The halo effect, private knowledge and retirement fund choice: A theoretical model for the case of México's Afores

El efecto halo, el conocimiento privado y la elección del fondo de retiro: un modelo teórico para el caso de las Afores de México

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■ **Abstract:** Empirical evidence shows that Mexican workers frequently chose a lower-yielding retirement savings manager over a higher-yielding one, damaging their prospects for retirement income. This research paper shows that such puzzling behavior can occur as a product of the unobservable private history between workers and the companies clustered around a common brand-name, in an example of what is known as the *halo effect*. To support this hypothesis, a theoretical model of private knowledge and subjective probability with long-term commitment is built. Results are consistent with the idea that private-knowledge-induced *halo effect* can produce a rational decision process to yield an apparently irrational outcome.

■ **Keywords:** Halo effect, retirement, private knowledge, AFORE.

■ **JEL classification:** D82, G14, G41, H55, J26.

■ **Resumen:** La evidencia empírica revela que los trabajadores formales en México frecuentemente cambian a una nueva Administradora de Fondos para el Retiro que otorga un menor rendimiento neto que la anterior, afectando su perspectiva de ingresos al momento del retiro. En este artículo de investigación se muestra que tal comportamiento puede ocurrir a causa de la historia no observable de la interacción entre los trabajadores y las compañías agrupadas alrededor de una marca publicitaria común, en un ejemplo de lo que se conoce como *efecto halo*. Para darle soporte a esta hipótesis, se construye un modelo teórico de conocimiento privado y probabilidad subjetiva, con compromiso de largo plazo. Los resultados son consistentes con la idea de que el *efecto halo*, inducido por el conocimiento privado, puede generar que un proceso de decisión racional produzca un resultado aparentemente irracional.

■ **Palabras clave:** Efecto halo, jubilación, conocimiento privado, AFORE.

■ **Clasificación JEL:** D82, G14, G41, H55, J26.

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■ *Introduction*

As in some other countries where defined-contribution retirement pensions are in place, in México's pension system workers are required by law to choose a specialized private financial company, called *Afore*, to manage their retirement accounts, which at the time of retirement will be used to buy an annuity or another mandatory retirement product. Therefore, net return on retirement savings should be an important issue for workers; as low net return jeopardizes workers' chances for an appropriate replacement rate. However, despite the large number of *Afores* supplying retirement managing services and a competition fostering environment, Mexican workers are choosing incorrectly. OECD (2015a: pp. 126-128) shows that, between years 2011-2014, more than half of the workers' switches between *Afores* were *negative transfers*, that is, more than half of the workers were switching to a new *Afore* with a lower net return than the incumbent.[2] After several changes, such as electronic switch confirmations and salesperson's certification, *negative transfers* have been reduced in 2016-2017, however, still four out of ten switches were *negative transfers* (CONSAR, 2017b). That is, after a couple of decades of government activity to educate workers and public policies aimed to foster a competitive environment, a noteworthy share of people is still switching to lower-yielding *Afores*, defying rational behavior.

To offer a plausible explanation to such puzzle, a theoretical model is developed in the current paper. It is based on the fact that most *Afores* are owned by larger diversified financial groups, government bodies or even some conglomerates, and they are typically clustered under a common brand-name that identifies all companies associated in these larger groups.[3] Such environment is fertile ground for the *halo effect*, defined by (Leuthesser *et al.,* 1995: 58) "as a failure to discriminate conceptually distinct and potentially independent attributes, with the result that individual attribute ratings covary more than they otherwise would." That is, people would not entirely distinguish individual attributes in a product or service, as they assign the attributes associated with the brand to all the products or services clustered under it. For instance, think of a given person that is ask to rate a particular personal care product as good or bad. A rational way to solve the issue for the person is to judge the particular features of the product that are easy to observe or test. Assume that the product does not score particularly high in one or two features. Then the rational person may rate the product as substandard. However, if the product's brand is well known to the person, and he has a good overall impression of it, this may influence him to overlook the bad individual features and to produce a positive evaluation of the product, despite having all the information to judge

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[2]   CONSAR, the retirement savings regulator in México, classifies worker's transfers between *Afores* in three categories. A *negative transfer* is a switch to an *Afore* that offers a lower net return than the incumbent. A *neutral transfer* is a switch to *Afore* that offers a net return located between the same as and less than 5% higher than the incumbent. A *positive transfer* is the complement (OECD; 2015a).

[3]   In fact, from eleven companies offering retirement account management services in the Mexican market, there is only one standalone *Afore* (COFECE, 2014: 786-789).

it individually. That is, there is a judgement bias emerging from the adverse psychological tension caused by inconsistency in beliefs, which drives the brain "to level out discrepancies" (Leuthesser *et al.,* 1995: 58).

In the case of the theoretical setting proposed in this model, the service offered by *Afores* in the market will be differentiated by the promise of a long-term return and workers are assumed capable to correctly assess it. What makes them myopic to such differentiated returns is that they have previous business engagements with other companies within the same brand as the *Afores,* and based on that experience they assign a probability they will deliver on their long-term return commitment. That is, the way in which this probability is built within the worker's preference space is based on private knowledge generated in previous dealings between himself and the companies clustered around a common brand-name, so experience with the brand-name is attributed to the *Afore* at the time of election, which is an example of the *halo effect*.

An important item should be notice at this point. Even if the motivation for this research project comes from the *Afores'* market in México, the predictions of the model are general enough to be adapted to similar financial markets or locations in which retirement savings services companies, clustered under a single brand name with other companies, may have contact with customers.

The analysis presented in this paper is divided as follows. In the next section, the relevant literature regarding retirement fund choice is reviewed. In the third section, the model of *Afore* choice, based on private experience and the *halo effect*, is developed and the main results are derived. In the fourth section, there is some space for discussing the results and further research, and finally, conclusions are drawn.

■ *Literature review*

In addition to the evidence on retirement fund's switches presented above, the fact that workers show certain unresponsiveness to pricing or return considerations has been previously reported in the literature. For instance (Calderón-Colín *et al*., 2008) for México and (Berstein and Cabrita, 2007) for Chile[4] describe such behavior a decade ago. That unresponsiveness is not consistent with the expected optimal path of savings derived from the "standard economic theories of saving," as Bernartzi and Thaler (2007: 81) called the life-cycle or the permanent income models. In their analysis, the latter identify three common assumptions in such theories, one explicit, people maximize their lifetime utility function –and two implicit– people have the cognitive ability to optimize and they have the will to stick to an optimal plan.

In the existing literature, there are two main research lines that may explain Afore's choice rationality mismatch as a product of a behavioral bias in the decision-making process. In the first one, researchers assume that people do not follow at least one of the three basic features identified by Bernartzi and Thaler in the standard theories of

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4   Recall that the Chilean pension reform was the first of its kind in the early 80's, followed by México and other Latin American and Easter European countries in the 90's, therefore, both retirement account systems share similar features and problems.

saving, and that creates a bias in the retirement fund selection process.[5] In the second one, a research line in the making, researchers assume that people behave in line with the three standard features identified by Bernartzi and Thaler, and the bias emerge from another source as incorrect incentives or, as in the current paper, from the *halo effect*.

Regarding the first line of research, in (Calderón-Colín *et al*., 2008) analysis for México, workers are assumed as not able to determine the true expected value of the service they contract at the time of *Afore* election. As they cannot see complexity or noise variables, they are *confused*. This may be due to advertising campaigns that create noise and that pricing may be difficult to understand for the worker. So *consumer confusion* allows *Afores* to charge prices above their marginal costs, and makes workers unreactive to price competition. Under this environment, workers chose suboptimal retirement account managers and the recommended public policy consists in measures to reduce noise, fostering the worker to be an active and well informed individual.

Also within the first line of research is the *significance of the middleman theory*. For instance, Berstein and Ruiz (2005) empirical study revealed that in the period 1995-1997, switches among AFPs -the Chilean equivalent to *Afores*- were reacting positively to yield and negatively to fees, and that regression parameters changed when the influence of a salesperson is taken into account, making switches among AFPs more sensitive to yield and less sensitive to fees. For the period 1998-2002, AFP selection process loses sensibility to yield and fees, responding to salesperson's extra-payment for each switch. Then, price or return competition seems to fade during the second period analyzed. Berstein and Cabrita (2007) also study AFP selection in Chile, performing an empirical analysis that uses microdata and concludes that the probability of a salesperson visit is instrumental to boost demand elasticities to variables as price or return, so salespeople are filling the role of informed middleman in the selection process.

Finally, into the same line of research, there is some literature that shows that the worker is unaware of his retirement adequacy. For instance, Miranda Pinto (2012) analyses the effects that information has on the choice of retirement year in Chile, where they have the practice of communicating to the worker an estimation of his expected pension at age of retirement and the value of wait three more years. This public policy considers workers that are in the final years of their expected working life, in an effort to increase their pension awareness. As a result, pensioners that received these estimations two years in a row -2005, 2006- had a lower probability of retirement by 2011.

Notwithstanding the literature described above has been dominant in the last decade, recently, a second line of research is emerging, one that does not rely on the behavioral biases emerging when the three standard assumptions described by Bernartzi and Thaler (2007) are not been followed.

One example of the second research line is under construction. It concentrates on incentives that may explain workers disregard for retirement income adequacy. For in-

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[5]   Bernartzi and Thaler (2007) are not convinced about the strength of any of the two implicit assumptions of the standard models of saving, and conclude that instead of involving themselves into complicated calculations, most people follow heuristic rules, which can lead to systematic biases.

stance, OECD (2015a: 128) discuss the lack of correct incentives that may cause a careless *Afore* choice. Recall that, because of the pension reform of 1997, México's current pension system beneficiaries can be divided into two different groups, with different rights. The first group is composed by the workers that contributed into the social security system before the reform. They have the right for a defined-benefit pay-as-you-go pension, and are called *transition generation*. The second group, or the *new generation* workers, entered the social security system with the new rules, so they have the right to a defined contribution fully-funded pension. The argument is that people have not the correct incentive to choose a higher yielding *Afore* because *transition generation* workers have earned the right to a defined benefit pension no matter their retirement account balance at the end of their working life. In this sense, transition generation workers can afford to be negligent with their *Afore*. However, there is more research to be done in this line, as it can be argued that some of the money accumulated on the retirement account will be paid to *transition generation* workers at the time of retirement, which may be large enough payoff to entice a better selection process.

Another example of the second line of research is the *market segmentation hypothesis*, as the one presented by Ramirez and Rochín (2014). They study México's retirement industry competition strategies in a two-stage game model. Their results indicate that *Afores* compete for workers' retirement accounts in a segmented market by wage levels, with differentiated strategic behavior at each segment: on the high salary segment, they compete as an oligopoly not based on prices or quantities, for example, using advertising or brand loyalty, while in the low salary segment they compete on prices. Even if these authors do not explicitly make the connection between their findings and the *Afore* choice problem depicted in the current manuscript, those differences in competition strategies may influence the incentives offered to workers in the most desirable segments, according *Afores*' advantages on costs or operational leverage.

Finally, the model presented in the current paper is also within the second line of research, as it assumes that workers maximize their expected utility, can correctly appraise the offers from *Afores* in terms of expected return and commitment is certain in the way the contract is design. Therefore, this model fulfils all three common assumptions from *the standard economic theories of saving*, such as the life-cycle or permanent income models. To model the bias shown by evidence, unobservable private knowledge is assumed to be the source of it. Such private knowledge is built based on the history of dealings between workers and the companies clustered around a common brand-name, in what is called the *halo effect.* Therefore, to conduct the analysis presented here, a theoretical model of private knowledge and subjective probability with long term commitment is constructed.

The *halo effect* has been widely studied since its inception more than a century ago, and is explained by the human tendency to maintain consistency of believes, assigning general attributes to particular experiences despite of having enough information to evaluate them on individual basis. Such effect has been proven relevant in financial brand–name studies. For instance, García de los Salmones Sánchez *et al* (2009) study the brand for two types of financial entities (saving banks and banks) in two different

markets: consumer and small firms. They find that the *halo effect* is differentiated according market and client type. The *halo effect* is stronger for saving bank in the consumer market and for the banks in the small firm's market.

The setting presented here can generate that a rational, utility maximizing worker may show behavior in accordance with the observed rationality mismatch in *Afores* market, without the need to use the particular bias defined by Bernartzi and Thaler (2007), and this is the first time such behavior is accomplished in this context with the use of the *halo effect* hypothesis. This represents the main contribution of the paper.

■ *Modelling private knowledge, subjective probability and the halo effect*

In this section, the decision model for retirement fund choice is built as a long term informed financial decision, using the existence of a function that can store the private history dealings between two partners developed by Wilson (1986). In addition, some features of the binomial option environment developed by Cox *et al*. (1979) are applied. In Wilson (1986), private history is used to construct a subjective probability of a counterpart taking certain strategy in a dynamic prisoner's dilemma type of game. Wilson uses it to build a retaliation algorithm to solve the game, in which expectations are updated at every stage. However, the approach we have taken in the current paper is that we assume long term commitment, therefore, Wilson's game is played just once, and commitment to the choice is assumed after that. In a more general environment, for example in a retirement system without the minimum pension feature, solving the problem will need several stages of the binomial three to reflect the extended possible outcomes, as shown at Cox *et al*. (1979).

To simplify the environment without the loss of generality, assume that there are three agents in the economy. Two retirement funds, *Afores*, and one worker that must select one of them with long term commitment, that is to sign a contract from the point they made contact up to the time of his retirement, without the possibility of getting out of it for both sides. Time is discrete and is depicted by $n = 0, 1, 2, 3, \ldots N$. Let β^n be the discount rate for the economy, where $\beta \in (0, 1)$, and N be the number of periods necessary for the worker to reach retirement age. Also assume that both *Afores* are ex-ante homogeneous in every aspect but on expected returns; so, using publicly available information, the worker, or any other agent for that matter, can estimate that they will yield different rate of return on retirement savings. As a matter of notation, financial companies in the model are called *AFORE*-A and *AFORE*-B, which correspondingly depict a high and a low expected yielding company; in order to distinguish among variables regarding both of them, let A and B be the sub-indexes for those variables referring to *AFORE*-A and *AFORE*-B.

In the modelled economy there is also a minimum monthly pension, similar to the one in place in some OECD countries.[6] For instance, under the Social Security Law (IMSS, 1995: Art. 170), in México if a formal worker at the time of retirement did not

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6   See (OECD, 2015b: Chapter 2) for a comparative analysis on minimum pension schemes in OECD countries.

accumulate in his saving account enough money to buy at least the minimum monthly pension, he will get a subsidy from the government, complementing his savings in order to reach that minimum monthly pension, and he is entitled to a yearly increase in line with the general inflation rate.

This has a simplifying effect, establishing a lower bound in the monthly income for pensioners. So, in this model, we can assume that there can be only two results that *Afores* can deliver at time of retirement, in the fashion of binomial options literature.[7] The two possible results are:

a) a minimum pension balance, denoted as *PMG*, or,
b) a higher amount that ensures a larger monthly pension than the minimum.

For notation purposes let's denote the payoff coming from *AFORE*-A, at time *N*, as PAY_A, and similarly, as PAY_B, the payoff coming from *AFORE*-B. To further simplify the environment, allow for setting the higher payoffs as multiples of the *PMG*, as follows:

(1) $$PAY_i = \zeta_i PMG$$

$$\text{where } i = \{A, B\}, \zeta_i = \{\alpha, \phi\} \text{ and } \alpha > \phi > 1.$$

Therefore, under the current framework, there will be two *AFORE*S with two possible values for the retirement balance at time *N* in each one, which produces four possible outcomes for the worker when he retires.

At this point, a concept developed by Wilson (1986) is introduced. Recall that Wilson define a function that can store all the private history of previous dealings, between two trading partners, and uses it to construct the probability for a trading partner to take certain strategy. The way in which Wilson's idea is introduced in the current model is by constructing a similar memory function, which can store the relevant history of dealings between the worker and the companies clustered under a brand-name. We hypothesize that there is a bias caused by the *halo effect*, which produces a myopic memory function, as the worker does not distinguish history among any company identified by the brand-name of the diversified financial group, government body or conglomerate from which the *Afore* is part of. So good or bad experiences with any firm under the same brand-name are identified by the worker as good or bad experiences that influence his decision with any other firm within the brand, and that affects also *Afore* choice.

Therefore, in the current model we have a worker that will choose an *Afore* to manage his retirement saving account and in his decision, he use his memory to assign a probability that the *Afore* will keep its commitment of return. The worker builds this probability using his memory of previous dealings, acting in the model as a memory

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7   Notice that this paper borrows some features from the basic environment developed in Cox *et al.* (1979) regarding the setting for binomial options.

function. However, he uses in the memory construction not only his experience with the *Afore*, but any experience with any firm that is identified by the *Afore*'s brand-name, as he is affected by the *halo effect* bias.

To incorporate this into the current model, let q_i be the discrete variable that measures the number of bad experiences in previous meetings between the worker and the brand in the time before the *AFORE* election. For simplicity assume that q_i follows a Poisson process, and it produces a match specific probability function $h_i = \{h_A, h_B\}$, that is, q_A is drawn from h_A in the case the worker is estimating the probability of *AFORE*-A to honor a commitment, and q_B is drawn form h_B otherwise. Also, assume that

(2) $$E(q_i) = \{\lambda_A, \lambda_B\} \text{ and that } \lambda_A > \lambda_B > 0$$

Let P_i for $i = \{A, B\}$ be the probability that *AFORE-i* will deliver a balance equivalent to *PMG* at time N, that is, the probability that *AFORE-i* will not deliver on the promise of a better than the minimum pension return. Now define $\hat{q}$ as the threshold in which h_A and h_B intersect, such that

(3) $$P_B > P_A \text{ for all } q_i < \hat{q} \text{ and}$$

$$P_B < P_A \text{ otherwise}$$

This implies that for low values of a given q_i, that is, relatively low number of bad experiences the worker will have a lower expectancy for *AFORE*-A to dishonor its commitment than *AFORE*-B to do it. The opposite is also true, for higher values of a given q_i. Therefore payoff for the worker for each possible path chosen will take the following form

(4) $$V_i = P_i PMG + (1 - P_i)\zeta_i PMG,$$

$$\text{where } i = \{A, B\} \text{ and } \zeta_i = \{\alpha, \phi\}$$

And the problem that the worker has to solve is given by

(5) $$\max_\Theta \hat{V} = \Theta V_A + (1 - \Theta)V_B$$

Definition 1. A pure strategy market equilibrium is the $\hat{\Theta} = \{0, 1\}$ *under which* $\hat{\Theta} = \text{argmax } \hat{V}(\Theta)$ *is achieved.*

For this setting there have been identified two possible equilibria in pure strategies. We called them *high equilibrium*, when $\hat{\Theta} = 1$, and *low equilibrium*, when $\hat{\Theta} = 0$.

For the worker to choose the *high equilibrium*, $\hat{\Theta} = 1$, must be true that $V_A > V_B$, that is,

(6) $$P_A PMG + (1-P_A)\alpha PMG > P_B PMG + (1-P_B)\phi PMG$$

Which occurs whenever

(7) $$\alpha > \gamma^*$$

This can be derived from Equations (3), (4) and (5), using simple algebraic manipulations and $\gamma^* \equiv \dfrac{(1-P_B)}{(1-P_A)}\phi + \dfrac{P_B - P_A}{(1-P_A)}$. Moreover, using a similar setting it can be proven that for the worker to choose the *low equilibrium*, $\hat{\Theta} = 0$, it will require that

(8) $$\alpha < \gamma^*.$$

which implies uniqueness of equilibrium in pure strategies.

Therefore, depending on the value of a given q_i regarding $\hat{q}$, as defined by Equation (3), the model may have a unique equilibrium or even some spaces where both equilibrium are feasible but not simultaneously.

For instance, for the *high equilibrium* to exist and be unique, it is sufficient to prove that

(9) $$\phi > \gamma^*$$

As if Equation (7) holds, from Equation (1) we have

(10) $$\alpha > \phi > \gamma^*,$$

and with that *low equilibrium* will not be feasible, so *high equilibrium* will exist and be unique. Then, from algebraic manipulation of equation (7) the necessary condition for existence can be derived, which is

(11) $$P_B > P_A$$

which occurs whenever a given $q_i < \hat{q}$. That is, for relatively lower occurrence of bad experiences, the *AFORE*-A, the highest expected yielding, will be the one chosen by the worker considering only an absolute return measure. Therefore, a lower given q_i provides the necessary condition for the *high equilibrium*, $\widehat{\Theta} = 1$, to exist and be unique, as any value of α lower than γ^* will not be feasible, as any of those values violate assumptions in Equation (1). The prevalence of the *high equilibrium* requires low bad experiences ratio with a brand, which cause that the worker beliefs on the *Afore* reliability would be high, and so it attributes a good chance the *Afore* offer will hold at the time of retirement. So for low values of bad experiences, the model predicts that the worker will decided based on *absolute return* to select an *Afore*.

However, as was previously mentioned, the empirical evidence shows that this is not always the case, in some rather frequent instances workers chose the lower-yielding *Afore*. In terms of the current model that means that the *low equilibrium* exists in actual election processes. To see what conditions can generate this equilibrium now look at the space for a given $q_i \geq \hat{q}$.

From Equations (1) and (6) - (8) it can be shown, after a simple algebraic manipulation that, when a relatively high occurrence of bad experiences between the worker and the financial institution is present, both equilibria are possible as there is an overlap in the feasibility and equilibrium conditions for both of them.

$$\text{That is, when } q_i \geq \hat{q} \begin{cases} if \ \ \alpha > \gamma^* > \phi \ \ \text{the } high \ equilibrium \text{ will prevail} \\[2mm] if \ \ \gamma^* > \alpha > \phi \ \ \text{the } low \ equilibrium \text{ will prevail} \end{cases}$$

This result also has a nice intuitive explanation: for high enough bad experiences, the deciding factor will be the *relative return* offered by the *Afore*. That is, if there is a high number of bad experiences with the brand-name, the worker will be putting attention to the difference between *Afores'* expected yield $\{\alpha, \phi\}$. If the difference is relatively high, $\alpha > \gamma^* > \phi$, the worker will not mind much the high number of bad experiences and will choose the higher-yielding *Afore*, however, if the relative difference between two offers is low, $\gamma^* > \alpha > \phi$, the worker a priori beliefs dominate the expected difference of returns and he will be choosing the lower-yielding *Afore*.

So, for an informed worker with the necessary skills to determine *Afore*'s expected long term return is possible to rationally choose a lower yielding *Afore*, if two conditions are present. The first is that there is a high count on bad experiences with the *Afore* brand, and the second, that there is not much relative difference in return. Therefore, a high enough relative return ensures that the high-yielding *Afore* will get the worker's account, while a slim difference between what *Afores* offer as long term return, past experiences can overcome the rational decision and the worker will go to the lower-yielding *Afore*.

These results have an important impact on public policy recommendations. Under the current model assumptions, it may always be a portion of *Afores'* switches that seem off, even if all the informational barriers and lack of financial education are overcome, rational workers can still be selecting the lower-yielding *Afore* over a higher-yielding incumbent. Therefore, in addition to all measures to eliminate informational barriers, and to increase financial literacy and to improve the competitive setting, there is also a work that *Afores* should do in order to improve the selection process, that is offering as a conglomerate or group better services in all the firms associated with their brand-name.

■ *Discussion and further research*

The model presented so far is simple and produces intuitive, strong predictions in the sense that may explain the rationality mismatch existing in the retired fund management market in México in an original manner. However, as any simple model that tries to break ground has limitations and potential to grow. In this section such features are discussed and some further research proposals are presented.

The first point to be discussed is simplicity. In this model there are some instances of simplification that may be relaxed to allow for more complex interactions. One example is the assumption of the long term commitment contract between the *Afore* and the worker. If periodical switches were allowed, the value of the contract may be constructed as a European option under the Cox *et al* (1979) way, that is, with multiple stages of a binomial tree. Albeit, this layer of complication would not change the presence of the *halo effect* in *Afore* choice, which is the matter in this paper, just would make the parameter space more complicated.

The second point to be discussed is that in most literature on the subject, there is an underlying assumption that is probable not good to rely on, which is that the past net return is used as a predictor of long term retirement fund performance. For instance, the Mexican retirement fund regulator, *CONSAR*, defines a *negative transfer* as the switch between two *Afores* in which the receiving one has a lower historical net return than the incumbent, which does not mean that the long-term history will be the same. This is a line of research that is being pursued, as there is some evidence in the investment literature under which negative transfers would not necessarily be equivalent to a wrong decision. For instance, under value investment philosophy, the best possible option may not be evident at the time of choice because is possible that the *Afore's* investment portfolio is temporarily undervalued by the market, as such *Afore* is following a long term value investment strategy.[8]

The third point to be discussed, is the lack of space in the model presented in this manuscript for strategic behavior on the *Afore's* side. In order to keep the model simple and cleanly achieve the theoretical feasibility of the *halo effect*, *Afores* do not interact in a meaningful way. That does not allow to incorporate oligopolistic competition issues on the model. This is important as there have been recent developments in México's *Afore* market, that could modify the competitive environment and may have an impact on the figures discussed in this paper regarding negative transfers, although it is too early to determine that because it is still an unsolved issue. The matter is the hefty penalty applied by the Mexican competitive regulator, *COFECE*, to four *Afores* and eleven individuals accused of absolute monopolistic practices. The authority claims that those *Afores* and individuals acted to limit switches among *Afores*. This matter is still unresolved at the time of writing this research paper, as it still can be disputed in court.[9] When this issue is settled it may be an interesting subject to be analyzed in a future manuscript that incor-

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[8]   For empirical evidence that support the value investment philosophy applied to stock markets see Damodaran (2013).
[9]   To see the official press release on the matter please refer to COFECE (2017).

porates oligopolistic competition and other strategic features in the *Afores* market within the *halo effect* model. That would require a more general setting in which several *Afores* interact with a large number of workers, in which strategic behavior of *Afores* becomes evident, such as in the Ramírez and Rochín Ruíz (2014) model.

A fourth and last point to discuss, that is already being addressed, is the development of empirical research pursuing to show the existence of the *halo effect* in the *Afore* election process with microdata coming from administrative records, individual experiments and surveys. So far in this paper a plausible theory of the importance of the *halo effect* in the *Afore* switching process has been developed and the existence of equilibria proven in a simplified mathematical model. However, the experiment design to empirically show the existence of the *halo effect* is still work in progress, which would be presented in future papers.

■ *Conclusion*

The model presented in the current research paper, departs from the assumptions that workers are rational, financially literate and have all the information needed at hand to build the expected return of any given *Afore*. The model hypothesizes that there is a *halo effect*, in which workers attribute bad experiences with a brand-name to the *Afore* that shares that brand with a diversified group, and also that such bias affects the selection process as it is used to construct a probability that the *Afore* will deliver the yield as promised at the time of retirement.

The model produces intuitively sound predictions. On one hand, the model forecasts that, when there is a low occurrence of bad brand experiences, people will choose the higher yielding *Afore*. As past experience is not enough to overcome financial expectations, this equilibrium -the *high equilibrium*, is unique. On the other hand, as bad experiences increase over certain threshold, the deciding factor will be the relative difference between the expected return offered by *Afores*. Thus, there can be more than only one equilibrium in this space parameter, but not simultaneously in pure strategies. A high enough relative return ensures that the high-yielding *Afore* will get the worker's account, the *high equilibrium*, while a slim difference between what *Afores* offer as long-term return, past experiences are going to overcome the rational decision and the worker will go to the lower-yielding *Afore*, the *lower equilibrium*.

So, this is the main contribution of the current manuscript, this model provides a way in which a rational worker can choose a lower-yielding *Afore* without the need of a failure on one or more of the assumptions in standard savings models, as defined by Bernartzi and Thaler (2007). That is important because departing form the assumption of fully informed agents provides two new insights into the analysis of *Afore*'s choice. First, under this model there is the possibility of the existence of people choosing wrong, even if all informational barriers are lifted, generating the feasibility for a natural or frictional level of bad choices, and second, this provides new public policy implications, putting at least some of the weight of improving the selection process into the retirement account private companies and their parent companies, as they need to

improve their global client experience in order to being more recognizable for their net return efforts.

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