fee dispersion in equilibrium. If this were the case, there should be no effect of agentes on inherent brand. Further, they would tend to make investors more price sensitive, not less as we have found. An alternative structure that is consistent with our results is one in which an Afore's marketing effort is a complement to price. Greater marketing effort, reflected in agente concentration, raises investor's willingness to pay to hold their pension account with that Afore and reduces their sensitivity to fee differences. This structure is discussed in models of persuasive advertising such as Schmalensee (1976), Becker and Murphy (1992), and Chioveanu (2008), and could possibly explain why price competition seems muted in the market.

To quantify the impact that sales force has on demand, Table 7 conducts some experiments regarding the effect of agentes on investors' brand preferences for specific Afores. For each Afore (listed by row), we first report summary statistics of the distribution of the Afore's agente saturation across our roughly 3700 demographic-geographic cells. We then show the average estimated brand preference parameter $\delta_{i,j}$ across these cells. (Our reference Afore in the logit-style demand specification, Garante, is omitted as it has $\delta_{i,j} = 0$ in every cell; the reported $\delta_{i,j}$ for the Afores are thus relative to investors brand preference for Garante.) Next, we use the Table 5 estimates of agente saturation on brand preference to compute what investors' average brand preference for each Afore would be if agentes had no impact on preferences. (To do this, we also zero-out the impact of Garante's sales agents as well.) Finally we compute the implied average price elasticity for each Afore, based on that Afore's customer attributes in the data. Again we do so for two cases: the implied values given current observations, and the alternative values implied by the estimates of Tables 3 and 5 setting the impact of agentes on preferences to zero. (Note that in the logit demand form, price elasticities will be a function of both the price sensitivity parameter $\lambda_i$ and the brand preference parameters $\delta_{i,j}$.) These elasticities are shown in the last two columns of Table 7.

Given the overall positive relationship between agente saturation and favorable brand preference, it is not surprising that we find in both of these sets of calculations that brand preferences weaken when demand is neutral to agente exposure. More interesting, however, is the substantial quantitative extent of this weakening. For example, the average drop in $\delta_{i,j}$ from the model's estimates in the data to the $\delta_{i,j}$ calculated assuming income-invariant agente effects is 4.03. This is larger than the size of the standard deviation in average $\delta_{i,j}$ across Afores (3.24). Another interesting result is that Afores are not affected equally if agentes have no effect on preferences. Some would suffer much greater changes to their $\delta_{i,j}$ than others. On several occasions, rank orders of investors' preference intensities would be changed.

Zeroing out the impact of agentes also makes demand more price elastic. Again the magnitudes of the implied changes are substantial. The average price elasticity more than doubles relative to its level in the data, from -0.75 to -1.93. There is also nontrivial variation in the size of the increase in the elasticity across Afores.

Table 8 shows how each Afore's market shares would change if agente exposure no longer had an impact on demand, all else equal. We first report for comparison purposes both the actual average market share of the Afores in the data as well as our demand model's predictions of these market shares, then again conduct the same counterfactual calculations for income-insensitive and income-sensitive utility parameters. Obviously, average market shares do not change in any of the calculations, as every investor must choose one Afore.

The most interesting patterns in these calculations are which Afores are most harmed and helped in this alternative scenario. The Afores that would suffer the greatest loss in market share are those that are currently the market leaders and have a large number of agentes in the field. For example, Bancomer, currently the largest-share Afore and one of the largest agente employers, would lose over 75% of its market share. Santander, Garante, and Profuturo would be similarly eviscerated. In contrast to these losses, considerable market share gains would be experienced by currently minor players like Zurich, Principal and Capitaliza and by the somewhat more major players, Inbursa and XXI. Overall, the HHI drops from 1088 to 860 when the impact of sales force on preferences is zeroed-out.

Moreover, Table 8 shows that total management fees paid in the system would have decreased by 17.45% if agentes had no impact on demand, all else equal. This helps to quantify their impact on demand and price sensitivity. Agente exposure influenced consumer choice enough so that in total, consumers chose substantially higher-cost fund managers than they would have in the absence of agente influence on preferences. This is important in light of a forced savings-for-retirement program, as larger management fees translate directly into reduced wealth at retirement.

## 5. Policy Simulations

We have shown evidence that the high fees in the Mexican social security market reflect the insensitivity of workers to price differences across asset management firms, that this insensitivity is related to exposure to the firms' sales forces, that this relationship is strongest for lower-wage workers, and that the quantitative effect of sales forces on workers' demand generally is quite large.

In this section, we conduct counterfactuals to explore how these patterns might be affected by two policy interventions, one oriented to the supply side of the market and the other to the market's demand side. The supply-side policy involves mandating the existing government-co-branded fund manager (XXI) to charge a very low fee. This counterfactual is inspired by the occasionally suggested policy of introducing a government or government-regulated competitor to increase competition in social-safety-net markets such as this. The demand-side intervention increases (say through educational programs) the price sensitivity of workers.

Too conduct these counterfactuals, we must first develop a model of the market's supply side. We face several hurdles that are indicative of some of the key features and difficulties in modeling a private market with mandatory participation and heavy regulation.

### *5.1. Modeling Firm Price Decisions: Nash-Bertrand Pricing*

Most prior analyses of discrete choice demand systems assume that firms compete in a static Nash-Bertrand fashion.[20] In our setting, competition is based on several endogeneous variables: balance fees and flow fees set at the national level, and agente levels set at the regional level. In such a model, revenues for Afore *j* are

[20] We model the supply side as a static game even though competition may at first glance appear to have an important dynamic element: workers can switch Afores (though at a cost), creating switching-cost-driven dynamics. However, we are comfortable approximating the market as static because it turns out that, empirically, almost all switching of Afores by workers (which occurs at a modest rate to begin with) is driven by changes in employment status (Duarte and Hastings 2009). That is, workers who do switch appear to being doing it in response to what occurs in the labor market, not competition among Afores. We therefore think of the arrival and departure of clients as being driven by an exogenous process; firms maximize profits taking this process as given.

$$\pi_j(f_j,b_j,A_j)=\sum_{i\in I}\rho_{ij}(f_j,b_j,A_j^{(i)};f_{-j},b_{-j},A_{-j}^{(i)})p_i(f_j,b_j),$$

where we sum over (expected) revenues obtained from each individual *i* in the system. Here $f_j$ and $b_j$ are flow and balance fees set by Afore *j*, $A_j$ is the vector of region-specific agente levels chosen by the Afore, and $A_j^{(i)}$ is the number of agentes that individual *i* is exposed to (which we assume is proxied by the regional number of agentes). Also, $\rho_{ij}$ is the probability that individual *i* chooses Afore *j* and $p_i$ is the present value of the revenue stream generated by this individual assuming s/he does not switch to another Afore.[21]

The individual level choice probabilities, $\rho_{ij}$, are given by the logit choice probabilities:

$$\rho_{ij}(f_j,b_j,A_j^{(i)};f_{-j},b_{-j},A_{-j}^{(i)})=\frac{\exp\left[\lambda_{ij}(A_j^{(i)};A_{-j}^{(i)})c_i(f_j,b_j)+\delta_{ij}(f_j,b_j,A_j^{(i)};A_{-j}^{(i)})\right]}{\sum_{j\in J}\exp\left[\lambda_{ij}(A_j^{(i)};A_{-j}^{(i)})c_i(f_j,b_j)+\delta_{ij}(f_j,b_j,A_j^{(i)};A_{-j}^{(i)})\right]}.$$

Here $c_i$ is the present discounted total fees that *i* pays *j* for management services ($c_i$ equals $p_i$ if the account holder's and the Afore's time horizons and/or discount factors are the same).

A Nash equilibrium of this game is a vector of balance and flow fees and regional advertising/agente levels such that each firm's choices are best-responses holding other firms' decisions as given.

However, the game played in this setting differs from the standard logit-Bertrand pricing game in a number of ways that complicate the calculation of an equilibrium. First, as we show in Appendix 3, the firms' maximization problems with respect to prices need not be convex. This arises because a substantial number of individuals are estimated to be price-insensitive. Thus, a profitable strategy in response to increased price competition could be to not compete and sell only to very inelastic individuals, charging them the highest permissible fee. Because all formally-employed individuals have contributions to their account automatically deducted from

[21] The Afore's profits also include the costs of hiring agentes. We could include this term in our analysis, but it would not change anything, as the counterfactuals we compute either leave marketing (i.e., agente) spending constant or shut it down completely. Hence we never need to know agente hiring costs, as we do not need to compute new optimal agente levels in any counterfactual.

their payroll, and because benefits from the account accrue in the future, there may be a density of inelastic individuals for a firm to price against.[22]

The nonconvexity introduced by price insensitive individuals also prevents us from characterizing the equilibrium as a system of equations defined by first order conditions, as is usually done in similar problems. Therefore, we utilize a sequential best-response iteration algorithm to solve for the equilibrium fees conditional on advertising levels in our policy simulations. As we discuss in more detail in Appendix 3, the solution found under this method is quite robust to initial starting points and sequence of iterations.

### *5.2 Implications of the Nash-Bertrand Model: Rationalizing Observed Fee Levels*

We begin by first checking if the observed balance and flow fees can be rationalized as the result of the above static equilibrium pricing game, taking our demand estimates and observed advertising levels as given. To do this, we calculate equilibrium balance and flow fees, taking advertising levels as they are observed in our data. Table 9 reports the results of this first exercise. They are not particularly promising. Specifically, the supply side model, when applied to the demand estimates predicts a mix of flow and balance fees that are very different than those in the data.

In our calculations, most Afores have considerably higher balance fees than they set in actuality. Further, the ratios of balance-to-flow fees is much higher in our "equilibrium" calculation than in the data. The main reason for this mismatch, as we will show, is in the nature of our assumption about Afores' planning horizons. We imposed the standard assumption in the literature that all of the firms display the same forward-looking behavior, in that they assume that their accounts, once signed up, will yield revenues through the Afore's chosen pricing structure for 10 years.[23]

Yet it is not at all clear that this assumption, while standard in the literature, accurately describes firm behavior in this industry. Given that this was the first year of the privatized social security system in Mexico, and that previous attempts to reform the system had not been

[22] For example, survey responses in Hastings (2011) show that, as in other developed economies, many participants lack basic financial skills and numeracy ('financial literacy'), and many are also time-inconsistent as measured by a standard battery of survey questions.

[23] We truncate our analysis at 10 years, as this is how long our sample of worker contributions extends beyond the competitive period at the start of the privatized system that we are studying, extending the years further would still result in Afores favoring balance fees to flow fees.

successful, it is likely that not all firms believed the relevant time horizon over which to calculate revenues to be as long 10 years or more. Indeed, this is suggested by the relative size of observed balance and flow fees. High balance fees won't generate a lot of revenue unless enough assets have been accumulated in the accounts. Firms with shorter time horizons should therefore set high flow fees, earning what revenues they can get while they can. This is the observed pattern in the data.

To explore the issue of planning horizons further, we allow in Table 9 for heterogeneity in Afores' time horizons. In other words, we modify the first best-response exercise by solving for the "rationalizing" time horizon for each firm, along with their best-response balance and flow fees. Allowing the time horizon to vary across Afores' brings calculated "equilibrium" balance and flow fees to be much closer than when we set all time horizons equal to 10 years. However, we should note that since we are using only one variable (time horizon) to fit variation in both balance and flow fees, the "fit" of this model is not guaranteed to be perfect. Still, the correlation between observed and "equilibrium" flow and balance fees are 0.90 and 0.85 respectively; much better than 0.14 and 0.15.

We conclude from this exercise that allowing for heterogeneous time horizons in essential in rationalizing firms' observed pricing policies. Moreover, the estimated time horizons, reported in the second column of Table 10 are quite interesting. We find considerable across-Afore differences in the planning horizons that rationalize their observed prices, ranging from as little as one year for one Afore, to nine years for several Afores, and one at the limit of ten years. (Recall that we set an upper bound on the horizon at 10 years, given our data on workers' contributions only extends for 10 years beyond our period of analysis.) Moreover, we actually observe a measure of the ex-post horizon for these Afores: how long after the system's inception they operated for before leaving the industry (or, if they remained in the industry, this is again truncated at ten years). These ex-post horizons are shown in the first column of Table 10.

Encouragingly, Afores' actual operating terms are positively correlated (correlation coefficient 0.33, p-value 0.19) with the estimated time horizons that rationalize the Afores' balance and flow fee choices. In other words, Afores that we estimate to have been pricing based on the notion that their revenue flows from worker accounts would occur over a more limited horizon did in fact exit the industry earlier on average. Afores pricing based on a longer horizon, on the other hand, were more likely to stay in the industry. The correlation between the estimated and observed ex post horizon is not perfect, of course, as other factors affect both a firm's planning horizon and its choice of whether to continue operating. For instance, the amount of switching among Afores by workers in the system that firms expect will impact their planning horizons as well. Nevertheless, we believe the notable connection between the Afores' pricing behaviors and their willingness (or ability) to stay in the industry supports the notion that these firms were engaging in a pricing game while having heterogeneous planning horizons. This is not the standard setup in models of competition among firms, but it strikes us as a potentially fruitful angle not just in this setting, but in other situations where competition is occurring in unstable or new industries.

### *5.3. Counterfactual Exercises*

We now conduct the counterfactual exercise motivating our analysis. We solve for Afores' profit-maximizing flow and balance fee rates when 1) the government-branded firm, XXI, must charge a (low), regulated fee, and 2) when policies are implemented that shift price sensitivity of investors. In all simulations, we impose an implicit cap on fees at the maximum of the flow and balance fees observed in the market (2.00% flow fee and 4.75% for balance fee) as fees much higher may not have been approved by regulators. It is computationally infeasible to solve the complete game in which we allow both prices and sales force choices for hundreds of municipalities to be reoptimized by all firms. However, we can solve the game in prices evaluated at current sales force levels with the estimated impact of sales force on demand, or under a policy where the sales force is neutral among alternatives. Both illustrate the potential impact on equilibrium fees of the two policies of interest in settings with and without a persuasive sales force.

Table 11 displays simulated outcomes for the policy simulation where XXI sets its flow fee to zero and its balance fee to 0.10. This fee structure approximates that charged by discount U.S. index mutual funds. The first three columns repeat the results for flow fees, balance fees and market share from the simulation at actual advertising levels and full demand estimates for comparison. We will call this "the base model." The next four columns show the solution to the game where the impact of advertising and advertising levels are held fixed at the base model levels, but XXI sets a competitive price (Model 1). The final four columns resolve the game with XXI's competitive price *and* assuming a zero impact of sales force on preferences (Model 2).

Comparing the results of Model 1 to the base model, it appears that there is little change in total costs from government competitor. Even though XXI has a strong brand value, with a sizeable share even at its previous price, setting a low price only increases its market share from 3.08% to 7.99%. This is due to inelasticity of demand attributable to sales force. Here the non-convexities in the maximization problem become apparent – most of the firms opt to price at the boundary cap and lose market share rather than compete on price with XXI. Thus the costs savings to the system for those who switch to XXI are undone by the increased management costs paid by those who choose based on brand even at the new higher prices.

The next four columns present Model 2 where XXI plays the competitive price and the impact of sales force on demand is set to zero (recall that neutralizing sales force's effect doubled the average price elasticity of demand in the base model). This has the effect of reducing total system costs by 41%. However, most of this savings is generated by customers choosing XXI. Its market share is now almost ten times what it was in the base model – over 36%. Without the persuasive effects of sales force, many more investors choose XXI given its relatively high base-line brand value. In addition a handful of firms do respond by lowering price relative to Model 1 (e.g. Dresdner, Santander). Yet there are still enough relatively price inelastic consumers for many firms to opt to lose market share and raise prices relative to the base model, and even relative to Model 1 (e.g. Garante, Inbursa).

Table 12 presents the demand-side policy simulation – increasing price elasticity of demand among those who are least price sensitive. To accomplish this, we decrease the coefficient on total costs in the indirect utility function by one standard deviation for those in the upper quartile of the distribution of preferences for fees. This could simulate, for example, a policy that increased financial literacy or understanding of the implication of management fees for wealth at retirement among the financially illiterate.[24] The first three columns repeat the base model. The next four columns present Model 3 – increased price sensitivity with advertising impact held at the base model values. Model 4 is presented in the last four columns – increased price sensitivity with the impact of advertising on demand set to zero. Interestingly, few firms price at the cap in either Model 3 or Model 4; increasing the price elasticity of the most inelastic customers makes it unprofitable for firms to price at the boundary to a small captive audience.

[24] For example Hastings and Tajeda-Ashton (2008) find that presenting fees in costs in pesos instead of APR's substantially increased implied demand elasticity for financially illiterate survey respondents in a conjoint analysis of SAR account holders in Mexico. This simulation is meant to reflect such a policy, for example.

Overall costs in Model 3 fall by 50% relative to the base model, with savings accruing for customers of every firm even in the presence of persuasive advertising. Neutralizing the impact of advertising on demand further increases demand elasticity, and results in a 35% decrease in total costs. However, in contrast to Model 2 these savings are not generated by one firm's low price combined with other firms pricing at the boundary. In this model, all firms compete; none price at the cap.

Table 13 adds to Model 4 a competitive XXI to examine how much more savings could accrue if a competitive government firm were added to a demand elastic market with neutral advertising. Here total costs fall by 56% relative to the base model; all firms respond to the competitive XXI by decreasing management fees.

While these counterfactual simulations depend on many assumptions about equilibrium conditions and firm strategy, we feel there are several interesting insights to take away from this exercise. First, in safety-net markets with mandatory subscription, the mere presence of a low-priced "government" option may not in fact lower market prices and increase competition. If there is a density of inelastic consumers – either because of persuasive advertising or because of inherent brand preferences or inattention to prices – private firms may best respond to a government competitor by increasing prices and focusing on a core, captive set of consumers. Policies aimed at increasing demand elasticity in the most inelastic portions of the population (for example, low-income or low-financial literacy) may be necessary to ensure competition, even in the presence of a government competitor. Limiting persuasive effects of advertising could be a key element of that policy, as we find advertising's persuasive effects are strongest among low-income workers, consistent with experimental evidence that low-education workers are most sensitive to framing of management fees.[25]

There are some important caveats to note about these counterfactuals. Actual implementation of such interventions can involve its own costs that we do not model here. Further, agents on either side of the market could respond to such interventions in ways that are outside of the scope of the model, and these responses could have additional costly consequences.

Additionally, we note that our calculations above do not say much about consumer welfare if Afores' advertising/marketing efforts were to be curbed. Exposure to a sales force can

[25] See for example Hastings and Tajeda-Ashton (2008), Hastings and Mitchell (2010).

actually raise an investor's utility from using a particular Afore. This feature is built directly into our demand model; agentes' influence on investors' $\delta_{i,j}$ parameters reflects this effect. The fact that we find agente use raises investors' brand preference for Afores indicates that agentes act to raise consumer surplus. Hence in our counterfactual exercises, we are eliminating this demand-side benefit of agentes. We also note that allowing this type of direct effect of advertising/marketing on consumer welfare is supported by the Becker and Murphy (1992) view of advertising as a complementary good.

Nevertheless, particularly in a market such as that for social insurance, the political process may arrive at a different evaluation criterion for an optimal social pension system. If policymakers focus on the net cost of delivering these portfolio management services (of which the major component is the total fees paid by investors), for example, a shift away from allowing agente use could be viewed favorably under this criterion.

## 6. Discussion and Conclusion

This paper used a new data set with rich detail on pension fund choices in Mexico's privatized social security system to examine how advertising can affect prices, competition, and efficiency in a private pension market. The inception of the system gives us a unique opportunity to examine the role advertising can play in one of the most important markets for policy debates. Firms set market-wide prices, but choose sales force locally. Using measures of sales force exposure we estimate a very flexible model of demand for fund managers, and find that advertising was a key competitive channel used to gain customers by increasing brand value and decreasing price sensitivity.

Mexican regulators at the time made an explicit decision to follow a free-market approach; they provided no information on fees nor did they regulate communication or advertising by the Afores. Instead, the government trusted that competitive pressure would lead to competition for accounts with perfect information and forward-looking choices by consumers. We find that competition with advertising lead to lower price sensitivity, with firms opting to persuade consumers rather than inform them about management fees and their importance for wealth at retirement.

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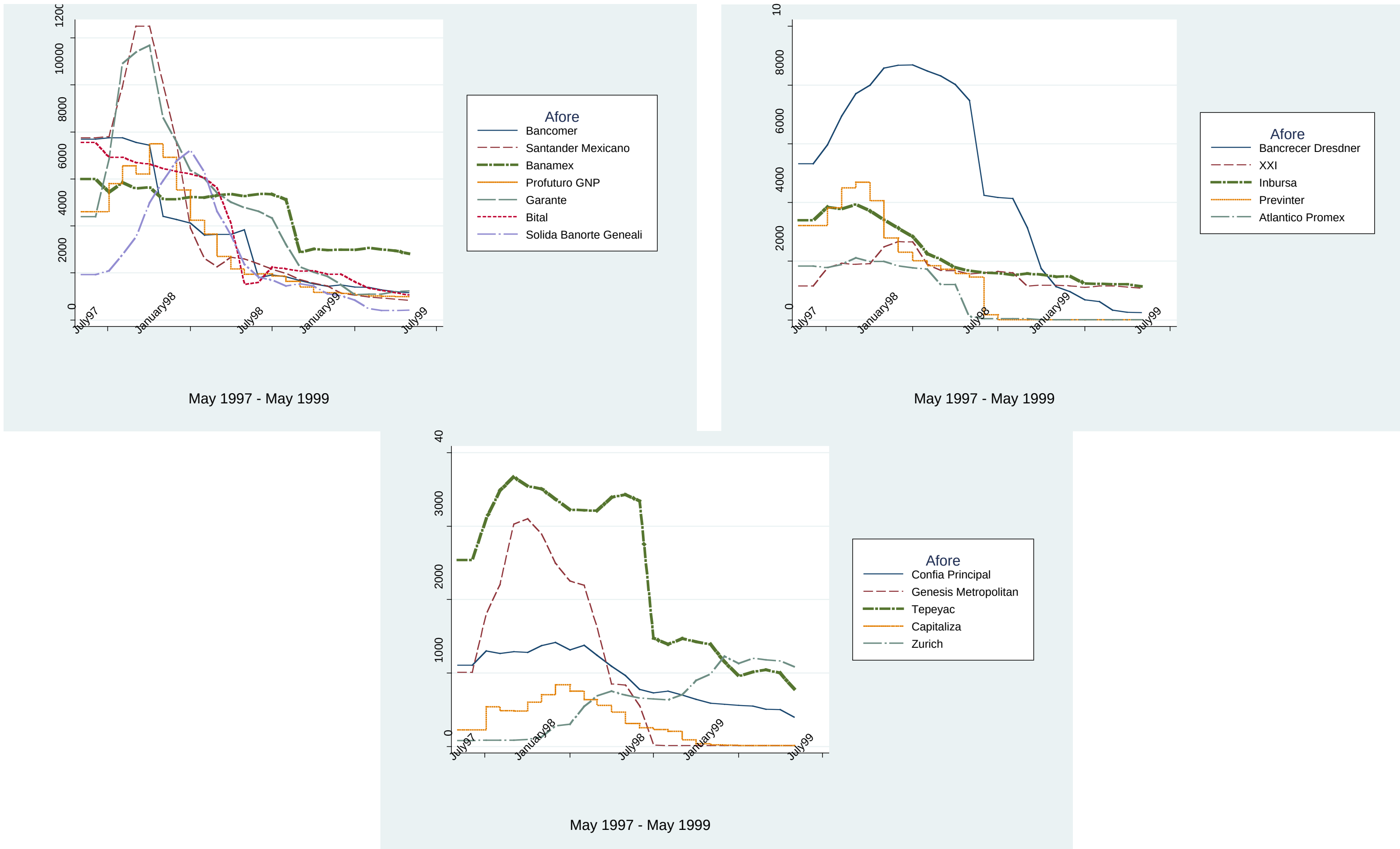
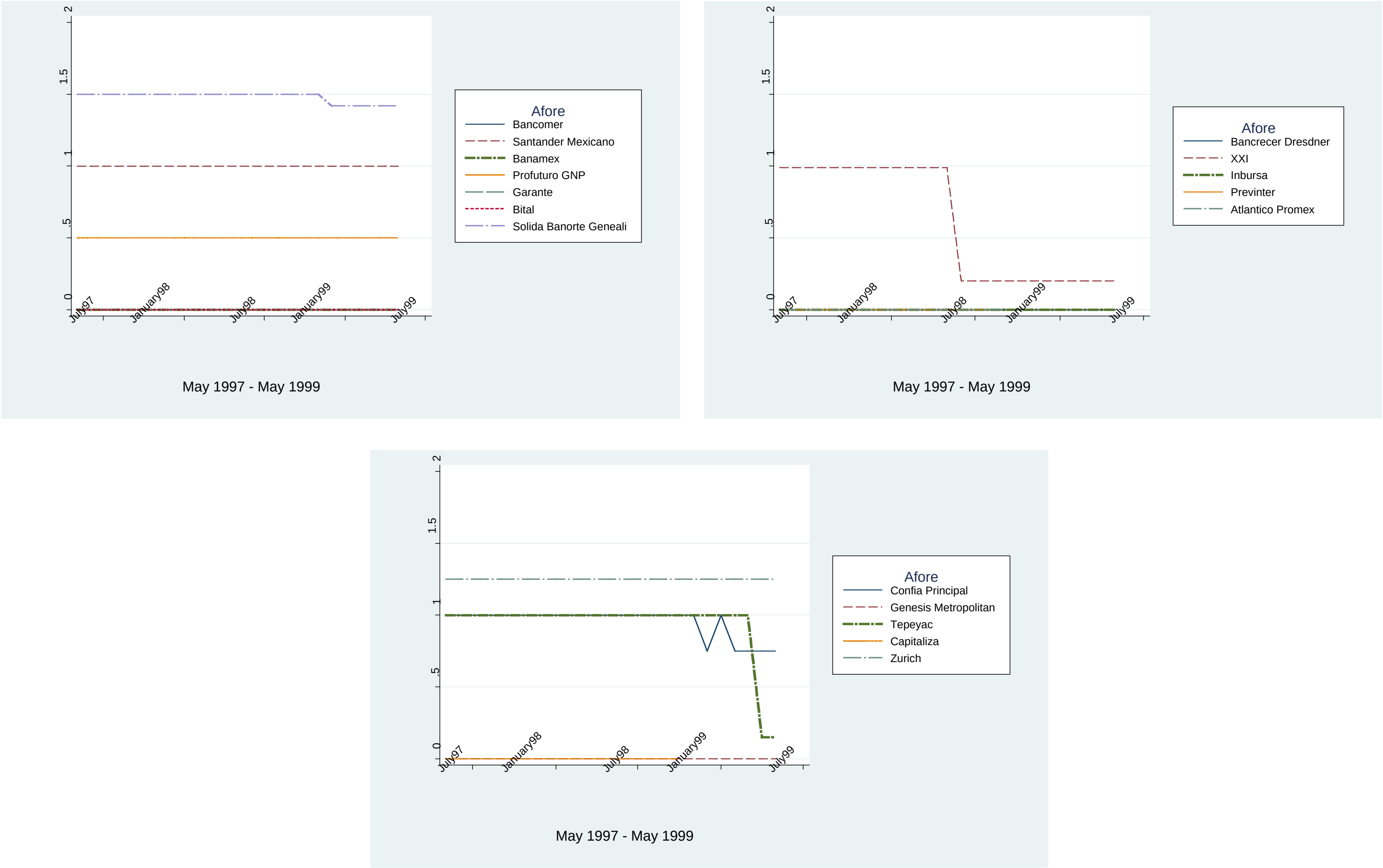
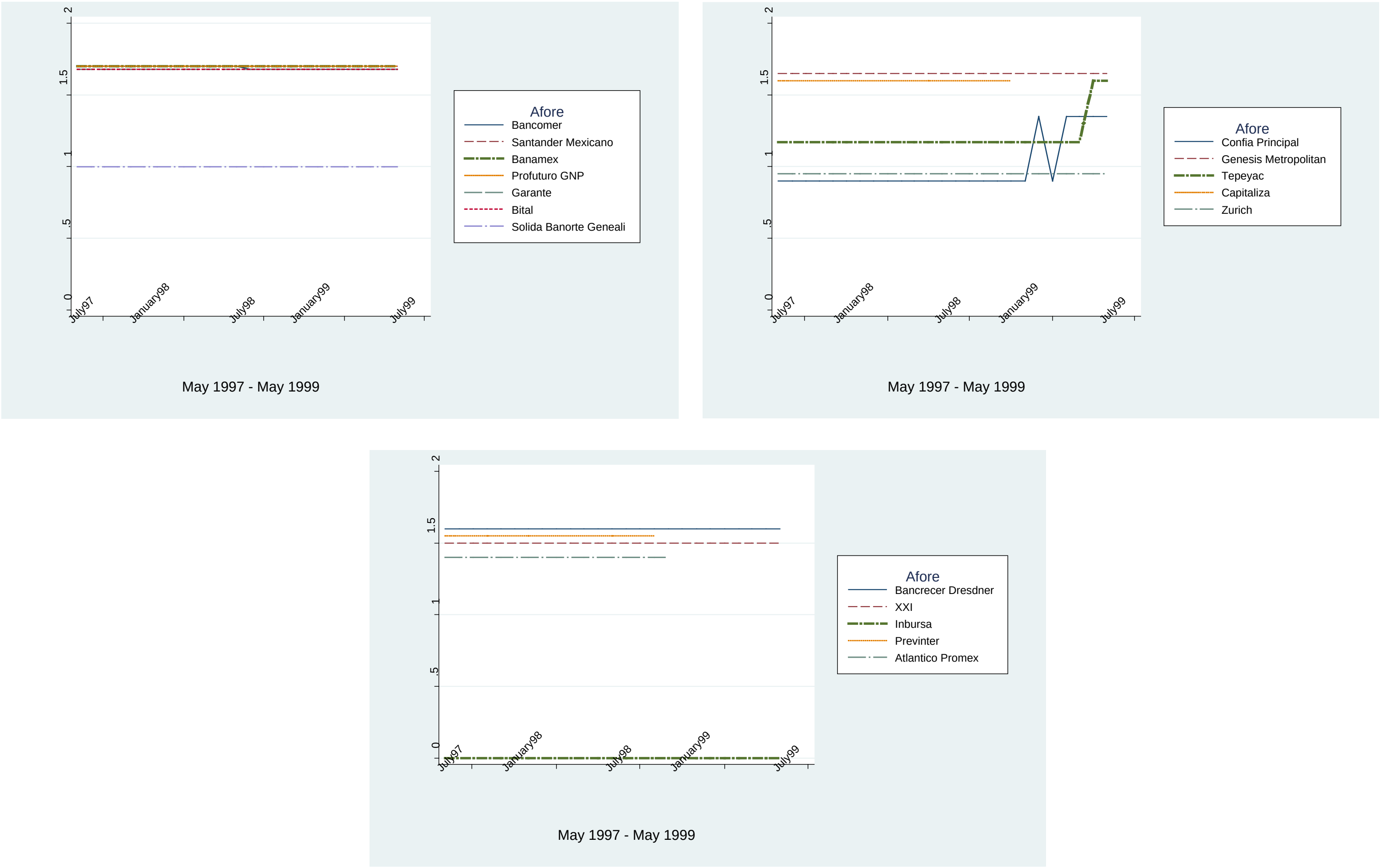
# FIGURE 1: NUMBER OF AGENTE PROMOTORES ACTIVE IN THE MARKET



# FIGURE 2A: AFORE 'BALANCE' FEES OVER TIME



## FIGURE 2B: AFORE 'FLOW' FEES OVER TIME



## TABLE 1: DESCRIPTIVE STATISTICS OF AFORES AT INCEPTION OF MARKET

| Afore | Description | Flow fee | Implied Load on Contributions | Balance fee | Share of Accounts | Number of Agentes |
|---|---|---|---|---|---|---|
| Genesis Metropolitan | | 1.65% | 25.38% | 0.00% | 0.93% | 3,213 |
| Zurich | | 0.95% | 14.62% | 1.25% | 0.20% | 910 |
| Tepeyac | | 1.17% | 18.00% | 1.00% | 0.50% | 3,685 |
| XXI | Branded by IMSS (former pension system administrator) | 1.50% | 23.08% | 0.99% | 2.75% | 2,521 |
| Banorte Generali | Large Mexican bank/north | 1.00% | 15.38% | 1.50% | 7.73% | 7,440 |
| Bancrecer Dresdner/HSBC | International Bank | 0.00% | 0.00% | 4.75% | 4.55% | 8,804 |
| Profuturo GNP | Mexican Insurance | 1.70% | 26.15% | 0.50% | 11.22% | 7,443 |
| Atlantico Promex | | 1.40% | 21.54% | 0.95% | 1.52% | 2,045 |
| Principal | International Financial Group | 0.90% | 13.85% | 1.00% | 0.94% | 1,732 |
| Santander | Spanish Bank | 1.70% | 26.15% | 1.00% | 13.42% | 12,361 |
| Previnter | | 1.55% | 23.85% | 0.00% | 2.56% | 4,614 |
| ING/Bital | International Financial Group | 1.68% | 25.85% | 0.00% | 9.23% | 7,369 |
| Capitaliza | | 1.60% | 24.62% | 0.00% | 0.21% | 925 |
| Garante | Mexican Insurance and Financial Group | 1.68% | 25.85% | 0.00% | 10.81% | 11,756 |
| Imbursa | Financial arm of Slim Corp. | 0.00% | 0.00% | 1.57% | 2.94% | 4,150 |
| Banamex | Largest Mexican bank (Citigroup) | 1.70% | 26.15% | 0.00% | 13.10% | 5,914 |
| Bancomer | Large Bank | 1.70% | 26.15% | 0.00% | 17.33% | 7,583 |
| Total | | | | | 100% | 92,465 |

TABLE 2: DESCRIPTIVE STATISTICS OF AFFILIATES BY AFORE

| | Mean rank for own clients | Mean rank over system | Mean savings, days of wages | Median savings, days of wages | SD savings, days of wages | Mean daily wage of clients (1997 pesos) | Fraction of clients who are male |
|---|---|---|---|---|---|---|---|
| Génesis Metropolitan | 8.10 | 7.91 | 26.42 | 22.76 | 86.04 | 63.20 | 0.65 |
| Zurich | 5.91 | 5.55 | 26.22 | 27.80 | 11.93 | 95.67 | 0.83 |
| Tepeyac | 7.19 | 7.62 | 26.88 | 24.43 | 26.51 | 70.32 | 0.71 |
| XXI | 14.84 | 14.83 | 39.58 | 40.75 | 48.49 | 121.28 | 0.57 |
| Banorte Generali Bancrecer | 8.04 | 9.23 | 34.70 | 26.70 | 153.15 | 64.30 | 0.68 |
| Dresdner/HSBC | 14.23 | 14.15 | 59.97 | 47.27 | 1100.39 | 69.48 | 0.69 |
| Profuturo GNP | 14.41 | 14.35 | 34.35 | 28.95 | 115.56 | 59.69 | 0.71 |
| Atlántico Promex | 13.02 | 12.92 | 39.57 | 36.42 | 145.09 | 72.79 | 0.66 |
| Confía Principal | 2.36 | 2.33 | 11.59 | 9.40 | 39.33 | 78.63 | 0.67 |
| Santander | 16.51 | 16.46 | 42.39 | 36.68 | 299.00 | 60.66 | 0.71 |
| Previnter | 4.09 | 4.16 | 25.24 | 22.42 | 77.44 | 99.51 | 0.65 |
| ING/Bital | 8.07 | 8.01 | 29.61 | 25.97 | 103.51 | 74.09 | 0.65 |
| Capitaliza | 6.05 | 5.51 | 22.35 | 20.34 | 14.42 | 103.44 | 0.66 |
| Garante | 11.15 | 11.02 | 31.01 | 25.40 | 143.57 | 76.92 | 0.69 |
| Inbursa | 1.21 | 1.34 | 0.48 | 0.00 | 6.03 | 217.89 | 0.65 |
| Banamex | 9.71 | 10.02 | 28.22 | 27.29 | 38.34 | 97.34 | 0.67 |
| Bancomer | 7.43 | 7.60 | 29.32 | 28.47 | 45.00 | 109.81 | 0.67 |

Note: Calculated using a 10% random sample of system affiliates

TABLE 3: ESTIMATED PRICE ELASTICITY OF DEMAND BY AFORE AND WAGE QUARTILE

| | Mean Elasticity | | | |
|---|---|---|---|---|
| | Quartile 1 | Quartile 2 | Quartile 3 | Quartile 4 |
| Génesis Metropolitan | -0.532 | -0.721 | -0.768 | -1.041 |
| Zurich | -0.534 | -0.706 | -0.738 | -0.981 |
| Tepeyac | -0.556 | -0.741 | -0.778 | -1.039 |
| XXI | -0.649 | -0.873 | -0.916 | -1.186 |
| Banorte Generali | -0.535 | -0.711 | -0.752 | -1.036 |
| Bancrecer Dresdner/HSBC | -0.801 | -1.025 | -1.052 | -1.385 |
| Profuturo GNP | -0.539 | -0.742 | -0.813 | -1.162 |
| Atlántico Promex | -0.614 | -0.822 | -0.864 | -1.156 |
| Confía Principal | -0.392 | -0.523 | -0.550 | -0.735 |
| Santander | -0.610 | -0.819 | -0.891 | -1.278 |
| Previnter | -0.493 | -0.670 | -0.711 | -0.952 |
| ING/Bital | -0.485 | -0.656 | -0.694 | -0.965 |
| Capitaliza | -0.521 | -0.707 | -0.750 | -1.012 |
| Garante | -0.479 | -0.653 | -0.705 | -0.971 |
| Inbursa | -0.296 | -0.380 | -0.388 | -0.460 |
| Banamex | -0.484 | -0.652 | -0.676 | -0.889 |
| Bancomer | -0.479 | -0.629 | -0.622 | -0.773 |
| Overall | -0.529 | -0.708 | -0.745 | -1.001 |

TABLE 4: REGRESSIONS OF PRICE SENSITIVITIES ($\lambda_i$) AND AFORE BRAND PREFERENCES ($\delta_{i,j}$) ON MEASURES OF LOCAL SALES FORCE

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | OLS | OLS | OLS | OLS |
| Dependent variable | $\lambda_i$ | $\lambda_i$ | $\delta_{i,j}$ | $\delta_{i,j}$ |
| Municipality total agentes per 1000 social security accounts | 4.57e-05*** | 9.36e-05** | | |
| | (1.19e-05) | (4.16e-05) | | |
| (Municipality total agentes per 1000 social security accounts)^2 | | -3.97e-06 | | |
| | | (2.72e-06) | | |
| Municipality agentes for Afore *j* per 1000 social security accounts | | | 7.601*** | 17.99*** |
| | | | (0.538) | (0.873) |
| (Municipality agentes for Afore *j* per 1000 social security accounts)^2 | | | | -8.196*** |
| | | | | (0.685) |
| Constant | -0.000606*** | -0.000719*** | -4.892*** | -6.316*** |
| | (8.13e-05) | (0.000141) | (0.140) | (0.134) |
| Cell Fixed Effects: | | | Y | Y |
| Observations | 3,699 | 3,699 | 59,184 | 59,184 |
| R-squared | 0.010 | 0.012 | 0.243 | 0.329 |
| Number of Cells | | | 3,699 | 3,699 |

Note: Robust standard errors in parentheses. Standard Errors clustered at the Municipio level. Significance levels denoted by: *** p<0.01, ** p<0.05, * p<0.1. Note as a fraction of the intercept, the size impact of Agentes in columns (1) and (2) is very similar to that estimated in Table 3 of the text.

TABLE 5: OLS FIRST-STAGE ESTIMATES OF IMPACT OF INSTURMENTS ON LOCAL AGENTE CONCENTRATION

| Potential Instrument: | | Neighbor Cell Revenues | | | Neighbor Cell Wages | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (1) | (2) | (3) |
| Instrument | 7.70e-05*** | 4.37e-05*** | 8.37e-05*** | 0.00331*** | 0.00269** | 0.00421*** |
| Instrument Squared | | 3.40e-09*** | | | 3.39e-06 | |
| Instrument*Zurich | | | -5.74e-05*** | | | -0.00293*** |
| Instrument*Tepeyac | | | -5.59e-05*** | | | -0.00252*** |
| Instrument*XXI | | | -7.61e-05*** | | | -0.00373*** |
| Instrument*Banorte | | | -3.65e-05* | | | -0.00187* |
| Instrument*Dresdner | | | -4.24e-05*** | | | -0.000783 |
| Instrument*Profuturo | | | -4.00e-05*** | | | -0.00151*** |
| Instrument*Atlantico | | | -6.57e-05*** | | | -0.00311*** |
| Instrument*Principal | | | -6.25e-05*** | | | -0.00337*** |
| Instrument*Santander | | | 3.96e-05*** | | | 0.00438*** |
| Instrument*Previnter | | | 2.60e-05* | | | 0.00116 |
| Instrument*ING | | | 5.15e-05** | | | 0.00313*** |
| Instrument*Capitaliza | | | -5.74e-05*** | | | -0.00295*** |
| Instrument*Garante | | | 4.47e-05*** | | | 0.00221*** |
| Instrument*Inbursa | | | 2.80e-05 | | | -0.00102** |
| Instrument*Banamex | | | -5.01e-05*** | | | -0.00214*** |
| Instrument*Bancomer | | | -8.51e-06 | | | -0.000258 |
| Afore Fixed Effects | | | Y | | | Y |
| Constant | -0.0396*** | 0.0293 | -0.192*** | 0.0271 | 0.0516 | -0.176*** |
| Observations | 62,883 | 62,883 | 62,883 | 62,883 | 62,883 | 62,883 |
| Number of cells | 3,699 | 3,699 | 3,699 | 3,699 | 3,699 | 3,699 |

Note: Robust standard errors in parentheses. Standard Errors clustered at the Municipio level. Significance levels denoted by: *** p<0.01, ** p<0.05, * p<0.1. Note that the Neighbor Cell Revenues is now calculated using the Optimal Prediction costs, so these estimates change. However, the estimates are exactly the same as those appearing in Table 2 of the text as we would expect since nothing in these columns is affected by the change in the measure of cost.

TABLE 6: INSTRUMENTAL VARIABLES REGRESSIONS FOR THE EFFECT OF SALES AGENTS ON BRAND VALUE

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | $\delta_{i,j}$ | $\delta_{i,j}$ | $\delta_{i,j}$ | $\delta_{i,j}$ | $\delta_{i,j}$ |
| Municipality agentes for Afore *j* per 1000 social security accounts | 10.37*** | 33.18*** | 12.79*** | 12.66*** | 12.87*** |
| | (0.221) | (1.253) | (0.109) | (0.109) | (0.110) |
| (Municipality agentes for Afore *j* per 1000 social security accounts)^2 | | -19.93*** | | | |
| | | (1.053) | | | |
| Municipality agentes for Afore *j* per 1000 social security accounts x cell-level mean wage | | | | | -0.000692*** |
| | | | | | (4.92e-05) |
| Constant | -5.612*** | -8.441*** | -6.240*** | -6.207*** | -6.239*** |
| | (0.0606) | (0.168) | (0.0346) | (0.0344) | (0.0346) |
| Instruments | Neighbor Cell Revenue by Afore | Neighbors Cell Revenue by Afore and its Square | Neighbor Cell Revenue by Afore, Interacted with Afore Fixed Effects, Afore Fixed Effects | Neighbor Cell Wages, Interacted with Afore Fixed Effects, Afore Fixed Effects | Neighbor Cell Revenue Interacted with Afore Fixed Effects, Afore Fixed Effects, All interacted with Cell Mean Wage |
| Observations | 59,184 | 59,184 | 59,184 | 59,184 | 59,184 |
| Number of cell | 3,699 | 3,699 | 3,699 | 3,699 | 3,699 |

Note: Standard errors in parentheses. All regressions control for demand-estimation cell fixed effects. *** p<0.01, ** p<0.05, * p<0.1

TABLE 7: CHANGE IN ELASTICITY WITH RESPECT TO COST UNDER DIFFERENT LEVELS OF SALES AGENTS

| | Mean Sales Agent Concentration | SD Sales Agent Concentration | Mean Delta | Mean Delta with No Sales Agents | Mean Elasticity | Mean Elasticity with No Sales Agents |
|---|---|---|---|---|---|---|
| Génesis Metropolitan | 0.146 | 0.194 | -5.855 | -0.043 | -0.775 | -1.922 |
| Zurich | 0.045 | 0.067 | -10.732 | -3.632 | -0.747 | -1.843 |
| Tepeyac | 0.202 | 0.167 | -4.617 | 0.469 | -0.787 | -1.976 |
| XXI | 0.148 | 0.142 | -2.147 | 3.635 | -0.915 | -2.127 |
| Banorte Generali | 0.351 | 0.372 | -1.365 | 1.824 | -0.767 | -2.046 |
| Bancrecer Dresdner/HSBC | 0.466 | 0.404 | -0.839 | 0.878 | -1.076 | -2.775 |
| Profuturo GNP | 0.397 | 0.207 | 0.194 | 2.785 | -0.825 | -2.274 |
| Atlántico Promex | 0.096 | 0.089 | -3.416 | 3.025 | -0.873 | -2.082 |
| Confía Principal | 0.088 | 0.102 | -3.832 | 2.716 | -0.556 | -1.166 |
| Santander | 0.669 | 0.446 | 0.493 | -0.395 | -0.911 | -2.577 |
| Previnter | 0.220 | 0.233 | -2.033 | 2.826 | -0.714 | -1.785 |
| ING/Bital | 0.367 | 0.330 | -0.170 | 2.804 | -0.708 | -1.889 |
| Capitaliza | 0.041 | 0.069 | -9.596 | -2.452 | -0.756 | -1.847 |
| Garante | 0.600 | 0.381 | 0.000 | 0.000 | -0.711 | -1.993 |
| Inbursa | 0.222 | 0.198 | -3.359 | 1.477 | -0.384 | -0.780 |
| Banamex | 0.314 | 0.201 | 0.220 | 3.880 | -0.682 | -1.818 |
| Bancomer | 0.385 | 0.241 | 0.377 | 3.131 | -0.630 | -1.877 |

Note: Elasticities calculated using a 10% random sample of system affiliates.

TABLE 8: SIMULATED CHANGE IN COSTS BY AFORE FROM BANNING SALES AGENTS, HOLDING PRICES CONSTANT

| Afore | Actual Market Share | Predicted Market Share with Sales Agents | Predicted Market Share with No Sales Agents | Expected Revenues with Sales Agents (1997 Pesos) | Expected Revenues with No Sales Agents (1997 Pesos) | Predicted Change in Revenue |
|---|---|---|---|---|---|---|
| GénesisMetro | 0.009132 | 0.009334 | 0.038051 | 269,087,340 | 844,891,520 | 213.98% |
| Zurich | 0.002044 | 0.002034 | 0.028395 | 87,648,010 | 945,801,920 | 979.09% |
| Tepeyac | 0.005518 | 0.005563 | 0.015601 | 172,707,160 | 389,443,480 | 125.49% |
| XXI | 0.027344 | 0.027378 | 0.114794 | 1,822,571,680 | 5,000,876,160 | 174.39% |
| Banorte | 0.077030 | 0.077212 | 0.037213 | 2,389,834,080 | 819,903,440 | -65.69% |
| Dresdner(AllianzHSBC) | 0.045476 | 0.045406 | 0.024776 | 1,765,148,960 | 668,561,080 | -62.12% |
| Profuturo | 0.113053 | 0.112004 | 0.036271 | 3,338,136,000 | 811,466,000 | -75.69% |
| AtlánticoPromex | 0.015250 | 0.015133 | 0.097651 | 546,659,920 | 2,528,499,680 | 362.54% |
| Principal | 0.009372 | 0.009405 | 0.145661 | 243,006,680 | 4,131,955,520 | 1600.35% |
| Santander | 0.133964 | 0.134196 | 0.019314 | 4,573,873,920 | 468,567,440 | -89.76% |
| Previnter | 0.025698 | 0.025725 | 0.048282 | 1,007,593,200 | 1,282,448,960 | 27.28% |
| ING / Bital | 0.091915 | 0.092364 | 0.063140 | 3,126,658,240 | 1,577,829,440 | -49.54% |
| Capitaliza | 0.002179 | 0.002133 | 0.037410 | 76,059,195 | 1,021,784,080 | 1243.41% |
| Garante | 0.108248 | 0.107922 | 0.011832 | 3,631,662,720 | 280,875,000 | -92.27% |
| Inbursa | 0.029482 | 0.029422 | 0.107751 | 1,287,503,600 | 5,053,292,480 | 292.49% |
| Banamex | 0.130994 | 0.131165 | 0.113410 | 5,554,062,080 | 3,670,728,000 | -33.91% |
| Bancomer | 0.173302 | 0.173604 | 0.060448 | 8,255,350,400 | 1,993,953,120 | -75.85% |
| | | | Total | 38,147,563,185 | 31,490,877,320 | |
| | | | | ***Total Revenue Change:*** | | -17.45% |

Note: Predictions calculated using a 10% random sample of system affiliates. Exchange rate in 1997 was 0.12 Pesos/USD.

TABLE 9: RATIONALIZING OBSERVED BALANCE AND FLOW FEES

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| | Observed | | | Equilibrium (10 yr horizon) | | | Equilibrium (fitted horizon) | | |
| Afore: | Flow Fee | Balance Fee | Market Share | Flow Fee | Balance Fee | Market Share | Flow Fee | Balance Fee | Market Share |
| GénesisMetro | 1.65% | 0.00% | 0.93% | 0.00% | 2.70% | 1.00% | 1.23% | 0.00% | 1.01% |
| Zurich | 0.95% | 1.25% | 0.20% | 0.00% | 2.20% | 0.26% | 0.82% | 0.25% | 0.28% |
| Tepeyac | 1.17% | 1.00% | 0.55% | 0.00% | 2.05% | 0.74% | 0.71% | 0.38% | 0.79% |
| XXI | 1.50% | 0.99% | 2.75% | 0.00% | 3.47% | 2.93% | 1.54% | 0.00% | 3.08% |
| Banorte | 1.00% | 1.50% | 7.69% | 0.00% | 4.39% | 6.43% | 0.99% | 2.07% | 6.52% |
| Dresdner(AllianzHSBC) | 0.00% | 4.75% | 4.62% | 0.00% | 3.29% | 5.47% | 0.00% | 3.54% | 5.24% |
| Profuturo | 1.70% | 0.50% | 11.10% | 0.00% | 3.94% | 10.81% | 1.71% | 0.00% | 11.36% |
| AtlánticoPromex | 1.40% | 0.95% | 1.52% | 0.00% | 2.61% | 1.83% | 0.77% | 0.81% | 1.89% |
| Principal | 0.90% | 1.00% | 1.00% | 0.05% | 2.38% | 0.90% | 0.75% | 0.59% | 1.14% |
| Santander | 1.70% | 1.00% | 13.30% | 0.05% | 4.13% | 13.48% | 1.77% | 0.00% | 14.60% |
| Previnter | 1.55% | 0.00% | 2.52% | 0.05% | 2.62% | 2.68% | 1.31% | 0.00% | 2.63% |
| ING / Bital | 1.68% | 0.00% | 9.16% | 0.05% | 3.63% | 8.18% | 1.69% | 0.00% | 8.38% |
| Capitaliza | 1.60% | 0.00% | 0.22% | 0.07% | 1.95% | 0.27% | 0.95% | 0.00% | 0.27% |
| Garante | 1.68% | 0.00% | 10.68% | 0.07% | 3.63% | 9.58% | 1.67% | 0.00% | 9.91% |
| Inbursa | 0.00% | 1.57% | 3.52% | 0.07% | 2.72% | 1.88% | 0.07% | 2.79% | 1.86% |
| Banamex | 1.70% | 0.00% | 13.10% | 0.05% | 2.48% | 15.30% | 1.32% | 0.00% | 14.39% |
| Bancomer | 1.70% | 0.00% | 17.12% | 0.06% | 2.87% | 18.26% | 1.59% | 0.00% | 16.65% |
| Correlation w. observed | | | | 0.14 | 0.15 | 0.99 | 0.90 | 0.85 | 0.99 |

Note: Equilibrium fee calculations are based on a 80229 random sample and a .0001 grid.

TABLE 10: FITTED TIME HORIZONS VERSUS ACTUAL LONGEVITY

| Afore | Observed Years | Fitted Years |
|---|---|---|
| GénesisMetro | 2.17 | 2 |
| Zurich | 4.59 | 9 |
| Tepeyac | 5.67 | 9 |
| XXI | 10.00 | 8 |
| Banorte | 10.00 | 9 |
| Dresdner(AllianzHSBC) | 10.00 | 10 |
| Profuturo | 10.00 | 5 |
| AtlánticoPromex | 1.25 | 9 |
| Principal | 10.00 | 9 |
| Santander | 10.00 | 8 |
| Previnter | 1.25 | 2 |
| ING / Bital | 10.00 | 4 |
| Capitaliza | 1.42 | 2 |
| Garante | 4.59 | 5 |
| Inbursa | 10.00 | 10 |
| Banamex | 10.00 | 2 |
| Bancomer | 10.00 | 2 |

Note: Observed horizon is truncated at 10 years.

TABLE 11: COUNTERFACTUAL SIMULATIONS WITH COMPETITIVE GOVERNMENT FIRM

| | Base Model | | | Model 1 – Government Player and Base Model Advertising | | | | Model 2 – Government Player and Neutral Advertising | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Afore | Flow | Balance | Share | Flow | Balance | Share | %Δcost from base model | Flow | Balance | Share | %Δcost from base model |
| Genesis Metro. | 1.23% | 0.00% | 1.01% | 2.00% | 0.00% | 0.76% | -15% | 2.00% | 0.00% | 3.23% | 169% |
| Zurich | 0.82% | 0.25% | 0.28% | 0.55% | 0.50% | 0.28% | -26% | 0.80% | 0.90% | 3.07% | 678% |
| Tepeyac | 0.71% | 0.38% | 0.79% | 2.00% | 4.75% | 0.31% | -24% | 0.45% | 1.10% | 2.16% | 80% |
| XXI | 1.54% | 0.00% | 3.08% | 0.00% | 0.10% | 7.99% | -85% | 0.00% | 0.10% | 36.06% | -57% |
| Banorte Generali | 0.99% | 2.07% | 6.52% | 0.60% | 2.00% | 7.48% | 0% | 0.80% | 0.80% | 4.72% | -61% |
| Bancrecer/HSBC | 0.00% | 3.54% | 5.24% | 0.00% | 2.90% | 5.63% | -9% | 0.00% | 2.40% | 4.20% | -53% |
| Profuturo GNP | 1.71% | 0.00% | 11.36% | 1.55% | 0.00% | 11.83% | -5% | 1.35% | 0.00% | 4.77% | -74% |
| Atlantico Promex | 0.77% | 0.81% | 1.89% | 2.00% | 4.75% | 0.92% | -15% | 2.00% | 4.75% | 5.56% | 427% |
| Principal | 0.75% | 0.59% | 1.14% | 2.00% | 4.75% | 0.46% | -22% | 2.00% | 4.75% | 4.79% | 730% |
| Santander | 1.77% | 0.00% | 14.60% | 1.40% | 0.05% | 16.53% | -1% | 1.15% | 0.00% | 2.98% | -89% |
| Previnter | 1.31% | 0.00% | 2.63% | 2.00% | 0.00% | 1.97% | -20% | 2.00% | 0.00% | 3.68% | 0% |
| ING/Bital | 1.69% | 0.00% | 8.38% | 1.55% | 0.00% | 8.72% | -5% | 1.90% | 0.00% | 5.48% | -51% |
| Capitaliza | 0.95% | 0.00% | 0.27% | 2.00% | 4.75% | 0.12% | -15% | 2.00% | 4.75% | 1.68% | 1205% |
| Garante | 1.67% | 0.00% | 9.91% | 1.45% | 0.00% | 10.61% | -5% | 1.20% | 0.00% | 1.41% | -92% |
| Imbursa | 0.07% | 2.79% | 1.86% | 0.05% | 2.40% | 1.93% | -14% | 2.00% | 4.75% | 1.66% | 29% |
| Banamex | 1.32% | 0.00% | 14.39% | 2.00% | 0.00% | 10.60% | -22% | 2.00% | 0.00% | 9.48% | -44% |
| Bancomer | 1.59% | 0.00% | 16.65% | 2.00% | 0.00% | 13.86% | -16% | 2.00% | 0.00% | 5.07% | -78% |
| ***Total*** | | | | | | | ***-15%*** | | | | ***-41%*** |

Note: Equilibrium fee calculations in columns (1) and (2) are based on an 80,229 random sample and a .0001 grid. Equilibrium Fee calculation for columns (5),(6),(9), and (10) are based on a smaller sample (20,000) and a coarser grid (.0005). Expected revenues and shares are calculated over the whole sample and based on a 10-year account horizon.

TABLE 12: COUNTERFACTUAL SIMULATIONS INCREASING PRICE SENSITIVITY OF MOST INELASTIC INVESTORS

| | Base Model | | | Model 3 – More Elastic Investors and Base Model Avertising | | | | Model 4 – More Elastic Investors and Neutral Advertising | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| Afore | Flow | Balance | Share | Flow | Balance | Share | %Δcost from base model | Flow | Balance | Share | %Δcost from base model |
| Genesis Metro. | 1.23% | 0.00% | 1.01% | 2.00% | 0.00% | 0.62% | -40% | 1.20% | 0.00% | 3.05% | 80% |
| Zurich | 0.82% | 0.25% | 0.28% | 0.40% | 0.00% | 0.24% | -69% | 0.45% | 0.05% | 3.56% | 372% |
| Tepeyac | 0.71% | 0.38% | 0.79% | 0.35% | 0.05% | 0.66% | -71% | 0.30% | 0.10% | 2.28% | -6% |
| XXI | 1.54% | 0.00% | 3.08% | 0.45% | 0.00% | 3.66% | -58% | 2.00% | 4.75% | 9.12% | 517% |
| Banorte Generali | 0.99% | 2.07% | 6.52% | 0.55% | 0.85% | 7.03% | -43% | 0.35% | 0.30% | 4.64% | -80% |
| Bancrecer/HSBC | 0.00% | 3.54% | 5.24% | 0.00% | 1.15% | 5.97% | -56% | 0.00% | 1.35% | 3.80% | -71% |
| Profuturo GNP | 1.71% | 0.00% | 11.36% | 1.05% | 0.00% | 10.84% | -43% | 0.65% | 0.00% | 4.67% | -84% |
| Atlantico Promex | 0.77% | 0.81% | 1.89% | 0.35% | 0.10% | 1.88% | -66% | 0.45% | 0.30% | 13.74% | 227% |
| Principal | 0.75% | 0.59% | 1.14% | 0.35% | 0.05% | 1.03% | -85% | 0.40% | 0.25% | 13.40% | 242% |
| Santander | 1.77% | 0.00% | 14.60% | 0.90% | 0.00% | 15.19% | -44% | 0.70% | 0.00% | 2.64% | -93% |
| Previnter | 1.31% | 0.00% | 2.63% | 0.50% | 0.00% | 2.70% | -59% | 0.65% | 0.00% | 4.83% | -33% |
| ING/Bital | 1.69% | 0.00% | 8.38% | 0.75% | 0.00% | 9.03% | -48% | 0.70% | 0.00% | 6.49% | -72% |
| Capitaliza | 0.95% | 0.00% | 0.27% | 0.30% | 0.00% | 0.26% | -72% | 0.50% | 0.00% | 4.54% | 584% |
| Garante | 1.67% | 0.00% | 9.91% | 0.70% | 0.00% | 10.80% | -48% | 0.50% | 0.00% | 1.39% | -96% |
| Imbursa | 0.07% | 2.79% | 1.86% | 0.20% | 0.45% | 2.08% | -63% | 0.20% | 0.55% | 4.15% | -30% |
| Banamex | 1.32% | 0.00% | 14.39% | 0.80% | 0.00% | 12.68% | -53% | 0.90% | 0.00% | 11.36% | -59% |
| Bancomer | 1.59% | 0.00% | 16.65% | 1.00% | 0.00% | 15.35% | -47% | 0.80% | 0.00% | 6.35% | -85% |
| ***Total*** | | | | | | | ***-50%*** | | | | ***-35%*** |

Note: Equilibrium fee calculations in columns (1) and (2) are based on an 80,229 random sample and a .0001 grid. Equilibrium Fee calculation for columns (4),(5),(8), and (9) are based on a smaller sample (20,000) and a coarser grid (.0005). Expected revenues and shares are calculated over the whole sample and based on a 10-year account horizon.

TABLE 13: SIMULATIONS WITH COMBINED SUPPLY-SIDE AND DEMAND-SIDE POLICIES

| | Base Model | | | Model 5 – Increased Price Sensitivity + Government Firm Competes + Neutral Advertising | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (8) | (9) | (10) | (11) |
| Afore | Flow | Balance | Share | Flow | Balance | Share | |
| Genesis Metropolitan | 1.23% | 0.00% | 1.01% | 1.20% | 0.00% | 3.05% | 97% |
| Zurich | 0.82% | 0.25% | 0.28% | 0.45% | 0.05% | 3.56% | 403% |
| Tepeyac | 0.71% | 0.38% | 0.79% | 0.30% | 0.10% | 2.28% | 13% |
| XXI | 1.54% | 0.00% | 3.08% | 2.00% | 4.75% | 9.12% | -65% |
| Banorte Generali | 0.99% | 2.07% | 6.52% | 0.35% | 0.30% | 4.64% | -76% |
| Bancrecer/HSBC | 0.00% | 3.54% | 5.24% | 0.00% | 1.35% | 3.80% | -69% |
| Profuturo GNP | 1.71% | 0.00% | 11.36% | 0.65% | 0.00% | 4.67% | -82% |
| Atlantico Promex | 0.77% | 0.81% | 1.89% | 0.45% | 0.30% | 13.74% | 231% |
| Principal | 0.75% | 0.59% | 1.14% | 0.40% | 0.25% | 13.40% | 762% |
| Santander | 1.77% | 0.00% | 14.60% | 0.70% | 0.00% | 2.64% | -93% |
| Previnter | 1.31% | 0.00% | 2.63% | 0.65% | 0.00% | 4.83% | -28% |
| ING/Bital | 1.69% | 0.00% | 8.38% | 0.70% | 0.00% | 6.49% | -67% |
| Capitaliza | 0.95% | 0.00% | 0.27% | 0.50% | 0.00% | 4.54% | 1314% |
| Garante | 1.67% | 0.00% | 9.91% | 0.50% | 0.00% | 1.39% | -95% |
| Imbursa | 0.07% | 2.79% | 1.86% | 0.20% | 0.55% | 4.15% | -33% |
| Banamex | 1.32% | 0.00% | 14.39% | 0.90% | 0.00% | 11.36% | -59% |
| Bancomer | 1.59% | 0.00% | 16.65% | 0.80% | 0.00% | 6.35% | -84% |
| ***Total*** | | | | | | | ***-56%*** |

Note: Equilibrium fee calculations in columns (1) and (2) are based on an 80,229 random sample and a .0001 grid. Equilibrium Fee calculation for columns (4),(5),(8), and (9) are based on a smaller sample (20,000) and a coarser grid (.0005). Expected revenues and shares are calculated over the whole sample and based on a 10-year account horizon.