# Online Appendix:
# Fettered Consumers and Sophisticated Firms

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## A1. Investment Regulations and Performance

We compile Siefore share prices from CONSAR website and calculate 30 day returns by Afore. We use the interest rate on a 28 day CETES federal treasury certificates as the short-term risk-free rate, the 30 day return on the Mexican stock exchange index (Mexbol), and the Mexico fixed bond auction rate for 10 year bonds, all available from Bloomberg. Mexbol and Mexican bond rate data series begin in 2000, so we restrict our analysis from 2000 through 2011. We regress monthly Siefore returns net the risk free returns on Mexican stock market and bond returns net the risk free rate by Afore for each Siefore. Tables A1.1 and A1.2 below show the coefficients of this regression for each of the Afores for Siefore Basíca 1 and Siefore Basíca 2. We try a handful of alternate specifications that allow the coefficients on bond and equity indices to vary with regulatory changes in caps on various investment vehicles. The estimates for Alpha are similar across the specification checks.

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TABLE A1.1: PERFORMANCE OF MONTHLY RETURNS TO SIEFORE BASÍCA 1 BY AFORE

| | Alpha | | Beta Bonds | | Beta Equity Index | | N |
|---|---|---|---|---|---|---|---|
| Actinver | -0.0070 | (0.004) | 0.393 | (0.052)** | 0.544 | (0.051)** | 57 |
| Azteca | -0.0030 | (0.003) | 0.358 | (0.047)** | 0.505 | (0.042)** | 98 |
| Banamex | 0.0000 | (0.003) | 0.362 | (0.042)** | 0.521 | (0.036)** | 118 |
| Bancomer | 0.0000 | (0.003) | 0.369 | (0.042)** | 0.514 | (0.036)** | 118 |
| Banorte Generali | -0.0010 | (0.003) | 0.364 | (0.041)** | 0.520 | (0.035)** | 118 |
| HSBC | -0.0010 | (0.003) | 0.379 | (0.041)** | 0.504 | (0.036)** | 118 |
| Inbursa | 0.0000 | (0.003) | 0.432 | (0.038)** | 0.447 | (0.033)** | 118 |
| ING | 0.0000 | (0.003) | 0.378 | (0.042)** | 0.509 | (0.036)** | 118 |
| Invercap | 0.0040 | (0.004) | 0.145 | (0.066)* | 0.467 | (0.054)** | 75 |
| Ixe | 0.0030 | (0.005) | 0.202 | (0.073)** | 0.365 | (0.058)** | 58 |
| Metlife | 0.0050 | (0.004) | 0.194 | (0.062)** | 0.408 | (0.050)** | 75 |
| Principal | 0.0000 | (0.003) | 0.378 | (0.041)** | 0.507 | (0.036)** | 118 |
| Profuturo GNP | -0.0010 | (0.003) | 0.373 | (0.042)** | 0.513 | (0.036)** | 118 |
| Santander | -0.0030 | (0.003) | 0.393 | (0.045)** | 0.528 | (0.039)** | 77 |
| XXI | 0.0000 | (0.003) | 0.375 | (0.041)** | 0.510 | (0.036)** | 118 |

Notes: Standard errors in parentheses. * significant at 5%; ** significant at 1%

TABLE A1.2: PERFORMANCE OF MONTHLY RETURNS TO SIEFORE BASÍCA 2 BY AFORE

| | Alpha | | Beta Bonds | | Beta Equity Index | | N |
|---|---|---|---|---|---|---|---|
| Actinver | -0.0010 | (0.003) | 0.210 | (0.059)** | 0.351 | (0.054)** | 44 |
| Azteca | 0.0010 | (0.004) | 0.213 | (0.055)** | 0.432 | (0.047)** | 84 |
| Banamex | 0.0010 | (0.004) | 0.173 | (0.055)** | 0.473 | (0.048)** | 84 |
| Bancomer | 0.0000 | (0.004) | 0.203 | (0.056)** | 0.459 | (0.049)** | 84 |
| Banorte Generali | 0.0000 | (0.004) | 0.208 | (0.055)** | 0.449 | (0.048)** | 84 |
| HSBC | 0.0010 | (0.004) | 0.216 | (0.056)** | 0.435 | (0.049)** | 84 |
| Inbursa | 0.0020 | (0.003) | 0.290 | (0.049)** | 0.355 | (0.042)** | 84 |
| ING | 0.0010 | (0.004) | 0.202 | (0.056)** | 0.464 | (0.049)** | 84 |
| Invercap | 0.0030 | (0.004) | 0.093 | (0.066) | 0.546 | (0.054)** | 75 |
| Ixe | 0.0010 | (0.005) | 0.164 | (0.072)* | 0.421 | (0.057)** | 58 |
| Metlife | 0.0040 | (0.004) | 0.156 | (0.063)* | 0.460 | (0.051)** | 75 |
| Principal | 0.0010 | (0.004) | 0.213 | (0.054)** | 0.449 | (0.047)** | 84 |
| Profuturo GNP | 0.0010 | (0.004) | 0.187 | (0.057)** | 0.485 | (0.050)** | 84 |
| Santander | -0.0040 | (0.003) | 0.169 | (0.061)** | 0.413 | (0.056)** | 43 |
| XXI | 0.0010 | (0.004) | 0.215 | (0.056)** | 0.449 | (0.048)** | 84 |

Notes: Standard errors in parentheses. * significant at 5%; ** significant at 1%

## A2: Fees on Independent Worker Accounts

TABLE A2.1: FEE SCHEDULE IN JUNE 2006 FOR INDEPENDENT WORKER ACCOUNTS

| | Independent Workers | | SAR Employee Contributions | | | |
|---|---|---|---|---|---|---|
| Afore | Load Fee | Balance Fee | Load Fee | Balance Fee | CEF25 | CEF1 |
| Actinver | -- | 1.25% | 15.85% | 0.20% | 0.55% | 2.02% |
| Afirme Bajío | -- | 0.24% | 9.54% | 0.24% | 0.51% | 1.52% |
| Bancomer | -- | 1.00% | 18.92% | 0.50% | 0.82% | 3.01% |
| Banorte Generali | -- | 0.40% | 19.54% | 0.40% | 0.97% | 2.98% |
| Coppel | -- | 0.30% | 14.15% | 0.30% | 0.76% | 2.21% |
| Metlife | -- | 1.73% | 18.92% | 0.25% | 0.69% | 2.67% |
| Profuturo GNP | -- | 1.25% | 25.38% | 0.50% | 1.06% | 3.00% |

Source: Downloadable historical fee schedules from www.consar.gob.mx. Note: Indpendent workers are workers in the informal sector or sole proprietors who can purchase shares of these Siefores to establish savings for retirement.

## A3: Hazard model of Afore Switching

In our expected profit calculations, we assume the probability of switching is determined by demographics and labor market participation. This assumption is based on the following analysis of Afore switching. To quantify the role that various individual and firm level factors have on the probability that individuals switch Afores, we estimate the following discrete-time hazard model of the probability that worker *i* switches to a new Afore in a given month *t*:

$$y_{it} = \beta' X_{it} + \lambda' Z_{it} + \delta' T_{it} + \delta' D_{it} + \varepsilon_{it} \qquad \text{(A3.1)}$$

where $X_{it}$, includes demographic characteristics such as average employed salary, gender and age, employment indicators, and indicators for periods in which a person switches jobs. Covariates, $Z_{it}$, capture independent variables that vary at the Afore, time, and affiliate level. These include the market share of person *i*'s current Afore at her current place of employment, and measures of the relative expense of management fees for person *i*'s Afore (flow fee, balance fee and CEF). We include dummies for each length of time in each month in the current Afore, $T_{it}$, and because our data tell us the date at which the

person registered with her current Afore, we can construct the length of time that each person had been in his Afore at the start of our panel. All specifications include monthly dummies and Afore fixed effects.

Table A.3.1 presents results from equation (A.3.1) run separately for 5 employed wage categories: by quartile with the last quartile split further into the $75^{th}$-$90^{th}$ percentile and the $90^{th}$ and above to allow for greater differences in behavior in the upper-tail of the income distribution. We report odds ratios with asterisks for significance, but we exclude standard errors from the table to save space. The mean dependent variable, the probability of switching Afores in a given month, and the mean wage in each category are reported in the bottom panel of the table. The mean probability of switching is very low, but increasing in income across the five columns. For the lowest wage category, the probability of switching is 0.002, but it is more than 10 times larger, 0.0215, for the highest decile of the income distribution. Thus inflation-adjusted last wage is one of the largest determinants of probability of switching Afores. Within each wage category, the odds ratio of switching is also increasing with wage, but at a decreasing rate as we move to higher wage categories. In general, age is not a significant determinant of frequency of account management, but the odds ratio of switching is significantly higher for men among higher-income workers.

The second panel of Table A.3.1 shows how employment status affects the odds of switching Afores. These variables, to some degree, help us measure the relative importance that salience and switching costs may play in the decision to evaluate and switch Afores. The first variable, *Recently Unemployed*, is an indicator if the person is in the first 2 months after exiting the formal sector; the time period in which one could file for unemployment insurance withdrawal from the pension account if qualified. The second variable, *Qualifies for Unemployment Insurance*, indicates if a person could be qualified to withdraw UI from their account that month, needing 3 years of contributions to qualify. The third variable, *Can Withdraw Unemployment Insurance*, is an indicator if a person is exiting the formal sector into a period of unemployment and qualifies for unemployment insurance withdrawals. The fourth variable, *Unemployed*, is an indicator if the worker is currently not contributing in the formal sector and exited the formal sector more than 2 months prior. Looking at these covariates together, we find that salience and switching costs are substantial determinants of account management behavior. The odds of switching Afores drops substantially for all income groups once they are persistently unemployed or employed in the informal sector. Workers appear to practically forget about their accounts once they enter this state. As they enter a period of unemployment, if they have sufficient contributions to qualify for an unemployment insurance withdrawal from their account, the odds of switching Afores increases dramatically. This could be for two reasons. First, to file for unemployment the worker must bring a current statement from their Afore, hence they may realize how much money they have in their account, and the value of that money may have immediate importance for their financial needs (workers can

withdraw up to 3 months of salary depending on their current balance). This realization may cause them to re-evaluate which Afore they are with. Secondly, because they must file paperwork with their Afore and with the social security administration to withdraw these funds, the cost of both evaluating the account and switching accounts would be much lower at this point in time.

We can also use changes in employment to examine how the relative popularity of an Afore at the place of work affects when workers decide to switch Afores. For example, if a worker moves to a new job where her current Afore is in the minority, is she more or less likely to switch her Afore? To measure this we construct the share of person *i*'s Afore at the moment they enter the place of work, *Popularity of Initial Afore.* It measures the market share of person *i*'s Afore at *i*'s new place of employment. At the start of each employment spell with a new employer, this is recalculated. For the lowest two income groups, it is a significant determinant of when workers switch Afores. A higher Popularity of Initial Afore significantly decreases the probability of switching Afores; and an increase of 10% decreases the odds ratio of switching by about 6% to 6.6% percent for the first and second wage categories respectively. There is no significant impact on higher-income workers, suggesting that lower-income workers are more influenced by peers when deciding when and how to manage their accounts.

All of these factors lead towards a market that is relatively unresponsive to price competition. The fact that salience, switching costs, employment status and peer/employer effects are so important in determining the time of choice presents a substantial barrier to price competition in a market with a large informal labor sector. Indeed, relative to demographic and employment characteristics, changes in fees appear to have little impact on when people switch Afores. The final panel of Table A.3.1 shows odds ratios for the effect of changes in relative fees on the probability of switching. To capture changes in relative fees, we create the rank for the current Afore according to balance and flow fees each month. The rank increases (decreases) if person *i*'s Afore becomes relatively more (less) expensive due to changes in its own fees or the fees of other Afores. The first is the personal flow fee, including tenure discounts which change exogenously with regulatory changes at the start of 2005 and when each person reaches a new tenure year. The second measure is the balance fee. For both fees, the impact of a change in rank is very small in magnitude, even if it is significant in some instances. Only the highest income workers appear to react to the flow fee and even they react by a very small amount (a 1 percentage point change in a flow fee is an additional 15.38% load). For both flow fees and balance fees, popularity of an Afore at the place of work is more likely to induce lower-income workers to switch than changes in a relative fee would.

These results show that the timing of switching is driven primarily by demographic characteristics and labor force participation, motivating our modeling assumptions for expected profits,

and adding further evidence of the hurdles consumers face in effectively managing their personal retirement accounts and encouraging price competition in the market.

TABLE A3.1: DISCRETE TIME HAZARD MODEL OF SWITCHING AFORES
BY EMPLOYED WAGE CATEGORY

| | Wage < 25th pctl. | Wage in 25-50th pctl. | Wage in 50-75th pctl. | Wage in 75-90th pctl. | Wage >90th pctl. |
|---|---|---|---|---|---|
| *Demographics* | Odds Ratio | Odds Ratio | Odds Ratio | Odds Ratio | Odds Ratio |
| Ave. Employed Wage (thousands pesos) | 2.525** | 1.157** | 1.211** | 1.071** | 1.001 |
| Male | 1.013 | 0.973 | 1.056* | 1.134** | 1.201** |
| Age | 1.020 | 0.997 | 0.999 | 0.995 | 1.011 |
| Age squared | 1.000 | 1.000 | 1.000* | 1.000 | 1.000* |
| *Employment Status* | | | | | |
| Recently Unemployed | 0.418** | 0.540** | 0.764** | 0.739* | 0.901 |
| Qualifies for Unemployment Insurance | 1.308** | 1.253** | 1.063 | 0.901* | 1.014 |
| Can Withdraw Unemployment Insurance | 1.921** | 1.792** | 1.862** | 3.008** | 3.742** |
| Unemployed | 0.137** | 0.171** | 0.162** | 0.131** | 0.115** |
| Entered Formal Sector | 0.932 | 0.974 | 1.069 | 1.145 | 0.924 |
| Switched Employers | 0.844 | 1.121 | 1.106 | 1.042 | 0.787 |
| *Peers and Advertising* | | | | | |
| Afore Share at Employer | 0.310** | 0.309** | 0.247** | 0.262** | 0.284** |
| Popularity of Initial Afore | 0.536* | 0.506** | 0.851 | 0.893 | 1.214 |
| *Measures of Prices* | | | | | |
| Personal Flow Fee | 1.008 | 0.961** | 0.982** | 0.994 | 1.015* |
| Balance Fee | 1.028** | 1.007 | 1.014** | 1.008 | 1.016** |
| | | | | | |
| Mean Wage | 1,072 | 2,405 | 3,872 | 6,981 | 19,278 |
| Dep. Variable Mean: | 0.002 | 0.006 | 0.0102 | 0.0165 | 0.0215 |
| Log Likelihood: | -8,428 | -23,120 | -36,103 | -32,142 | -26,128 |
| N Obs. | 688,374 | 688,224 | 688,311 | 413,054 | 275,365 |

Notes: *significant at 5%; **significant at 1%. Results from a logistic discrete time hazard model. All regressions include Afore fixed effects, monthly fixed effects and dummies for length of time in current Afore at time *t*. Standard errors are clustered at the affiliate level.

## A4: Afore Profit Calculations

At time 0, the revenue of Afore *j* from consumer type *i* is:

$$\pi_{ij}^{0} = M_{i0}S_{ij0}(1 - \alpha_{i0}) * rev_{ij0} + M_{i0}\alpha_{i0} * q_{ij0} * rev_{ij0} \quad \text{(A4.1)}$$

Where, $M_{i0}$ is the total market, $S_{0,i,j}$ is the probability of individual *i* is in Afore *j* at time 0, $\alpha_{i0}$ is the probability that individual *i* "wakes up" at time 0 and evaluates their Afore choice, $rev_{i,j0}$ is the revenue and $q_{ji0}$ is the demand for Afore *j* at time 0 for a person of type *i*. The first term corresponds to individuals that are currently affiliates of Afore *j* do not "wake-up" and evaluate their account. They choose (or remain in) their current Afore for certain. The second term represents individuals who "wake up" at time 0 and evaluate their current Afore choice. They evaluate all Afores in the system, and choose to remain in their current Afore or switch to another Afore with probability $q_{i,j0}$. This choice probability is governed by *i's* preferences over Afore characteristics, and the characteristics of each Afore *j* in the market at time 0.

At time 1, the revenue of Afore *j* from consumer type *i* is:

$$\pi_{ij}^{1} = M_{i1}S_{ij1}(1 - \alpha_{i1}) * rev_{ij1} + M_{i1}\alpha_{i1} * q_{ij1} * rev_{ij1} \quad \text{(A4.2)}$$

where:

$$S_{ij1} = S_{ij0}(1 - \alpha_{i0}) + \alpha_{i0} * q_{ij0}$$

This implies that period 1 profits (assuming marginal costs are zero) are given by:

$$\pi_{ij}^{1} = M_{i1}(1 - \alpha_{i1})(S_{ij0}(1 - \alpha_{i0}) + \alpha_{i0} * q_{ij0}) * rev_{ij1} + M_{i1}\alpha_{i1} * q_{ij1} * rev_{ij1}$$

In time period 2, profits are

$$\pi_{ij}^{2} = M_{i2}S_{ij2}(1 - \alpha_{i2}) * rev_{ij2} + M_{i2}\alpha_{i2} * q_{ij2} * rev_{ij2} \quad \text{(A4.3)}$$

where:

$$S_{ij2} = S_{ij1}(1 - \alpha_{i1}) + \alpha_{i1} * q_{ij1}$$

$$= S_{ij0}(1 - \alpha_{i0})(1 - \alpha_{i1}) + \alpha_{i1} * q_{ji1} + \alpha_{i0} * q_{ji0}(1 - \alpha_{i1})$$

In period *n*, we have:

$$\pi_{ij}^{n} = M_{in} * rev_{ijn} * \{S_{ij0} \prod_{k=0}^{n}(1 - \alpha_{ik}) + \alpha_{in} q_{ijn} + \sum_{l=0}^{n-1} \alpha_{il} q_{ijl} \prod_{k=l+1}^{n}(1 - \alpha_{ik})\} \quad \text{(A4.4)}$$

Therefore, the present discounted value of profits for Afore *j* from individuals of type *i* , is

$$\Pi_{ij} = \sum_{t=0}^{\infty} \delta^{t} \pi_{ij}^{t} \quad \text{(A4.5)}$$

and therefore total profits is:

$$\Pi_{j} = \sum_{t}\Big[\delta^{t} M_{it} * rev_{ijt} * S_{0,i,j} \prod_{k=0}^{t}(1 - \alpha_{ik}) + M_{it} * rev_{ijt} \delta^{t} \sum_{l=0}^{t-1}\{\alpha_{il} q_{ijl} \prod_{k=l+1}^{t}(1 - \alpha_{ik})\} + \delta^{t} M_{it} \alpha_{it} * q_{ijt} * rev_{ijt}\Big] \quad \text{(A4.6)}$$

For estimation purposes we make the following simplifying assumptions. First, we assume that the probability that an individual of type *i* evaluates her Afore is constant over time and is equal to $\alpha_i$. This is consistent with the hazard model results, that Afore switching is primarily a function of labor force participation, which is a function of demographics and macroeconomic factors. The assumption implies that Afores assume that this switching rate is only a function of demographics, and expect current macroeconomic conditions to be constant over time when calculating expected profits as a function of fees. In addition, we assume that Afores assume that preferences for Afore characteristics for individuals of type *i* are constant over time. So while preferences can change with age, gender, and income, conditional on those demographics Afores expect preferences to remain the same in the future.

Next, we use the Afore's market share on June 2005 as their market share for each consumer type *i* at time 0, and we use the total number of individuals in the market of each type as the total market size, $M_0$. Overtime, new people enter the market, starting accounts for the first time while retirees exit the market. We assume a constant entry rate into the market for young workers equal to the current annual rate of entry into the market on the eve of the reform. Individuals then age each year and exit the market when they reach age 60 for women and 65 for men (we assume that Afores assume the future retirement age will be the same as it is today).

With these assumptions we can re-write the profits in period *n* as:

$$\pi_{ij}^{n} = M_i * rev_{ij} * \{S_{ij0}(1 - \alpha_i)^{n+1} + \alpha_i q_{ij} \sum_{t=0}^{n}(1-\alpha_i)^t\} \quad \text{(A4.7)}$$

Therefore, the present discounted value of profits for Afore *j* from market segment *i* , is

$$\Pi_{ij} = \sum_{t=0}^{\infty} \delta^t \pi_{ij}^t$$

$$\Pi_{ij} = \sum_{t=0}^{\infty} \delta^t M_i * rev_{ij} * \{S_{ij0}(1 - \alpha_i)^{t+1} + \alpha_i q_{ij} \sum_{l=0}^{t}(1-\alpha_i)^l\} \quad \text{(A4.8)}$$

Which is equal, after rearranging terms, to

$$\Pi_{ij} = M_i rev_{ij} S_{ij0}(1 - \alpha_i) \sum_{t=0}^{\infty}(\delta(1 - \alpha_i))^t + M_i rev_{ij}\alpha_i q_{ij} \sum_{t=0}^{\infty} \delta^t \sum_{l=1}^{t}(1-\alpha_i)^l + M_i rev_{ij}\alpha_i q_{ij} \sum_{t=0}^{\infty} \delta^t \quad \text{(A4.9)}$$

To calculate best responses, we assume that each Afore calculates this profit function at alternative fees assuming that other Afores hold their fees constant. We perform this calculation using our demand estimates and a 0.10 grid of balance and flow fees, subject to the constraint that any new balance and flow combination would need to result in a lower CEF than the Afore's current CEF, according to the official CEF calculations in place just before and after the policy intervention. For $\alpha_i$ we calculate the share of active formal sector workers by demographic group and age, where active is defined by CONSAR as having worked in the formal sector in the past year. We compute market size and Afore market share by age and by demographic cell. We set the discount factor to 5%. Table XI shows the fee combinations that result in the highest profit pre- and post-intervention for each Afore.