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Relation in Colombian Open-End
Investment Funds

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No. 1323
2025



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Abstract

We provide the first comprehensive analysis of the flow-performance relation in Colombian open-end investment funds. We employ a rich dataset containing weekly information at the fund level, including balance sheets, portfolio holdings, liquidity indicators, capital flows, and returns, from January 2018 to December 2023. By analyzing fixed and variable-income funds separately, our empirical findings indicate that performance is relevant for the sensitivity of flows only in fixed-income funds. For these, outflows are more sensitive to poor performance than inflows to good performance. However, macro-financial variables significantly influence investing decisions for both fixed and variable-income funds.

Keywords: flow-performance relation, investor redemptions, open-end funds

JEL Codes: G01, G11, G23

*This paper has grandly benefited from being part of the working group of the NBFIs initiative of the International Banking Research Network (IBRN) coordinated by Linda Goldberg and Falko Fetch. The authors thank Falko Fetch, Linda Goldberg, Hernando Vargas, Andrés Murcia, Carlos Quicazán, Juan Carlos Mendoza, and Miguel Sarmiento for their insightful comments and suggestions. The opinions contained herein are the sole responsibility of the authors and do not commit Banco de la República nor its Board of Directors.

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Explorando la relación entre aportes netos de capital y rentabilidad en los fondos de inversión colectiva abiertos sin pacto de permanencia en Colombia

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Resumen

Este documento presenta el primer análisis de la relación entre los aportes netos de capital (aportes menos retiros) y la rentabilidad en los fondos de inversión colectiva abiertos sin pacto de permanencia en Colombia. Utilizamos un conjunto de datos detallado que contiene información semanal a nivel de fondo, incluyendo balances, composición del portafolio de inversiones, aportes y retiros de capital, indicadores de liquidez y rentabilidad, desde enero de 2018 hasta diciembre de 2023. Analizamos por separado los fondos que invierten principalmente en renta fija y en renta variable. Encontramos una alta sensibilidad de los aportes netos a la rentabilidad únicamente en los fondos de renta fija. En estos, las rentabilidades negativas se asocian con una fuerte caída en los aportes netos, posiblemente explicada por un aumento en los retiros de capital. No obstante, las variables macrofinancieras parecen influir de manera significativa en las decisiones de aportar o retirar capital tanto en fondos de renta fija como de renta variable.

Palabras clave: Relación aportes-rentabilidad, retiros de capital de inversionistas, fondos de inversión abiertos sin pacto de permanencia

Códigos JEL: G01, G11, G23

1 Introduction

Open-end investment funds (OEFs) have grown rapidly in recent years. This fact is not exclusive to Colombia but to several jurisdictions worldwide. According to the International Investment Fund Association, in the first quarter of 2024, worldwide assets of regulated OEFs reached \$74.5 trillion (t), representing a growth rate of 18.3% in just one year, with quarterly net inflows of \$814 billion (IIFA, 2024). The outstanding performance of these funds, which are mutual funds that can issue or redeem shares daily at a price set at the end of the trading day, has raised concerns about financial stability. The substantial assets managed by OEFs have rendered these funds and their managers systemically important within the non-bank financial sector.

OEFs must hold enough liquid assets to meet the daily redemptions requested by investors. During periods of market stress, however, large-scale withdrawals could force these funds to sell assets to meet redemptions. The sale of assets that can be at prices below the fundamental values (fire sale) could generate downward pressure on asset prices, amplifying the initial effects of the shocks and thereby inducing additional withdrawals. Therefore, recent literature has prompted the potential role of OEFs in amplifying excessive volatility in debt markets, especially when market liquidity deteriorates (IMF, 2022).

Several episodes of market stress have materialized across history, leading OEFs to face massive redemptions. For instance, during the 2008 global financial crisis, the total net assets of mutual funds fell by 20% worldwide, leading to increasing market volatility (ICI, 2009). Likewise, during the mid-2013 taper tantrum and the COVID-19 pandemic, OEFs saw large outflows of capital from their investors. Specifically, during the first episode, net redemptions were estimated to be around \$20 billion in emerging market currencies funds (Farrell et al., 2020). Meanwhile, at the onset of the pandemic

in March 2020, emerging market economies saw large and abrupt outflows of about \$78 billion (IMF, 2022).

Considering the multiple materialized episodes of stress, several studies have analyzed fund inflows and outflows to better understand the potential threats to the financial stability they pose. Christoffersen et al. (2014) point out, through a vast review, a large and growing literature on flows on the main open-end mutual funds. Among these studies, some have focused on the flow-to-performance relation (Ippolito, 1992; Chevalier and Ellison, 1997; Sirri and Tufano, 1998; Chen et al., 2010; Spiegel and Zhang, 2013; Christoffersen et al., 2014; Casavecchia, 2016; Goldstein et al., 2017), finding heterogeneous results.

On the one hand, empirical findings suggest a convex shape for the flow-to-performance relation, meaning that inflows respond more to good past performance than outflows to bad past performance (Ippolito, 1992; Chevalier and Ellison, 1997; Sirri and Tufano, 1998). As pointed out in Goldstein et al. (2017), this pattern may indicate that fragility is not a pressing concern. In other words, if investors do not withdraw their capital after negative performances, worrying about outflows depressing prices and leading to negative consequences seems irrelevant.

On the other hand, Spiegel and Zhang (2013) argue that fund flows are linear in returns. Meanwhile, Ciccone et al. (2022) indicate that flows to global funds react more strongly to extreme than medium performance, contrary to flows to funds domiciled in Luxembourg, where sensitivity is statistically insignificant. However, Chen et al. (2010) and Goldstein et al. (2017) suggest that, in general, outflows are more sensitive to poor performance than inflows to good performance. Importantly, these two studies find outflows in funds with illiquid assets to exhibit a stronger sensitivity to bad past performance. Likewise, the effect of illiquidity on the sensitivity of outflows

to poor performance is weaker in funds held mostly by institutional investors, mainly because these agents are more likely to internalize the negative externalities generated by their outflows, given the significant positions they hold. In addition, Goldstein et al. (2017) highlight that outflows are more sensitive to poor performance during periods characterized by a less liquid corporate bond market.

The inclusion of liquidity in the flow-performance relation captures the fact that funds with more liquid assets could meet redemptions without liquidating their positions on short notice, thus not bearing high costs and mitigating the negative externalities following capital withdrawals. Literature relying on stress testing designs for funds has made notable efforts in this regard. The vast majority focuses on analyzing the response of outflows in OEFs that are investing in potentially illiquid assets (Bouveret, 2017; Baranova et al., 2017; Gourdel et al., 2019; Fricke and Fricke, 2021) and particularly, Fricke and Fricke (2021) incorporate the sensitivity of flows to performance as an additional shock to the fire sales model. Furthermore, these studies highlight the relevance of considering macro-financial variables when assessing liquidity mismatches and capital flow behavior. Macro-financial shocks could not only negatively impact funds' performance but also exacerbate funds' outflows (Baranova et al., 2017).

All literature mentioned up to this point focuses on analyzing funds in jurisdictions different to Colombia (mainly in the US and Europe). To the best of our knowledge, research on mutual funds in Colombia is scarce. So far, Muller et al. (2024) investigate the impact of large-scale investment funds redemptions on banks' wholesale deposits during the outbreak of the COVID-19 pandemic, while Vivas and Joven (2019) explore whether Colombian mutual funds deliver abnormal risk-adjusted returns and delves on their persistence, finding that mutual funds underperform the market and suggesting that investors may pursue passive investment strategies and analyze past performance. We contribute to the existing literature on mutual funds in Colombia and, notably,

present the first analysis of the flow-performance relationship in Colombian OEFs.

We employ a rich data set comprising weekly information from January 2018 to December 2023 on the balance sheet, liquidity indicators and returns of all OEFs operating in Colombia. Additionally, considering the correlation between financial market stress episodes and massive capital redemptions (Gourdel et al., 2019), we include weekly macro-financial variables, such as the spread between the interbank and the monetary policy rate, the spread between 12-month private and public debt rates, as well as the GARCH-estimated volatility of private debt securities.

We aim to analyze the flow-performance relation to understand investors' behavior. To do so, we estimate a panel regression, including fixed effects at the fund and time levels. Following Goldstein et al. (2017) and considering the differences among fixed and variable-income OEFs in Colombia¹, we intend to evaluate whether fixed-income funds exhibit stronger sensitivity of outflows to poor performance than variable-income funds. We are also interested in assessing the effect of illiquid assets on the flow-performance relation. Given the experience in Colombia and some other jurisdictions, we suspect that in OEFs holding illiquid assets, the magnitude of redemptions to negative past performance is higher than that of funds with liquid assets. The rationale is that in OEFs with less liquid assets, the investors who withdraw their money due to performance generate a cost to the fund, which is borne mostly by the investors who keep their capital in. Therefore, the expectation that some investors will withdraw increases the incentive for other investors to do the same thing, increasing the overall amount of redemptions.

In addition to the analysis mentioned above, we assess the effect of illiquidity on the sensitivity of outflows to poor performance in funds with an exposition greater than

¹See Section 3.

20% to institutional investors, the real sector, and natural persons. This exercise is carried out bearing in mind the results of SFC (2020), which suggest that in Colombia, several investors, such as institutional investors, exhibit a higher net withdrawal factor. Therefore, funds exposed to these investors may have higher levels of liquidity risk.

Our empirical findings indicate that inflows increase as returns rise. However, outflows exhibit more sensitivity to poor performance than contributions to good performance. Furthermore, funds holding more liquid assets may experience higher inflows when increasing returns, and greater outflows are exhibited regardless of returns during periods characterized by massive redemptions. These results apply only to fixed-income funds, as the estimates are not statistically significant for variable-income funds.

Regarding macro-financial variables, low liquidity in the money market, increasing public debt market volatility, and the devaluation of certificates of deposits increase outflows in funds highly exposed to fixed-income securities in most models analyzed. Furthermore, the spread between the 12-month private-to-public rate is negative and statistically significant in almost all specifications. This result is reasonably expected, as an increase in the spread may reflect lower liquidity and relative value in the private debt market, which could affect profitability as OEFs invest more in private debt instruments, leading investors to redeem their shares. Our findings support the relevance of market monitoring in the investor's decision to redeem.

In addition, when analyzing whether OEFs face higher levels of liquidity risk depending on their exposure to certain investors, we find that, regardless of the type of agent (institutional, real sector or natural person), investors appear to tend to redeem their shares when OEFs performance declines, suggesting a general concern about the effect on prices. However, the magnitude of the impact is greater in institutional-oriented funds. Likewise, estimates related to fund liquidity are greater for institutional-oriented

OEFs. This suggests that, in funds with a larger presence of institutional investors, lower asset liquidity leads to lower capital flows, resulting in either higher outflows or lower contributions.

Notably, we do not attempt to address the potential systemic implications of OEFs fragility, given that our goal differs from answering whether outflows in funds significantly impact market prices or the real economy. Instead, we provide an approximation to understand the drivers that affect an investor's decision to redeem their shares. This is achieved by focusing on the flow-performance relationship under various circumstances, including poor performance, low asset liquidity, and periods of increasing market volatility or massive redemptions.

The rest of the paper is organized as follows. Section 2 describes the industry of OEFs in Colombia. Section 3 introduces the data we use. Section 4 elaborates on the empirical strategy, and Section 5 presents the results. Finally, in Section 6, we briefly conclude.

2 Open-end investment funds in Colombia

Like in most jurisdictions, in Colombia, OEFs are mutual funds managed by a third party, corresponding to stock brokerage firms, trust funds, and investment management companies. The fund manager issues or redeems shares daily at a price set at the end of the trading day. The benefits to investors are that these funds are always open to new investments, do not impose minimum holding periods, and provide security while offering a return.

The Colombian OEF market has deepened during the last few years. Their total assets under management (AUM) increased by 165,2% between 2016 and 2023, reaching

COP 90,9 t in December 2023 and accounting for approximately 5% of the non-bank financial sector's assets. This performance reflects an increasing attractiveness of mutual funds.

Unlike some OEFs worldwide, in Colombia, these funds are categorized by their investment portfolio composition instead of by the investors to which they are intended. Therefore, according to the Colombian regulatory framework, OEFs can be classified into three categories.² The first one corresponds to money market funds (MMFs), whose portfolio consists of securities registered in the National Registry of Securities and Issuers with an investment-grade rating granted by a credit rating agency.³ MMFs must not hold investments in shares or commodities directly or indirectly, the exposure in foreign currency (unhedged position) must not exceed 5% of the fund's net value, the maximum weighted average term for maturity of their securities must not exceed 365 days, and the redemptions must be attended the business day following the request. The second type is variable-income funds, which must invest mainly in shares, exchange-traded funds, or other equity participation instruments. Finally, balanced funds diversify their investments between fixed-income and equities. In the latter two, the period to process redemptions may not exceed three business days.⁴

Figure 1(a) presents assets under management (AUM) by fund type. Fixed-income funds (MMFs and balanced funds) have grown significantly since 2016, while the variable-income funds' assets have decreased since the beginning of 2022. As of December 2023, the total AUM of MMFs stood at COP 44.6 t (representing 49%), at COP 46.1 t for balanced funds (50.6%), and at COP 0.3 t for variable income funds (0.3%).

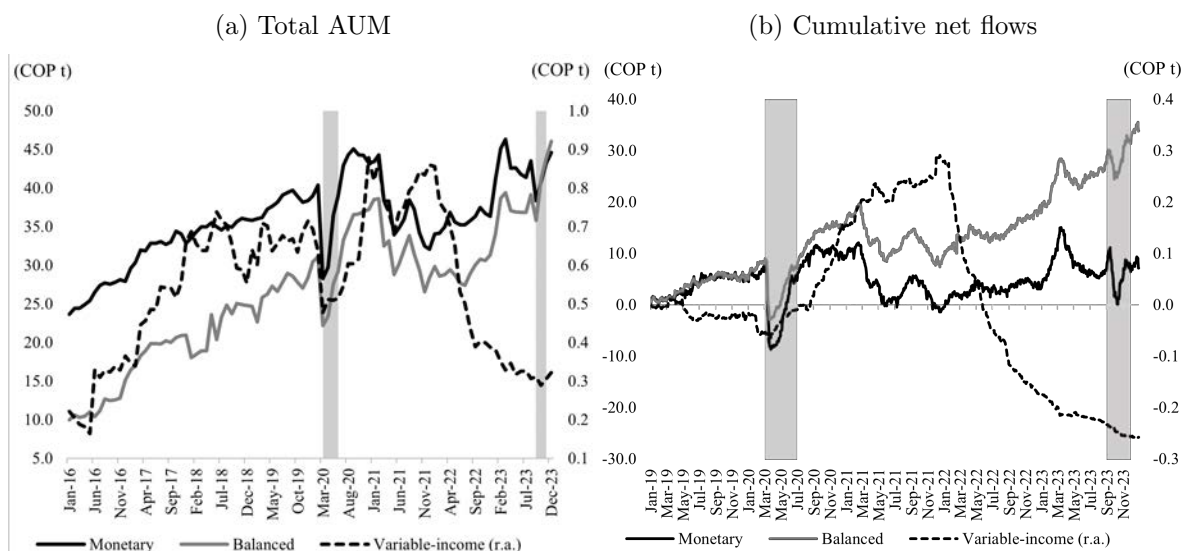
Between 2016 and early 2020, AUM exhibited a relatively constant growth rate.

²Part 3 of Decree 2555 of 2010

³MMFs may also invest in securities issued or guaranteed by the General Government, Central Bank of Colombia, or the Deposits Insurance Institution, in which case the credit rating is not required.

⁴This period may not exceed five business days if international assets are involved.

Figure 1: Assets and capital flows



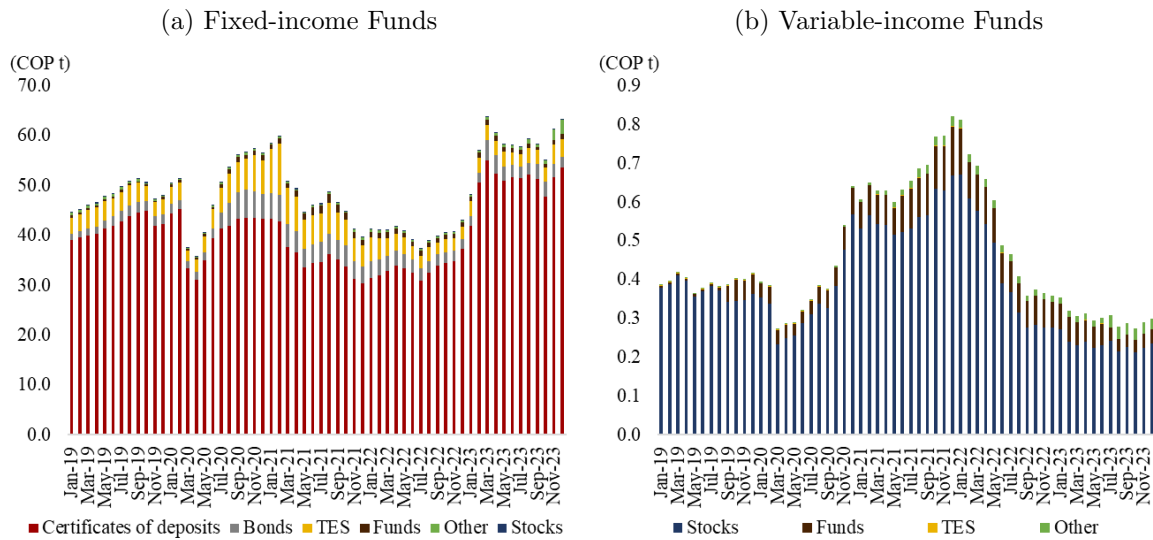
Panel (a) depicts total assets under management by type of OEF. Panel (b) presents the cumulative net flows (contribution minus redemption) starting from January 1, 2019. Source: Financial Superintendence of Colombia. Authors' calculations.

However, since the COVID-19 pandemic, this positive trend changed. For instance, between March 6 and March 30, 2020, the total AUM decreased by COP 23.7 t. Afterwards, it recovered but diminished by COP 15.7 t between January 2021 and December 2022. Likewise, between September 13 and September 29, 2023, the total AUM decreased by COP 16.2 t, followed by constantly increasing until COP 90 t in December 2023. The dynamic of fixed-income funds drove this performance, which is highly related to capital flows. Figure 1(b) exhibits cumulative net flows (redemptions less contributions) between 2019 and 2023. Notably, declining AUM periods correlate with fewer subscriptions and higher redemptions in fixed-income funds. These funds experienced net redemptions amounting to COP 26.4 t between March 6 and March 30, 2020; COP 3.8 t from January 2021 to December 2022; and COP 14.8 t between September 13 and September 29, 2023.

Fixed-income funds have driven the dynamic of total AUM not only because they are

the most representative but also because their investment portfolio mainly consists of CD. Therefore, seeking to minimize losses, investors likely respond to price devaluation or market volatility in private debt markets by redeeming their shares. Figure 2(a) depicts the composition of the investment portfolio of fixed-income funds. Historically, around 83% of the total investment portfolio is in CD, 8% in Colombian Government bonds (TES), and 6% in corporate and credit institutions bonds. Figure 2(b) presents the investment portfolio of variable-income funds. Unlike fixed-income funds, around 84% of the total portfolio is equity, 12% corresponds to shares in investment funds, and 0.3% to TES.

Figure 2: Investment portfolio composition of OEFs



The figure depicts the composition of the investment portfolio of OEFs between 2019 and 2023. Panel (a) corresponds to fixed-income funds, and Panel (b) to variable-income funds. Source: Financial Superintendence of Colombia. Authors' calculations.

When analyzing the price of certificates of deposits (CD), one can argue that increasing redemptions in fixed-income funds correlate to devaluations recorded by these securities. In fact, between March 6 and March 30, 2020, and September 13 and September 29, 2023, periods characterized by massive redemptions, the CD price index exhibits a sudden decrease (Figure 3). Meanwhile, from January 2021 to December 2022, per-

manent reductions in the price index were recorded.⁵

Figure 3: Price index of certificates of deposits



The figure depicts the daily price index of certificate deposits starting in January 2019. The first observation equals 100. We compare the recorded price level to this initial value for subsequent dates. Source: Deceval and Precia. Authors' calculations.

The aforementioned periods of massive withdrawals have pointed out the liquidity risks borne by OEFs. Although these funds must comply with several liquidity indicators in Colombia, during these periods, several experienced a significant drop in their liquidity, leading to struggle while attending the redemptions.⁶ According to the Financial Superintendence of Colombia, OEFs must hold a percentage of liquid assets (i.e., securities that can be converted into cash quickly and with little impact on their value), which varies depending on the type of fund.⁷ However, during the COVID-19

⁵Net redemptions between March 6 and March 30, 2020, were equivalent to 35,6% of total AUM as of March 6. Net redemptions between January 2021 and December 2022 accounted for 5% of total AUM as of January 1. Net redemptions between September 13 and September 29, 2023, represented 16.3% of total AUM as of September 13.

⁶According to regulations, there are four liquidity indicators: liquidity risk indicator, cash indicator, 1-day liquidity indicator, and 30-days liquidity indicators.

⁷MMFs must maintain at least 5% of the fund's net value in cash, at least 10% in liquid resources (1-day liquidity), at least 25% in 30-day liquidity, and an LRI greater than 100%. The limits for balanced funds are as follows: at least 5% in liquid resources and an LRI greater than 100%. Variable-income funds must hold at least 3% in liquid resources and an LRI greater than 100%.

pandemic, some OEFs failed to comply with regulatory liquidity limits for up to five days, given the market dislocations and the increasing redemptions. Regulators and supervisors took action, and due to their responses, OEFs holding less liquid assets were not forced to sell their securities (neither negotiating directly with issuers nor in the secondary market).⁸ These measures contributed to ameliorating OEFs' liquidity and contained the increasing capital redemptions.

After the COVID-19 pandemic, neither similar nor other measures have been taken to address the potential effects of massive redemptions. However, since withdrawals emerge suddenly and some funds may not be prepared to attend them, financial stability concerns about OEFs continue to be discussed. Therefore, in this context, the analysis of the flow-performance relation gains relevance as it is an approximation to evaluate the investors' behavior.

3 Data

To explore the flow-performance relation in Colombian OEFs, we take advantage of weekly granular datasets, which these funds report to the Financial Superintendence of Colombia. We employ data on balance sheets, portfolio holdings, liquidity indicators, and capital flows and returns recorded by each local OEF. We merge these sources at the fund level and end up with a dataset containing information for 81 OEFs (18 MMFs, 54 balanced funds, and nine variable-income funds). Our analysis period spans

⁸Among several actions, the Central Bank of Colombia, aiming to provide liquidity, adopted the following measures: on March 12, 2020, authorized repo operations with private debt securities and access with these securities to temporary expansion auctions for brokerage, trust management, and investment management companies; on March 18, 2020, authorized access with public debt securities to temporary expansion auctions for brokerage, trust management, and investment management companies, and on March 23, 2020, authorized definitive expansion operations with private debt securities for credit institutions and management companies in proprietary and third-party position.

from January 2018 to December 2023, meaning we include 415 weeks.⁹

The key variables in our empirical analysis are fund flows and performance. We define the former as the total weekly net flow (contributions minus redemptions) over the total AUM. The latter is simply the monthly raw return recorded each week. To mitigate the influence of outflows, we winsorize fund flows at the 1% and 99% levels. Additionally, since we include levels of liquidity to analyze the flow-performance relation, we calculate the 1-day liquidity ratio to capture the most liquid assets held by each OEF to meet redemptions.¹⁰ To control for fund characteristics, we calculate the share of investments on total assets and the fund's size as the natural logarithm of total AUM.

Furthermore, considering that we wonder whether funds exposed to several investors may face higher redemptions due to the historical net withdrawal factor registered by each type of agent, we employ an additional dataset provided by the Financial Superintendence of Colombia. This source comes from an extraordinary request made by the financial supervisor to OEFs in 2024, containing information at the fund level on the capital balance and the nature of the investors that accounted for at least 25% of the total AUM. We identify the funds in which institutional, real sector and natural persons investors represent more than 20% of total assets as of December 2023. We classify these OEFs into institutional-oriented, real sector-oriented, and natural persons-oriented funds to analyze them separately further.¹¹ We acknowledge, however, that this classification might be a noisy way to capture funds' exposition. Still, we believe it is the best proxy, given the data availability.

Table 1 presents the summary statistics for the funds in our sample. We divide

⁹The information on the balance is reported in Template 19, portfolio holdings in Template 351, liquidity indicators in Template 519, and the information on capital flows and returns in Template 523

¹⁰See Section 2

¹¹See Section 4

OEF into fixed-income (MMFs and balanced funds) and variable-income funds, considering that the former invests the most in CD and the latter in equity.¹² This fact is reflected in a higher share of CD in total investments recorded by fixed-income funds over our sample period. On average, these funds hold 56% of their investments in CD and record monthly returns of 7%. Meanwhile, variable-income funds hold only 0.9% of their investments in fixed-income securities and record higher monthly returns (27%). Furthermore, fixed-income funds face higher capital flows (contributions and redemptions) than variable-income funds. Thus, it is not rare that, on average, the former holds a greater percentage of cash, and their 1-day liquidity indicator is three times that of variable-income funds. Finally, on average, fixed-income funds are more exposed to institutional, real sector, and natural persons investors.

Table 1: Summary statistics

| VARIABLE | Fixed-income Funds | | | | Variable-income Funds | | | |
|--|--------------------|--------|--------|--------|-----------------------|--------|--------|---------|
| | Mean | p1 | p50 | p99 | Mean | p1 | p50 | p99 |
| Assets (COP t) | 1.10 | 0.00 | 0.44 | 12.29 | 0.08 | 0.00 | 0.05 | 0.41 |
| Cash (% Assets) | 29.00 | 6.19 | 30.08 | 55.25 | 9.46 | 3.62 | 7.41 | 35.15 |
| Investments (% Assets) | 70.55 | 44.01 | 69.42 | 93.76 | 90.23 | 64.67 | 92.3 | 96.25 |
| Certificates of Deposits (% Investments) | 55.75 | 0.00 | 65.21 | 100 | 0.85 | 0 | 0 | 14.48 |
| 1-day Liquidity Ratio (%) | 29.33 | 6.41 | 30.45 | 55.87 | 9.4 | 3.63 | 7.4 | 33.37 |
| Liquidity Coverage Ratio (%) | 391.52 | 135.9 | 367.17 | 887.48 | 735.5 | 154.32 | 843.73 | 959.83 |
| Net Flows (COP t) | 0.00 | -0.28 | 0.00 | 0.30 | 0.00 | -0.01 | 0.00 | 0.01 |
| Daily Row Return (%) | 18.39 | -64.37 | 4.99 | 357.92 | 198.67 | -89.48 | 69.28 | 1938.41 |
| Monthly Raw Return (%) | 6.93 | -29.7 | 4.5 | 66.14 | 27.09 | -77.48 | 15.48 | 255.83 |
| Institutional Investors (% Assets) | 4.79 | 0.00 | 0.72 | 38.96 | 0.69 | 0.00 | 0.01 | 3.25 |
| Real Sector Investors (% Assets) | 9.63 | 0.00 | 0.58 | 84.61 | 7.83 | 0.00 | 0.73 | 31.85 |
| Natural Persons Investors (% Assets) | 14.44 | 0.00 | 11.78 | 64.18 | 4.91 | 0.00 | 0.16 | 22.87 |

The table depicts the summary statistics for characteristics of fixed-income and variable-income funds in our sample from January 2018 to December 2023. For the investors' participation in the assets we use data as of December 29th 2023. We report the mean (Mean), 1st percentile (P1), 50th percentile (P50), and 99th percentile (P99). Authors' calculations.

Finally, to analyze whether macro-financial variables impact capital flows, we employ a dataset containing information on weekly private and public debt interest rates and monetary policy interest rates. We construct the spread between the 12-month private-to-public rate and between the interbank and the monetary policy rate. Likewise, we calculate the GARCH-estimated volatility of private debt securities.

¹²See Section 2

4 Empirical strategy

Following Chen et al. (2010), Goldstein et al. (2017) and Ciccone et al. (2022), we run panel regressions to analyze the flow-performance relation in OEFs. Considering that fixed-income funds differ from variable-income funds, given that the former may hold much more illiquid assets and has recorded historically higher levels of redemptions under periods of stress, we estimate all models presented separately by fund type. Furthermore, following Ciccone et al. (2022), we cluster standard errors at the fund level and include fixed effects at the fund and time levels. Dummies by fund account for individual-specific unobservable effects, which may be correlated with explanatory variables.

First, to evaluate the sensitivity to different levels of lagged monthly raw return, we employ the following regression:

$$\begin{aligned} Flow_{i,t} = & \alpha + \beta_1 MonthlyRawReturn_{t-1} + \gamma Controls_{i,t-1} + \\ & \delta MacroFinancial_{t-1} + \epsilon_{i,t} \end{aligned} \tag{1}$$

where $flow_{i,t}$ corresponds to fund i 's net flow in week t , and $MonthlyRawReturn_{t-1}$ to fund i 's monthly raw return in week $t - 1$. $Controls_{i,t-1}$ includes a set of fund characteristics, such as net flow, fund size, and the percentage of investments in week $t - 1$. Meanwhile, $MacroFinancial_{t-1}$ comprises the interbank and the monetary policy rate spread, the 12-month private and public debt rate spread, and the GARCH-estimated volatility of private debt securities. Our interest relies on β_1 since it captures the sensitivity of flows to returns.

We also intend to examine whether there is a stronger sensitivity of flows when lagged monthly raw returns are negative. Therefore, in addition to the previous speci-

fication, we estimate the following model:

$$Flow_{i,t} = \alpha + \beta_1 MonthlyRawReturn_{t-1} + \beta_2 MonthlyRawReturn_{t-1} \cdot \mathbf{I}(RawReturn_{t-1} < 0) + \beta_3 \mathbf{I}(RawReturn_{t-1} < 0) + \gamma Controls_{i,t-1} + \delta MacroFinancial_{t-1} + \epsilon_{i,t} \quad (2)$$

where $\mathbf{I}(RawReturn_{t-1} < 0)$ is an indicator variable equal to one if the fund records a negative lagged monthly raw return and zero otherwise. In this regression, β_2 captures the asymmetry in investor responses to positive and negative returns.

Secondly, we analyze the impact of asset liquidity on the flow-performance relation. For this purpose, we consider two different measures of liquidity. The first -IlliqFund- corresponds to the distance between the 1-day liquidity ratio exhibited by the fund i in week $t - 1$ and the minimum required by the supervisor.¹³ The rationale behind using this variable is that it can be argued that OEFs hold less liquid assets as the spread narrows. The second measure - $\mathbf{I}(\text{IlliqFund})$ - is an indicator variable equal to one if the distance mentioned above is lower than the 5th percentile of the historical distribution. These variables are included in the model as follows:

$$Flow_{i,t} = \alpha + \beta_1 MonthlyRawReturn_{t-1} + \beta_2 MonthlyRawReturn_{t-1} \cdot \mathbf{I}(IlliqFund_{i,t-1}) + \beta_3 \mathbf{I}(IlliqFund_{i,t-1}) + \gamma Controls_{i,t-1} + \delta MacroFinancial_{t-1} + \epsilon_{i,t} \quad (3)$$

and

$$Flow_{i,t} = \alpha + \beta_1 MonthlyRawReturn_{t-1} + \beta_2 MonthlyRawReturn_{t-1} \cdot IlliqFund_{i,t-1} + \beta_3 IlliqFund_{i,t-1} + \gamma Controls_{i,t-1} + \delta MacroFinancial_{t-1} + \epsilon_{i,t}. \quad (4)$$

¹³We employ the 1-day liquidity ratio since it captures the immediate liquidity of OEFs to meet redemptions (cash holdings and one-day liquid assets). According to the Financial Superintendence of Colombia, monetary OEFs have a daily liquidity ratio requirement of 10%, mixed funds of 5%, and variable-income funds of 3%. See Section 2.

Equations (3) and (4) let us capture if outflows in OEFs with lower asset liquidity exhibit a greater sensitivity to performance. For instance, under negative returns, funds holding more illiquid assets and facing redemptions could liquidate their positions on short notice. This liquidation process supposes high costs, mainly borne by investors who maintain their capital in the fund. In consequence, if investors consider other investors' negative externalities, then the tendency to withdraw is amplified. The parameter β_2 captures this effect.

Thirdly, to evaluate if the sensitivity of flows to performance exacerbates in periods of illiquidity in the debt markets, we construct the variables *CrisisPeriod* and *VolPeriod*. The former is an indicator variable equal to one during the period spanning from March 2020 to May 2020 and from September 2023 to October 2023. As highlighted in Section 2, private debt securities (certificate of deposits) exhibited an abrupt price decline during these dates, leading to increased capital redemptions. The second variable, in turn, is equal to one if the GARCH-estimated volatility of sovereign bonds and private debt yields exceeds the 95th percentile of its historical volatility. To include these variables, we perform the following regressions:

$$\begin{aligned} Flow_{i,t} = & \alpha + \beta_1 MonthlyRawReturn_{t-1} + \beta_2 MonthlyRawReturn_{t-1} \cdot CrisisPeriod_t \\ & + \beta_3 CrisisPeriod_t + \gamma Controls_{i,t-1} + \delta MacroFinacial_{t-1} + \epsilon_{i,t} \end{aligned} \quad (5)$$

and

$$\begin{aligned} Flow_{i,t} = & \alpha + \beta_1 MonthlyRawReturn_{t-1} + \beta_2 MonthlyRawReturn_{t-1} \cdot VolPeriod_t \\ & + \beta_3 VolPeriod_t + \gamma Controls_{i,t-1} + \delta MacroFinacial_{t-1} + \epsilon_{i,t}. \end{aligned} \quad (6)$$

Finally, as mentioned in Section 3, we classify OEFs into institutional-oriented, real

sector-oriented, and natural persons-oriented funds to run each previously presented model separately. This last exercise seeks to determine whether funds exposed to several investors may face higher redemptions due to the historical net withdrawal factor registered by each type of agent.

5 Results

In this section, we report the results of each estimated regression. Columns (1) and (3) of Table 2 present the estimates for Equation (1) for fixed and variable-income funds in their order. Our findings suggest that some macro-financial variables are relevant when included in the flow-performance relation analysis. For fixed-income funds, the estimates of the lagged spread between the interbank and the monetary policy rate and the volatility indicator of sovereign bond yields are negative and statistically significant. This result indicates that when liquidity in the money market is low, which is captured by an increasing spread, net flows decrease, as well as when private debt market volatility increases. On the contrary, these estimates are not statistically significant when analyzing variable-income funds. For these funds, however, the 12-month private-to-public rate spread is negative and statistically significant, suggesting a response of lower net flows to devaluations of private debt securities (i.e., increases in the spread).

Regarding the flow-performance relation, our main interest, Column (1) of Table 2 exhibits a positive relation between lagged monthly raw return and net flows for fixed-income funds. A 1% increase in the former variable leads to a rise of 0.005% in net flows. This result differs from what is found for variable-income funds, in which the estimate is not statistically significant (Column (3) of Table 2). Furthermore, when analyzing if poor performance impacts the flow-performance relation (Equation

2), we find that lagged negative monthly returns conduct to negative net flows only in fixed-income funds (-1.48%), which is equivalent to higher outflows. The estimate's significance and magnitude suggest redemptions are more sensitive to poor performance than contributions to good performance. This result is in line with that of Goldstein et al. (2017). However, it differs because these authors find a concave flow-performance relation. Our findings suggest a linear relationship, as the estimate for the lagged monthly raw return interacted with the indicator variable representing negative returns is statistically insignificant.

Table 2: Flow-performance relation.

| VARIABLES | Fixed-income funds | | Variable-income funds | |
|--|------------------------|------------------------|-----------------------|----------------------|
| | (1) | (2) | (3) | (4) |
| Net flow _{<i>t</i>-1} | 0.170*** (0.0296) | 0.169*** (0.0295) | 0.252** (0.0987) | 0.255** (0.0998) |
| Monthly raw return _{<i>t</i>-1} | 0.0042* (0.0025) | 0.0047* (0.0027) | -0.0003 (0.0009) | 0.0048 (0.0050) |
| Monthly raw return _{<i>t</i>-1} · I(Raw return _{<i>t</i>-1} < 0) | | -0.0115 (0.0128) | | -0.0430 (0.0419) |
| I(Raw return _{<i>t</i>-1} < 0) | | -1.479** (0.569) | | -0.145 (0.621) |
| Fund size _{<i>t</i>-1} | -2.474*** (0.481) | -2.550*** (0.474) | -4.492** (1.798) | -4.570** (1.836) |
| Percentage of investments _{<i>t</i>-1} | 0.0720** (0.0303) | 0.0727** (0.0303) | -0.0109 (0.1065) | 0.0037 (0.1117) |
| Interbank-to-Monetary policy rate spread _{<i>t</i>-1} | -0.0825*** (0.0193) | -0.0774*** (0.0183) | 0.0628 (0.0477) | 0.0617 (0.0426) |
| 12-month Private-to-Public debt rate spread _{<i>t</i>-1} | 0.0348 (0.0548) | 0.0468 (0.0520) | -0.6976* (0.3430) | -0.6984* (0.3343) |
| Volatility index _{<i>t</i>-1} | -0.0117*** (0.0038) | -0.0104*** (0.0039) | -0.0063 (0.0062) | -0.0224 (0.0145) |
| Observations | 21,230 | 21,230 | 1,726 | 1,726 |
| Adjusted R-squared | 0.326 | 0.326 | 0.310 | 0.313 |
| Time FE | YES | YES | YES | YES |
| Individual FE | YES | YES | YES | YES |

Authors' calculations. The table depicts flow-performance relations for active fixed-income and variable-income funds from January 2018 to December 2023. It indicates the asymmetry in investor responses to outperformance and underperformance (positive versus negative raw returns). Standard errors are clustered at the fund level. *, **, and ***, indicate significance at the 10%, 5%, and 1% respectively.

Table 3 presents the results of Equations (3) and (4). Columns (1) and (3) depict the estimates for the specifications that include the interaction term between the distance of the 1-day liquidity indicator to its minimum required and the performance variable. As

exhibited, this term is statistically significant for both fixed and variable-income funds. However, the monthly raw return is insignificant for the latter, as in the results of Table 2. Therefore, for fixed-income funds, Figure 4 provides evidence of the difference in the sensibility of net flows to performance depending on the level of liquidity. A fund with high 1-day liquid assets holdings may experience higher inflows when increasing returns.¹⁴

Regarding the macro-financial variables, for fixed-income funds, the estimates of the differential between the interbank and monetary policy rates, the 12-month private-to-public rate spread, and the volatility indicator of sovereign bond yields are all negative and statistically significant. As shown in Table 2, low liquidity in the money market, increasing private debt market volatility, and the devaluation of certificates of deposits increase outflows in funds highly exposed to fixed-income securities. These findings remain relatively similar across the different models we analyzed. The spread between the 12-month private-to-public rate is also negative and statistically significant across the different specifications for variable-income funds. Generally, an increasing spread indicates lower liquidity and market value of private debt securities compared to public debt bonds. Since OEFs are highly exposed to private debt instruments, this may negatively affect profitability, pushing investors to redeem their shares.

Columns (2) and (4) of Table 3 present the results of Equation (4), in which liquidity is included as an indicator variable.¹⁵ Again, the interaction term and the performance variable are not statistically significant in variable-income funds, confirming that macro-financial variables are more important for these OEFs' investors. These findings differ from those in fixed-income funds. In fact, in a fund that has a distance between the 1-day liquidity indicator and the required minimum greater than the 5th percentile of the

¹⁴See Section 4.

¹⁵See Section 4.

historical distribution of said distance, an increase of 1% in raw returns raises capital inflows by 0.01%. On the contrary, capital inflows are lower in a fund whose distance is lower than the 5th percentile of the historical distribution.

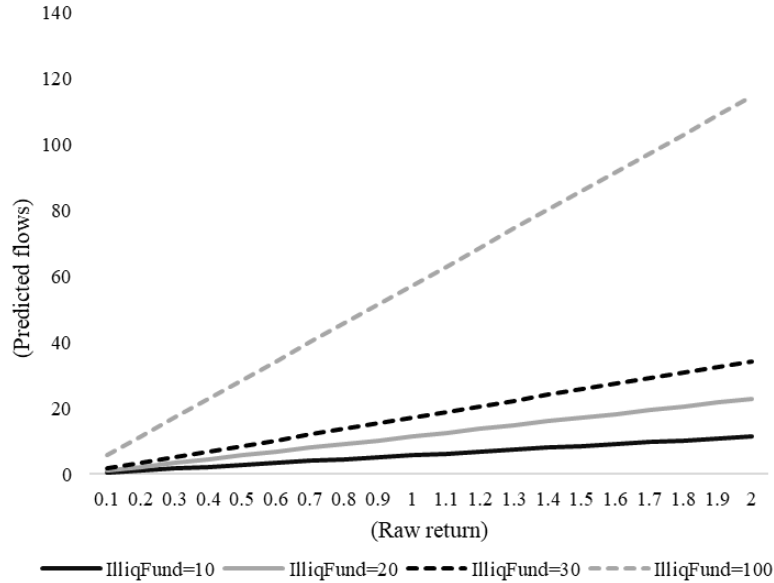
Table 3: Flow-performance relation of funds with illiquid assets

| VARIABLES | Fixed-income funds | | Variable-income funds | |
|---|------------------------|-----------------------|-----------------------|-----------------------|
| | (1) | (2) | (3) | (4) |
| Net flow $_{t-1}$ | 0.171*** (0.0297) | 0.169*** (0.0244) | 0.289* (0.132) | 0.251** (0.0997) |
| Monthly raw return $_{t-1}$ | -0.0011 (0.0016) | 0.0084* (0.0050) | 0.0004 (0.0010) | 0.0014 (0.0009) |
| Monthly raw return $_{t-1} \cdot I(\text{IlliqFund}_{t-1})$ | | -0.0099** (0.0048) | | -0.0033 (0.0018) |
| $I(\text{IlliqFund}_{t-1})$ | | -0.1319 (0.2337) | | -0.1382 (0.3021) |
| Monthly raw return $_{t-1} \cdot \text{IlliqFund}_{t-1}$ | 0.0015** (0.0007) | | -0.0017 (0.0016) | |
| IlliqFund_{t-1} | 0.572*** (0.114) | | 0.508*** (0.118) | |
| Fund size $_{t-1}$ | -2.398*** (0.557) | -2.805*** (0.419) | -4.475** (1.874) | -5.194** (1.900) |
| Percentage of investments $_{t-1}$ | 0.5443*** (0.1145) | 0.0882*** (0.0285) | 0.5052* (0.2590) | 0.0081 (0.1173) |
| Interbank-to-Monetary policy rate spread $_{t-1}$ | -0.0577*** (0.0166) | -0.0689* (0.0403) | 0.0605 (0.0807) | 0.0487 (0.0411) |
| 12-month Private-to-Public debt rate spread $_{t-1}$ | -0.1582** (0.0755) | -0.0998 (0.1246) | -0.4844** (0.1815) | -0.5097** (0.1785) |
| Volatility index $_{t-1}$ | -0.0331*** (0.0043) | -0.0288** (0.0141) | -0.0123** (0.0050) | -0.0164* (0.0085) |
| Observations | 21,230 | 21,230 | 1,726 | 1,726 |
| Adjusted R-squared | 0.368 | 0.327 | 0.375 | 0.315 |
| Time FE | YES | YES | YES | YES |
| Individual FE | YES | YES | YES | YES |

Authors' calculations. The table depicts the effect of illiquid fixed-income and variable-income fund assets on the flow-performance relation from January 2018 to December 2023. Standard errors are clustered at the fund level. *, **, and ***, indicate significance at the 10%, 5%, and 1% respectively.

Table 4 shows the sensitivity of investor flows in periods of increasing volatility in debt markets or massive redemptions (Equations (5) and (6)). When considering the withdrawal period dummy variable (Columns (1) and (3)), we find statistical significance for the estimate of the interaction term between the aforementioned dummy variable (CrisisPeriod) and monthly raw returns in fixed-income funds, but not in variable-income funds. Likewise, the monthly raw returns are not significant for the latter. This finding indicates that fixed-income funds exhibit greater outflows, regardless of returns, during periods characterized by massive redemptions. On the contrary, estimates are

Figure 4: Flow-performance relation of funds with different levels of liquid assets



The figure depicts the sensitivity of net flows to performance depending on the level of liquidity, which is measured as the distance of the 1-day liquidity indicator to its minimum required. Authors' calculations.

not statistically significant when considering periods of high volatility in debt markets (Columns (2) and (4)).

Finally, in Table 5, we present the results of all equations, dividing fixed-income funds by exposure to investors. As mentioned, we are interested in analyzing whether these OEFs face higher levels of liquidity risk depending on their exposure to several investors.

The findings suggest that, regardless of investor type (institutional, real sector or natural person), net flows decline when liquidity in the money market is low or market volatility rises. Moreover, the estimate of monthly raw return is positive and statistically significant when examining the individual effect of return on net flows. This suggests that flows increase as returns improve or, conversely, that contributions decrease or redemptions increase when OEFs performance deteriorates.

Table 4: Flow-performance relation of funds during periods of massive withdrawals and increasing market volatility

| VARIABLES | Fixed-income funds | | Variable-income funds | |
|--|------------------------|------------------------|-----------------------|-----------------------|
| | (1) | (2) | (3) | (4) |
| Net flow _{t-1} | 0.169*** (0.0296) | 0.169*** (0.0296) | 0.250** (0.0997) | 0.252** (0.0996) |
| Monthly raw return _{t-1} | 0.0061** (0.0027) | 0.0027 (0.0023) | 0.0023 (0.0013) | 0.0005 (0.0011) |
| Monthly raw return _{t-1} · CrisisPeriod | -0.0108*** (0.0040) | | -0.0027 (0.0019) | |
| CrisisPeriod | -0.527* (0.299) | | -0.984* (0.461) | |
| Monthly raw return _{t-1} · VolPeriod | | 0.0042 (0.0044) | | 0.0047 (0.0031) |
| VolPeriod | | -1.758** (0.291) | | -1.006* (0.488) |
| Fund size _{t-1} | -2.815*** (0.563) | -2.800*** (0.562) | -5.226** (1.905) | -5.218** (1.902) |
| Percentage of investments _{t-1} | 0.0875** (0.0351) | 0.0863** (0.0350) | 0.0053 (0.1186) | 0.0091 (0.1187) |
| Interbank-to-Monetary policy rate spread _{t-1} | -0.025*** (0.0169) | -0.0757*** (0.0162) | 0.0620 (0.0412) | 0.0420 (0.0403) |
| 12-month Private-to-Public debt rate spread _{t-1} | -0.0852 (0.0759) | -0.0700 (0.0802) | -0.4705** (0.1793) | -0.4838** (0.1687) |
| Volatility index _{t-1} | -0.0254*** (0.0045) | -0.0231*** (0.0045) | -0.0086 (0.0101) | -0.0065 (0.0098) |
| Observations | 21,230 | 21,230 | 1,726 | 1,726 |
| Adjusted R-squared | 0.327 | 0.316 | 0.327 | 0.316 |
| Time FE | YES | YES | YES | YES |
| Individual FE | YES | YES | YES | YES |

Authors' calculations. The table depicts the effect of periods of crisis and high volatility in debt markets on the flow-performance relation from January 2018 to December 2023. Standard errors are clustered at the fund level. *, **, and ***, indicate significance at the 10%, 5%, and 1% respectively.

Additionally, the relation between flows and performance is linear across all analyzed funds. There is also an additional negative impact on flows due to poor performance, which may suggest an increase in outflows when returns decline (Columns (1) - (3)). The magnitude of these effects is greater in institutional-oriented funds, possibly reflecting the fact that these investors tend to monitor the market more closely to avoid realizing losses.

As for the effect of liquidity (Columns (4)–(6)), the estimates are positive and statistically significant across all investor profiles, indicating that fund liquidity plays a key role in shaping investor behavior. Specifically, funds with higher holdings of 1-day liquid assets tend to attract larger inflows when returns increase, relative to less liquid funds.

This suggests that investors respond to performance and regard the fund's capacity to meet redemptions promptly, particularly during periods of uncertainty or market stress. This liquidity-performance sensitivity is notably stronger in funds highly exposed to institutional investors. As previously mentioned, these investors actively monitor the market, which includes liquidity conditions, and therefore may reallocate assets more quickly in response to changes in fund characteristics.

Finally, in institutional-oriented funds, net flows decline by nearly 1% during periods of heightened uncertainty, which is captured by the dummy variable `VolPeriod`, representing increasing volatility in the public debt market, and episodes of widespread redemptions, which are captured by the dummy variable `CrisisPeriod`. This finding is particularly relevant, as it suggests that institutional investors may exacerbate redemption pressures precisely during times when market stability would benefit from more restrained behavior. In other words, rather than acting as a stabilizing force, institutional investors may contribute to procyclical outflows, amplifying liquidity stress in the market.

Table 5: Flow-performance relation considering the funds' type of investors.

| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|--|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| | Institutional | Real Sector | Natural Persons | Institutional | Real Sector | Natural Persons | Institutional | Real Sector | Natural Persons | Institutional | Real Sector | Natural Persons |
| Net flow _{t-1} | 0.1725*** (0.0306) | 0.1744*** (0.0315) | 0.1746*** (0.0316) | 0.1742*** (0.0310) | 0.1758*** (0.0319) | 0.1760*** (0.0320) | 0.1722*** (0.0307) | 0.1740*** (0.0316) | 0.1742*** (0.0316) | 0.1723*** (0.0307) | 0.1741*** (0.0316) | 0.1742*** (0.0317) |
| Monthly raw return _{t-1} | 0.0058* (0.0028) | 0.0052* (0.0027) | 0.0052* (0.0028) | -0.0007 (0.0016) | -0.0033 (0.0015) | -0.0002 (0.0015) | 0.0060** (0.0027) | 0.0053** (0.0026) | 0.0060** (0.0026) | 0.0031 (0.0024) | 0.0026 (0.0024) | 0.0026 (0.0024) |
| Monthly raw return _{t-1} · I(Raw return _{t-1} < 0) | -0.0139 (0.0127) | -0.0157 (0.0129) | -0.0157 (0.0132) | -0.0157 (0.0129) | -0.0157 (0.0132) | -0.0157 (0.0132) | -0.0157 (0.0132) | -0.0157 (0.0132) | -0.0157 (0.0132) | -0.0157 (0.0132) | -0.0157 (0.0132) | -0.0157 (0.0132) |
| I(Raw return _{t-1} < 0) | -1.6397*** (0.5477) | -1.5841*** (0.5433) | -1.6127*** (0.5560) | -1.6127*** (0.5560) | -1.6127*** (0.5560) | -1.6127*** (0.5560) | -1.6127*** (0.5560) | -1.6127*** (0.5560) | -1.6127*** (0.5560) | -1.6127*** (0.5560) | -1.6127*** (0.5560) | -1.6127*** (0.5560) |
| Monthly raw return _{t-1} · IlliqFund _{t-1} | | | | 0.0016** (0.0007) | 0.0015* (0.0007) | 0.0015* (0.0008) | | | | | | |
| IlliqFund _{t-1} | | | | 0.5785*** (0.1280) | 0.4891*** (0.1034) | 0.4860*** (0.1056) | | | | | | |
| Monthly raw return _{t-1} · CrisisPeriod | | | | | | | -0.0099** (0.0039) | -0.0094** (0.0037) | -0.0094** (0.0038) | | | |
| CrisisPeriod | | | | | | | -0.6743* (0.3377) | -0.5864 (0.3765) | -0.5570 (0.3901) | | | |
| Monthly raw return _{t-1} · VolPeriod | | | | | | | | | | | | |
| VolPeriod | | | | | | | | | | 0.0036 (0.0046) | 0.0040 (0.0046) | 0.0043 (0.0047) |
| Fund size _{t-1} | -2.3394*** (0.4705) | -2.4048*** (0.5002) | -2.3943*** (0.5018) | -2.2183*** (0.5870) | -2.3055*** (0.5932) | -2.3029*** (0.5985) | -2.5827*** (0.5671) | -2.5969*** (0.5788) | -2.5971*** (0.5817) | -2.5666*** (0.5658) | -2.5892*** (0.5791) | -2.5903*** (0.5820) |
| Percentage of investments _{t-1} | 0.0813** (0.0365) | 0.0534** (0.0230) | 0.0578** (0.0238) | 0.5569*** (0.1277) | 0.4559*** (0.0953) | 0.4573*** (0.0974) | 0.0952** (0.0426) | 0.0574** (0.0249) | 0.0618** (0.0255) | 0.0938** (0.0425) | 0.0564** (0.0249) | 0.0606** (0.0255) |
| Interbank rate-to-Monetary policy rate spread _{t-1} | -0.0752*** (0.0199) | -0.0733*** (0.0233) | -0.0701*** (0.0242) | -0.0508*** (0.0186) | -0.0406** (0.0200) | -0.0367** (0.0207) | -0.0567*** (0.0189) | -0.0464** (0.0210) | -0.0416** (0.0217) | -0.0715*** (0.0183) | -0.0575*** (0.0195) | -0.0531*** (0.0201) |
| 12-month Private debt-to-Public debt rates spread _{t-1} | 0.0425 (0.0556) | 0.0154 (0.0625) | 0.0032 (0.0640) | -0.1297 (0.0810) | -0.1523 (0.0963) | -0.1689* (0.0993) | -0.0474 (0.0798) | -0.0850 (0.0945) | -0.1033 (0.0974) | -0.0474 (0.0843) | -0.0854 (0.1010) | -0.1072 (0.1041) |
| Volatility index _{t-1} | -0.0100** (0.0043) | -0.0109** (0.0051) | -0.0106* (0.0053) | -0.0325*** (0.0046) | -0.0278*** (0.0047) | -0.0278*** (0.0048) | -0.0231*** (0.0049) | -0.0210*** (0.0057) | -0.0202*** (0.0059) | -0.0214*** (0.0046) | -0.0216*** (0.0059) | -0.0216*** (0.0061) |
| Observations | 18,469 | 15,546 | 14,926 | 18,469 | 15,546 | 14,926 | 18,469 | 15,546 | 14,926 | 18,469 | 15,546 | 14,926 |
| Adjusted R-squared | 0.3676 | 0.3991 | 0.4022 | 0.4068 | 0.4235 | 0.4259 | 0.3979 | 0.3991 | 0.4023 | 0.3680 | 0.3990 | 0.4021 |
| Time FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Individual FE | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |

Authors' calculations. The table depicts the effect of periods of crisis and high volatility in debt markets on the flow-performance relation from January 2018 to December 2023. Standard errors are clustered at the fund level. *, **, and *** indicate significance at the 10%, 5%, and 1% respectively.

6 Concluding Remarks

This paper evaluates the flow-performance relation in Colombian OEFs, considering the extensive literature worldwide on this topic. By analyzing the sensitivity of net flows (contributions minus redemptions) to lagged monthly raw returns under different circumstances (low fund liquidity, periods of massive withdrawals or increasing debt market volatility), we intend to shed light on the investors' behavior. To do this, we employ a rich dataset containing information at the fund level from January 2018 to December 2023, and we estimate panel regression models, including fixed effects at both fund and time levels.

Our research contributes by providing the first comprehensive analysis of the flow-performance relation in Colombian OEFs. While the vast majority of studies focused on developed jurisdictions (Chen et al., 2010; Spiegel and Zhang, 2013; Bouveret, 2017; Baranova et al., 2017; Goldstein et al., 2017; Gourdel et al., 2019; Ciccone et al., 2022), our findings offer insights related to the behavior of investors in emerging markets. Analyzing asymmetries in investors' responses to past positive and negative performance, to performance in funds with more or less illiquid assets, and in periods of massive redemptions or increasing market volatility contributes to a better understanding of the factors and circumstances that lead investors to redeem their shares in an OEF sector that differs greatly from other jurisdictions.

Our empirical findings indicate a statistically significant flow-performance relation in fixed-income funds. For instance, inflows increase as returns rise in these funds. Likewise, outflows are more sensitive to poor performance than inflows to good performance. This result may be attributed to the fact that returns in this type of fund are relatively low, and shares can be redeemed quickly. Therefore, in the event of negative performance, investors may prefer to withdraw their capital and invest in another

instrument, seeking greater profitability. On the contrary, results for variable-income funds suggest that capital flows do not respond immediately to past returns.

Regarding the effect of illiquidity on the sensitivity of outflows, again effects are statistically significant only in fixed-income funds. OEFs holding more liquid assets may experience higher inflows when increasing returns or outflows are more sensitive to negative past returns in funds with illiquid assets. This finding aligns with the strand suggesting that investors recognise that others' redemption will impose liquidation costs on funds holding less liquid assets, and thereby reduce returns for those who remain in the fund. Thus, there is a tendency to redeem, which amplifies the effect of negative performance on capital outflows. Notably, this effect is recorded only in fixed-income funds, which may be due to the fact that these OEFs are more likely to hold illiquid assets than variable-income funds. Finally, fixed-income funds exhibit greater outflows during periods characterized by massive redemptions and market turmoil, regardless of returns.

Our analysis also confirms that macro-financial variables play a significant role in influencing investing decisions. For instance, low liquidity in the money market, increasing private debt market volatility, and the devaluation of certificates of deposits increase outflows in funds highly exposed to fixed-income securities in most models analyzed. Furthermore, the spread between the 12-month private-to-public rate is negative and statistically significant across the different specifications for variable-income funds. These findings align with previous research, underscoring the significance of macroeconomic stability in influencing investor decisions.

The substantial assets managed by OEFs, along with their ability to issue and redeem shares daily, make these funds key players in the financial system. The possibility that large and sudden redemptions could trigger asset fire sales, which will likely affect

credit institutions (as major issuers of certificates of deposit), underscores the appropriateness of research focused on exploring the factors that amplify capital outflows. This paper contributes to the latter and may inform future evaluations to determine measures to alleviate the amplification of redemptions on OEFs.

Our findings suggest that institutional investors exhibit greater sensitivity (in magnitude) to market conditions than other types of investors. Given the active monitoring of institutional investors, they are more likely to withdraw their capital in response to changes in fund characteristics, such as liquidity and returns, as well as macroeconomic conditions. Consequently, it is likely that institutional investors exacerbate redemption pressures, which may draw the attention of policymakers when implementing measures aimed at reducing the first-mover advantage. Perhaps it is worth considering classifying OEFs based on their intended investors rather than by the composition of the investment portfolio. For instance, higher liquidity requirements may be applied to OEFs focused on investors with a higher net redemption factor, such as institutional agents. Likewise, the pattern of flows in fixed-income funds may be valuable for regulators and supervisors when considering externalities of OEFs on market prices and the financial system as a whole.

References

- Baranova, Yuliya, Jamie Coen, Joseph Noss, and Pippa Lowe**, “Simulating stress across the financial system: the resilience of corporate bond markets and the role of investment funds,” *Bank of England Financial Stability Paper*, 2017, (42).
- Bouveret, Antoine**, *Liquidity stress tests for investment funds: A practical guide*, International Monetary Fund, 2017.
- Casavecchia, Lorenzo**, “Fund managers’ herding and the sensitivity of fund flows to past performance,” *International Review of Financial Analysis*, 2016, 47, 205–221.
- Chen, Qi, Itay Goldstein, and Wei Jiang**, “Payoff complementarities and financial fragility: Evidence from mutual fund outflows,” *Journal of Financial Economics*, 2010, 97 (2), 239–262.
- Chevalier, Judith and Glenn Ellison**, “Risk taking by mutual funds as a response to incentives,” *Journal of political economy*, 1997, 105 (6), 1167–1200.
- Christoffersen, Susan EK, David K Musto, and Russ Wermers**, “Investor flows to asset managers: Causes and consequences,” *Annu. Rev. Financ. Econ.*, 2014, 6 (1), 289–310.
- Ciccone, Julien, Luca Marchiori, and Romuald Morhs**, “The flow-performance relationship of global investment funds,” *Journal of International Money and Finance*, 2022, 127, 102690.
- Farrell, Diana, George Eckerd, Chen Zhao, and Melissa O’Brien**, “Tracking Spillovers During the Taper Tantrum: Evidence from Institutional Investor Transactions in Emerging Markets,” *Available at SSRN 3640801*, 2020.
- Fricke, Christoph and Daniel Fricke**, “Vulnerable asset management? The case of mutual funds,” *Journal of Financial Stability*, 2021, 52, 100800.
- Goldstein, Itay, Hao Jiang, and David T Ng**, “Investor flows and fragility in corporate bond funds,” *Journal of Financial Economics*, 2017, 126 (3), 592–613.

- Gourdel, Régis, Eduardo Maqui Lopez, and Matthias Sydow**, “Investment funds under stress,” *Available at SSRN 3478539*, 2019.
- ICI, Investment Company Institute**, *Investment company fact book*, Vol. 49, Investment Company Institute, 2009.
- IIFA, International Investment Funds Association**, “Worldwide regulated open-end fund assets and flows,” 2024.
- IMF, International Monetary Fund**, *Global Financial Stability Report, October 2022: Navigating the High-Inflation Environment*, International Monetary Fund, 2022.
- Ippolito, Richard A**, “Consumer reaction to measures of poor quality: Evidence from the mutual fund industry,” *The Journal of Law and Economics*, 1992, 35 (1), 45–70.
- Muller, Carola, Matias Ossandon Busch, Miguel Sarmiento, and Freddy Pinzón-Puerto**, “Fragile wholesale deposits, liquidity risk, and banks’ maturity transformation,” *Unpublished*, 2024.
- SFC, Superintendencia Financiera Colombia**, “Recuadro 2 – Reflexiones frente a la composición de los adherentes como una variable relevante para la gestión del riesgo de liquidez de los FIC,” *Actualidad del sistema financiero colombiano*, 2020.
- Sirri, Erik R and Peter Tufano**, “Costly search and mutual fund flows,” *The journal of finance*, 1998, 53 (5), 1589–1622.
- Spiegel, Matthew and Hong Zhang**, “Mutual fund risk and market share-adjusted fund flows,” *Journal of Financial Economics*, 2013, 108 (2), 506–528.
- Vivas, Fredy Alexander Pulga and María Teresa Macías Joven**, “Portfolio Managers on the Colombian Open-End Mutual Fund Industry: Performance, downside risk and persistence,” *Cuadernos de Administración*, 2019, 32 (59).