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Is there a conflict of interest between Brazilian investment advisors and their clients? An econometric analysis from the perspective of the principal-agent problem

By Alexandre Magno Andrade REIS [a]
Mathias Schneid TESSMANN [b†]
Gustavo José De Guimarães e SOUZA [c]
Marcelo De Oliveira PASSOS [d]

Abstract. This paper investigates the Brazilian investment advisors' model of action. Starting from the principal-agent relationship, we sought to answer the following question: does the current Brazilian remuneration model for investment advisors reduce information asymmetry? For this, the theoretical model of Golec (1992) was adapted and panel data was used on Brazilian investment funds from 2010 to 2020. The results show that the current system of commissioning advisors does not reduce information asymmetry between investors and investment fund managers. Furthermore, given the large share of fixed-income funds in the Brazilian market, advisors do not have incentives to provide all the information they have to increase the profitability of investors' portfolios. These results are useful for the literature that studies the capital market by bringing empirical evidence to Brazil and financial market agents in general.
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1. Introduction

Investment firms control a large and growing percentage of investors' aggregate wealth and, increasingly, such investors have placed their money under the control of investment advisers. In this scenario, there may be potential conflicts of interest between the owners of these investment firms and their advisors, as well as conflicts between advisors and client investors (Starks, 1987).

In neoclassical economics, these conflicts are studied by the Agency Theory. In Jensen & Meckling (1976) the agency relationship comes from a contract in which one or more people (principal) hire another person (agent) to perform some activity on their behalf or at their behest, that is, the agent has a delegation of power to act in favor of the principal.

Likewise, Barney & Hesterly (2004) state that agency theory seeks to understand the causes and consequences of the misalignment of interests between the principal and the agent. This misalignment of interests can cause

[a] Brazilian Institute of Education, Development and Research – IDP, Brazil
[b†] Brazilian Institute of Education, Development and Research – IDP, Brazil.
[c] Brazilian Institute of Education, Development and Research – IDP, Brazil.
[d] Federal University of Pelotas – UFPel, Brazil.

conflicts between the principal and the agent. For Arrow (1984), the principal cannot monitor the agent's actions perfectly and there are costs involved in carrying out this monitoring and obtaining information. Such factors can favor the conflict of interest as the agent starts to act in its interest and seek what the principal wants.

Several economic situations have been studied by agency theory. As an example, studies dealing with the relationship can be cited: shareholder-manager (Jensen & Meckling, 1976), owner-mineral extractor (Leland, 1978), contractor-government (Weitzman, 1980), investment bank-issuer (Baron, 1982), and investment advisor-investor (Starks, 1987).

Among the various relationships studied by the agency theory, the relationship between investment advisors and Brazilian investors is the one that will be studied, because, in recent years, interest in the financial market in Brazil has been growing. According to recent data from the Brazilian stock exchange, the Brazilian equity market reached the milestone of one million investors in July 2019. And that number has doubled in less than a year, with two million investors investing in the Brazilian market, especially in variable income.

For the Brazilian stock exchange - B3 - this increase in the number of individual investors in the equity market represents a structural change in the Brazilian capital market. The Brazilian market has always been characterized by investments in fixed income, despite still being the main investment product consumed in the country. However, the economic instability and the constant drops in interest rates made room for the growth of the equity market. The variable income investor is young, is concerned with diversifying his investments, and begins to build his portfolio with low values.

In this group, a long-term vision is observed in maintaining their positions even at the height of market volatility. Regarding the volume of accumulated resources, in March 2017, individual investors had R$ 203 billion invested in the stock exchange. This volume rose to almost BRL 260 billion in April 2020, an increase of 30%. On the other hand, the average amount invested by individuals fell, showing the democratization of the capital market. In 2011, 44% of individuals had wallets with up to R$10,000 in balance. In March 2020, this percentage had increased by 10%, representing 54% of the total universe of individual investors who have resources on the stock exchange.

This change is the result of the profile of the new generation of Brazilians, the age group from 25 to 39 years old grew by 21% from 2017 to 2020. This group, which previously represented 28% of all individuals who invested in variable income, represents, in 2020, 49% of investors in B3. Another outstanding aspect is the diversification of these investors' portfolios. In 2016, 78% of individuals held only shares in their portfolios. In 2020, it is observed that this number drops to 54% and that 46% of individual investors have a position in more than one variable income product. In addition, individuals are investing in more companies, diversifying their stock portfolios. In 2016, only 26% of the investor base had five or more companies in their portfolio. In 2020, that number has risen to almost half the base (48%).

The growth of the Brazilian capital market led to the expansion of the profession of Investment Consultants, this professional is responsible for attracting and monitoring new clients for the capital market. Thus, the present study seeks to answer the following question: does the current Brazilian remuneration model for investment advisers reduce information asymmetry?

Thus, the work aims to verify the Brazilian model of action of investment consultants. For this, the theoretical model based on the principal-agent problem developed by Golec (1992) and an econometric model with panel data for the Brazilian stock exchange from 2010 to 2020 will be used. The results show that the current system of commissioning Brazilian investment advisors by performance fee does not lead to a reduction in the asymmetry of information between investors and investment advisors and contributes to the scientific literature that investigates the capital market by bringing evidence to Brazil, as well as to financial market agents.

In addition to this introduction, the work contains four more sections, Section Two with the literature review, Section Three explains the theoretical model and the empirical model, Section Four presents the database and analyzes the results and Section Five brings the final considerations.

2. Literature review

Interest in information about the investment market has grown significantly in recent years, especially in the stock market. The subject's complexity tends to generate information asymmetry between those who know the capital market and those who are starting this type of investment.

According to Noda (2010), savings and mechanisms that allow savers to meet resource borrowers allow exchanges to occur, with the capital market being one of those responsible for this intermediation. When the investor benefits from the saver's capital contribution, the market as a whole tends to be more efficient, as the saver's risk decreases by becoming a partner in a company without the need to manage it and companies reduce costs of capture.

The Agency Theory is presented as a model where one of the parties, designated as an agent, acts representing another party, known as the principal. The relationship between these parties may contain conflicts based on information asymmetry between who is responsible for managing it, in this case, the autonomous investment agent, and who is the owner of the investment, the investor. In addition, as it is a contractual relationship, moral hazard problems may occur (Arrow, 1984).

The moral hazard problem arises in any situation where the interests of the principal and the agent are not aligned and the agent's actions are difficult to observe and monitor. According to Kotowitz (1989), moral hazard arises from the actions of agents who seek to maximize their utilities to the detriment of the principal, in situations of uncertainty or incomplete contracts. In this way, the party that has more information can act opportunistically.

In the relationship between investment advisors and investors, the commission paid by the stockbroker to these professionals, as it is not presented to the investor, can generate an incentive for the investment options presented by these professionals to be aimed only at personal gains, to receive a higher commission and not about the quality of the investment made, considering the interests of the investor. Therefore, in this relationship, there is both information asymmetry and moral hazard.

For Dalmácio & Nossa (2004), in principle, agency theory suggests the search for efficiency between the principal and the agent, since the principal has the value to be invested, while the agent has the experience and competence to perform that service. However, if both parties to the relationship are utility maximizers, there is good reason to believe that the agent will not always act in the best interests of the principal, in the business context, as the agent has privileged information and has the power to make management decisions. of the business, he can act to maximize his interest, to the detriment of the principal, appropriating the company's resources (Jensen & Meckling, 1976).

Agents do not depend only on their competencies to guarantee the quality of decisions, the incentives offered must also be considered, the agency's problem being perceptible when the maximization of the utility of that investment is favoring the agent and not the principal (Byrd, Parrino & Pritsch, 1998).

On the other hand, Golec (1992) shows that the principal-agent model can be used to construct detailed analyzes of specific economic relationships. In his case, the author uses this framework to test an empirical model for the investor-investment advisor relationship. In this context, investors participating in the stock market seek professional advice only when they perceive that their investment capabilities are insufficient or when they have sufficient confidence in investment advisers.

On the other hand, if investors believe that their knowledge of the stock market is sufficient to make decisions, they do not seek the recommendations of investment advisors (Georgarakos & Inderst, 2011). Guiso & Jappelli (2006) state that overconfident investors may be less likely to seek advice from investment advisors. Likewise, people who are confident in their financial education are less likely to seek investment advice (Kramer, 2016).

In addition, people with relatively less knowledge may fail to recognize their inadequacies, leading them to overestimate their abilities and not seek investment advice (Kruger & Dunning, 1999). For Martinez (1998) the proposition of mechanisms can favor more efficient contracts as a solution to the problems presented by the principal-agent relationship. The principal-agent problem can present itself in different situations, among different market relationships.

For Martins & Paulo (2014), the use of privileged information, which is also associated with information asymmetry, is present in transactions involving shares. This can lead to negative results in asset trading, increasing the possibility of insider trading. According to the Brazilian Securities and Exchange Commission, the commission paid to the autonomous investment agent or the intermediary generates an incentive, ceteris paribus, for products that reflect higher commissions to these agents to be indicated.

In the event of commissioning on the investor's equity, the incentive based on the commission rate ceases to exist, considering some types of applications. However, this form of commissioning may not be the best for the client in other products, if one considers the number of one-time transactions carried out, as in the stock market. According to Golec (1992), commissioning through benchmark has some limitations, its use being presented mainly in large funds, in only 27 of 370 analyzed funds use reference indexes to pay commission and the assets managed by these funds are substantially higher. to the proportion of funds analyzed, showing that this form of commissioning occurs mainly in large funds.

The benefit of using a consultant may not be enough to motivate your hiring, but the use of a consultant is justified when the information provided by the professional is of high value, when the amount of investment is substantial, and when there is high volatility in risky assets (Liu, 2005).

This study will address the analysis of conflicts of interest generated by the performance of investment advisors, proposing mechanisms for aligning the interests between the parties, as the commission paid to the agent for each type of investment can demonstrate whether the agent is acting for its benefit or that of the main. Thus, we seek to contribute to the literature listed that investigates the principal-agent problems in the most varied ways by presenting empirical evidence for the Brazilian capital market.

3. Methodology

3.1. Theoretical model

Considering Golec (1992), the investor-investment advisor relationship can be characterized as a principal-agent relationship, in which the investor (principal) hires an investment advisor (agent) to provide investment information (input) that affects the distribution of the investment. return (product) of the investor's portfolio. In this relationship, the investor does not receive the information directly, but benefits from the knowledge of the autonomous agent, through the return on his portfolio that the agent can generate.

Golec (1992) points out that, as it is prohibitively expensive for the investor to monitor the investment advisor, in principle, the agent has no incentive to apply information to the investor's portfolio. To gain access to the agent's information, the investor must optimally build an incentive contract for the agent. This agreement is subject to information restrictions and aims to provide adequate incentives for the agent to make its information available to the investor's portfolio. In this relationship, investment advisors are endowed with investment information or information-gathering skills but do not have the capital to invest. On the other hand, investors are endowed with capital, but no information about the capital market and investment options. Investors believe that the information that self-employed agents have can be applied to their investment portfolios. In this sense, the following return generation process is expected to continue:

$$\tilde{R}_p = \beta_p \widetilde{M} + I + (I\delta)^{\frac{1}{2}} \tilde{\varepsilon} \tag{1}$$

where $\tilde{R}_p$ is the gross random return of the portfolio, $\widetilde{M}$ is the random gross return of the market, β_p is a real-valued scalar, I is the non-random return units associated with the information units applied to the portfolio, $\tilde{\varepsilon}$ is a unit of portfolio-specific random return and δ is the investment advisor information rate.

Suppose that E $(\tilde{R}_p) = \tilde{R}_p$, E $(\widetilde{M}) = \overline{M}$, E$(\tilde{\varepsilon})$ = 0, Var$(\widetilde{M}) = \sigma_M^2$, Var$(\tilde{\varepsilon}) = \sigma_\varepsilon^2$ and Cov$(\widetilde{M}, \tilde{\varepsilon})$ = 0, where *E()*, *Var()* and *Cov()* are the expectation, variance and covariance operators, respectively. $\widetilde{M}$ and $\tilde{\varepsilon}$ are considered normally distributed and therefore $\tilde{R}_p$ is normally distributed.

The information rate describes the tradeoff that each additional unit of portfolio-specific variation for each portfolio-specific non-random return unit generates as a function of information from the autonomous investment agent. In this scenario, the investor must support additional variability due to the autonomous agent's actions, which concentrate investments in securities that he believes offer superior returns.

By definition, a lower information rate implies that an autonomous investment agent is better able to act on the information while insulating the portfolio from the random effects of portfolio-specific information. In cases where the investor decides to hire the autonomous investment agent, the average portfolio return distribution increases I, and its variance increases $I\delta\sigma_{\varepsilon}^{2}$. On the other hand, in cases where the investor does not hire any autonomous investment agent, the investor maintains a perfectly diversified portfolio that presents a return $\beta_p\widetilde{M}$.

As Golec (1992) points out, investors who believe that equation (1) holds, do not believe that markets are perfectly efficient concerning information from autonomous investment agents. In the model in question, the market is not perfectly efficient since there is information asymmetry, that is, only autonomous investment agents have the information that can increase the return on the portfolio.

In the model, the investor observes, at no cost, $\widetilde{M}$, $\tilde{R}_p$ and β_p. On the other hand, as I, δ and ε are prohibitively expensive to observe, investors are not able to determine whether a superior return is the result of information from the autonomous investment agent or whether this return results from a random return specific to the investment portfolio. In turn, the autonomous investment agent has no incentive to reveal whether luck is responsible for the superior return.

To deal with this information asymmetry, an incentive rate can be inserted in the model, following the approach of Ramakrishnan & Thakor (1984). Equation (2) presents a fee schedule for open-end mutual funds:

$$\phi(k_b, k_i, \tilde{R}_p, \tilde{R}_x, A) = k_b A\tilde{R}_p + k_i A(\tilde{R}_p - \tilde{R}_x) \tag{2}$$

where A is the investment amount, $\tilde{R}_p$ and $\tilde{R}_x$ are the gross returns of the portfolio and the benchmark, respectively and k_b and k_i are the base rate and incentive parameters, respectively. The benchmark has a perfectly diversified portfolio and therefore, $\tilde{R}_x = \beta_x\widetilde{M}$, where β_x is the beta of the benchmark portfolio.

Base rate and incentive rate terms can be misleading. Base rates also provide incentives for independent investment agents to provide information and increase portfolio returns, as they are paid at the end of each period. This means that the agent receives a portion of the initially invested assets and the return over the period.

Over a multi-period horizon, base rates can provide risk-averse autonomous investment agents with significant incentives to provide information, as superior returns are compounded (assuming returns are not paid to investors) and therefore the assets and base rates increase. Higher returns can also attract assets from new investors or more assets from old investors. Only the one-period incentive is captured in the model.

The first component of the core agent model is the agent utility function. Assume that although their endowments of information may not be identical, autonomous investment agents have identical utility functions that exhibit risk aversion and all of their equity is earned at their rates, which implies that they are not diversified. The equivalent utility of certainty of the representative autonomous investment agent can be expressed by equation (3) below:

$$U(I,\phi) = E(\phi) - \tau\sigma^2(\phi) = f(w,I) \quad (3)$$

where $E(\phi)$ and $\sigma^2(\phi)$ are the expected value and the rate variation, respectively and τ is the positive risk aversion parameter. In turn, $f(w,I)$ is a function that specifies the opportunity cost of the autonomous investment agent's information, that is, its value to the agent in its next best use alternative.

Many principal-agent models, including Ramakrishnan & Thakor (1984), assume that agent effort is associated with disutility rather than an opportunity cost. In this model, the agent can be endowed with information, therefore, its allocation does not entail disutility. For simplicity, it is assumed that $f_I = w$ and $w > 0$, where f_I is the partial derivative of f in relation the I. The specification of $f(w,I)$ may contain a constant term that represents an income on the information endowment of an autonomous investment agent.

The second component of the model is the investor objective function. Assume that investors have identical risk aversion preferences for wealth and are well diversified. The present value of an investment for a representative investor can be defined by equation (4):

$$V_0 = \alpha\left[E(\tilde{V}_1) - \bar{M}Cov(\tilde{V}_1,\tilde{V}_M)\{\sigma_M\sigma(\tilde{V}_M)\}^{-1}\right] \quad (4)$$

where $\tilde{V}_1 = A\tilde{R}_p - \phi$ is the terminal value of the investment, α is the risk-free discount factor, $\tilde{V}_M$ is the terminal value of the market portfolio and $\sigma(\tilde{V}_M)$ is the standard deviation. The investor's objective is to maximize the current value of his investment, choosing the parameters of the rates, respecting the restrictions that equation (3) maintains, and that the autonomous agent chooses the amount of information applied to the portfolio. The principal-agent formal problem is:

$$Maximize\, V_{0_{k_b k_i}}, subject\ to\ f(w,I) - U(I,\phi) = 0 \quad (5)$$
$$I \in argmax[f(w,I) - U(I,\phi)] \quad (6)$$

Substituting equations (1) and (2) in equation (5), the optimal sizes of the rate parameters are obtained by the Lagrangian:

$$L = \alpha\left[A\bar{R}_p - \tau Var(\phi) - f(w,I) - \bar{M}\{(1-k_b)A\beta_p - k_iA(\beta_p - \beta_x)\}\right] + \mu\left[w - k_bA - k_iA + A^2\tau\delta\sigma_\varepsilon^2(k_b^2 + 2k_bk_i + k_i^2)\right] \quad (7)$$

where $Var(\phi) = k_b^2A^2\beta_p^2\sigma_M^2 + k_b^2A^2I\delta\sigma_\varepsilon^2 + k_i^2A^2(\beta_p - \beta_x)^2\sigma_M^2 + k_i^2A^2I\delta\sigma_\varepsilon^2 + 2k_ik_bA^2\beta_p(\beta_p - \beta_x)\sigma_M^2 + 2k_ik_bA^2I\delta\sigma_\varepsilon^2$ and μ is the Lagrange multiplier associated with (5).

Note that the first and third terms of the rate change represent the rate change due to the change in market return transmitted through the base and incentive rates, respectively. Likewise, the second and fourth terms are due to portfolio-specific return variability. Finally, the last two terms represent the covariance between the two rates due to market and portfolio-specific variation, respectively.

The structural solution of the rates for the first order conditions is:

$$k_b = \frac{\mu - \alpha\bar{M}\beta_p - 2A\tau[\delta\sigma_\varepsilon^2(\mu-\alpha I) - \alpha\beta_p(\beta_p-\beta_x)\sigma_M^2]k_l}{2A\tau[\delta\sigma_\varepsilon^2(\mu-\alpha I) - \alpha\beta_p^2\sigma_M^2]} \tag{8}$$

$$k_i = \frac{\mu - \alpha\bar{M}(\beta_p-\beta_x) - 2A\tau[\delta\sigma_\varepsilon^2(\mu-\alpha I) - \alpha\beta_p(\beta_p-\beta_x)\sigma_M^2]k_b}{2A\tau\left[\delta\sigma_\varepsilon^2(\mu-\alpha I) - \alpha(\beta_p-\beta_x)^2\sigma_M^2\right]} \tag{9}$$

Note that each parameter depends on the size of the other pre-multiplied by a term representing the impact of covariance between rates. It can be seen that the implications of the model when examining the solutions in reduced form for the rates, from the first order conditions, that is:

$$k_b = \frac{1}{2A\tau}\left[\frac{\bar{M}}{\beta_x\sigma_M^2} - \frac{(\beta_p-\beta_x)\mu}{\beta_x\delta\sigma_\varepsilon^2[\mu-\alpha I]}\right] \tag{10}$$

$$k_i = \frac{1}{2A\tau}\left[\frac{-\bar{M}}{\beta_x\sigma_M^2} + \frac{\beta_p\mu}{\beta_x\delta\sigma_\varepsilon^2[\mu-\alpha I]}\right] \tag{11}$$

From (10) and (11), it is observed that the unconstrained solution implies that the parameters can assume negative or positive values. However, given that $\beta_p > 0$ and $\mu > 0$ (the shadow price of inducing more information from the autonomous agent is positive), then $[\mu - \alpha I]$ must also be positive so that k_t can take on positive values. As shown below, both parameters cannot be negative simultaneously and the sum of the two parameters must be positive.

To get an intuition of equations (10) and (11), note that the rates k_b and k_i reward the agent for two services of value to the investor, systematic risk sharing and information provision. The portfolio returns and therefore the fee can be split into installments based on the market and based on the information. Using (1) and (2), the expected rate can be written as:

$$E(\phi) = [\beta_p k_b + (\beta_p - \beta_x)k_i]A\bar{M} + [k_b + k_l]AI \tag{12}$$

The first part of the fee rewards the autonomous agent for taking the systematic risk: k_b is applied to a return with a beta of β_p and k_i is applied to a return with a beta of $(\beta_p - \beta_x)$. The second part is information-based: each rate parameter is applied to a return with the same information-based component, so the parameters are equally weighted.

The relative sizes of the parameters will depend on their relative contributions to achieving an efficient level of risk sharing and information delivery. To see this, add (10) and (11) to get:

$$k_b + k_l = \frac{1}{2A\tau}\left[\frac{\mu}{\delta\sigma_\varepsilon^2[\mu-\alpha I]}\right] \tag{13}$$

Likewise, consider k_b, in (10) for β_p and k_i in (11) for $(\beta_p - \beta_x)$ and add to get:

$$\beta_p k_b + (\beta_p - \beta_x)k_i = \frac{1}{2A\tau}\left[\frac{\bar{M}}{\sigma_M^2}\right] \tag{14}$$

So, ignoring the scalar $\frac{1}{2A\tau}$, weighted sums depend on different variables. $[k_b + k_i]$ depends on the marginal benefit-cost ratio that guides the efficient provision of information. An additional unit of information, I, produces benefits from μ for the investor, but the cost $\delta\sigma_\varepsilon^2[\mu - \alpha I]$.

On the other hand, $[\beta_p k_b + (\beta_p - \beta_x)k_i]$ depends on the marginal benefit-cost ratio of the sharing risk. Sharing a unit of risk with the autonomous investment agent generates for the investor $\bar{M}$, but it costs σ_M^2. The scalar, $\frac{1}{2A\tau}$, adjust risk costs to suit an undiversified independent investment agent with a risk aversion coefficient of μ that manages a portfolio of A currency units in assets.

Changes in β_p affect only the relative attraction of k_b and k_i, for risk sharing. Since the parameters are equally attractive concerning inducing information, one would expect their relative sizes to depend on risk-sharing considerations. As long as β_p increases, ki increases while kb decreases by equal amounts, since from equation (13), $(k_b + k_i)$ is not affected by a change in β_p.

The parameters in (10) and (11) are defined by the fixation of the reference point β_x and its size of about β_p. Suppose that $\beta_p = \beta_x$, then specialization takes place, k_b is solely determined by the relative benefits and costs of systematic risk sharing.

However, it is applied to the gross return of the portfolio which includes both the market-based and the information-based portions, therefore, it still affects the incentives to provide information. This explains the first term in square brackets in (11), which reduces k_i by the amount of the effect that k_b has on the incentives.

In addition to this adjustment, k_i is based solely on the relative costs and benefits of providing information, as it is $\beta_p = \beta_x$, then k_i only the information-based portion of the return is applied and therefore has no risk-sharing potential.

One might ask why k_i would be used when $\beta_p < \beta_x$, since, ignoring the information-based return, the autonomous investment agent can expect to lose when the return on its portfolio is compared to that of the higher beta index portfolio.

The answer is that k_i can be used to achieve an efficient amount of risk sharing when the β_p that the investor prefers is greater than the beta that offers the efficient amount of risk sharing. Losses on the market-based portion of the incentive rate will be offset by gains perfectly correlated to the market-based portion of the base rate that would not have arisen if the investor had chosen a lower β_p. Therefore, k_i can be used to reduce market risk shared with the autonomous investment agent. On the other hand, when $\beta_p > \beta_x$, k_b is not necessarily zero because it can be used to increase risk sharing.

3.2 Empirical Model

Considering that the empirical analysis is transversal, the empirical model to be tested in the present study will only have k_b, k_i, I, δ. A and β_p. Furthermore, the model assumes that all autonomous investment agents have τ identical. It should be noted that risk preferences may fluctuate and are not measurable.

The following hypotheses (comparative statics) are generated from the results of the theoretical model. First, from (10), k_b is negatively related to A and β_p, This is because the negative relationship between k_b and A captures the economies of scale in portfolio management, while the negative relationship between k_b and β_p demonstrates that, as β_p increases, k_b becomes relatively less attractive for risk-sharing. On the other hand, as the sign of $(\beta_p - \beta_x)$ is indeterminate, the relationships between k_b and δ and between k_b and I are also indeterminate.

Second, out of (11), k_i is positively related to β_p and I and negatively related to δ and A. This stems from the fact that as β_p increases, k_i becomes relatively more attractive for risk-sharing, while k_i and I are positively related because greater I require better compensation. The negative relationship between k_i and A is explained by economies of scale. Furthermore, k_i is also negatively related to δ. When δ increases, the cost of risk associated with providing information increases, which decreases the optimal amount of I and therefore decreases the compensation.

Finally, (13) offers some testable hypotheses. The sum of the parameters (k_b + k_i) is not related to β_p. Furthermore, it is positively related to I and negatively related to δ and A.

Recall from (12) that the expected rate is composed of market and information components and that the sum ($k_b + k_i$) is applied to information-based feedback. So, β_p has no impact on this part of the return and should not affect ($k_b + k_i$).

Furthermore, I require better compensation, so ($k_b + k_i$) and I are positively related. A δ higher implies a higher risk cost per unit of I and therefore less is required, which implies that ($k_b + k_i$) must be smaller.

Finally, A and ($k_b + k_i$) are negatively related as a consequence of economies of scale. In addition, keeping I, δ and A constant, k_b and k_i are negatively related. Therefore, it is expected that k_b should be bigger when k_i = 0 than when $k_b > 0$ and $k_i > 0$.

In this way, the empirical model can be written by the following regression:

$$k_b + k_i = \beta_0 + \beta_1 \ln(A_i) + \beta_2 \beta_{pi} + \beta_3 \delta_i + \beta_4 I_i + \varepsilon_i \quad (15)$$

where A_i is the fund's net worth i; β_{pi} it's the beta of the bottom i; δ_i is fund-specific return i; I_i is the return of the fund i arising from the information aggregated by the autonomous investment agent; and, ε_i is the random error of the regression. Table 1 shows the expected signs of the regression coefficients (15).

Table 1. *Expectation of the signs of the regression coefficients*

Coefficients	Signal	Justification
β_0	(+)	$k_b > 0$ and $k_i > 0$
β_1	(-)	Economy of scale
β_2	Undefined	Has no impact
β_3	(-)	Higher cost of risk
β_4	(+)	Higher compensation

Source: Elaborated by authors.

It has to be observed that I_i and δ_i are not easy to measure, as they represent the essence of the principal-agent problem. However, investors can use imperfect measures to help determine rate parameters. CAPM facilitates the use of Jensen's (1968) alpha as a proxy for I_i. In this case, alpha can be negative even if the advisor applies information to the portfolio if random portfolio-specific returns are negative.

On the other hand, δ_i is represented by the standard deviation of a fund's specific portfolio returns; that is, the standard deviation of the CAPM residuals. This is not a pure measure of δ_i because it matches δ_i and I_i multiplicatively. However, the effects of I_i cannot be deleted from δ_i by the simple division of δ_i per I_i, because nonsense numbers result when alpha is negative.

Furthermore, β_{pi} is calculated as proposed by Jensen (1969):

$$\beta_i = \frac{cov(r_i, R_M)}{\sigma^2(R_M)} \tag{16}$$

Thus, the alphas of the funds will be calculated using the CAPM model (Jensen, 1967), presented in equation (17):

$$r_i - R_L = \alpha_i + \beta_i(R_M - R_L) + \varepsilon_i \tag{17}$$

where r_i is the return of the fund i; α_i is the alpha of the background i; β_i it's the beta of the bottom i; R_M is the market return; R_L is the return on the risk-free asset; and, ε_i is regression error.

At this point, the following observation is in order. All costs incurred by an investment fund are covered by the investors of that fund by charging fees (Da Silva, Roma & Iquiapaza, 2018). In Brazil, funds charge a management fee from their investors to cover all of their expenses, including customer acquisition costs through commissions paid to investment advisors.

In this context, as the funds do not disclose $k_b + k_i$, but the administration fee (ta_i) that they charge from customers and given that $k_b + k_i \leq ta_i$, since the funds have to cost other expenses with the administration fee, there are no significant losses when approaching $k_b + k_i \approx ta_i$.

Therefore, the empirical model to be tested in the present study will be:

$$ta_i = \beta_0 + \beta_1 \ln(PL_i) + \beta_2\beta_i + \beta_3\sigma(\varepsilon_i) + \beta_4\alpha_i + \varepsilon_i \tag{18}$$

where ta_i is the fund management fee i; PL_i is the fund's net worth i; $\sigma(\varepsilon_i)$ is the standard deviation of the regression residuals (17); α_i is the alpha of the background i; and, ε_i is the regression error (18).

4. Results

4.1. Data

The used data were obtained from the Brazilian Association of Financial and Capital Markets Entities – ANBIMA, for the period from 2010 to 2020. Data from the Brazilian Securities Commission – CVM, from 2010 to 2020 were also used.

From the Brazilian Securities and Exchange Commission, the investment advisor's registration database was obtained. The data contains the names of investment advisors, the date of registration with the commission, the status of registration, and the date of this status. Figure 1 shows the evolution in the number of investment advisors in good standing with the commission, from October 2001 to December 2020.

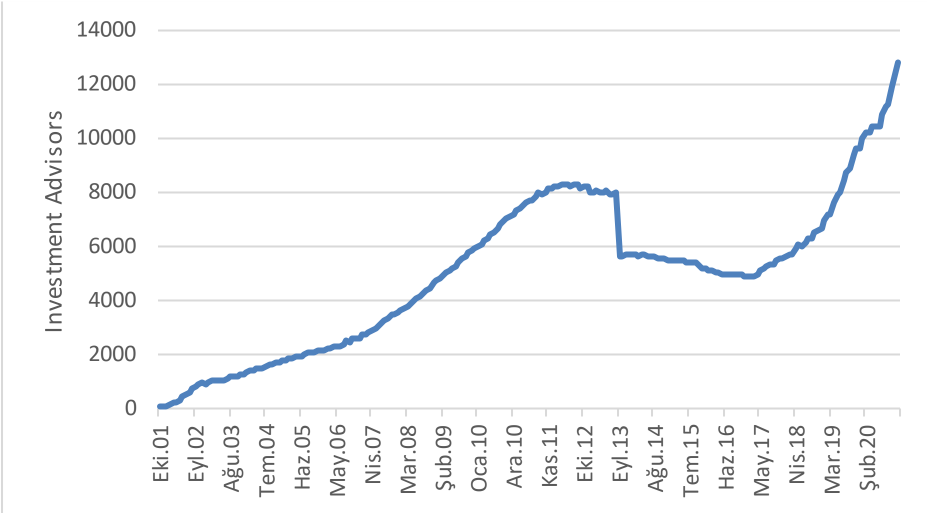

Figure 1. *Investment Advisors in Brazil*
Source: Elaborated by authors.

As can be seen, the number of investment advisors active in the Brazilian securities commission increased from 47, in October 2001, to 8,319, in May 2012, to 12,790, in December 2020. Data collected from the Brazilian Association of Financial and Capital Markets Entities contain information about investment funds such as net worth, net funding, profitability, number of funds, number of accounts, and management fee. Being classified into fixed-income funds, stock funds, and hedge funds. As the model seeks to measure whether investment advisors have an incentive to provide information and their knowledge to maximize investor returns and considering that in Brazil, fixed income funds play a leading role in portfolios, it was decided to separate the data into two subgroups: one with stock funds and hedge funds and the other with fixed-income funds.

Table 2 shows the descriptive statistics of the data used to estimate equation (18) in this work, for the subgroup of stock funds and hedge funds, while Table 3 presents the descriptive statistics of the fixed-income fund's data. It should be noted that the administration fees are stratified by the entry ticket, that is, AT1 is the fee for the entry ticket greater than or equal to BRL 1.00 and less than or equal to BRL 1,000.00; AT2 is the rate for the entrance ticket greater than BRL 1,000.00 and less than or equal to BRL 25,000.00; AT3 is the rate for the entry ticket greater than BRL 25,000.00 and less than or equal to BRL 100,000.00; and, AT4 is the fee for the entrance ticket greater than BRL 100,000.00.

Table 2. *Stock funds and Hedge funds*

	AT1	AT2	AT3	AT4	ln_PL	Beta	Residual	Alpha
Average	1.698	2.255	1.797	1.767	9.514	0.434	1.530	0.142
Median	1.965	2.411	1.750	1.900	9.272	0.280	0.897	0.063
Std. Dev.	0.400	0.293	0.123	0.360	1.711	0.436	1.601	0.649
Minimum	1.189	1.830	1.580	0.933	6.001	-0.140	0.114	-2.517
Maximum	2.205	2.689	2.048	2.262	13.215	2.050	7.980	2.072

Source: Elaborated by authors.

Table 3. *Fixed-Income funds*

	AT1	AT2	AT3	AT4	ln_PL	Beta	Residual	Alpha
Average	2.206	1.064	0.834	0.507	9.943	0.012	0.471	0.114
Median	2.481	1.052	0.884	0.529	10.795	0.007	0.195	0.021
Std. Dev.	0.615	0.040	0.088	0.039	2.565	0.009	0.684	0.401
Minimum	1.112	1.020	0.700	0.435	2.613	-0.648	0.002	-0.751
Maximum	2.817	1.135	0.907	0.543	13.480	0.187	3.336	2.742

Source: Elaborated by authors.

4.2. Model estimation

Equation (18) was estimated separately for the two subgroups and considered each of the four administration rate ranges. Table 4 presents the results of the regressions for the subgroup of stock funds and hedge funds, while Table 5 presents the results for the subgroup of fixed-income funds.

Table 4. *Stock funds and hedge funds*

	Dependent Variables			
	TA1	TA2	TA3	TA4
ln_PL	0.005	0.003	-0.006	0.017
	(0.0001)	(0.0001)	(0.0000)	(0.0001)
Beta	0.729***	0.504***	-0.182***	0.439***
	(0.0005)	(0.0004)	(0.0002)	(0.0006)
Residual	0.054***	0.042***	-0.013**	0.034**
	(0.0150)	(0.0120)	(0.0063)	(0.0172)
Alpha	-0.201***	-0.134***	0.045***	-0.099***
	(0.0320)	(0.0257)	(0.0134)	(0.0367)
Balanced Panel n = 23, T = 6, N = 138				

Note: ***p< 0.01, ** p<0.05, * p< 0.10
Source: Elaborated by authors.

Table 5. *Fixed-Income funds*

	Dependent Variables			
	TA1	TA2	TA3	TA4
ln_PL	-0.513***	-0.031***	-0.054***	-0.025***
	(0.0011)	(0.0001)	(0.0002)	(0.0001)
Beta	-1.264	-0.116	-0.033	-0.006
	(0.0111)	(0.0007)	(0.0017)	(0.0008)
Residual	-0.204	0.033**	-0.052	-0.011
	(0.2091)	(0.0141)	(0.0320)	(0.0144)
Alpha	-0.530**	-0.029**	-0.067**	-0.031**
	(0.2141)	(0.0144)	(0.0328)	(0.0148)
Balanced Panel n = 16, T = 6, N = 96				

Note: ***p< 0.01, ** p<0.05, * p< 0.10.
Source: Elaborated by authors.

The presence of heteroscedasticity was detected in the subgroup of stock funds and hedge funds. In this case, it is necessary to estimate the coefficients using the robust matrix of covariance a la Arellano (1987). Table 6 presents the results after this correction.

Table 6. *Stock funds and Hedge funds a la Arellano*

	Dependent Variables			
	TA1	TA2	TA3	TA4
ln_PL	0.005	0.003	-0.006	0.017
	(0.0001)	(0.0001)	(0.0000)	(0.0001)
Beta	0.729***	0.504***	-0.182***	0.439***
	(0.0010)	(0.0007)	(0.0003)	(0.0009)
Residual	0.054**	0.042***	-0.013***	0.034***
	(0.0207)	(0.0138)	(0.0041)	(0.0112)
Alpha	-0.201***	-0.134***	0.045***	-0.099***
	(0.0244)	(0.0208)	(0.0116)	(0.0277)
Balanced Panel n = 23, T = 6, N = 138				

Note: ***p< 0.01, ** p<0.05, * p< 0.10.
Source: Elaborated by authors.

Initially, it is highlighted that in the subgroup of stock funds and funds, the variables Beta, Residue, and Alpha are statistically significant to explain the Administration Fee, in the four AT ranges, at 5%. On the other hand, in the fixed-income funds subgroup, only ln_PL and Alpha were statistically significant about AT, in the four ranges. All regressions are statically significant (F and Wald test) and have explanatory power, with R2 ranging from 42.5% to 73.4% for the stock funds and hedge funds subgroup and from 20.8% to 31.0% for the fixed-income funds subgroup.

Considering the signs of the coefficients of the regressions of equation (18), it is observed that ln_PL is positively related to AT1, AT2, and AT4 and negatively related to AT3, for the subgroup of stock funds and hedge funds, that is, only in the range of An entry ticket greater than BRL 25,000 and less than or equal to BRL 100,000 is an economy of scale in the administration fee.

On the other hand, in the subgroup of fixed-income funds, ln_PL is negatively related to AT1, AT2, AT3, and AT4, which shows that there are economies of scale in fixed-income funds in all management fee ranges. Considering the Beta of funds, in the subgroup of stock funds and hedge funds, it is positively related to AT1, AT2, and AT4 and negatively related to AT3. On the other hand, in fixed-income funds, Beta is negatively related to AT1, AT2, AT3, and AT4. This negative relationship between Beta and rates was expected since Beta is the return on funds that do not depend on the actions of investment advisors.

Regarding Residue, in the subgroup of stock funds and hedge funds, it is positively related to AT1, AT2, and AT4 and negatively related to AT3. In fixed-income funds, Residual is positively related to AT2 and negatively related to AT1, AT3, and AT4.

Finally, Alpha is negatively related to AT1, AT2, and AT4 and positively related to AT3, in stock funds and hedge funds, while in fixed-income funds, Alpha is negatively related to AT1, AT2, AT3, and AT4. Alpha's positive relationship with rates implies that more information allocated by the investment advisor requires more compensation for its work.

Alpha is the proxy in the model that captures the effect of the information that the investment advisor places on the investment portfolio. In this sense, it was to be expected that the more information the investment advisor added to the portfolio, the higher its remuneration would be.

However, when observing the results, it is noted that in the case of fixed-income funds the relationship between Alpha and the management fee is negative for all ranges. This shows that the investment advisor has no incentive to place information in fixed income portfolios. Although the model indicates a positive relationship, from an economic point of view, the result obtained is coherent, as the portfolio's profitability is already known ex-ante and there is no way for the investment advisor to improve the portfolio's performance with the addition of more information, in normal situations. However, if the market behaves differently, as can be seen in this pandemic period, profitability may be negative and the investment advisor could use its information to minimize the investor's loss.

In stock funds and hedge funds, only in cases where the entry ticket is greater than BRL 25,000 and less than or equal to BRL 100,000 is there an incentive for investment advisors to add information to the portfolios. In the other bands, as the alpha ratio of the management fee is negative, there are no incentives for investment advisors to add information to investment portfolios.

One explanation for this may be the fact that previous results show a negative relationship between the management fee and the performance of funds (Gil-Bazo & Ruiz-Verdu, 2008; Rochman & Ribeiro, 2003; Lazo, Iquiapaza & Bressan, 2017). This negative relationship signals the occurrence of information asymmetry. That is, the management fee structure of Brazilian funds does not generate incentives to reduce the asymmetry of information between investors and fund managers, even with the presence of investment advisors.

5. Conclusion

The Brazilian capital market is booming and the challenges related to this growth are becoming clearer every day. One of the questions that arise is about the performance of investment advisors. Although it is a profession regulated by the Brazilian Securities Commission, its performance can be studied through the problem of principal and agent. The central point is to understand if agents have the right incentives to maximize the return of the investors who hire them or if they act in a way to maximize their interests.

Within the scenario, the work investigated the relationship between these investment advisors and their incentives to put their information about the market in favor of the investor's portfolio. Therefore, we analyzed the relationship between the fund management fee, as a proxy for the performance fee that investment advisors receive, and the characteristic variables of investment portfolios, notably the shareholders' equity, alpha, and beta of funds.

The results show that the incentive that investment advisors have to place information in investment portfolios is presented in the form of risk sharing between the agent and the investor. This is because the investment advisor has an incentive to take more risk and receive higher remuneration in the form of a performance fee as he adds more information to the portfolios.

This may indicate that the current system of commissioning Brazilian investment advisors by performance fee does not lead to a reduction in the asymmetry of information between investors and investment fund managers, since the work used the management fee as a proxy for the In terms of performance, it was not possible to directly capture the relationship between this rate and the behavior of agents, even though the performance rate is a fraction of the administration rate and it is expected that the behavior of both will be similar.

Furthermore, because of the large share of fixed income in the Brazilian market, investment advisors do not have incentives to provide all the information they have to increase the profitability of investors' portfolios. This result is in line with previous results both in the US market (Gil-Bazo & Ruiz-Verdu, 2008) and in the Brazilian market (Rochman & Ribeiro, 2003; Lazo, Iquiapaza & Bressan, 2017). Such results are useful for the literature that investigates the capital market by bringing evidence to Brazil, as well as for financial market agents in general who use this information in their decisions.

This study could be deepened as more data becomes available and if investment funds more accurately report their commission structures. It is also possible to investigate which ways would be more appropriate to deal with information asymmetry and how the Brazilian Securities Commission could act to reduce this asymmetry.

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