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Opacity in Hedge Funds: Does it Create Value for Investors and Managers?

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ABSTRACT
This paper investigates if opacity (as measured by derivatives usage) creates value for investors and the managers of hedge funds that charge performance fees. Since we do not identify a positive relation between opacity and managers' revenue, it is not possible to state that opacity is a source of manager's value creation for hedge fund investors and managers. However, considering that opacity is positively associated with risk-taking and negatively related with investors' adjusted returns, we suggest policies aiming at protecting investors, especially those less qualified. We examine a unique and comprehensive database related to the positions in derivatives taken by managers, which was enabled due to specific disclosure regulatory demands of the Brazilian Securities Exchange Commission, where detailed information on hedge funds' portfolio allocation should be provided on a monthly basis.

KEYWORDS
Value Creation, Opacity, Hedge Funds

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1. INTRODUCTION

Sato (2014, p. 2) claims that funds' opacity level is derived from the portfolio's non-disclosure and/or from the non-comprehension of the complex assets' pricing operated by funds. Brunnermeier, Oehmke and Jel (2009) define these complex assets as those that present cash flow structures that cannot be easily understood and projected by investors.

Thus, hedge funds can be considered the most opaque segment in the fund industry due to their operational complexity (this segment allows a variety of investments' strategies, especially leveraged operations). Thus, as a basic premise, we assume that hedge fund managers who invest more in derivatives increase their fund's opacity level. According to Arora *et al.* (2009), derivatives have many opacity sources such as the composition of the payout return equation and the large volume of negotiations associated with a low level of transparency in their markets.

Therefore, this paper aims to verify if opacity (as measured by derivatives usage) creates value for investors and managers of hedge funds that charge performance fees. To test our main hypothesis, we investigate if managers increase the funds' opacity to maximize their incomes to the detriment of the investors' interest, as indicated by Sato (2014). This can be confirmed by means of the empirical relation between derivatives and: (i) the funds' risk level, (ii) the investors' yields and (iii) the managers' remuneration (calculated on the fund's net worth).

In summary, we show that the high level of opaque assets (derivatives) raises the funds' risk but does not necessarily contribute to a higher adjusted return paid to investors either monthly or annually. Additionally, in regard to the intrinsic benefits received by managers, we doid not find a significant and positive relation between investments in derivatives and the fund's net flows in funds that charge performance fees. Our empirical findings indicate that the increase in opacity (as measured by percentage of the net worth invested in derivatives) does not create value for the investor (qualified or not). The coefficients of models exploring the manager's value generation dimension were not significant.

We innovate by exploring a unique derivative database composed of positions of swaps, options, futures, and forward markets. Although Koski and Pontiff (1999) considered the impact of investments made in options, futures, and securities interest rates on fund profitability and volatility, their data was supported by telephone interviews. Later, Chen (2011) used only dummies differentiating users and non-users and types of derivatives as a proxy for derivatives usage. Therefore, while the literature in this field has focused on the US market and does not apply detailed quantitative information on derivative investments (e.g., the volume traded), our analyses are based on such data, which are available for the Brazilian market but not for many other markets.

2. LITERATURE REVIEW

2.1. Opacity, Derivatives and risk-taking strategy

An investment fund is considered opaque if the information about its returns' volatility is incomprehensible or inaccessible for the majority of current or potential investors because of its non-disclosure and/or because of the use of complex assets to build the fund's portfolio (Sato, 2014). Arora *et al.* (2009) define derivatives as complex assets due to their payout composition, and the need for complex pricing models in order to evaluate their payoffs, as well as their low transparency level.

According to Chen (2011), managers can employ derivatives for both speculative and hedging purposes, depending if the derivatives usage is positively or negatively associated with risk. Cumming, Dai and Johan (2013) define the strategy of risk taking in investment funds as a potential source value creation for managers, since they usually change the investment funds' risk, aiming to affect theresults disclosed at the end of every year, and to attract higher inflows. Given that the managers of hedge funds are typically compensated by two types of fees (the fixed one, which is based on the funds' net worth value and the variable one, generally related to the funds' performance), this remuneration structure can be compared to a call portfolio. The owner of this call (represented by the manager) will choose a higher variance related to the asset's price, considering that the higher the variance, the greater the probability of the asset's value to exceed the strike price.

Moreover, Basak, Pavlova and Shapiro (2007) highlighted that, as the fund is prone to receive more resources if its relative performance (compared with its benchmark) is satisfactory, its manager will have implicit incentives to distort his choices of portfolio's asset allocation, aiming to amplify the higher inflows' probability. The positive relation between flows and relative performance triggers this phenomenon because managers' remuneration is connected to the amount managed.

Managers running investment funds with low performance are more likely to increase the tracking error variance as measured by the difference between fund's return related to its benchmark than to raise the fund's standard deviation. Accordingly, the agent´s risk taking behavior is characterized by his or her tolerance level and the fund's return position related to its reference index. This strategy may generate a portfolio with a return/risk relationship that is considerably distinct from the one preferred by investors, notably in the context of funds that present a low disclosure level (Basak, Pavalova, & Shapiro, 2008).

American studies have empirically found a negative relation between derivatives and risk-taking strategies. Koski and Pontiff (1999) analyzed 675 US stock funds from 1992 to 1994, and observed that 21% of their sample used derivatives for hedging purposes, and derivatives users and non-users did not present significant differences in comparison with their funds' adjusted returns. In addition, Chen (2011) demonstrated that (considering data for 2006 only), 71% of the hedge funds employed derivatives to reduce risk (total, systematic and non-systematic). According to Aragon and Martin (2012) stock options were employed by hedge funds to reduce risk and increase Sharpe's ratios. Recently, Cici and Palacios (2015) also evaluated the positions of options maintained by managers of US stock funds from 2003 to 2010, verifying that options reduced the funds' risk but were not correlated with funds' performance.

2.2. The investor's level of qualification and the fund's performance

As this article analyzes whether the use of derivatives creates value for hedge fund investors and managers who charge a performance fees, considering the segment of qualified and non-qualified investors, it is important to highlight additional studies that explored this subject. Paz, Iquiapaza and Bressan (2017), for example, analyzed investor influence on monitoring the performance of equity investment funds from January 2005 to April 2015. They found that the net annual return on institutional funds was 0.15% higher than the return on retail funds. Using gross returns, they found that retail funds generated, on average, a yearly return of 10%, while institutional funds obtained only 8.93% per annum. This difference between net and gross return measures is possibly due to the existence of a management fee structure that is less favorable to non-qualified investors. Regarding the risk-adjusted performance measure, the authors confirmed that funds directed to institutional investors achieve the highest levels.

On the other hand, James and Karceski (2006) compared the return on American mutual funds, both retail and institutional, noting that, although institutional funds have significantly lower management fees, they did not necessarily show, on average, higher returns than retail funds.

Del Guercio and Tkac (2002) compared the relationship between the flows and the performance of retail funds and fiduciary pension funds. It was observed that, in contrast to mutual fund investors, pension fund investors tend to punish underperforming fund managers by redeeming their shares. However, these resources are not necessarily reallocated in the winning funds. This behavior can be explained by the fact that investors in pension funds (as compared to investors of retail funds) employ, more frequently, risk-adjusted return measures during the assessment of managers.

Additionally, using a sample of American mutual funds, Gil-Bazo and Verdú (2009) observed that the funds with the worst performance charged higher rates. This phenomenon was more pronounced in the sample of funds destined for less qualified investors. Salganik (2015) compared two samples of American equity funds: the first focused on institutional investors and the second on retail investors. He noted that institutional fund clients used more sophisticated selection criteria, such as risk-adjusted return measures (Jensen's alpha, tracking error, among others) and were less sensitive to expenses and fees charged by the fund. This was possibly due to the fact that economies of scale provided institutional investors with more access to the services of management experts, and reduced the costs of looking for investment opportunities and access to diversified portfolios.

3. METHODOLOGICAL PROCEDURES

3.1. The sample

Due to regulatory issues, Brazil has a unique data set on the portfolio allocation in hedge funds. This information is (compulsorily) provided monthly by all hedge funds while this reporting standard is not observed in other countries with well-developed hedge fund industries, such as the United Kingdom or the United States. Our sample period is from January 2010 (the oldest data available in the database given that before this time Economatica® did not register this information precisely) to December 2015. It is restricted to the 352 Brazilian hedge funds that charge performance fees, since this research evaluates the possible relation between opacity and investors and managers value creation within the context of these funds. Exactly 332 hedge funds are currently active and 20 are inactive, all of them listed on the Brazilian Securities and Exchange Commission (CVM). Among these 352 Brazilian hedge funds (also called multimarket funds according to Joaquim and Moura (2011)), 309 were classified as Strategy; 37 as Allocation and 6 as Investment Abroad in line with the Anbima's Classification[1].

It is important to highlight that Brazilian hedge funds differ from US hedge funds in some aspects such as: i) regulation (Brazilian hedge funds face stricter legal regulation); ii) liquidity (US hedge funds present a 3 to 6 monthlockup period, while,in Brazil, hedge_funds present general daily liquidity); iii) categories divisions (US hedge funds are more varied and specialized than Brazilian ones); iv) derivatives investments (in Brazil, the derivative market is less diversified and liquid) (Petersen, 2007).

Only open-end funds composed of non-exclusive and non-restricted shares were selected. The analysis was conducted on three segments of hedge funds. According to CVM (2014), the first one refers to non-qualified investors, investments lower than BRL 1,000,000.00 (approximately US$ 298,000[2]) and does not require a qualification certificate. The second segment refers to qualified investors, investments superior to BRL 1,000,000.00 and a qualification certificate. The third segment is composed of professional investors with professional certifications and investments over BRL 10,000,000.00 (approximately US$ 2,980,000). In accordance with these qualification levels, our sample is composed of 352 funds as follows: 115 directed at professional and qualified investors (32.67% of the sample) and 237 directed at retail investors (67.33% of the sample).

This segmentation is based on Sato (2014) who claims that the increase in the fund's opacity could affect different investors (according to their qualification level). Probably, retail investors do not have much access to information related to portfolio composition and would consequently have more difficulties in evaluating their fund's risk.

3.2. Empirical Models

Aiming to verify if opacity creates value for investors and for managers, we analyzed the relation between the derivatives usage and the following variables: i) risk level (expressed by Models 1 to 4); ii) investor remuneration (presented in Models 5 and 6) and iii) the manager's income (represented by Model 7). Each analysis is presented in distinct subsections below[3].

3.2.1. Models regarding investor's risk

Based on the models proposed by Chen (2011), Opazo, Raddatz and Schmukler (2015) and Basak, Pavlova and Shapiro (2008), our Models 1, 2, 3 and 4 (M-1, M-2, M-3 and M-4, respectively) are expressed as:

$$\frac{\sigma_{risk\ i,m}}{\sigma_{risk\ i,m-1}} = \beta_1\sigma_{total\ i,m-1} + \beta_2 Dmang_{\ i} + \beta_3 r_{\ i,m} + \beta_4 r_{\ i,m-1} + \beta_5\sum_{l=0}^{1}\Delta Futc_{\ i,m-l} + \beta_6\sum_{l=0}^{1}\Delta Forwc_{\ i,m-l} + \beta_7\sum_{l=0}^{1}\Delta Opt_{\ i,m-l} + \beta_8\sum_{l=0}^{1}\Delta Swap_{\ i,m-l} + \beta_9 Dleverg_{\ i} + \beta_{10} Size_{\ i,m} + \beta_{11} Age_{\ i,m} + \sum_{k=12}^{25} Rf_m + \beta_{26} Dcat_i + \beta_{27} Dyear_i + \epsilon_{i,m}$$

M-1

where, in M-1, σ_{risk} is measured as σ_{total} and the dependent variable becomes:

$\frac{\sigma_{\text{total i,m}}}{\sigma_{\text{total i,m}-1}}$ = variation of the fund's i monthly total risk, in month m (Chen, 2011, p. 1097). This variable is calculated as:

$$\sigma_{total\ i,m} = \sqrt{\frac{1}{n-1}\sum_{d=1}^{n}\left(r_{i,d} - \overline{r}_{i,m}\right)^2} \times \sqrt{21} \qquad (1)$$

The variable $r_{i,d}$ represents the return of fund i, on day d, while $\overline{r}_{i,m}$ is the daily mean return of fund i. We consider 21 business days in each month.

In M-2, σ_{risk} is measured as $\sigma_{systematic}$ and the dependent variable becomes:

$\frac{\sigma_{\text{systematic } i,m}}{\sigma_{\text{systematic } i,m-1}}$ = variation of the fund's i monthly systematic risk, for month m (as suggested by Chen, 2011, p. 1097). Since fund managers (mainly the better informed ones) can enhance their fund´s performance through leverage (Chen, 2011, p.1075), the systematic risk could be associated with derivatives usage. Derivatives amplify the exposure of funds to market factors such as exchange rate risk, interest rate fluctuation, or stocks (by margin deposits, as is the case of future contracts, or even paying a premium value, as in the case of options). The systematic risk is measured using the same procedures employed by Alexander (2008, p. 11), over beta estimation as pointed out in Chen (2011), since its calculation includes the covariance matrix of the risk factors returns. In this paper, we measure the exposure of funds to the following risk factors: foreign currency (dollar and euro exchange rates), domestic stock index market returns (Ibovespa return and domestic Carhart (1997) factors), domestic bonds (Ima-geral, Ida-geral), domestic commodities price index (Icb), domestic inflation rate (Ipca) and domestic interest rate (Cdi-over).This set of variables is similar to those considered by Bali Brown and Caglayan (2011) but it takes into account their adjustment to the Brazilian market.

M-3 is defined by $\sigma_{non\text{-}systematic}$ and the dependent variable becomes:

$\frac{\sigma_{\text{nonsystematic } i,m}}{\sigma_{\text{nonsystematic } i,m-1}}$ = variation of the fund's i monthly nonsystematic risk and is computed between the difference of total and systematic risk.

M-4 is given by:

$$\frac{\sigma_{tracking\ error\ i,m}}{\sigma_{tracking\ error\ i,m-1,}} = \beta_1 \Delta\sigma_{tracking\ error\ i,m-1} + \beta_2 Dmang_{\,i} + \beta_3 r_{\,i,m} + \beta_4 r_{\,i,m-1} + \beta_5 \sum_{l=0}^{1} \Delta Futc_{\,i,m-l} + \beta_6 \sum_{l=0}^{1} \Delta Forwc_{\,i,m-l} + \beta_7 \sum_{l=0}^{1} \Delta Opt_{\,i,m-l} + \beta_8 \sum_{l=0}^{1} \Delta Swap_{\,i,m-l} + \beta_9 Dleverg_{\,i} + \beta_{10} Size_{\,i,m} + \beta_{11} Age_{\,i,m} + \sum_{k=12}^{25} Rf_m + \beta_{26} Dcat_i + \beta_{27} Dyear_i + \beta_{28} Dbench_i + \epsilon_{i,m}$$

M-4

where:

$\frac{\sigma_{tracking\ error\ i,m}}{\sigma_{\text{tracking error } i,m-1}}$ = variation of the fund's i monthly *tracking error* risk, for month m (BASAK; PAVLOVA;SHAPIRO, 2008). This variable is calculated as follows:

$$\sigma_{tracking\ error\ i,m} = \sqrt{\frac{1}{n-1}\sum_{d=1}^{n}\left(r_{i,d} - rbench_{i,d}\right)^2} \times \sqrt{21} \qquad \textbf{(2)}$$

The variable $r_{i,d}$ represents the return of fund *i*, on day *d*, while $rbench_{i,d}$ is the daily return of the fund' benchmark (employed as reference for the performance calculation).

A description of all the independent variables of each model is presented in Table 1.

3.2.2. Models regarding investor's return

Does the strategy to increase fund risk really raise the investor's adjusted return? Models 5 and 6 (M-5 and M-6, respectively) are proposed to assess this relationship. While M-4 is focused on monthly adjusted return (measured by the adjusted Sharpe ratio), M-6 refers to an annual return.

These models test if opaque assets (derivatives) are related to short and long term adjusted return. M-5 and M-6 are based on Edwards and Caglayan (2001), Do, Faff and Wickramanayake (2005) and Soydemir, Smolarski and Shin (2014):

$$Dasr_{i,m} = \beta_1 Dasr_{i,m-1} + \beta_2 Dmang_{i} + \beta_3 r_{i,m-1} + \beta_4 \sum_{l=0}^{1} \Delta Futc_{i,m-l} + \beta_5 \sum_{l=0}^{1} \Delta Forwc_{i,m-l} + \beta_6 \sum_{l=0}^{1} \Delta Opt_{i,m-l} + \beta_7 \sum_{l=0}^{1} \Delta Swap_{i,m-l} + \beta_8 Dleverg_{i} + \beta_9 Size_{i,m} + \beta_{10} Size2_{i,m} + \beta_{11} Age_{i,m} + \beta_{12} Smb_{i,m} + \beta_{13} Hml_{i,m} + \beta_{14} Wml_{i,m} + \beta_{15} Premium_{i,m} + \beta_{16} Mang_{Fee\ i} + \sum_{k=17}^{30} Rf_{i,m} + \beta_{31} Dcat_i + \beta_{32} Dyear_i + \epsilon_{i,m}$$

M-5

$$Dasr_{i,y} = \beta_1 Dasr_{i,y-1} + \beta_2 Dmang_{i} + \beta_3 r_{i,y-1} + \beta_4 \sum_{l=0}^{1} \Delta Futc_{i,y-1} + \beta_5 \sum_{l=0}^{1} \Delta Forwc_{i,y-1} + \beta_6 \sum_{l=0}^{1} \Delta Opt_{i,y-1} + \beta_7 \sum_{l=0}^{1} \Delta Swap_{i,y-1} + \beta_8 Dleverg_{i} + \beta_9 Size_{i,y} + \beta_{10} Size2_{i,y} + \beta_{11} Age_{i,y} + \beta_{12} Smb_{i,y} + \beta_{13} Hml_{i,y} + \beta_{14} Wml_{i,y} + \beta_{15} Premiun_{i,y} + \beta_{16} Mang_{Fee\ i} + \sum_{k=17}^{30} Rf_{i,y} + \beta_{31} Dcat_i + \beta_{32} Dyear_i + \epsilon_{i,y}$$

M-6

Table 1
Description of the independent variables (M-1 to M-7)

	Model							
Variables	M-1	M-2	M-3	M-4	M-5	M-6	M-7	Theoretical Background
ΔFutc$_{i,m}$: variation of the monthly percentage invested in future contracts by fund i in month m, where ΔFutc$_{i,m,y}$ = Futc$_{i,m,y}$ - Futc$_{i,m-1,y}$.	√	√	√	√	√	√ *	√	According to Chen (2011) managers can employ derivatives for speculative or hedging purposes, which can affect the risk assumed by fund in the long term.
ΔForwc$_{i,m}$: variation of the monthly percentage invested in forward contracts by fund i in month m, where ΔForwc$_{i,m,y}$ = Forwc$_{i,m,y}$ - Forwc$_{i,m-1,y}$.	√	√	√	√	√	√ *	√	
ΔOpt$_{i,m}$: variation of the monthly percentage invested in option by fund i in month m, where ΔOpti,m,y = Opt$_{i,m,y}$ - Opt$_{i,m-1,y}$	√	√	√	√	√	√ *	√	
ΔSwap$_{i,m}$: variation of the monthly percentage invested in swaps by fund i in month m, where ΔSwap$_{i,m,y}$ = Swap$_{i,m,y}$ - Swap$_{i,m-1,y}$.	√	√	√	√	√	√ *	√	
Dmang$_i$: dummy regarding the type of the relation between the fund's administrator and manager. It is 0 if both belong to the same financial group and 1 otherwise.	√	√	√	√	√	√		As suggested by Iquiapaza (2009) it is important to verify if the manager and the administrator belong to the same financial group (since it would contribute to conflict of interest problems), which would affect the funds' performance.
r$_{i,m}$: monthly percentage return obtained by fund i, in month m.	√	√	√	√				Opazo, Raddatz and Schmukler (2015) employed both variables to explain the fund's risk changing. The variable r$_{i,m-1}$ was also employed by Agarwal, Daniel and Naik (2009) to verify the impact of past performance on present return..
r$_{i,m-1}$: monthly percentage return obtained by fund i, in month m-1.	√	√	√	√	√	√ *	√	
Dleverg$_i$: dummy equal to 1 if fund *i* is allowed to adopt leverage strategies and equal to 0 otherwise.	√	√	√	√	√	√	√	Chen (2011) used this dummy as a proxy for funds that are able or not to use derivatives for speculative purposes.
Size$_{i,m}$: natural logarithm of the fund's net worth in month m.	√	√	√	√	√	√ *	√ †	Employed by Edwards and Caglayan (2001), Do, Faff and Wickramanayake (2005), and Soydemir, Smolarski and Shin (2014) as a factor to explain the hedge fund performance.

Table 1
Cont.

	Model							
Variables	M-1	M-2	M-3	M-4	M-5	M-6	M-7	Theoretical Background
Age$_{i,m}$: natural logarithm of the difference between the current date (or the liquidation date, if the fund ends before the last data in our sample period) and the fund's opening date.	√	√	√	√	√	√ *	√	According to Brown; Harlow and Starks (1996) younger funds invest more in risky assets, trying to get a better performance, mainly when they do not have a long return time series. It was also employed by Edwards and Caglayan (2001) in their study of hedge funds' return.
Dbench$_i$: dummy equal to 1 if fund i is below the benchmark (the reference index used to calculate the performance fee) and 0, otherwise.				√				According to Basak, Pavlova and Shapiro (2008) risk management practices also account for benchmarking.
Dcat$_i$: dummies representing the three Anbima's (Brazilian Association of Financial Market Institutions) classifications of funds such as "Strategy" (Dcat1$_i$), "Allocation" (Dcat2$_i$) and "Investment abroad" (Dcat3$_i$)**.	√	√	√	√	√	√	√	Chen (2011) grouped the funds according to their categories in their risk and performance analyses
Dyear$_i$: dummies representing each year of the sample (time fixed effect).	√	√	√	√	√	√	√	It was an effort to capture the effect of high volatilities periods occurred in Brazil, which would affect our analysis
Rf$_m$: In terms of "risk factors" the following variables are considered (in monthly periods	√	√	√	√	√	√ *	√	It is in accordance with Bali, Brown and Caglayan (2011): stocks (Ibrx-$_{100m}$, Ibovespa$_m$ and Carhart(1997) factors); government bonds (ima-geral $_m$); corporate bonds (Ida-Geral$_m$); domestic interest rates (Cdi-over$_m$; Selic-over$_m$); foreign currency (dollar (Dol$_m$) and euro (Eur $_m$) exchange rates); commodities price (Icb $_m$); and inflation (Ipca $_m$).
Size2 $_{i,m}$: the inverse of the natural logarithm of the value of fund assets in month m.					√	√ *		Factor used by Edwards and Caglayan (2001) for capturing the possible non-linear relation between performance and fund's size.
Mang$_{Feei}$: management fee charged by fund i (percentage of net worth).					√	√	√	Sirri and Tufano (1998) highlight that funds which decrease their manager fees in a particular period are more prone to grow faster.

Table 1
Cont.

Variables	Model M-1	M-2	M-3	M-4	M-5	M-6	M-7	Theoretical Background
Smb$_{i,m}$: return of the low market capitalization stock portfolio minus the return of the high market capitalization stock portfolio for fund i in month m.					√	√ *		Fama and French (1993) employed this factor to estimate hedge fund returns.
Premium$_{i,m}$: return of the domestic stock market portfolio (Ibovespa) minus the return of the domestic risk-free asset (Cdi-over) for fund i in month m.					√	√ *		Fama and French (1993) employed this factor to estimate hedge fund returns.
Hml$_{i,m}$: return of a stock portfolio with a high ratio of accounting value / market value minus the return of a stock portfolio with a low ratio of accounting value / market value for fund i in month m.					√	√ *		Fama and French (1993) employed this factor to estimate hedge fund returns.
Wml$_{i,my}$: return of a winner stock portfolio less the return of a loser stock portfolio for fund i in month m.					√	√ *		Fama and French (1993) employed this factor to estimate hedge fund returns.
cmret$_{i,y-1}$: annual return of fund i in year y-1.						√		This variable aims to capture the effect of past return on present return as observed by Agarwal, Daniel and Naik (2009).
Volret$_{i,m}$: standard deviation of the fund *i*'s daily return in month m and year *y* multiplied by √ 21.							√	Huang, Wei and Yan (2007) observed that the funds' flows could be impacted by the funds' return volatility.
$\mathbf{r}^2_{i,m-1}$: monthly squared return obtained by fund *i* in month *m-1*.							√	As stated by Sirri and Tufano (1998) and by Huang, Wei and Yan (2007), the funds' flows are non-linear related with their past performance. Those with recently better performance suffer higher inflows while those with worse return suffer lower outflows.
Dloser$_{i,m-1}$: performance dummy equal to 1 if the fund's monthly return lagged in 1 month is in the group of loser funds (those with return lower than or equal to percentile 20), and 0, otherwise.							√	As stated by Huang, Wei and Yan (2007) these dummies would be helpful for the estimation of non-linear relations between funds' flow and performance.

Table 1
Cont.

Variables	M-1	M-2	M-3	M-4	M-5	M-6	M-7	Theoretical Background
$Dmid_{i,m-1}$: performance dummy equal to 1 if the fund's monthly return lagged in 1 month in the group of middle funds (those with return lower than 80 or higher than percentile 20), and 0, otherwise.							√	As stated by Huang, Wei and Yan (2007) these dummies would be helpful for the estimation of non-linear relations between funds' flow and performance.
$Dwin_{i,m-1}$: performance dummy equal to 1 if the fund's monthly return lagged in 1 month, is in the group of loser funds (those with return higher than or equal to percentile 80), and 0, otherwise.							√	As stated by Huang, Wei and Yan (2007) these dummies would be helpful for the estimation of non-linear relations between funds' flow and performance.

* indicates annual frequency. † indicates lagged in one month.

**The "Strategy" classification includes funds whose operations follow the strategies selected by manager. All of them allow leverage. The "Allocation" classification encompasses funds directed to long-term return. Some of them can have leverage operations. The "Investment abroad" classification considers funds that invest more than 40% of their net worth in assets that are traded abroad. All of them allow leverage operations.

Source: Elaborated by authors.

Since there is empirical evidence that hedge funds return distributions are often asymmetric, our dependent variable in these two models is the adjusted Sharpe ratio proposed in Koenig (2004, p. 44). The additional variables included in M-5 and M-6 are:

$Dasr_{i,m}$ = the difference between the Sharpe Adjusted Ratio in months *m* and *m-1* for fund *i*..

$Dasr_{i,y}$ = the difference between the adjusted Sharpe ratio between years *y* and *y-1* for fund *i*.

The independent variables of M-5 and M-6 are described in Table 1. The risk factors (variable $Rf_{m,y}$) are the same ones used in Models 1 (M-1) to 4 (M-4).

3.2.3 Models regarding managers remuneration

The manager could raise the portfolio's risk aiming to inflate the return, to increase the fund's net worth, and consequently receive more benefits (due to the fact that the performance fee is calculated based on this amount). Thus, it is important to check if investments in derivatives are positively correlated with this net worth's increment. This is investigated by means of Model 7 (M-7). Following Ferreira *et al.* (2012), the variation in the net worth is calculated as:

$$Flow_{i,m} = \frac{Nw_{i,m} - \left[Nw_{i,m-1} \times \left(1 + r_{i,m}\right)\right]}{Nw_{i,m-1}} \quad (3)$$

where:
Flow $_{i,m}$ = variation of the fund's net worth for month *m* ;
Nw$_{i,m,}$ = fund *i*'s net worth for month *m;*
Nw$_{i,m-1}$ = fund *i*'s net worth for month *m-1;*
r$_{i,m}$ = log monthly return obtained by fund *i*, in month *m.*

The variables in Model 7 were selected in line with the factors used in Sirri and Tufano (1998), Greene and Hodges (2002), Agarwal and Naik (2004), Schiozer and Tejerina (2013), Cashman *et al.* (2014) and Berggrun and Lizarzaburu (2015):

$$Flow_{i,m} = \beta_1 Flow_{i,m-1} + \beta_2 Size_{\,i,m-1} + \beta_3 Age_{\,i,m} + \beta_4 Mang_{\,Fee\,i} + \beta_5 Volret_{\,i,m} + \beta_6 r_{\,i,m-1} + \beta_7 r^2{}_{\,i,m-1} + \beta_8 \sum_{l=0}^{1} \Delta Futc_{\,i,m-l} + \beta_9 \sum_{l=0}^{1} \Delta Forwc_{\,i,m-l} + \beta_{10} \sum_{l=0}^{1} \Delta Opt_{\,i,m-l} + \beta_{11} \sum_{l=0}^{1} \Delta Swap_{\,i,m-l} + \beta_{12} Dleverg_{\,i} + \sum_{k=13}^{26} Rf_{i,m} + \beta_{27} Dcat_i + \beta_{28} Dyear_i + \epsilon_{i,m}$$

M-7

A description of all the independent variables in this model is presented in Table 1. The three performance dummies (Dloser$_{i,m-1}$, Dmid$_{i,m-1}$ and Dwin$_{i,m-1}$) were included in M-7 in order to investigate if the fund's relative return (compared to its peers) would affect the net worth's variation as stated by Berks and Tonks (2007).

Before estimating the models, we ran collinearity and stationarity tests. Then, all models were calculated using the Generalized Method of Moments (GMM). The GMM estimator can simultaneously address the main problems of endogeneity, which is commonly found in research with observational data.

4. RESULTS AND DISCUSSION

4.1. Summary Statistics

Since GMM models present estimators that are easily influenced by outliers, as pointed out by Lucas, Dijk and Kloek (2009), we winsorize our data by adjusting the values below and above percentiles 1 and 99, respectively, of the total sample distribution. The basic statistics computed for the dependent variables (from M-1 to M-7) are detailed as follows:

As for the monthly total risk (measured by the standard deviation of daily returns multiplied by $\sqrt{21}$), the systematic risk, and the tracking error, Table 2 shows that, based on the mean and the median, the funds aimed at professional investors are the riskier ones. In contrast to the adjusted Sharpe ratio, by observing the quantiles and the mean, one can note that the funds directed at non-qualified investors offer a lower risk-adjusted return than those offered to the non-retail public.

Furthermore, funds for non-qualified investors have lower values of net flows (based on the 1st quantile, mean and the median observations).

The summary statistics concerning the percentage of the funds' net worth invested in derivatives (opaque assets) are reported in Table 3:

Table 2
Summary statistics for the dependent variables (after winsorization)

Investor Type	Variable	Minimum	1st Quartile	Median	Mean	3rd Quartile	Standard Deviation	Maximum
Professional	Monthly Total Risk	0.00041	0.00366	0.00773	0.01286	0.01660	0.01399	0.07530
	Monthly Systematic Risk	0.00025	0.00287	0.00606	0.00986	0.01291	0.01105	0.06660
	Monthly Non-Systematic Risk	0.00001	0.00048	0.00113	0.00164	0.00216	0.00173	0.00920
	Monthly Tracking Error Risk	0.00029	0.00361	0.00768	0.01257	0.01608	0.01381	0.07531
	Monthly Adjusted Sharpe Ratio	-4.50	-0.41	0.45	3.58	1.03	19.14	176.10
	Annual Adjusted Sharpe Ratio	-8.34	-0.81	0.19	8.26	1.76	48.81	366.23
	Monthly Net Flow (In Thousand Reais)	-83438	-452.50	0.67	351.1	225.70	19.381	84.365
Qualified	Monthly Total Risk	0.00002	0.00244	0.00589	0.01057	0.01272	0.01399	0.07775
	Monthly Systematic Risk	0.00001	0.00184	0.00479	0.00885	0.01023	0.01230	0.07029
	Monthly Non-Systematic Risk	0.00000	0.00028	0.00084	0.00171	0.00208	0.00235	0.01263
	Monthly Tracking Error Risk	0.000001	0.00231	0.00583	0.01010	0.01259	0.01301	0.07589
	Monthly Adjusted Sharpe Ratio	-5.93	-0.69	0.12	1.17	1.39	7.81	66.36
	Annual Adjusted Sharpe Ratio	-11.58	-0.79	-0.04	1.49	1.26	9.43	74.17
	Monthly Net Flow (In Thousand Reais)	-85953	-1747	0.05	-1.171	357	16.264	69.183
Non-Qualified	Monthly Total Risk	0.00012	0.00326	0.00650	0.00906	0.01187	0.00852	0.04486
	Monthly Systematic Risk	0.00008	0.00242	0.00497	0.00738	0.00952	0.00752	0.04063
	Monthly Non-Systematic Risk	0.00004	0.00040	0.00110	0.00297	0.00366	0.00437	0.02320
	Monthly Tracking Error Risk	0.00001	0.00315	0.00635	0.00895	0.01168	0.00867	0.04644
	Monthly Adjusted Sharpe Ratio	-4.9	-0.81	-0.04	0.06	0.82	1.83	5.67
	Annual Adjusted Sharpe Ratio	-6.90	-0.90	-0.12	0.43	0.76	3.77	28.43
	Monthly Net Flow (In Thousand Reais)	-82.473	-3.303	-230	-1.231	352	18.115	83.713

This table reports the summary statistics for the dependent variables of Models 1 to 6 according to the investors' qualification level. To treat outliers' presence, all the data was winsorized considering extreme values below percentile 1 and above percentile 99.

Source: Elaborated by authors.

Table 3
Basic Statics related to the funds' net worth invested in opaque assets (derivatives) after winsorization

Investor	Variable (as a percentage of net worth)	Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum	Number of funds: Percentage > Mean	Number of funds: Percentage <= Mean
Professional	Future Market-Short Position	-14.280%	-0.129%	0.000%	-0.612%	0.038%	27.800%	16	10
	Future Market-Long Position	-4.423%	-0.023%	0.000%	0.705%	0.111%	23.680%	6	20
	Call Option –Sellers Position	-8.886%	-0.107%	0.000%	-0.304%	0.000%	0.000%	14	12
	Call Option –Buyers Position	0.000%	0.000%	0.056%	0.607%	0.311%	12.820%	8	18
	Put Option –Sellers Position	-3.506%	-0.145%	-0.018%	-0.185%	0.000%	0.000%	11	15
	Put Option –Buyers Position	0.000%	0.000%	0.058%	0.349%	0.288%	6.718%	7	19
	Swap to pay	-11.810%	-0.029%	0.000%	-0.189%	0.000%	0.000%	9	17
	Swap receivable	0.000%	0.000%	0.000%	0.490%	0.146%	11.280%	8	18
	Forward- Purchases receivables	-1.071%	0.000%	0.000%	0.470%	0.043%	61.840%	8	18
	Forward - Sales receivables	-2.608%	0.000%	0.000%	0.803%	0.306%	18.120%	5	21
Qualified	Future Market-Short Position	-14.280%	-0.048%	0.000%	0.702%	0.127%	30.890%	9	80
	Future Market-Long Position	-4.423%	-0.015%	0.000%	0.640%	0.104%	23.680%	13	76
	Call Option –Sellers Position	-8.886%	-0.394%	-0.069%	-0.519%	0.000%	0.000%	41	48
	Call Option –Buyers Position	0.000%	0.000%	0.150%	1.032%	0.881%	12.820%	30	59
	Put Option –Sellers Position	0.000%	-4.315%	-0.185%	-0.031%	-0.296%	0.000%	49	40
	Put Option –Buyers Position	0.000%	0.000%	0.068%	0.464%	0.398%	6.8700%	23	66
	Swap to pay	-38.050%	-0.028%	0.000%	-0.149%	0.000%	0.000%	30	59
	Swap receivable	0.000%	0.000%	0.000%	0.396%	0.069%	57.320%	16	73
	Forward- Purchases receivables	-0.584%	0.000%	0.000%	0.173%	0.000%	17.400%	25	64
	Forward - Sales receivables	-3.874%	0.000%	0.000%	0.808%	0.061%	49.590%	17	72

Table 3
Cont.

Investor	Variable (as a percentage of net worth)	Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum	Number of funds	
								Percentage > Mean	Percentage <= Mean
Non-Qualified	Future Market-Short Position	-14.280%	-0.052%	0.000%	0.508%	0.070%	30.890%	17	220
	Future Market-Long Position	-4.423%	-0.010%	0.000%	0.549%	0.051%	23.680%	33	204
	Call Option –Sellers Position	-8.886%	-0.226%	-0.014%	-0.421%	0.000%	0.000%	151	86
	Call Option –Buyers Position	0.000%	0.000%	0.028%	0.660%	0.359%	12.820%	72	165
	Put Option –Sellers Position	0.000%	-4.315%	-0.112%	-0.001%	-0.196%	0.000%	127	110
	Put Option –Buyers Position	0.000%	0.000%	0.011%	0.379%	0.226%	6.870%	74	163
	Swap to pay	-39.860%	0.000%	0.000%	-0.206%	0.000%	0.000%	129	108
	Swap receivable	0.000%	0.000%	0.000%	0.538%	0.000%	50.600%	35	202
	Forward- Purchases receivables	-23.130%	0.000%	0.000%	0.146%	0.000%	72.720%	68	169
	Forward - Sales receivables	-5.096%	0.000%	0.000%	0.546%	0.000%	60.270%	44	193

To treat outliers' presence, all the data was winsorized considering extreme values below percentile 1 and above percentile 99.The negative percentages are related to: i) values to be paid; ii) negative adjustments of buyers or sellers positions; iii) option sale operations (these transactions are registered with a negative sign in the monthly portfolio balance sheet because, despite leading to cash inflows, they may also result in potential obligations).

Source: Elaborated by authors.

In summary, it can be observed (see Table 3) that managers of funds directed to less qualified investors employ lower mean levels of derivative contracts compared to funds focused on qualified and professional investors, which can also be inferred based on the results in Table 2 (since these last two classes presented the higher risk levels). Furthermore, as shown in Table 2, the risk premium received by non-qualified investors is lower than that received by the qualified group, which could harm their wealth in the long run.

4.2. Results

The variation of the fund's net worth value invested in derivatives in month *m,* year *y* (ΔDerivi,m,y) is calculated as the sum of the positions in four markets: swaps, future and forward contracts, and options. Additionally, the models were calculated based on two criteria. First, a variable was estimated in absolute terms according to the assumption that the higher the absolute value, the greater the degree of the portfolio's opacity regardless of the derivative usage for hedging or for speculative purposes. This reflects the fact that managers can increase the fund´s opacity for retail investors through the purchase of assets characterized by complex cash flow structures (SATO, 2014; CÉLÉRIER; VALLÉE, 2013).

However, as stated by Chen (2011), managers can engage in multiple operations using derivatives with the intention of hedging the fund's net worth against market risks, acting on a long or short position. Consequently, the net values obtained through the interaction of both strategies expresses how much managers invested in derivatives, with the real intention of increasing the fund's risk. To model this behavior, we adopteda second criterion, which uses only net values calculated as the difference between the amount invested in buyers and sellers' positions in swaps, options, future and forward contracts.

The results are presented in three distinct subsections, each one exploring the main findings regarding investor's risk and return and manager's remuneration. For every model described in Section 3.2, we use the dependent lagged variable as an instrument based on the Arellano–Bond estimator, as suggested by Cameron and Trivedi (2005, p.765). The authors also stated that the use of lagged regressors is an additional procedure for softening the problem of endogeneity, if it is reasonable to admit a null correlation between this and the error term. Furthermore, factors that were not initially included in the model, but that were considered significant instruments by the Sargan test are also employed. For all models, the null hypothesis is assessed at the 5% significance level. Consequently, we can infer that the linear specification of all equations is correct, and the set of instruments[4] chosen was not correlated with the error term.

Also, regarding the Arellano & Bond test, for all the estimated equations in this study, we found evidence at the 5% significance level that the null hypothesis of zero auto correlation could not be rejected for the lagged superior levels of differenced idiosyncratic error term.

4.2.1. Results regarding investors risk

The results presented in Table 4 show the relations between the dependent variables (risk shifting in monthly terms) and the main independent variable (the variation of the total percentage of fund's net worth invested in derivatives, in absolute (ΔDerivi,m,y (absolute) and net terms ΔDerivi,m,y (net)).

Table 4
Relation between the risk variables and the variation of derivatives in absolute and net terms

Models	Type of Derivative	Panel A : Derivatives in Absolute Terms			Panel B : Derivatives in Net Terms		
		Total	*Qualified*	*Non-qualified*	*Total*	*Qualified*	*Non-qualified*
		Coefficient	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
M-1: Variation of the Monthly Total Risk	$\Delta Deriv_{i,m}$	0.00353*** (0.00090)	0.00282** (0.00141)	0.00391*** (0.00111)	0.00729*** (0.00198)	0.00755** (0.00309)	0.00685*** (0.00201)
	$\Delta Deriv_{i,m-1}$	0.00320*** (0.00086)	0.00390* (0.00144)	0.00284*** (0.00095)	0.00386** (0.00176)	0.00388 (0.00282)	0.00416** (0.00173)
M-2: Variation of the Monthly Systematic Risk	$\Delta Deriv_{i,m}$	0.01021*** (0.00167)	0.00336** (0.00134)	0.00395*** (0.00101)	0.03639*** (0.00567)	0.00816*** (0.00285)	0.00744*** (0.00210)
	$\Delta Deriv_{i,m-1}$	0.00548*** (0.00080)	0.00428*** (0.00137)	0.00272*** (0.00100)	0.00935*** (0.00203)	0.00265 (0.00234)	0.00261 (0.00192)
M-3: Variation of the Monthly Non-Systematic Risk	$\Delta Deriv_{i,m}$	0.00304** (0.00103)	0.00381** (0.00184)	0.00194 (0.00147)	0.00282 (0.00257)	0.00700* (0.00396)	0.00040 (0.00266)
	$\Delta Deriv_{i,m-1}$	0.00534*** (0.12953)	0.00662*** (0.00205)	0.00457*** (0.00099)	0.01075*** (0.00227)	0.01123*** (0.00422)	0.01026*** (0.00234)
M-4: Variation of the Monthly Tracking Error	$\Delta Deriv_{i,m}$	0.00329*** (0.00329)	0.00343*** (0.00131)	0.00338*** (0.00080)	0.00656*** (0.00143)	0.00749*** (0.00264)	0.00616*** (0.00163)
	$\Delta Deriv_{i,m-1}$	0.00324*** (0.00066)	0.00364*** (0.00131)	0.00271*** (0.00080)	0.00377*** (0.00127)	0.00302 (0.00241)	0.00361** (0.00153)

Table 4 considers the derivatives percentage in absolute and net terms as well as the total sample and its subsets (according to investors' qualification level).
Total sample: 18,259 monthly observations/ Qualified investors sample: 5,560 monthly observations / Non-qualified investors sample: 12,699 monthly observations.
Values in parentheses are the standard errors of the coefficients.
***Significant at the 1% level/**Significant at the 5% level/*Significant at the 10% level.
$\Delta Deriv_{i,m-1}$(absolute)= $\Delta Futc_{i,m}$ (absolute) + $\Delta Forwc_{i,m}$ (absolute)+ $\Delta Opt_{i,m}$ (absolute)+ $\Delta Swap_{i,m}$ (absolute)
$\Delta Deriv_{i,m-1,y}$(net)= $\Delta Futc_{i,m}$ (net) + $\Delta Forwc_{i,m}$ (net)+ $\Delta Opt_{i,m}$ (net)+ $\Delta Swap_{i,m}$ (net)
Source: Elaborated by authors.

In general, there is a significant positive relationship between the variation of the fund's net worth percentage invested in derivatives (in absolute terms) and the increment in total risk, systematic and non-systematic risk, and the tracking error of the portfolio, even when the sample is segmented into qualified and non-qualified investors.

We also tested the individual significance of the derivatives markets (swap, future and forward contracts and options). The results are shown in Table 5:

Table 5
Relation between risk variables and the net worth percentage invested in derivatives

Model	Type of Derivative	Panel A: Derivatives in Absolute Terms			Panel B: Derivatives in Net Terms		
		Total	*Qualified*	*Non-Qualified*	*Total*	*Qualified*	*Non-Qualified*
		Coefficient	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
M-1: Variation of the Monthly Total Risk	$\Delta Futc_{i,m,}$	0.00100 (0.00093)	0.00221 (0.00187)	0.00130 (0.00127)	0.00639*** (0.00216)	0.00676 (0.00498)	0.00709* (0.00381)
	$\Delta Futc_{i,m-1}$	0.00509*** (0.00092)	0.00521*** (0.00157)	0.00492*** (0.00100)	0.01168*** (0.00243)	0.00939* (0.00526)	0.01160*** (0.00243)
	$\Delta Swap_{i,m}$	0.12237*** (0.01429)	0.10271*** (0.02246)	0.06800*** (0.01838)	0.08773*** (0.01954)	0.11226** (0.03378)	0.06230** (0.02597)
	$\Delta Swap_{i,m-1}$	-0.02633** (0.01049)	Inserted as instrument	-0.01854* (0.01032)	-0.07718*** (0.01545)	Inserted as instrument	-0.05071*** (0.01443)
	$\Delta Opt_{i,m}$	0.05997*** (0.00706)	0.01125*** (0.00375)	0.01646*** (0.00242)	0.08576*** (0.01236)	0.01947** (0.00761)	0.03922*** (0.00701)
	$\Delta Opt_{i,m-1}$	0.01556*** (0.00270)	0.00398 (0.00330)	0.01186*** (0.00253)	0.01531*** (0.00525)	0.00198 (0.00604)	0.02162*** (0.00569)
	$\Delta Forwc_{i,m}$	0.00081 (0.00322)	0.00354 (0.00477)	0.00130 (0.00401)	0.00348 (0.00316)	0.00293 (0.00482)	0.00282 (0.00410)
	$\Delta Forwc_{i,m,-1}$	-0.00043 (0.00404)	0.00647 (0.00503)	-0.00477 (0.00546)	-0.00155 (0.00388)	0.00482 (0.00507)	-0.00462 (0.00544)
M-2: Variation of the Monthly Systematic Risk	$\Delta Futc_{i,m}$	0.00238** (0.00100)	0.00222 (0.00178)	0.00207 (0.00126)	0.01668*** (0.00514)	0.00821 (0.00501)	0.00524 (0.00323)
	$\Delta Futc_{i,m-1}$	0.00560*** (0.00108)	0.00667*** (0.00210)	0.00511*** (0.00138)	0.01419*** (0.00358)	0.01276*** (0.00493)	0.01029*** (0.00273)
	$\Delta Swap_{i,m}$	0.10180*** (0.01648)	0.15612 (0.02816)	0.08428*** (0.02198)	0.13269*** (0.02380)	0.17103*** (0.03762)	0.10077*** (0.03102)
	$\Delta Swap_{i,m-1}$	Inserted as instrument	Inserted as instrument	-0.01803 (0.01541)	Inserted as instrument	Inserted as instrument	-0.05542*** (0.0202685)
	$\Delta Opt_{i,m}$	0.01814*** (0.00240)	0.01413*** (0.00482)	0.01719*** (0.00604)	0.03907** (0.00572)	0.02413*** (0.00823)	0.06152*** (0.01769)
	$\Delta Opt_{i,m-1}$	Inserted as instrument	0.00443 (0.00478)	0.01179*** (0.00300)	Inserted as instrument	0.00095 (0.00771)	0.03202*** (0.00681)
	$\Delta Forwc_{i,m}$	-0.00077 (0.00355)	-0.00358 (0.00563)	0.00015 (0.00468)	0.00114 (0.00349)	-0.00031 (0.00555)	0.00148 (0.00466)
	$\Delta Forwc_{i,m,-1}$	-0.00809* (0.00441)	0.00023 (0.00617)	-0.01346** (0.00632)	-0.00838** (0.00427)	0.00001 (0.00648)	-0.01431** (0.00622)

Table 5
Cont.

		Panel A: Derivatives in Absolute Terms			Panel B: Derivatives in Net Terms		
M-3: Variation of the Monthly Non-Systematic Risk	$\Delta Futc_{i,m}$	0.00435*** (0.00155)	0.00237 (0.00256)	-0.00097 (0.00216)	0.01632** (0.00662)	0.01131 (0.00857)	-0.00139 (0.00589)
	$\Delta Futc_{i,m-1}$	0.00592*** (0.00136)	0.00960*** (0.00329)	0.00241** (0.00115)	0.02152*** (0.00598)	0.03371** (0.01408)	0.01502*** (0.00457)
	$\Delta Swap_{i,m}$	0.01024 (0.02513)	0.06491** (0.02952)	-0.03220 (0.02772)	-0.03367 (0.02742)	0.02980 (0.03721)	-0.09107*** (0.03217)
	$\Delta Swap_{i,m-1}$	0.03184 (0.021112)	-0.02241 (0.02833)	0.04890** (0.02214)	0.01324 (0.0288)	-0.06435 (0.05825)	0.04542*** (0.02641)
	$\Delta Opt_{i,m}$	0.00285 (0.00338)	-0.00135 (0.00552)	0.00445 (0.00417)	0.00981 (0.00735)	0.00448 (0.01217)	0.00860* (0.00988)
	$\Delta Opt_{i,m-1}$	0.00845** (0.00393)	0.00390 (0.00810)	0.01181** (0.00475)	0.00593 (0.00836)	0.00365 (0.01327)	0.00833 (0.01036)
	$\Delta Forwc_{i,m}$	0.00131 (0.00485)	0.01190* (0.00715)	0.00081** (0.00624)	0.00242 (0.00496)	0.01115 (0.00789)	0.00254 (0.00615)
	$\Delta Forwc_{i,m,-1}$	0.01225** (0.00502)	0.01471*** (0.00536)	0.01688** (0.00730)	0.01399*** (0.00509)	0.01458*** (0.00545)	0.01995*** (0.00715)
M-4: Variation of the Monthly Tracking Error	$\Delta Futc_{i,m}$	0.00387 (0.00123)	0.00148 (0.00199)	0.00144 (0.00116)	0.01425*** (0.00478)	0.00415 (0.00575)	0.00597** (0.00285)
	$\Delta Futc_{i,m-1}$	0.00685 (0.00103)	0.00791*** (0.00158)	0.00498*** (0.00112)	0.01710*** (0.00348)	0.02178*** (0.00594)	0.01000*** (0.00228)
	$\Delta Swap_{i,m}$	0.08612 (0.01377)	0.14965*** (0.02537)	0.08470*** (0.01771)	0.11622*** (0.01956)	0.14676*** (0.03413)	0.07682*** (0.02378)
	$\Delta Swap_{i,m-1}$	Inserted as instrument	-0.04753*** (0.01677)	-0.02024* (0.01141)	Inserted as instrument	-0.10687*** (0.02802)	-0.04361*** (0.01415)
	$\Delta Opt_{i,m}$	0.01342*** (0.0021418)	0.01039** (0.00395)	0.01657*** (0.00271)	0.03207*** (0.00531)	0.02003** (0.00780)	0.04036*** (0.00715)
	$\Delta Opt_{i,m-1}$	0.01121*** (0.00215)	0.00448 (0.004088)	0.01263*** (0.00283)	0.01691*** (0.00426)	0.00219 (0.00712)	0.023701*** (0.00581)
	$\Delta Forwc_{i,m}$	-2.51E-05 (0.00324)	0.00263 (0.00528)	-0.00078 (0.00422)	0.00038 (0.00310)	0.00238 (0.00570)	0.00082 (0.00422)
	$\Delta Forwc_{i,m,-1}$	-0.00229 (0.00383)	0.00362 (0.00560)	-0.00524 (0.00537)	-0.00326 (0.00369)	0.00247 (0.00568)	-0.00528 (0.00530)
	$Dleverg_i$	-0.01022*** (0.00300)	-0.01597** (0.006841)	0.00493** (0.00205)	-0.00798*** (0.00290)	-0.01544** (0.00701)	0.00380** (0.00192)

Table 5 considers the derivatives percentage in absolute and net terms as well as the total sample and its subsets (according to investors' qualification level). Total sample: 18,259 monthly observations/ Qualified investors sample: 5,560 monthly observations / Non-qualified investors sample: 12,699 monthly observations.
Values in parentheses are the standard errors of the coefficients. ***Significant at the 1% level/**Significant at the 5% level/*Significant at the 10% level. Source: Elaborated by authors.

As observed in M-1 and M-2, the results in Table 5 indicate that higher percentages (of the fund's net worth) invested in swaps, options, and future contracts (in net and absolute terms) are mostly still associated with higher variation of total and systematic risk, both for the total and the segmented samples (independent of the investors' qualification level). It is important to highlight that swaps presented the higher coefficients. According to Hull (1997) a swap is a risky derivative since it involves the possibility of considerable losses, given that the increase of the difference between the fees (computed on a notional value considerably higher than the amount required as margins) is unlimited, and, generally, the counterparts are obligated to hold their positions until the maturity of the contract.

Regarding to M-3, even though the number of significant coefficients were lower than the ones obtained for M-1 and M-2, we also found a positive relation between this risk measure and derivatives, in particular for future and forward contracts and swaps (independent of the investors' qualification level). It indicates that derivatives were positively associated with the amount of risk not explained by the market (such as human risk, credit risk, and liquidity risk (VARGA; LEAL, 2006, p.35). The results are in line with Chen (2011) who found that the difference in fund risks between derivatives users and nonusers was more substantial for market-related systematic risk than for idiosyncratic risk.

However, in accordance with Basak, Pavlova and Shapiro (2007), managers of lower performance funds would amplify the shares volatility when the fund's return is below the benchmark (increasing the tracking error volatility). Therefore, through M-4, it was possible to verify in general a positive relation between the percentage invested in swaps, future contracts and options and the tracking error variation. It is important to highlight that only for the non-qualified investors' context, the leverage dummy ($Dleverg_i$) is positive, showing that hedge funds that are allowed to have leveraged positions will probably present returns that are more distant from the benchmark.

4.2.2. Results regarding investors return

The results presented in Table 6 show the relations between the dependent variables (adjusted Sharpe index variation - in monthly and annual terms) and the main independent variable (the variation of the total percentage of fund's net worth invested in derivatives, in absolute (ΔDerivi,m,y (absolute) and net terms ΔDerivi,m,y (net)).

As indicated by M-5, this strategy does not increase the level of monthly adjusted returns offered to the investor. When this relation is analyzed in annual terms (M-6) non-significant coefficients are observed. Moreover, funds that are able to employ derivatives for leverage purposes suffered a decrease in this annual return measure (as indicated by the coefficient of $Dleverg_i$).

We also tested the individual significance of the derivatives markets (swap, future and forward contracts and options). The results are reported in Table 7:

The effect of the share's volatility on the adjusted returns incurred by managers was assessed in Model 5, which investigates the dynamics between the fund's amounts invested in derivatives and the variation of the monthly-adjusted Sharpe ratio ($Dasr_{i,m,y}$). Overall, as showed by Table 7, the coefficients point to a negative relation between $Dasr_{i,m,y}$, and the usage of futures and swaps (in absolute and net terms for the total and qualified samples) revealing that higher positions in these opaque assets reduces the adjusted returns offered to investors on a monthly basis. About the annual investor's adjusted return (M-6), the leverage dummy ($Dleverg_i$) is negative and significant in the total and the retail investors' samples, indicating that funds which can adopt derivatives for speculative purposes do not raise this measure. In net terms, swap is significant and positive related to qualified investor's return.

Table 6

Relation between the return variables and the variation of derivatives in absolute and net terms

Models	Type of Derivative	Panel A: Derivatives in Absolute Terms			Panel B: Derivatives in Net Terms		
		Total	*Qualified*	*Non-qualified*	*Total*	*Qualified*	*Non-qualified*
		Coefficient	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
M-5: Variation of the Monthly Adjusted Sharpe Ratio	$\Delta Deriv_{i,m}$	-0.02448* (0.01379)	-0.13704** (0.05471)	-0.00389 (0.01465)	-0.04849 (0.03205)	-0.30036** (0.15127)	-0.02075 (0.05937)
	$\Delta Deriv_{i,m-1}$	0.00326 (0.01409)	-0.08083*** (0.02931)	-0.00103 (0.00786)	0.04605 (0.03048)	-0.05203 (0.05379)	0.01721 (0.01906)
M-6: Variation of the Annual Adjusted Sharpe Ratio	$\Delta Deriv_{i,m}$	0.02721 (0.02414)	0.00809 (0.03291)	0.04118 (0.06583)	0.03118 (0.03828)	0.01882 (0.04405)	0.02064 (0.17254)
	$\Delta Deriv_{i,m-1}$	-0.01913 (0.02822)	-0.02103 (0.06922)	Inserted as instrument	-0.05043 (0.05589)	-0.01810 (0.07168)	Inserted as instrument
	$Dleverg_{i}$	-0.73683* (0.37792)	-0.95579 (0.90784)	-0.46772** (0.19009)	-0.76018* (0.39384)	-0.76594 (1.04601)	-0.46345*** (0.15817)

Table 6 considers the derivatives percentage in absolute and net terms as well as the total sample and its subsets (according to investors' qualification level).

Total sample: 18,259 monthly observations/ Qualified investors sample: 5,560 monthly observations / Non-qualified investors sample: 12,699 monthly observations.

Values in parentheses are the standard errors of the coefficients.

***Significant at the 1% level/**Significant at the 5% level/*Significant at the 10% level.

$\Delta Deriv_{i,m-1}$(absolute)= $\Delta Futc_{i,m}$ (absolute) + $\Delta Forwc_{i,m}$ (absolute)+ $\Delta Opt_{i,m}$ (absolute)+ $\Delta Swap_{i,m}$ (absolute)

$\Delta Deriv_{i,m-1,y}$(net)= $\Delta Futc_{i,m}$ (net) + $\Delta Forwc_{i,m}$ (net)+ $\Delta Opt_{i,m}$ (net)+ $\Delta Swap_{i,m}$ (net)

Source: Elaborated by authors.

4.2.3 Results regarding managers remuneration

Since opacity increases the fund's risk level but do not normally generate adjusted return increment to investors, what is the impact of this decision on the managers' remuneration? As for the variation of the fund's net flow (M-7), the results in Table 8 indicate that typically no significant coefficients were obtained considering the variation of the total percentage of fund's net worth invested in derivatives, in absolute (ΔDerivi,m,y (absolute) and net terms ΔDerivi,m,y (net)):

Because of this low level of significance for the main independent variable (the fund's net worth percentage invested in derivatives), we also tested the individual significance of each of the derivatives markets (swap, future and forward contracts and options). The results are reported in Table 9.

Table 7

Relation between return variables and the net worth percentage invested in derivatives

Model	Type of Derivative	Panel A: Derivatives in Absolute Terms			Panel B: Derivatives in Net Terms		
		Total	*Qualified*	*Non-Qualified*	*Total*	*Qualified*	*Non-Qualified*
		Coefficient	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
M-5: Variation of the Monthly Adjusted Sharpe Ratio	$\Delta Futc_{i,m}$	-0.02035 (0.01333)	-0.03831 (0.04337)	-0.00781 (0.00862)	0.04857 (0.04800)	-0.04856 (0.12704)	-0.042648 (0.03871)
	$\Delta Futc_{i,m-1}$	-0.04083** (0.01600)	-0.10414** (0.05299)	-0.00988 (0.01070)	-0.05074* (0.02632)	-0.21016* (0.12359)	-0.020067 (0.02582)
	$\Delta Swap_{i,m}$	-0.87056*** (0.28520)	-2.64574*** (0.83247)	-0.05779 (0.09078)	-2.50219** (1.17828)	-2.44775*** (0.63485)	0.09418 (0.17612)
	$\Delta Swap_{i,m-1}$	0.01520 (0.18428)	0.28045 (0.47607)	-0.05573 (0.11623)	Inserted as instrument	Inserted as instrument	-0.00740 (0.1381389)
	$\Delta Opt_{i,m}$	0.06878 (0.06089)	0.21624* (0.11587)	0.01007 (0.02261)	0.00242 (0.22958)	0.36004* (0.20801)	0.04755 (0.07864)
	$\Delta Opt_{i,m-1}$	Inserted as instrument	-0.03222 (0.06412)	0.03389 (0.02914)	Inserted as instrument	-0.06661 (0.17993)	0.19123** (0.09563)
	$\Delta Forwc_{i,m,}$	-0.16980 (0.14132)	0.02776 (0.05847)	-0.0916 (0.07385)	-0.12250 (0.14031)	0.02167 (0.05998)	-0.10359 (0.07641)
	$\Delta Forwc_{i,m,-1}$	Inserted as instrument	0.16635*** (0.05724)	0.19297 (0.11898)	Inserted as instrument	0.16380*** (0.05927)	0.18789 (0.11854)
M-6: Variation of the Annual Adjusted Sharpe Ratio	$\Delta Futc_{i,m}$	-0.01121 (0.02769)	0.00678 (0.04618)	0.01709 (0.02733)	-0.01724 (0.03923)	0.01897 (0.04996)	0.00411 (0.02972)
	$\Delta Futc_{i,m-1}$	0.03463 (0.02728)	0.08212 (0.09835)	Inserted as instrument	0.03452 (0.03109)	0.10891 (0.10296)	0.60697 (0.47044)
	$\Delta Swap_{i,m}$	0.15927 (0.21290)	-0.00827 (0.52539)	-0.03198 (0.41378)	0.65132** (0.28279)	1.33167* (0.76224)	0.27143 (0.30489)
	$\Delta Swap_{i,m-1}$	-0.15943 (0.31431)	0.13820 (0.83271)	Inserted as instrument	-0.73801 (0.48641)	-1.71483 (1.68078)	Inserted as instrument
	$\Delta Opt_{i,m}$	-0.00027 (0.10740)	0.18039 (0.26570)	0.03842 (0.09046)	0.21563 (0.44508)	0.19130 (0.62709)	-0.03992 (0.17932)
	$\Delta Opt_{i,m-1}$	inserted as instrument	0.16201 (0.21104)	Inserted as instrument	Inserted as instrument	0.24101 (0.81285)	Inserted as instrument
	$\Delta Forwc_{i,m}$	0.11177 (0.12331)	0.13654 (0.45794)	0.27761 (0.28428)	0.11035 (0.13871)	0.19214 (0.52957)	0.15533 (0.281698)
	$\Delta Forwc_{i,m,-1}$	-0.12203 (0.14882)	0.06154 (0.41874)	-0.14073 (0.23477)	-0.11835 (0.10751)	0.06450 (0.51325)	-0.04107 (0.24231)
	$Dleverg_{i}$	-0.63100** (0.31895)	-4.27287 (6.46721)	-0.41374** (0.16346)	-0.62311* (0.35941)	-3.67785 (8.22668)	-0.48003*** (0.16373)

Table 7 considers the derivatives percentage in absolute and net terms as well as the total sample and its subsets (according to investors' qualification level). Total sample: 18,259 monthly observations/ Qualified investors sample: 5,560 monthly observations / Non-qualified investors sample: 12,699 monthly observations.

Values in parentheses are the standard errors of the coefficients. ***Significant at the 1% level/**Significant at the 5% level/*Significant at the 10% level.

Source: Elaborated by authors.

Table 8
Relation between the net flow and the variation of derivatives in absolute and net terms

		Panel A: Derivatives in Absolute Terms			Panel B: Derivatives in Net Terms		
Models	Type of Derivative	*Total*	*Qualified*	*Non-qualified*	*Total*	*Qualified*	*Non-qualified*
		Coefficient	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*	*Coefficient*
M-7: Variation of the Net worth (Net Flow)	$\Delta Deriv_{i,m}$	-0.00014 (0.00019)	-0.00012 (0.00023)	0.00049 (0.00077)	-0.00028 (0.00029)	-0.00021 (0.00054)	0.00112 (0.00155)
	$\Delta Deriv_{i,m-1}$	-0.00020 (0.00016)	-0.00022 (0.00018)	-0.00075 (0.00058)	-0.00047* (0.00026)	-0.00082** (0.00037)	0.00029 (0.00174)

Table 8 considers the derivatives percentage in absolute and net terms as well as the total sample and its subsets (according to investors' qualification level).
Total sample: 18,259 monthly observations/ Qualified investors sample: 5,560 monthly observations / Non-qualified investors sample: 12,699 monthly observations.
Values in parentheses are the standard errors of the coefficients.
***Significant at the 1% level/**Significant at the 5% level/*Significant at the 10% level.
$\Delta Deriv_{i,m-1}$(absolute)= $\Delta Futc_{i,m}$ (absolute) + $\Delta Forwc_{i,m}$ (absolute)+ $\Delta Opt_{i,m}$ (absolute)+ $\Delta Swap_{i,m}$ (absolute)
$\Delta Deriv_{i,m-1,y}$(net)= $\Delta Futc_{i,m}$ (net) + $\Delta Forwc_{i,m}$ (net)+ $\Delta Opt_{i,m}$ (net)+ $\Delta Swap_{i,m}$ (net)
Source: Elaborated by authors.

As performance and management fees are calculated on the fund's net worth, according to Kouwenberg and Ziemba (2007), greater increments in this amount are associated with higher intrinsic benefits received by managers. Thus, referring to the fund's net flow variation ($Flow_{i,m,y}$), Model 7 (Table 9) shows a significant but negative association between it and swaps and options usage (in net and absolute terms) for the total and non-qualified samples. The same relation is observed for the leverage dummy ($Dleverg_i$). In principle, this could imply that the investors reacted to the strategy adopted by managers withdrawing their money from funds that take riskier positions in derivatives.

Since the variable $Flow_{i,m,y}$ is positively associated with the previous fund's return and with the Ibrx-$100_{m-1,y}$ return (as one can see in Table 10), it is possible that the net flow reduction had directly impacted the retraction of the funds' net worth, considering the total sample.

Additionally, it is important to emphasize that the volume of outflows is significant for the non-qualified investors, in which it was observed a positive net flow only for the third quartile (as seen in Table 2, section 4.1). A possible aspect that could have contributed for these outflows is the fact that, as shown in Table 11, the majority of funds presented an inferior or at least a less superior return compared to those offered by investments correlated with the risk-free rate. Such alternatives of investment are expressed by, for instance, funds, public and private bonds, whose risk is in general lower than those performed by hedge funds.

Table 9
Relation between the net flow and the net worth percentage invested in derivatives

		Panel A: Derivatives in Absolute Terms			Panel B: Derivatives in Net Terms		
Model	Type of Derivative	*Total* *Coefficient*	*Qualified* *Coefficient*	*Non-Qualified* *Coefficient*	*Total* *Coefficient*	*Qualified* *Coefficient*	*Non-Qualified* *Coefficient*
M-7: Variation of the Net worth (Net Flow)	$\Delta Futc_{i,m}$	0.00015 (0.00028)	-0.00034 (0.00022)	0.00021 (0.00035)	-0.00017 (0.00056)	-0.00134 (0.00085)	-0.00010 (0.00057)
	$\Delta Futc_{i,m-1,}$	-0.00028 (0.00026)	-0.00023 (0.00033)	-0.00055** (0.00027)	-0.00078 (0.00063)	-0.00129 (0.00087)	-0.00131* (0.00068)
	$\Delta Swap_{i,m}$	-0.01101*** (0.00364)	-0.00596 (0.00586)	-0.01750*** (0.00423)	-0.010520** (0.00424)	-0.00355 (0.00661)	-0.01718*** (0.0059)
	$\Delta Swap_{i,m-1}$	-0.00810*** (0.00239)	-0.00572 (0.00349)	-0.00917*** (0.00294)	-0.01123** (0.00358)	-0.00515 (0.00471)	-0.01328 *** (0.00434)
	$\Delta Opt_{i,m}$	-0.00153** (0.00062)	-0.00134 (0.00121)	-0.00154** (0.00062)	-0.00365*** (0.00118)	-0.00319* (0.00170)	-0.00408*** (0.00151)
	$\Delta Opt_{i,m-1}$	0.00015 (0.00066)	-0.00087 (0.00077)	0.00094 (0.00076)	-0.00110 (0.00114)	-0.00269** (0.00116)	0.00120 (0.00154)
	$\Delta Forwc_{i,m}$	0.00093 (0.00063)	0.00229** (0.00110)	6.334E-05 (0.00078)	0.00112* (0.00063)	0.00260** (0.00115)	0.00031 (0.00077)
	$\Delta Forwc_{i,m,-1}$	0.00069 (0.00056)	0.00152 (0.00100)	8.557E-05 (0.00070)	0.00075 (0.00056)	0.00194* (0.00104)	0.00040 (0.00070)
	$Dleverg_i$	-0.01163*** (0.00214)	-0.00969*** (0.00311)	-0.01367*** (0.00273)	-0.01124*** (0.00214)	-0.010148 (0.00309)	-0.01340 (0.00277)

Table 9 considers the derivatives percentage in absolute and net terms as well as the total sample and its subsets (according to investors' qualification level). Total sample: 18,259 monthly observations/ Qualified investors sample: 5,560 monthly observations / Non-qualified investors sample: 12,699 monthly observations.

Values in parentheses are the standard errors of the coefficients. ***Significant at the 1% level/**Significant at the 5% level/*Significant at the 10% level.

Source: Elaborated by authors.

Table 11 shows that, for the 1st quartile, the median and the mean of the monthly return of risk-free rate are not superior to 0.5% per month in the majority of the sample, having a negative value for the retail investors. Consequently, it is not possible to state that investors, particularly those less informed, react negatively to the use of opaque assets (derivatives), taking their resources out. In other words, it cannot be claimed that they could clearly foresee the impact of managers' strategies on both the increase of the fund's risk and the investors net wealth losses. It could be the case that the investors had just observed the fund's return before withdrawing without evaluating the portfolios' composition or even its associated risks. This empirical evidence is supported by Chen (2011, p.1) who state that investors do not differentiate derivatives users when making investment decisions, and by Ivković and Weisbenner (2009, p.4) who claim that, in the context of mutual funds, outflows are related only to funds' one-year "absolute" returns. Also, Grecco (2013, p. 108) observe a "herd outflow behavior" by retail investors of equity funds in the Brazilian market, especially when the performance of the stock market is negative.

Table 10
Model 7 (variation of the fund's net flow)

Variable	Total Investors		Qualified Investors		Non-qualified investors	
	Coefficient		*Coefficient*		*Coefficient*	
$Flow_{i,m-1}$	0.153564* (0.02174)		0.081591** (0.02465)		0.183410* (0.02465)	
$Flow_{i,m-2}$	0.066309* (0.01703)		0.074743* (0.02031)		0.067084* (0.02031)	
$r^2_{i,m-1}$	0.244817* (0.05088)		0.178732* (0.06378)		0.289040* (0.06563)	
$r^2_{i,m-2}$	0.292254* (0.04187)		0.22401* (0.05034)		0.339520* (0.05783)	
$Dleverg_i$	-0.011636* (0.00211)		-0.009691* (0.00311)		-0.013678* (0.00273)	
$Dleverg_{i\ x}\ Dloser_{i,m-1}$	-		-		-0.009653* (0.00327)	
$Ibrx\text{-}100_{m-1}$	0.032626** (0.01609)		0.045610*** (0.02773)		-	
$\Delta Futc_{i,m}$ (absolute)	0.000157 (0.00029)		-0.000348 (0.00022)		0.000212 (0.00035)	
$\Delta Futc_{i,m-1}$ (absolute)	-0.000285 (0.00027)		-0.00023 (0.00033)		-0.000551** (0.00028)	
$\Delta Swap_{i,m}$ (absolute)	-0.011014* (0.00364)		-0.00596 (0.00586)		-0.017502* (0.00423)	
$\Delta Swap_{i,m-1}$ (absolute)	-0.008102* (0.00239)		-0.00572 (0.00349)		-0.009173* (0.00294)	
$\Delta Opt_{i,m}$ (absolute)	-0.001534* (0.00062)		-0.00134 (0.00122)		-0.001550** (0.00062)	
$\Delta Opt_{i,m-1}$ (absolute)	0.000159 (0.00066)		-0.00087 (0.00077)		0.000945 (0.00076)	
$\Delta Forwc_{i,m}$ (absolute)	0.000937 (0.00064)		0.00229** (0.00110)		0.000622 (0.00423)	
$\Delta Forwc_{i,m,-1}$ (absolute)	0.000696 (0.00057)		0.00152 (0.00100)		0.000080 (0.00070)	
$Dyear_{2014}$	-0.006476* (0.00225)		-		-	
$Dyear_{2010}$	-		0.016669** (0.00827)		-	
Test	Statistic Test	P-Value	Statistic Test	P-Value	Statistic Test	P-Value
Sargan's Test	206.873	1.000	92.361	1.000	145.346	0.523
Test of 1st Autocorrelation Order	-10.007	0.000	-5.225	0.000	-8.881	0.000
Test of 2st Autocorrelation Order	-1.243	0.214	-1.589	0.112	-0.825	0.409

*Significant at the 1% level/**Significant at the 5% level/***Significant at the 10% level. Values in parentheses are the standard errors of the coefficients.
Instruments applied to the qualified investor sample equation: $Flow_{i,m-3.}$
Instruments applied to the non-qualified investor sample equation*:* $Dyear_{2014}$, $Flowi,_{m-3.}$
Instruments applied to the total sample equation: $Flow_{i,m-3}$ and $Dcat2_i$.
Source: Elaborated by authors.

Table 11
Basic Statics for the fund's monthly premium *

	Investors' qualification level		
Statistics	Professional	Qualified	Non-qualified
Minimum	-37.680%	-29.550%	-10.900%
1st Quartile	-0.417%	-0.356%	-0.429%
Median	0.126%	0.030%	-0.015%
Mean	0.219%	0.008%	-0.033%
3rd Quartile	0.783%	0.337%	0.394%
Maximum	38.730%	29.850%	12.190%

*The monthly premium is calculated as the difference between the fund's return and the Cdi-Over return.
Source: Elaborated by authors.

5. CONCLUSION

Using a sample covering 352 Brazilian hedge funds in the period from January 2010 to December 2015, we verified if opacity (measured by derivatives usage) creates value for investors and managers of hedge funds (that charge performance fee). In sum, we find that more investments in opaque assets are associated with higher portfolios' risk, but not with higher adjusted return to investors. Nevertheless, we also checked the relation between opaque assets and their benefits received by managers. Sato (2014, p.3) states that managers can inflate the expected funds' returns through leveraged operations raising their investments in opaque assets, in order to raise investors' expectations and consequently increase funds' inflows. When investors allocate their money in these investment funds, the amount of fees (such as those related to management and performance fees, which are based on the fund's net worth) goes up and leads to higher revenues to the managers. As shown by M-7 (Table 8 and 9) we do not find a significant and positive relation between derivatives and the fund's net flows.

However, due to the negative relationship found between opaque assets (derivatives) and investors' adjusted return, some protective policies are required, particularly those directed to hedge fund retail investors. These investors cannot clearly understand the risks associated with the strategies implemented by managers or even employ sophisticated performance analyses that incorporate the shares' volatility in their calculation, as stated by Jones, Lee and Yeager (2013).

Our evidence is supported by the discussion in Ongena and Zalewska (2017) with regard to pension funds, since: i) the level of financial education of the general population remains low and there are no signs that it will rise over the time (Ongena and Zalewska, 2017, p.9); ii) individual investors always have limited access to information (Ongena and Zalewska, 2017, p.13); and iii) pension fund managers have their own objectives, which can direct the fund towards better short-term performance, to the detriment of higher long-term returns that tend to be preferred by investors (Ongena and Zalewska, 2017, p.14).

Therefore, a first suggestion to mitigate this problem would be to limit access of this segment to hedge funds by raising the minimum amount required as initial investment or requiring a minimum level of qualification. Furthermore, as suggested by Basak, Pavlova and Shapiro (2008) and Dybving, Farnsworth and Carpenter (2010), the contract that regulates the management of third parties resources should clearly specify not only the fees charged but also all the allowed investment operations and their risk.

Additional regulatory issues should be considered regarding the protection of small retail investors, such as the establishment of restrictions on fund managers' decisions concerning investments made in derivative markets, even in leveraged funds. We expect our empirical findings would contribute to debates on the introduction of more protective policies that favor these investors.

For future research, we also suggest further exploring the evaluation of the impact of derivatives on outflows, inflows and net inflows separately since we only employed the net flow measure in our analysis.

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AUTHOR'S CONTRIBUTION

Each author contributed equally for this research.

CONFLICTS OF INTEREST

The authors state that there are no conflicts of interests.

Endnotes

[1] The "Strategy" classification includes funds whose operations follow the strategies selected by managers. All of them are allowed to adopt leverage strategies. The "Allocation" classification encompasses funds directed to long-term return. Some of them can engage in leverage operations. The "Investment abroad" classification considers funds that invest more than 40% of their net worth in assets negotiated abroad. All of them are allowed to conduct leverage operations.

[2] [Exchange rate on January 4th, 2016.]

[3] The description of the instruments employed in each equation can be required to the authors.