Shedding Light on the Causes for Reaching for Yield: Evidence From an Emerging Country

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Abstract

We test the Reach-for-Yield (RFY) phenomenon - agents' greater risk appetite when base interest rates are low - in the Brazilian investment fund market. We find evidence of RFY for fixed-income funds and equity funds, despite the fact that Brazilian interest rates were well above the zero-lower bound during the sample period. We also test empirically four of the latest theoretical explanations for the RFY effect, finding favourable evidence for three of them: (i) a Behavioral Hypothesis in the spirit of Lian, Ma & Wang (2019) and theories such as Salience (Bordalo, Gennaioli & Shleifer, 2012); (ii) a Manager Skill Heterogeneity Hypothesis, as in the Guerrieri & Kondor (2009) model; (ii) a Budget Constraint Hypothesis, based on the sustainable budget constraint of the Campbell & Sigalov (2022) model. These hypothesis are not mutually exclusive, indicating that a model that integrates both explanations for RFY may be a good venue for future research. To the best of our knowledge, this is the first paper to empirically test different theoretical explanations for the RFY, and also the first one to find direct evidence of this effect in an emergent economy.

1 Introduction

The prolonged period of near-zero interest rates in developed markets since the 2010s has aroused the interest of researchers in economics and finance regarding the effects of the extended occurrence of this scenario on the portfolio choices of economic agents. In this context, particular interest has arisen regarding the Reach for Yield effect (RFY), which can be defined as the greater risk appetite by economic agents when basic interest rates are low (Lian, Ma and Wang, 2019; Campbell and Sigalov, 2022)[1] Much of the empirical literature corroborates the occurrence of this effect in developed markets for institutional investors (Boubaker et al, 2017; Di Maggio and Kacperczyk, 2016) and for individuals (Lian et al., 2019). A notable exception, however, is the work of La Spada (2018), who, using a sample of American Money Market Funds prior to 2008, finds that RFY occurs when there is an increase in the market risk premium, but not when there is a decrease in the risk free rate.

[1] We note that the RFY term was initially used with a slightly different meaning than the most recent papers on the subject. This concept was initially associated with greater risk-taking by investment funds and financial institutions due to incentives related to fund managers' compensation rules (Rajan, 2006) and imperfections in the risk metrics used in the evaluation of managers' performance (Becker and Ivashina, 2015; Choi and Kronlund, 2018; Czech and Roberts-Sklar, 2019). Two reasons lead us to adopt the more recent concept of RFY as greater risk-taking by economic agents in environments of low basic interest rates: (i) there was consensus in this initial literature that greater risk-taking is exacerbated in environments of low interest rates; (ii) the greater risk taking in low interest rate environments was more recently documented also for individual investors, both in the portfolio compositions of various economic agents (Boubaker et al, 2018; Di Maggio and Kacperczyk, 2017; LU et al, 2019), and in randomized experiments with individuals (Lian et al., 2019).

RFY contradicts finance conventional theory (MERTON, 1971), according to which the risk-taking of agents should not change with variations in the risk-free interest rate. To accommodate the existence of this effect, some of the theoretical model approaches adopted in the literature are highlighted.

First, there are approaches that start from conventional finance models, such as those of Merton (1975) and Black (1972), but changing the consumer's budget constraint, so that their consumption is linked to the expected return of their portfolio in each period and how much the agent manages to leverage its portfolio in each period. An important consequence of this approach is that agents with higher leverage have the means to exacerbate their RFY, i.e., amplify their increase in risk-taking for a given decrease in the risk-free rate (Frazzini and Pedersen, 2014; Campbell and Sigalov, 2022). Henceforth, we will call the forecasts reported in this approach the Budget Constraint Hypothesis (BCH).

A second approach highlights the behavioral character of RFY. In this theoretical interpretation, investors form reference points regarding the expected returns of investments. If the risk-free rate falls, for example, the individuals would interpret the new expected return scenario as a loss in comparison with the previous status quo. Assuming that the individual's preferences can be represented by a typical loss aversion function, the individual's portfolio would be located in the loss domain of this function, in which the individual would be risk-loving (Ganzach and Wohl, 2018). Therefore, a decrease in the risk free would induce economic agents to hold riskier portfolios, regardless of the existing institutional arrangements, and their eventual frictions or resulting agency problems (Lian et al., 2019). This hypothesis is also consistent with a Salience-theory like model (Bordalo et al., 2012), where low interest rates make asset returns the more salient characteristic of the assets, estimulating higher risk-taking and, consequently, RFY behavior[2]. It is noteworthy here that this approach provides an important testable prediction: agents with higher reference points (in terms of expected returns) will tend to RFY more. That is, in low interest rate environments, agents that need higher returns to consider themselves in a region of gains (in their loss aversion type value function) tend to have more pronounced RFY. From now on, we will refer to the hypothesis raised by this interpretation of the Behavioral Hypothesis (BH).

A third approach to RFY highlights the heterogeneity of investment managers, and how they may have incentives to engage in RFY behavior to maintain their reputation and investors' perception of their performance high enough to remain in the market. Guerrieri and Kondor (2009), for example, propose a principal-agent model in which investors can "fire" their investment managers if their performance is too low. Managers are heterogeneous, and may be sophisticated (S) - with superior information on asset risk - or unsophisticated (U). Investors, however, do not know if their manager is S or NS, and they only look at the results obtained by their manager in order to try to identify her type. The authors show that, in equilibrium, low interest rate scenarios would be associated with lower risks for the market as a whole (e.g., lower default risk due to low interest rates), which would encourage U managers to RFY, so that they can increase their expected returns without incurring a sharp increase in the probability of incurring losses that may imply the firing of theses managers. Thus, U managers would be able to obtain visible performance comparable to S managers, not being "fired" by investors. On the other hand, a high risk-free rate scenario would be associated with high market risks, which would encourage the opposite behavior from U managers (reduce the risk of the managed portfolios), in order to avoid large losses that could result in their "dismissal" . Thus, a

[2]Lian et al. (2019) highlight that there are interpretations of te Salience Theory Under Risk (Bordalo et al., 2012) that could imply a "reverse RFY", i.e., less risk appetite whenever risk-free rates are low. However, the discussion of this interpretation is not the focus of this paper, since the empirical and experimental evidence for "reverse RFY" is rather scarce in the literature.

prediction of the model is the prediction that more sophisticated investment managers - i.e., those with better information about the risk of assets available in the market - tend to exhibit lower RFY behavior. Throughout this article, the predictions associated with this approach to the literature will be called the Heterogeneous Manager Skill Hypothesis (HMSH).

An additional hypothesis is raised in the principal-agent model proposed by Acharya and Naqvi (2019). Their model suggests that RFY behavior is more pronounced for intermediaries in capital management that have greater liquidity available. This would occur because these capital managers would have incentives to underestimate the penalty generated by the risk of a liquidity squeeze, as this penalty would only be observable for the principal (affecting the fund's returns) in cases where liquidity falls below a certain threshold. Furthermore, expansionary monetary policies - typically associated with low basic interest rates - would exacerbate the risk-taking of financial intermediaries, by reducing the risks associated with lack of liquidity in the market. In this paper, this proposition will be referred to as the Liquidity Risk Hypothesis (LRH).

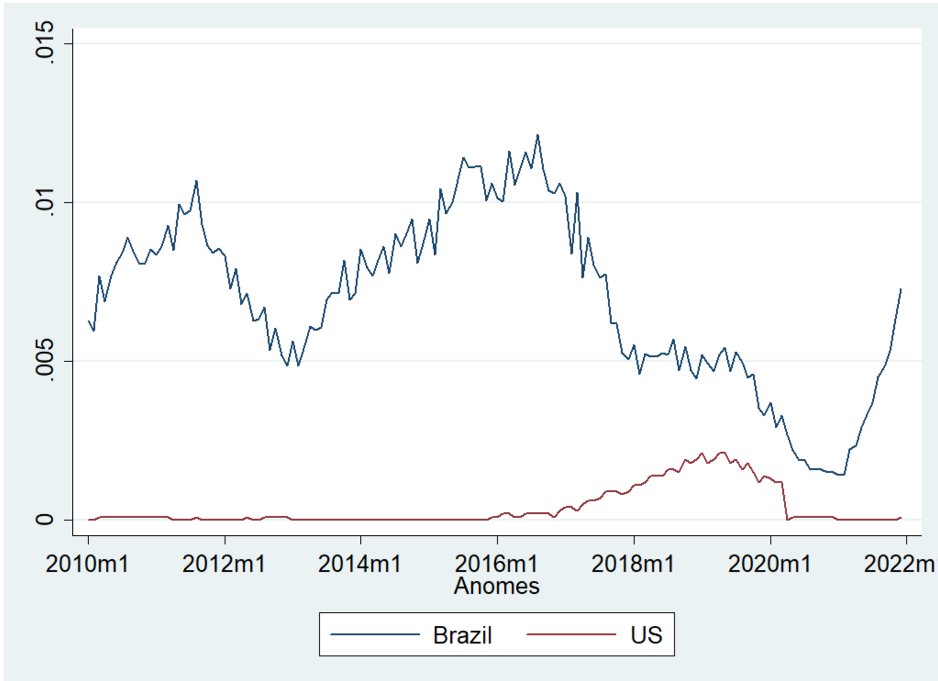
Given the described theoretical propositions, the present study contributes to the existing literature in the following ways: (i) we identify the relationship of characteristics of these funds with the RFY, indicating which models are more plausible to explain the characteristics related to the RFY effect; (ii) we verify the existence of RFY in an emerging country, taking advantage of a base with the monthly composition of fund portfolios from different classes.

Regarding this last contribution, we note that there are other studies that seek to identify RFY in emerging countries, especially in the sovereign debt securities market. In this market, a series of papers have already specifically documented the decrease in the spread of sovereign debt of emerging countries when there is a fall in international risk-free rates (GONZALEZ-ROSADA and LEVY YEYATI, 2007; FOLEY-FISHER and GUIMARÃES, 2013), which would indicate an RFY movement of international investors, moving their capital from developed to emerging countries and thus affecting the pricing of securities in the latter. Sabbadini (2019) formally proposes a behavioral model - in line with the BH hypothesis proposed here - that seeks to explain this investor response to low risk-free rates. From simulated data, the author shows that his model's predictions are consistent with the investors' RFY.

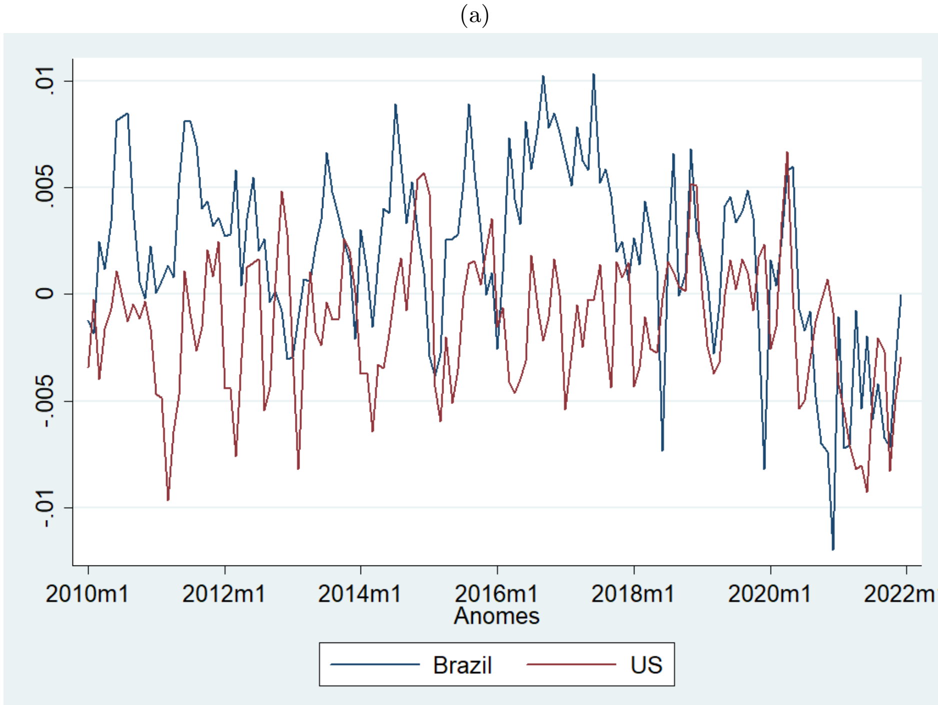
However, as far as we know, this is the first paper that directly tests the effects of changing international and domestic basic interest rates on RFY behavior in fund portfolios in an emerging country, while instead of observing this behavior only indirectly via market prices. Furthermore, it is noted that Brazil, during the sample period (2010-2021), is a particularly interesting case to test some characteristics of the RFY. Unlike developed countries (and even some emerging ones) Brazilian interest rates showed great nominal and real interest rate variability in this period, with periods of increase and decrease of these rates that do not closely follow the international market[3]. These specific characteristics of the Brazilian market allow for any asymmetries in the RFY to emerge from the data - and to differentiate to what extent the international or local interest rates are the drivers of this effect. Figure 1 illustrates some of the statements about Brazil's peculiar macroeconomic scenario in the period studied.

Furthermore, in the period studied there were periods of domestic recession that do not coincide with international recessions, which allows us to empirically disentangle the influence of two potential explanations for the eventual occurrence of the RFY: (a) the argument for the pro-cyclicality of the RFY based on at the time of the economic cycle of the argument, which argues that moments of economic boom would stimulate the RFY due to the lower need to concentrate portfolios in low-risk assets to protect against high systemic risks; (b) the RFY for the variation of the risk-free rate, which

[3] Illustrates In this scenario, the low correlation between the Brazilian and American risk-free rates in the studied period - of 0.35.



(a)



(b)

Figure 1: Brazil and US monthly risk-free rates. Subfigure (a) show the US nominal rate taken from Kenneth French's website (2022), and Brazil´s equivalent, taken from the São Paulo University (USP) Nucleus for Finance Studies' (NEFIN, 2022) website. Subfigure (b) shows the same rates, inflation-adjusted by the US Consumer Price Index (CPI) and Brazil's IPCA inflation index, respectively.

conjectures that increases in the risk-free rates are perceived by economic agents as opportunities for attractive returns to risks that are still relatively low, i.e., that low-risk assets have a risk ratio -return more attractive than before.

These features are used to test LRH - which is in line with argument (a) - and BH - which is in line with argument (b). Furthermore, in this article we were able to take advantage of a database that contains characteristics of the fund's regulation, to differentiate from pooled OLS regressions the occurrence of RFY funds by their budget constraint (BCH) and by characteristics that denote differences in the skill of the fund managers (HMSH).

Moreover, previous studies generally analyze empirically only one class of funds/financial institutions, such as insurance companies (BECKER and IVASHINA, 2015), Money Market Funds (DI MAGGIO and KACPERCZYK, 2016) or mutual funds (CHOI and KRONLUND , 2017). Hewe we apply the same methodology to identify the RFY and its characteristics for equity funds and fixed income funds.

Finally, this paper contributes to the literature by empirically testing different hypotheses raised by several recent theoretical models. In this section, the four theoretical hypotheses to be tested were highlighted: (i) the Budget Constraint Hypothesis (BCH); (ii) the Behavioral Hypothesis (BH); (iii) the Heterogeneous Managers Skill Hypothesis (HMSH); and (iv) the Liquidity Risk Hypothesis (LRH). These hypotheses are not mutually exclusive, i.e., an eventual RFY behavior can be derived from several causes suggested in these hypotheses. For example, it is possible that there is a behavioral factor associated with the formation of a reference point of past return and also an influence of budget constraints that require sustainable spending influencing the RFY behavior of agents. Besides, we identify whether the RFY is found for all classes of funds studied here, and what factors influence this behavior in each class of funds.

The rest of this paper is organized as follows: section 2 details the database and the methodology used; section 3 reports the main results; finally, section 4 highlights the main conclusions of the paper.

2 Data and Methodology

A database provided by Economática® was used in this paper. The database contains the end of the month portfolios of investment funds, from January/2010 to December/2021. The classes of investment funds on this basis that were used in the analysis were those classified as: (i) equity funds; (ii) fixed income funds.

To determine the class of an investment fund, the following informations were used: (i) the classification made by the regulatory agency (CVM, 2020), as recorded in the database; (ii) when (i) was not available, the classification made by Economática®, similar to that of the regulatory agency, was used; (iii) if none of the above information was available for any fund, the classification made by the Brazilian Association of Financial and Capital Market Entities (ANBIMA) was used. Additionally, only funds with a minimum of 12 months of portfolio data were used.

Once this classification was made, some additional filters were used to determine the sample of funds considered: (i) if the fund does not have portfolio composition data for December/2021, its last month is excluded from the sample, to avoid distortions caused by portfolio compositions chosen to meet fund closure procedures [4]; (ii) mirror funds are disregarded[5], to avoid duplicating portfolio

[4] This treatment is necessary because investment funds that are closing typically increase their holdings of cash and low-risk, high-liquidity assets to pay their shareholders. These choices are related to the fund's closure process, not to portfolio choices that may reflect the agents' risk appetite.

[5] Mirror funds are defined by the Brazilian regulatory agency as funds with at least 95% of their portfolios allocated

decisions of the master fund (from a master-feeder fund structure) in the database [6]; (iii) funds with assets under management of less than R$ 100 thousand [7] are disregarded.

After the sample was selected, each fund portfolio risk was estimated for each month, using the CAPM β was estimated based on weekly sample returns from January/2001 to December/2021[8]. The estimation was made from OLS regressions of the traditional CAPM equation for each asset n with a minimum sample of 30 periods (weeks) of available return data:

$$r_{n,s} = r_{f,s} + \hat{\beta}_s^{TS}(r_{M,s} - r_{f,s}) \tag{1}$$

where $r_{n,s}$ is the asset n return, $r_{f,s}$ is the risk-free rate and $r_{M,s}$ is market portfolio return - all for the s week. The market portfolio adopted is the one available on the Nucleus for Finance Studies' (NEFIN) website (2022)[9]. To reduce the influence of outliers, the estimated β in the time series are reduced, following the procedure of Vasicek (1973) and Elton et al (2003), which is also adopted in papers with a similar risk estimation procedure (FRAZZINI and PEDERSEN, 2014):

$$\hat{\beta}_n = \omega_n \hat{\beta}_n^{TS} + (1 - \omega_n)\hat{\beta}^{XS} \tag{2}$$

where $\hat{\beta}^{XS}$ is the asset's CAPM β estimated in the cross-section. Following Frazzini and Pedersen (2014), $\omega = 0.6$ and $\hat{\beta}^{XS} = 1$ for all active n [10]. Once the β_n have been estimated for all assets that meet the minimum sample size requirements, the following procedure is adopted for the other M assets that did not meet the previous estimation requirements: (i) the industry β is used of the issuer's performance of M, estimated for the sample period by the equation (2)[11] ; (ii) the average β of assets of the same type as n is used, considering possible leverage of the risk assumed in the case of derivatives [12].

Once we have a $\hat{\beta}_n$ estimate for each asset available at the database, the portfolio risk for each investment fund i and month t is calculated:

$$R\hat{isk}_{i,t} = \sum_{n=1}^{N} \omega_{i,n,t}\hat{\beta}_n \tag{3}$$

where $\omega_{i,n,t}$ is the share of asset n in the composition of the portfolio of fund i at the end of month

in other funds of the same class.

[6]To illustrate the need for this treatment, suppose that the fund i is a fund of accounts fund that invests 100% of its capital in fund j. Since the fund j is already considered in the sample, if we also include the fund i, we will be considering that two individuals from the population of investment funds have adopted exactly the same portfolio composition. However, the i fund in the example is usually created to reduce costs and take advantage of possible scale gains, and not because it represents a coincidence of portfolio choices between two different economic agents

[7]about 20 thousand USD in the average exchange rate of the sample period

[8]The β calculation procedure was chosen for the entire available sample - as opposed to rolling window estimates used in other articles (e.g. FRAZZINI and PEDERSEN, 2014) - to expand the amount of assets with a sufficient sample so that the estimation of a specific β of the asset was possible. This was the same reason why weekly returns were used to estimate the β, since daily returns could distort the risk estimate of assets due to nontrading (a common occurrence in an emerging market), and monthly returns would greatly reduce the number of assets with a representative sample for estimation.

[9]Robustness tests were also made using the Ibovespa Index as the market portfolio. The results obtained are very similar to those reported, and are in agreement with the other results here presented.

[10]The reduction factor of Vasicek (1973) is given by $\omega_i = 1 - \sigma^2_{n,TS}/(\sigma^2_{n,TS} + \sigma^2_{XS})$, where $\sigma^2_{n,TS}$ is the variance of asset n β_n in the time series and σ^2_{XS} is the variance of the β in the cross-section. Intuitively, the idea of this estimator is to give more weight to the β of the time series when the dispersion of β in the cross-section is smaller. Frazzini and Pedersen (2014) calculate an average ω_i of 0.61 for their sample of daily returns on the US stock market from 1965 to 2012, and use the same simplification for their sample of multi-class assets ($\omega_i = 0.6$ for all assets) adopted here.

[11]The industry returns used are calculated by the Nucleus of Finance of the University of São Paulo (NEFIN, 2021) for the Brazilian market, using a similar methodology to that adopted by French (2022) for the American market. The sectoral classification of issuers of assets used is made by Economática in the database. The reduction procedure is not adopted in this case due to the lower variability of the *beta* of industry portfolios.

[12]for further details, see appendix B.2

t.

The fund's portfolio liquidity is also variable of interest in this study, so we measure each asset's liquidity based on the ZEROS indicator, as suggested by Lesmond, Ogden and Trzcinka (1999):

$$ZEROS_n = \frac{1}{D}\sum_{d=1}^{D} \mathit{1}_{n,d} \tag{4}$$

where D is the set of days that goes from the first to the latest day when there is a valid end-of-the day price for the asset (in the January/2001 to December/2021 period) for asset n at the database. $\mathit{1}_{n,d}$ is an indicator that assumes the value one if there is a trade registered for the asset n on the day d and zero otherwise. Intuitively, equation (4) calculates the percentage of days in the sample in which the asset n was not traded. Thus, greater values of $ZEROS_n$ indicate that the asset n is more illiquid (or less liquid). From this indicator, the liquidity of the fund's portfolio i in a given month is defined in a similar way to (3):

$$ILQ_{i,t} = \sum_{n=1}^{N} \omega_{i,n,t} ZEROS_n \tag{5}$$

After estimating funds' risk-taking, we want to estimate how this variable responds to changes in response to the risk-free rate level - to directly test if there is a RFY effect for Brazilian investment funds. We also want to test how an eventual RFY effect interacts with proxies for the different theoretical hypothesis that explain this behavior. These proxies and the model equation estimated by pooled OLS are detailed in equation (6):

$$\hat{Risk}_{i,t} = \beta_0 + \beta_1 r_{f,t} + \beta_2(r_{f,t}R_{i,t-1}) + \beta_3(r_{f,t}ILQ_{i,t}) + \beta_4(r_{f,t}LEV_{i,t}) + \beta_5(r_{f,t}Q_{i,t}) + \beta_5\mathbf{X}_{i,t} + \epsilon_{i,t} \tag{6}$$

where $R_{i,t-1}$ is the i fund return in the twelve months prior to the month t, $ILQ_{i,t}$ is the illiquidity of the fund's portfolio i in t, $LEV_{i,t}$ is a dummy that takes the value 1 if the fund's regulations i allow leverage, and zero otherwise; $Q_{i,t}$ is a dummy that assumes the value one if the fund is intended exclusively for accredited or professional investors. $\mathbf{X}_{i,t}$ is the set of control variables $\mathbf{X}_{i,t} = \{R_{t,t-1}, LIQ_{i,t}, LEV_{i,t}, Q_{i,t}, Real12mGDPg_t, lnSize_{i,t}, Inflation12m_t, \Delta IVOL_t\}$. $Real12mGDPg_t$ is the growth of the Brazilian real GDP accumulated in 12 months (ending at the end of the month t); $lnSize_{i,t}$ is the natural logarithm of the market value of the fund i at the end of of the month t, measured in local currency (BRL); $Inflation12m_t$ is the accumulated inflation in 12 months, measured by the IPCA index; $\Delta IVOL_t$ is the variation of the calculated IVOLBR by NEFIN, and which is an index similar to the VIX for the American market, denoting a measure of expected market volatility [13]. This last variable helps to differentiate variations in portfolio due to changes in the risk expected by economic agents, and the effect of RFY, in which changes in risk taking are only due to the change in the risk-free rate (without this being interpreted as a change in market risk). Equation (7) is estimated separately for fixed income funds and equity funds, so that any differences in behavior due to regulatory constraints are considered. Finally, the pooled OLS method is adopted in a similar spirit to the Choi and Kronlund (2017) RFY tests.

his estimate is related to the hypotheses raised in the following way. First, if there is RFY behavior in the studied fund class, it is expected that $\beta_1 < 0$, i.e., the increase in risk of the fund portfolio is related to low risk-free rate environments.

[13]This variable is available from August/2011 to December/2021

Second, if the Behavioral Hypothesis (BH) is true, $\beta_2 > 0$ is expected, which would indicate higher RFY of funds with a past history of low returns. The idea here is that for a fund that already has low recent returns it is more likely to already have recent returns below the reference point of its loss aversion function. If these agents suffer an additional loss in their expected return due to the fall in basic interest rates, they will tend to become even more risk-loving - thus increasing the risk of their portfolio to compensate for the losses. Here, it is implicitly assumed in the methods that we adopt that the reference point is common for funds of the same class.

Third, if the Liquidity Risk Hypothesis (LRH) is true, $\beta_3 > 0$ is expected, indicating that less illiquid (or more liquid) funds are more prone to RFY. Here, it is assumed that funds with more liquid portfolios are less subject to the risk of their liquidity falling below the threshold that observablely affects the fund's returns (Acharya and Naqvi, 2019).

Fourth, if the Budget Constraint Hypothesis (BCH) is true, $\beta_4 < 0$ is expected, indicating that funds that have access to leverage RFY more. The logic here is that funds with access to leverage would be able to respond more to declines in expected return caused by low interest rates (CAMPBELL and SIGALOV, 2022).

Fifth, if the Heterogenous Manager Skill Hypothesis (HMSH) is true, $\beta_5 > 0$ is expected, indicating that funds intended exclusively for accredited investors have milder RFY behavior. The premise adopted here is that funds intended exclusively for accredited investors are operated by managers who are better informed about the risks of market assets, given that the fund's shareholders are investors who have a degree of qualification and high invested capital, so that fund-market competition should allocate the most qualified managers in this kind of fund. Thus, it is assumed that this type of funds is managed by more qualified and sophisticated managers, who should have a milder RFY, if the HMSH is true.

Finally, the choice of the pooled OLS - besides its previous use in the literature (CHOI and KRONLUND, 2001) - occurs for two main reasons. First, the estimators are asymptotically unbiased, consistent, and $\sqrt{I}$ normal for panels with large cross-section samples (large I) for a given sample size in the time series (T) (WOOLDRIDGE, 2001). This is particularly relevant given the sizes of I and T in our sample. Second, some fund characteristics of interest are not rarely constant over time for the same fund i (such as $Q_{i,t}$ $LEV_{i,t}$). This makes other panel data methods (e.g. Fixed Effects) less interesting than the methodology used here, as they mix the effects of different constant fund characteristics in the estimates. When using this method, it is also important to note that it is implicitly assumed that the intercept and the estimated angular coefficients for each independent variable are the same for funds of the same class. It is argued that this is a reasonable assumption, given that funds of the same class have the same regulatory restrictions on their capital allocation (CVM, 2020).

3 Results

A first glance at our sample shows that there are more than 800 funds of each type for all the months analyzed in the sample (Fig. 2). Both the fixed income and equity funds quantity grows over time with the sample of fixed income funds becoming larger than equity funds, in line with the Brazilian funds market growth during the sample period (ANBIMA, 2022). In addition, descriptive statistics of the main variables of interest of the model to be estimated are exposed in tables 1 and 2 below.

First of all, it is worth noting that the annual returns obtained by fixed income funds are, on average, higher than those of equity funds. This reproduces a well-known characteristic of the Brazilian market, that fixed-income securities - including sovereign debt - have historically performed better than the

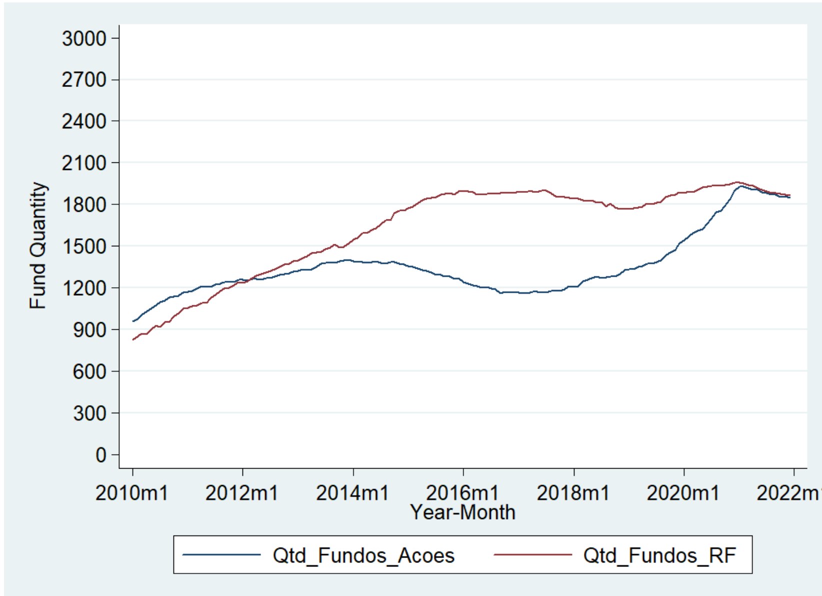


Figure 2: Sample Fund Quantity, by fund class and month.

local stock exchange. Second, as expected, the risk assumed by fixed income funds is, on average, lower than equity funds. Equity funds, which by monetary authority regulation are required to hold at least 67% of their portfolio in stocks[14] take greater risk, on average, which is not surprising.

Additionally, table 2 shows something that was already invoked in the introduction of this text: the Brazilian risk-free rate is significantly high - being 65bps above its American equivalent, although this rate has fluctuated greatly during the sample period. The consideration of the Brazilian risk-free rate is particularly important in the present study because, from the point of view of a Brazilian investor, the US rate may not represent a risk-free option. Currency risk, which makes the American risk-free option risky from the point of view of a Brazilian investor (assuming that the Brazilian economic agent cares about the purchasing power of its wealth in BRL) helps to explain the reason for this difference.

Moreover, Figure 3 shows graphically the evolution between the average risk (in the cross-section) taken by funds of each class per month. Comparing this evolution with that of the Brazilian risk-free rate, it is noted that there are times when the relationship between the fall in the risk-free rate and the increase in the risk taken seems to be more pronounced. Notably, the periods between 2010 and 2012, and from 2017 to 2022 seem to show an increase in risk taking by Fixed Income funds, but the same does not occur with equity funds.

Finally, Figure 4 shows the evolution of average allocations (in the cross-section) among some of the main types of assets. Here it becomes clearer how each fund class varies its risk taking. Equity funds - naturally - vary the composition between government bonds and stocks in their portfolio, keeping a higher percentage of stocks to increase their risk and doing the opposite movement to reduce their risk taking. Fixed income funds are able to increase their risk taking mainly changing the percentage of private and sovereign debt fixed income securities.

[14]Stock funds must allocate 67% of their portfolio among the following types of assets: actions; Brazilian Depositary Receipts (BDRs); Bonuses, subscription rights and share deposit certificates; share fund quotas (CVM, 2020).

Variable	TS Mean	TS SD	TS Minimum	TS Maximum
$Risk_{i,t}$	0.884	0.027	0.83	0.98
$R_{i,t-1}$	0.089	0.145	-0.187	0.535
$ILQ_{i,t}$	0.035	0.007	0.021	0.448
$LEV_{i,t}$	0.378	0.052	0.310	0.468
$Q_{i,t}$	0.300	0.080	0.201	0.420
$FundSize$ (BRL)	264,474	813,533	113,968	9,915,102

(a) Equity Funds

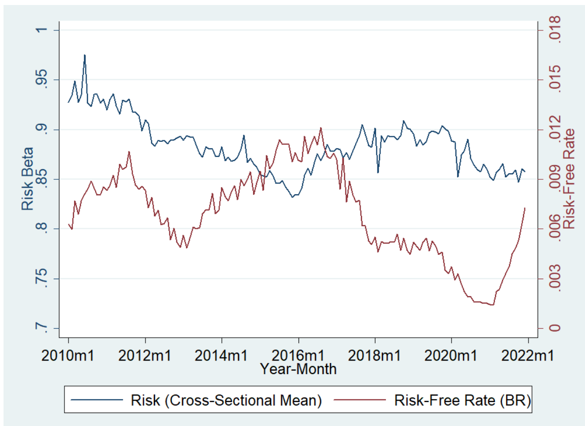
Variable	TS Mean	TS SD	TS Minimum	TS Maximum
$Risk_{i,t}$	0.471	0.005	0.305	0.558
$R_{i,t-1}$	0.095	0.032	0.031	0.160
$ILQ_{i,t}$	0.001	0.001	0.000	0.002
$LEV_{i,t}$	0.030	0.009	0.021	0.052
$Q_{i,t}$	0.259	0.081	0.350	0.104
$FundSize$ (BRL)	1,371,253	2,434,730	759,926	30,123,710

(b) Fixed Income Funds

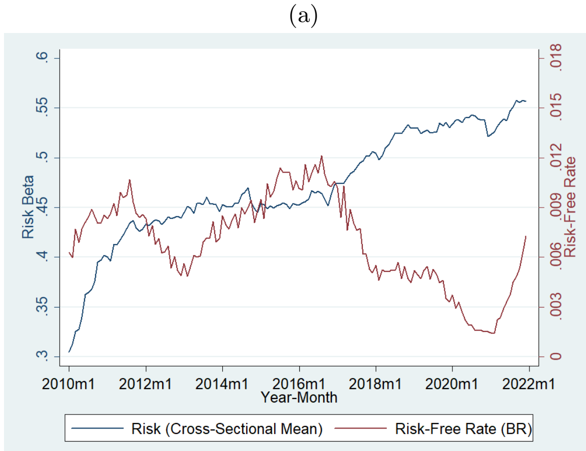
Table 1: Time-Series descriptive statistics. This table contains time-series descriptive statistics (over the 132 months in the sample, jan/2010 to dec/2021) of the cross-sectional mean of each variable, by fund class. Subtables a and b contain data on equity funds and fixed income funds, respectively.

Variable	Mean	SD	Minimum	TS Maximum
$r_{f,t}^{BR}$	0.69 %	0.27 %	0.14 %	1.21 %
$r_{f,t}^{US}$	0.04 %	0.06 %	0.00 %	0.21 %

Table 2: Monthly Risk-Free Rate (Brazil and US) descriptive statistics. Sample period: jan/2010 to dec/2021.

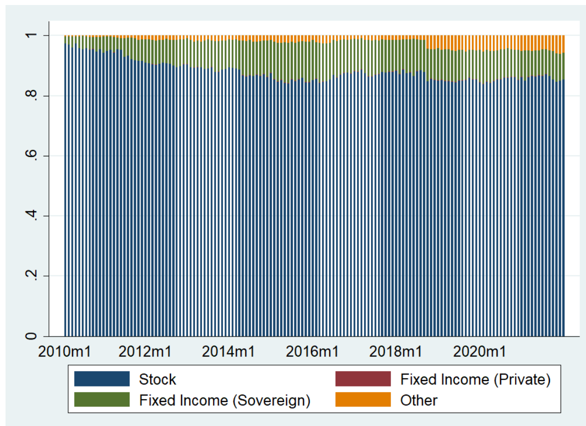


(a)

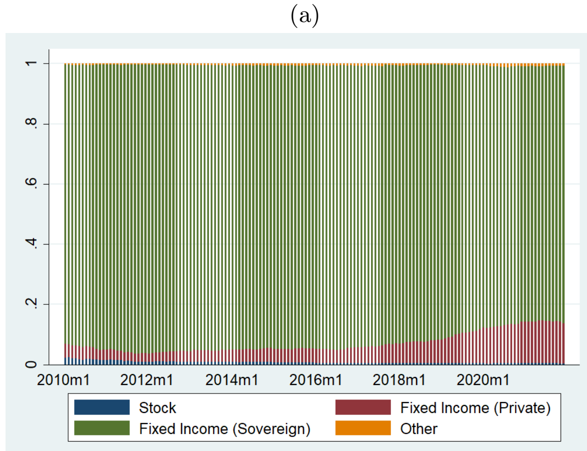


(b)

Figure 3: Fund Risk-Taking and Brazil monthly risk-free rates. Each subfigure shows the cross-sectional monthly average CAPM $\hat{Risk}_{i,t}$ for a class of funds - estimated by equation (6). On the right axis (and red line in the graph), the Brazilian Montlhy Risk-Free Rate is shown. Subfigures (a) and (b) show Risk-taking data for Equity Funds and Fixed Income Funds, respectively.



(a)



(b)

Figure 4: Monthly Fund Allocation. Each subfigure shows the cross-sectional monthly average allocation among asset types. On the right axis (and red line in the graph), the Brazilian Montlhy Risk-Free Rate is shown. Subfigures (a) and (b) show Risk-taking data for Equity Funds and Fixed Income Funds, respectively.

Regression Results		
	Equity Funds	Fixed Income Funds
$r_{f,t}$	-4.27 (-10.67)**	-9.73 (-28.48) **
$r_{f,t}$ x $R_{i,t-1}$	3.70 (3.65)**	-39.66 (-15.52) **
$r_{f,t}$ x $ILQ_{i,t}$	-12.66 (-3.33)**	6.71 (0.35)
$r_{f,t}$ x $LEV_{i,t}$	-4.71 (-9.71)**	-5.69 (-5.53) **
$r_{f,t}$ x $Q_{i,t}$	9.01 (16.29)**	3.61 (8.40)**
$R_{i,t-1}$	-0.09 (-12.99)**	0.40 (25.55)**
$ILQ_{i,t}$	0.02 (0.65)	0.06 (0.61)
$LEV_{i,t}$	0.02 (4.91) **	-0.01 (-1.68).
$Q_{i,t}$	-0.11 (-12.24)**	-0.06 (-17.90)
$Real12mGDPg_t$	2.28 (15.36)**	-0.97 (-8.81)**
$lnSize_{i,t}$	-0.01 (-1.98)*	0.01 (12.44)**
$Inflation12m_t$	-0.28 (-8.46)**	0.28 (11.59)**
$\Delta IVOL_t$	-0.02 (-6.65)**	0.01 (5.45)**
$constant$	1.03 (200.02)**	0.50 (129.91)**
$AdjustedR^2$	10.38 %	4.07 %
$F - stat$	989.37**	494.85***

Table 3: Regression Estimation Results. The table reports estimates and statistics for Pooled OLS estimates of equation (7). Robust standard errors are in parentheses. $./**/***$ indicates statistical significance at the 10%, 5%, and 1% level, respectively.

3.1 Estimation Results

We then proceed to the analysis of the results of the estimation of equation (6) by Pooled OLS, as stated in section 2 of this paper. Regressions are estimated separately for each type of fund analyzed. The results are reported in Table 3 below.

It is noteworthy that the results obtained are consistent with the pre-existing literature: there is evidence of RFY for equity funds and fixed income funds ($\beta_1 < 0$). This result agrees with the extensive evidence regarding RFY in fixed income funds (BECKER and IVASHINA, 2015; CHOI and KRONLUND, 2017) and in equity funds (KIM and OLIVAN, 2015).

One can also see some indications of the most plausible hypotheses to explain the RFY behavior observed for these background classes. First, the interaction between the risk-free rate and leverage ($r_{f,t}$ x $LEV_{i,t}$) had a negative coefficient in all regressions, indicating that funds with access to leverage tend to have more RFY, in accordance with what was suggested by the BCH. On the other hand, the interaction coefficient with the illiquidity of the fund's portfolio ($r_{f,t}$ x $LEV_{i,t}$) was not significant in the regressions for fixed income funds, and was significant but in the opposite direction to provided by the LRH. This indicates evidence against this hypothesis.

On the other hand, $r_{f,t}$ x $Q_{i,t}$ had a positive and significant coefficient for equity funds, evidence in favor of HMSH, i.e., that more sophisticated managers tend to have lower RFY. Finally, $r_{f,t}$ x $R_{i,t-1}$ had positive and significant coefficients, indicating BH plausibility, which points out that high past returns slow down RFY behavior. This argument is reinforced by the fact that the coefficients of $R_{i,t-1}$ are also negative and significant, indicating that funds with higher returns already tend to reduce their risk (even if there is no change in the risk-free rate), corroborating BH's logic that high past returns obtained lead to lower subsequent risk taking.

3.2 Robustness Tests

Here we describe some of the ongoing robustness tests being made, and that will be available in the next version of this paper. Some of these next steps are: replace the proxies of $R_{i,t-1}$, $ILQ_{i,t}$, $LEV_{i,t}$ and $Q_{i,t}$ with other proxies to check the robustness of the conclusions. First, the twelve-month return ending in $t-1$ minus the fund benchmark return may be a more relevant reference point than $R_{i,t-1}$ for funds, worth replacing one variable with the other to verify that the results generally hold.

$ILQ_{i,t}$ associates the fund's liquidity risk to the liquidity of the composition of its portfolio, however, it could be argued that the liquidity risk of the fund's shares is the most relevant for the manager and the fund´s shareholders. Amihud's (2002) measure, which relates volume traded and changes in market price, can be used to measure this effect and verify the robustness of the results obtained.

$LEV_{i,t}$ is dummy about access to leverage of mutual funds. However, it could be argued that access to leverage would not necessarily be analogous to a more flexible budget constraint in the sense generally given in macro-finance models (Campbell and Sigalov, 2022). It is possible that what matters is the budget constraint of the fund's shareholder (who is most subject to the budget constraint in each period in determining its consumption), and not of the fund itself - and that these interests may not be fully aligned between principal and agent. One measure that should be correlated with the shareholder's budget constraint is the amount of initial investment required by the fund, which can help to differentiate whether other factors associated with a lighter budget constraint also mitigate the effect of RFY.

Also, there are questions in the literature about how much more sophisticated fund managers exclusively for qualified investors are in fact. Furthermore, specifically for fixed income funds, the proportion of the sample of funds with this characteristic is quite small, hampering the analysis of this class of fund. Kacperczyk et al. (2014) propose a manager skill measure based on the difference in allocation between the fund and the market at different times of the economic cycle, which can be constructed from the existing database - at least for equity funds[15]. Extending this indicator from the premise that fund managers with greater skill for funds in which this variable is measurable for the other classes of funds will be an interesting robustness test of the results related to HMSH.

4 Conclusion

This paper studied the Reach-for-Yield phenomenon - defined as the greater risk appetite of agents in moments of low risk-free rate - for the Brazilian investment fund market. Evidence of RFY was found for equity and fixed income funds.

Additionally, for equity and fixed income funds, preliminary evidence points out that behavioral factors related to changing the reference point of expected returns should be part of the explanation of this phenomenon, as proposed by Lian, Ma and Wang (2019). In addition, more sophisticated/informed capital managers tend to be less likely to have RFY behavior, as proposed by Guerrieri and Kondor (2009). Finally, agents' budget constraints in the spirit of Campbell and Sigalov (2022) also seem to play a relevant role, at least with regard to the relationship between access to leverage and the intensity of RFY behavior agents. On the other hand, the liquidity risk hypothesis seemed to play a minor role in this behavior, especially for fixed income funds.

On the other hand, the liquidity risk hypothesis (ACHARYA and NAQVI, 2009) had weaker evidence in its favor than the other hypotheses, especially not seeming to influence the RFY behavior of

[15]For these funds, information on the market capitalization of each asset is available, enabling a comparison of how much the fund has allocated to a given asset and how much the market has in the same asset.

fixed income funds.

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