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The Effects of Foreign Investor Composition on Colombia's Sovereign Debt Flows

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# The Effects of Foreign Investor Composition on Colombia's Sovereign Debt Flows

FREDY GAMBOA-ESTRADA[+] ANDRES SANCHEZ-JABBA [++]

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**Abstract**

Assessing the composition of sovereign debt holders is important because investors' behavior varies according to distinctive components, including shareholders' preferences, regulatory constraints, and profitability mandates. To study this issue, we examine the determinants of offshore investments of mutual funds and pension funds, which concentrate Colombia's outstanding sovereign debt. Our results indicate that mutual funds exhibit considerable sensitivity to shocks in global factors, such as the Federal Funds Rate, sovereign risk, and the composition of financial indices. This contrasts with findings among pension funds, for which we detected no statistically significant effects when examining these factors, underlining the differences in foreign investor behavior that could impact sovereign debt flows within emerging markets.

**JEL Classification:** C22, G11, G15, G23.

**Keywords:** Foreign investors, sovereign debt flows, global shocks, generalized method of moments.

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# Los efectos de la composición de la base inversionista extranjera sobre los flujos de deuda soberana en Colombia

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Las opiniones contenidas en el presente documento son responsabilidad exclusiva de los autores y no comprometen al Banco de la República ni a su Junta Directiva.

**Resumen**

La composición de la base inversionista en el mercado de deuda soberana es importante porque el comportamiento de los inversionistas varía según distintos factores, como las preferencias de los accionistas, las restricciones regulatorias y los mandatos de rentabilidad, que pueden afectar los flujos en este mercado. Para evaluar lo anterior, examinamos los determinantes de las inversiones en deuda soberana de los fondos de inversión y los fondos de pensiones extranjeros en Colombia. Nuestros resultados indican que los fondos de inversión muestran alta sensibilidad a choques en factores globales, como la tasa de política de la Reserva Federal, el riesgo soberano y la composición de índices financieros. Ello contrasta con los hallazgos para los fondos de pensiones, que no presentan una respuesta estadísticamente significativa al examinar estos factores, aspectos que resaltan las diferencias en el comportamiento de los inversionistas extranjeros en mercados emergentes.

**Códigos JEL:** C22, G11, G15, G23.

**Palabras clave**: inversionistas extranjeros, flujos de deuda soberana, choques globales, método generalizado de momentos.

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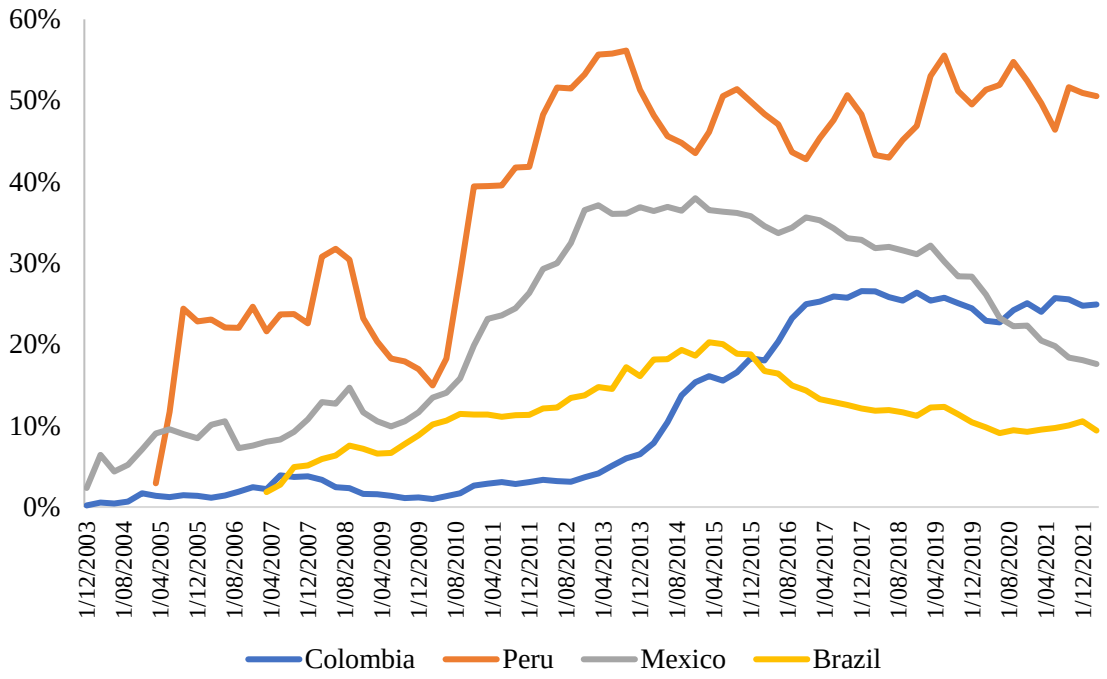
## 1. Introduction

During the last decades, foreign participation in the local sovereign debt market in LATAM has shown a remarkable growth. Low financial returns in advanced economies, combined with an improvement in macroeconomic conditions in emerging economies have led to a significant increase in portfolio investments in these markets (Figure 1).

**Figure 1**. Share of offshore holdings of local currency sovereign debt in LATAM.




Source: International Institute of Finance.

The effects associated with this growth are mixed. On the one hand, the expansion of public financing sources facilitates access to resources that make it possible to cushion episodes of economic crisis and volatility, such as the debacle caused by the COVID-19 pandemic. Additionally, it can improve the balance sheets of domestic firms and the government through reductions in external borrowing costs (Gennaioli, Martin & Rossi, 2014; Williams, 2018; Pandolfi & Williams, 2020). At the same time, however, the exposure to global shocks increases as portfolio flows progressively depend on the behavior of foreign investors, whose investment strategies differ from those of local agents (Carstens & Shin, 2019; Beirne, Renzhi & Volz, 2021). For instance, while access to currency hedging determines the response of foreigners to shocks in expectations related to local currency depreciation, residents base their decisions mostly on the profitability of the domestic market, since they do not face exchange risk in the local sovereign debt market (Toro et al., 2022)[1].

[1] In the absence of currency hedging, foreign investors could react by liquidating their positions, since the expected depreciation would reduce their return, triggering capital outflows.

Just as investor residence affects the dynamics of capital flows, the composition of the investor base can have a significant impact on portfolio investments (Oura et al., 2014; Cerutti, Claessens & Puy, 2019). In this area, Fang, Hardy & Lewis (2022) find that market sensitivity to global shocks rises in tandem with the share of sovereign debt holdings among mutual funds. This contrasts with the stabilizing role played by pension funds, which display limited sensitivity to these types of shocks (Thomas et al., 2014).

The preferences of the depositors, the regulatory and institutional framework, the profitability mandates, and the redemption scheme constitute factors that explain the differences in the behavior of the investor base. Mutual funds reflect the preferences of individual investors, which are characterized by the search for immediate returns, a low tolerance for losses, little portfolio diversification, and allocation based on circumstances and trends. In addition, they face a flexible redemption scheme, in which depositors can claim their capital without major restrictions, raising the need for portfolios with a high degree of liquidity and reducing risk tolerance. In contrast, institutional investors (e.g., pension funds, insurance companies and sovereign wealth funds) base their decisions on structural factors and market signals, such as the intrinsic value of assets and the comparative return on investments. These have a long-time horizon for their investments, since regulatory and institutional constraints restrict the withdrawal of capital, favoring the adoption of an investment strategy that allows transitory losses and illiquid portfolios.

In emerging market economies, mutual funds have channeled the recent growth in sovereign debt purchases, an increase that contributed to greater market volatility (Arslanalp & Tsuda, 2015; Arslanalp et al., 2020; Fang, Hardy & Lewis, 2022). In Colombia, mutual funds concentrated about half of the net purchases in TES (local public debt securities) during the last decade, which affected the financial performance in this market (García-Andrade, 2019; Romero, et al. 2021, Murcia & García-Andrade, 2022). However, this expansion was coupled with a notable increase in the participation of pension funds, limiting the sensitivity to global shocks attributable to a high participation of mutual funds.

This paper analyzes how the composition of the investor base affects capital flows in the Colombian sovereign debt market, which concentrates most portfolio investments among foreign investors (Annex 1). To achieve this objective, this paper studies whether the main determinants of investment by foreigners vary among the agents with the largest market share. We focus our analysis on foreign mutual funds and pension funds as they are the most important foreign investors in public bonds in Colombia[2]. In line with the findings of the literature, we find that mutual funds have a high degree of exposure to global shocks (the external interest rate, financial conditions in advanced economies, sovereign risk, and

[2] In December 2020, investment funds and pension funds accounted for 68.3% of offshore holdings of Colombia's outstanding sovereign debt. Other foreign investors, such as sovereign wealth funds, insurance companies, hedge funds, and commercial banks showed low participation after the rebalance of J.P. Morgan's GBI Financial Index (Figure 3). In the case of the monetary authorities, which concentrated 11.4% of total offshore holdings, our results indicate that their behavior follows that exhibited by pension funds. Therefore, we decided to focus the analysis on the two types of foreign investors who, in addition to concentrating outstanding sovereign debt, display clear differences in investment strategies.

country participation in financial indices). However, the results indicate that pension funds' investments are less sensitive to shocks in global factors.

These results highlight the importance of monitoring the composition of the foreign investor base in sovereign debt markets in emerging market economies. The growing sensitivity to global shocks, attributed to high participation of foreign mutual funds in the sovereign debt market, suggests that episodes of volatility in portfolio flows triggered by external shocks could arise in the future. In this sense, it would be desirable to promote a greater participation of institutional investors, particularly foreign pension funds, an expansion that could moderate the market's exposure to external financial fluctuations.

This document consists of five sections aside from the introduction. The second section describes the stylized facts about the evolution and investment behavior of foreign investors in the sovereign debt market in Colombia. The third section analyses the literature review of portfolio decisions among different type of investors. The fourth section explains the methodology and describes the data. The fifth presents and analyzes the results. The last section summarizes the conclusions and discusses policy implications.

## 2. Foreign investor base in Colombia's sovereign debt market

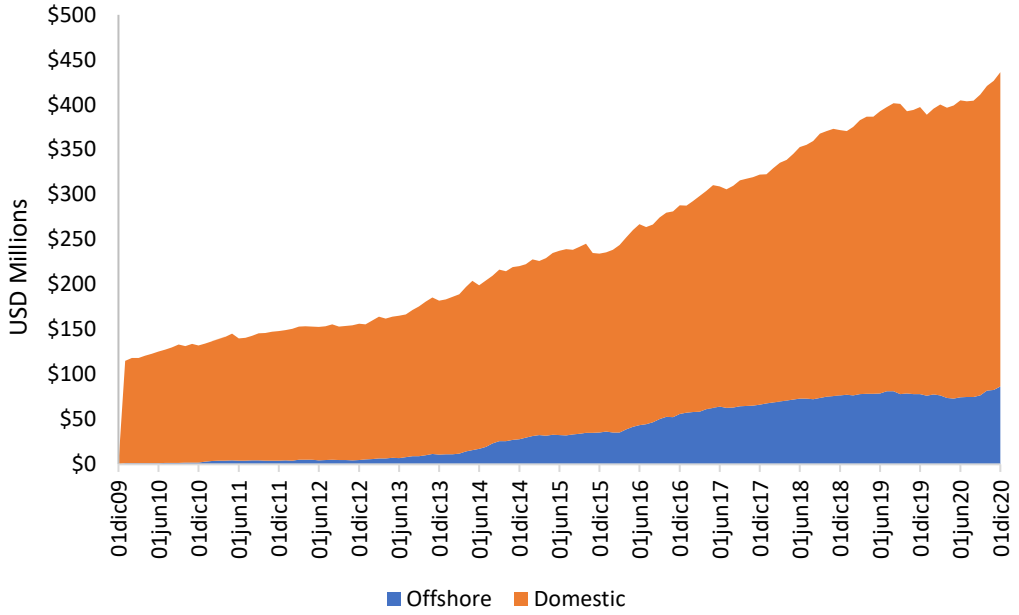
The main assets in Colombia's sovereign debt market are Treasury Bonds (TES) issued by the Central Government, which constitute a vital source of public revenue. TES can be issued with fixed or variable rates; in local or foreign currency; and under different maturity terms (e.g., 1, 5, 10 years). Recent developments in the market include noticeable gains in the value of investments, which tripled over the last decade, making sovereign bonds the main financial instrument in the country's capital market.

Regulatory changes in the sovereign debt market; comparatively low interest rates in advanced economies; the improvement in domestic fundamentals, particularly economic growth, and macroeconomic stability, as well as the increase in Colombia's participation in sovereign debt indices for emerging markets constitute factors driving the recent developments in Colombia's sovereign debt market (Romero et al., 2021; Toro et al., 2022).

The expansion of the market is mostly attributable to the entry of non-resident investors –foreigners–, whose participation increase from 1% to 25% between 2010 and 2020 (Figure 2), driven by the introduction of regulatory changes aimed at facilitating the access of this type of investors[3]. This was accompanied by significant changes in the foreign investor base: at the beginning of the previous decade, commercial banks concentrated 96.8% of market assets. However, mutual funds and, to a lesser extent, pension funds have recently concentrated the bulk of investments, contributing 44.8% and 23.5% of the total, respectively, towards the end of 2020 (Figure 3).

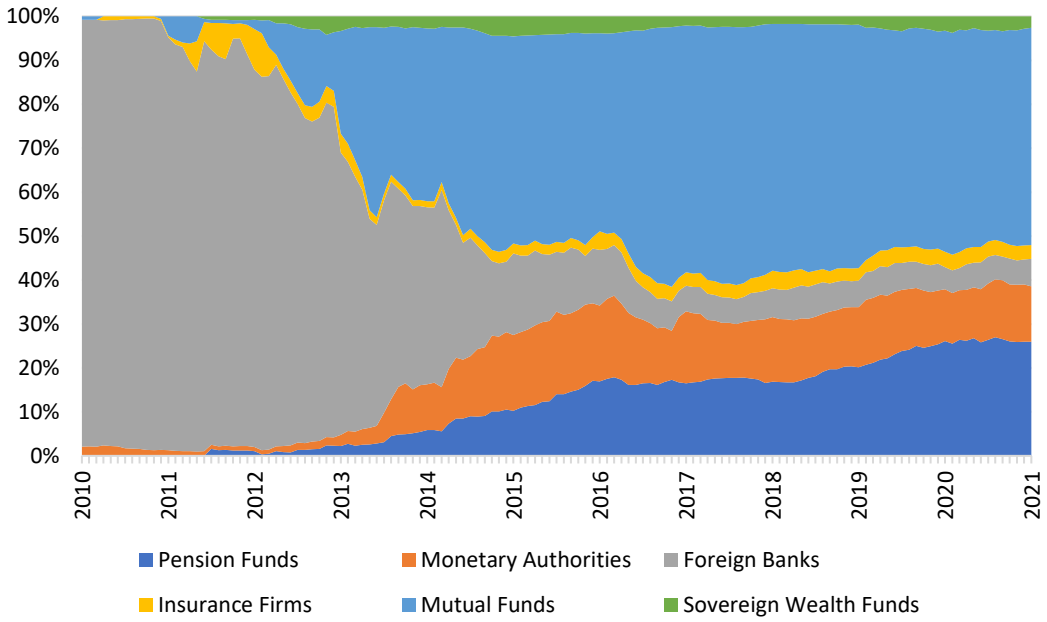
[3] According to Toro et al. (2022), non-resident investors were the main beneficiaries of the reduction in the income tax on investments in TES –from 33% to 14% in 2013, and then from 14% to 5% in 2019; the elimination of the requirement to set up a local investment fund to invest in the sovereign market; and the simplification of the payment of taxes on the financial yields of local public debt securities.

**Figure 2.** Outstanding TES in Colombia according to investor residence (2010 – 2020).




Source: Central Bank of Colombia.

**Figure 3.** Foreign investor composition in Colombia's sovereign debt market (2010-2020).



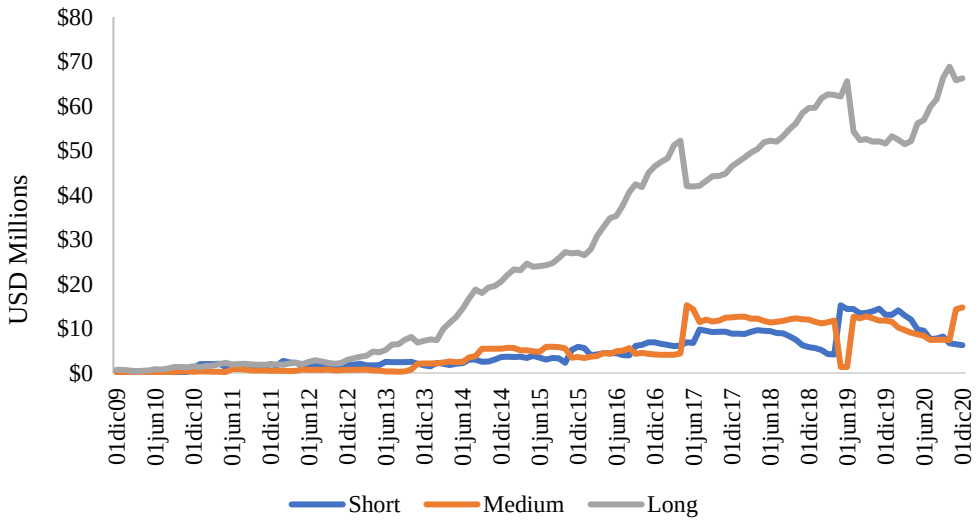

Note: The following types of investors were not included: hedge funds, endowment funds, multilateral organizations, and unclassified investors. The first three were excluded due to their low participation during the period of analysis.

Source: Central Bank of Colombia.

The changes in the composition of the foreign investor base are explained by several factors. The most important is the increase in Colombia's participation in the GBI-EM Global

Diversified index of J.P. Morgan, a fact that triggered an unprecedented increase in sovereign debt purchases by foreign mutual funds (Arslanalp and Tsuda, 2015; García-Andrade, 2019; Romero et al., 2021). However, there are other factors that also encouraged the participation of other types of investors that not necessarily base their decisions on the composition of financial indices. In particular, the development of the sovereign market facilitated the entry of agents that consider a long-time horizon when making their investments, an aspect evidenced in the distribution of TES holdings at different tranches of the yield curve (Figure 4)[4]. As can be seen, the concentration of assets in the long-term tranche, coincides with the entry of pension funds into the market.

**Figure 4.** Offshore holdings of TES by stretch in the yield curve (2010-2020).




Source: Central Bank of Colombia.

## 3. Portfolio decisions among distinct types of investors

The literature related to portfolio flows has found that a considerable proportion of mutual funds, passive funds, base their investment decisions on the composition of financial indices, which explains up to 70% of asset allocation by this type of investors in emerging market economies; 80% in the case of Colombia (Raddatz et al., 2017; Romero et al, 2021). According to Arslanalp et al. (2020), mutual funds accounted for 90% of offshore TES purchases until 2016, before investments by foreign pension funds in Colombia's sovereign debt market rose considerably.

Indexed investments pose domestic risks due to increased sensitivity of portfolio flows to external shocks, particularly in global risk aversion and foreign interest rates (Miyajima and Shin, 2014; Oura et al., 2014 Raddatz et al., 2017; Bush et al., 2019; Cerutti et al., 2019). Such risks can materialize when (i) domestic shocks negatively influence the perception of

[4] The short tranche corresponds to all securities with maturities between 0 and 3 years, the medium tranche to maturities between 3 and 5 years, and the long tranche to maturities greater than 30 years.

risk associated with economies exhibiting similar macroeconomic characteristics, turning them into aggregate shocks, and (ii) external monetary shocks affect the performance of local investments through deviations from the covered interest parity and alterations in the portfolio channel, leading to the withdrawal of positions in relatively risky markets (Milesi-Ferreti and Tille, 2011; Fratzscher, 2012; Broner[5] et al., 2013; Rey, 2013; Ananchotikul and Zhang, 2014; Koepke, 2014; Nier et al. 2014; Bruno and Shin, 2015). These shocks can lead to a rebalance of financial indices (e.g., reductions on the weight of emerging market economies) that are used by passive mutual funds to allocate investments, particularly in emerging markets. Consequently, there could be a decrease in portfolio investments in emerging economies even in the absence of idiosyncratic shocks **(**Bush et al., 2019**).**

This risk can be countered by the behavior of institutional investors, particularly pension funds, whose sensitivity to global shocks is significantly lower and which play a stabilizing role in financial markets (Friedman, 1956; Walker and Lefort, 2002; Thomas et al., 2014). According to Oura et al. (2014), the effect of an increase in global risk aversion bond flows to emerging economies among institutional investors is about one-fifth that observed for mutual funds. For Colombia, between 2010 and 2020, TES balances held by foreign mutual funds showed a volatility 2.3 times higher compared to the holdings of foreign pension funds.

This difference is explained by divergences in the optimization process of these agents (Cohen 1998; Dennis and Strickland, 2002). On the one hand, mutual funds reflect, to a large extent, the preferences of individual investors -*retail investors*-, whose behavior in the financial market has been questioned because they withdraw their positions early, they configure non-diversified portfolios, and they respond to trends that do not necessarily incorporate fundamental analyses (*herd behavior*) and are based on immediate returns (*momentum trading*) (Bush et al., 2019; Raddatz and Schmukler, 2012; Gelos, 2011; Kumar, 2007; Chan-Lau and Ong, 2005; Odean, 1998; Lee et al, 1991; De Long et al, 1990; Shiller 1984; Fama, 1965). Instead, the literature suggests that institutional investors adopt investment behaviors that respond to market signals, basing their decisions on sophisticated processes that use a broad set of information (Kaniel et al., 2008; Brennan, 2004; Daigler and Wiley, 1999; Chopra et al., 1992; Aggarwal and Rao, 1990; Fama, 1965). They take advantage of deviations in the intrinsic value of assets, attributable to the behavior of individual investors, to sell when they are overvalued and vice versa (Huang et al., 2015; Boehmer and Kelley, 2009; Lipson and Pucket, 2006; Sias et al., 2006; Hughen and McDonald, 2005; Kim and Nofsinger, 2005; Brunnermeier and Nagel, 2004; Collins et al., 2003; Cohen et al., 2002; Dennis and Strickland, 2002; Bartov et al., 2000; Sias and Starks, 1997; Badrinath et al., 1995).

Explanatory factors of this investment strategy include (i) profitability mandates, (ii) investment horizon, and (iii) redemption system. For pension funds, defined benefit contributions, which guarantee pre-determined transfers to individual investors upon retirement, imply that the risk associated with investment decisions falls primarily on the

[5] In this area, Arslanalp et al. (2020) find that, compared to the overall market, passive investment funds are between three and five times more sensitive to crashes in external factors.

institutional investor that fulfills this mandate (BIS, 2007). This obligation limits the risk that pension funds are willing to take, an aspect that favors the conformation of fixed income portfolios. This obligation, however, is imposed under a redemption scheme conditioned on retirement, which reduces sensitivity to short-term fluctuations in the determinants of portfolio flows. This type of restrictions reduce liquidity needs, limiting *herd behavior* and *momentum trading* observed, to a greater extent, among mutual funds (Oura et al., 2014).

## 4. Methodology and data

We analyze what are the main determinants of investments in TES among non-residents, specifically mutual funds and pension funds. First, we select the variables that potentially explain capital flows using the stepwise least squares combined (SLSC) method. For a set of variables[6], both external and local financial ones, as well as factors identified in the literature as determinants of capital flows, this methodology evaluates different combinations of these variables and selects the one that exhibits the best fit, measured through the R-squared. Second, using the variables selected by the SLSC method, we estimate a generalized method of moments model (GMM) with errors robust to heteroscedasticity and autocorrelation (HAC), and including lags of the explanatory variables as instruments. We use this method as the orthogonality condition between the error term and regressors could be not satisfied in an ordinary least square model (OLS) and the estimators lack of consistency. The GMM estimation addresses endogeneity issues in the selected specification. This method controls for three possible sources of endogeneity: unobservable heterogeneity; simultaneity; dynamic endogeneity. In our specification, endogeneity arises due to unobservable heterogeneity since the explanatory variables may be correlated with the error term. Likewise, endogeneity can occur due to simultaneity, where two variables can be co-determined.

According to Hayashi (2011), if an estimated equation is linear and follows this form:

$$y_i = z_i'\delta + \varepsilon_i \ \ (i = 1,2, \dots \dots, n),$$

where $z_i$ is a vector of regressors of dimension $L$, $\delta$ is a vector of coefficients of dimension $L$, and $\varepsilon_i$ is an unobservable error term, the orthogonality condition implies that if exists a vector of instruments $x_i$ of size $K$, $E[x_i(y_i - z_i'\delta)] = \mathbf{0}$ or $E(g_i) = 0$, $where\ g_i \equiv x_i\varepsilon_i$ and $g_i = g(w_i; \delta)$, and $w_i$ correspond to the unique and nonconstant elements of $(y_i, z_i, x_i)$. In our case $y_i$ is our measure of portfolio flows, $z_i$ are the controls selected from the SLSC method, and $x_i$ are the lags of the regressors as instruments in the estimation.

The method of moments estimator chooses the parameter estimate in order that the corresponding sample moments are equal to zero. This estimator evaluated at a hypothetical value $\tilde{\delta}$ of $\delta$ solves the system of $K$ simultaneous equations:

[6] We included the following variables in the estimations: risk perception; raw material prices; indices of financial conditions and economic surprises in advanced economies; local and foreign interest rates; Colombia's inflation and GDP growth differential with respect to the United States; sovereign risk ratings from different rating agencies; the exchange rate.

$$g_n(\tilde{\delta}) = \frac{1}{n}\sum_{i=1}^{n} g(w_i; \tilde{\delta}) = 0 \quad (1)$$

If the system is overidentified as there are more orthogonality conditions than parameters (*K*>*L*), the system of equations in 1) may do not have an exact solution. However, if $g_n(\tilde{\delta})$ cannot be exactly equal to zero, it is possible to choose $\tilde{\delta}$ so that $g_n(\tilde{\delta})$ is as close to zero as possible. Assuming there exists a weighting matrix $\widehat{W}$ of size *K* x *K* and symmetric positive definite, the GMM estimator of $\delta$, denoted $\hat{\delta}(\widehat{W})$, is:

$$\hat{\delta}(\widehat{W}) \equiv argmin\, J(\tilde{\delta}, \widehat{W}), \quad (2)$$

where

$$J(\tilde{\delta}, \widehat{W}) \equiv n g_n(\tilde{\delta})' \widehat{W} g_n(\tilde{\delta})$$

Full identification of the GMM model requires there is an equivalent–or grater–number of instruments and parameters. The objective function is quadratic in $\tilde{\delta}$ when the equation is linear:

$$J(\tilde{\delta}, \widehat{W}) \equiv n(s_{xy} - S_{xz}\tilde{\delta})' \widehat{W} (s_{xy} - S_{xz}\tilde{\delta}) \quad (3)$$

where

$$s_{xy} = \frac{1}{n}\sum_{i=1}^{n} x_i y_i \text{ and } S_{xz} = \frac{1}{n}\sum_{i=1}^{n} x_i z_i'$$

The GMM estimator yields the unique solution:

$$\hat{\delta}(\widehat{W}) = (S_{xz}' \widehat{W} S_{xz})^{-1} S_{xz}' \widehat{W} S_{xz} \quad (4)$$

Finally, to corroborate the robustness of the GMM estimations, we estimate a VAR-X model with endogenous and exogenous variables, and the corresponding impulse-response functions to evaluate the impact of shocks in the explanatory variables on TES flows. We estimate the following VAR-X (p,q) model:

$$\boldsymbol{Y}_t = \boldsymbol{v} + \sum_{i=1}^{p} A_i \boldsymbol{Y}_{t-i} + \sum_{i=0}^{q} B_i \boldsymbol{X}_{t-i} + \boldsymbol{u}_t \quad (5)$$

where $\boldsymbol{u}_t \sim WN(\boldsymbol{0}, \sum)$, and:
$\boldsymbol{Y}_t'$ = (endogenous variables).
$\boldsymbol{X}_t'$ = (exogenous variables).

The dataset we work with is monthly, starting in December 2009 and ending in December 2020. Sovereign debt flows correspond to the monthly variation of the nominal value of TES balances of mutual funds and foreign pension funds. We obtained this data from the Fiduciary and Securities Department of Banco de la República (Central Bank of Colombia). The explanatory variables selected through the SLSC method are: the domestic interest rate,

measured by the Reference Banking Indicator (IBR); the foreign interest rate, measured by the Overnight Index Swap (OIS); the Bloomberg Index of Financial Conditions in the United States (BFICUS)[7]; the long-term sovereign risk ratings of Standard & Poor's (S&P) [8] for Colombia obtained from Bloomberg and the Ministry of Finance; Colombia's weighting in the J.P. Morgan (GBI); the real effective exchange rate, calculated by the Bank of International Settlements (REER); and the average index exchange rate returns for Brazil, Chile, Colombia, Peru and Mexico, which reflects the common component of exchange rates in the region (LATAM)[9].

## 5. Determinants of sovereign debt flows for distinct types of investors

The results presented in Table 1 and indicate that foreign mutual funds exhibit greater sensitivity to shocks in external factors. Investments in TES by these investors respond significantly to shocks in the external interest rate, to changes in Colombia's participation in the GBI index, to the improvement in sovereign risk and to the financial conditions of the United States[10]. According to these results, the coefficients have the expected signs. For instance, an increase in the external interest rate decreases investments in TES of foreign mutual funds, while an increase in the index of financial conditions in the United States, an improvement in sovereign risk and a higher share of Colombia in the GBI index increase their investments in TES. Regarding foreign pension funds[11], the selected explanatory variables are not statistically significant, except for the weight of Colombia in the GBI index and the common component of exchange rates in LATAM. When the share of Colombia in the GBI index is higher, foreign pension funds increase their investments in TES, while a higher rate of depreciation of LATAM currencies discourages their investment incentives. The effect of monetary policy on capital flows is measured through the Reference Banking Indicator. The results indicate that the domestic interest rate does not exert a statistically significant influence on TES flows between non-residents.

[7] The index of financial conditions in the United States, calculated by Bloomberg, describes the general level of stress in financial markets. A positive value indicates greater stability in the markets, while a negative value reflects greater instability, usually related to periods of crisis. This index captures the risk measured by the VIX, a standard measure of risk, since it is one of the factors used for its calculation. In fact, the correlation coefficient between the BFICUS and the VIX was -0.84 between December 2009 and December 2020.

[8] The sovereign risk ratings have an irregular frequency. We applied a linear transformation, using the methodology of Kim and Wu (2008) to convert the series into a time series.

[9] We performed unit root tests for all variables to assess stationarity (Annex 2). Colombia's sovereign risk ratings and weight in the J.P. Morgan index correspond to monthly variations. Likewise, we measured the returns of the real effective exchange rate as the first difference of the logarithm. The local and external interest rates are stationary when we perform unit root tests with breaks.

[10] This result holds when we include financial conditions in Europe (rather than the United States) or when we use Moody's sovereign risk ratings.

[11] The variables included in the model for pension funds are not the same to the ones included for mutual funds because the stepwise method selects the variables that potentially have the best fit according to the R-squared.

**Table 1.** TES flows determinants among non-residents by type of investor (millions of USD).

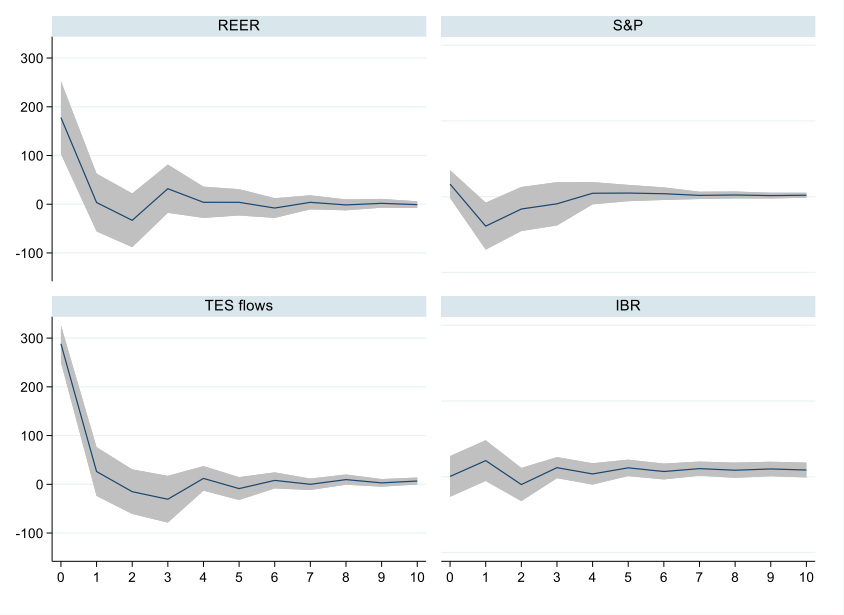
| Variable | Investment funds | Pension funds |
|---|---|---|
| IBR | 51.418 | -7.160 |
| | [1,596] | [-0,843] |
| OIS | -141.862 *** | -20.354 |
| | [-4,311] | [-1,122] |
| BFCIUS | 112.395 * | 7.174 |
| | [1,894] | [0,299] |
| S&P | 357.481 * | 4.699 |
| | [1,841] | [0,067] |
| GBI (J.P. Morgan) | 445.735 *** | 86.245 ** |
| | [3,288] | [2,306] |
| Dummy (J.P. MORGAN) | | 108.157 *** |
| | | [4,481] |
| REER | 62.811 | |
| | [1,605] | |
| LATAM | | -45.366 |
| | | [-2,333] |
| R-squared | 0.512 | 0.377 |
| Adjusted R-squared | 0.488 | 0.336 |
| Durbin-Watson statistic | 1.691 | 2.073 |
| P-value of the J Hansen statistic | 0.541 | 0.425 |
| [] t statistic, standard error and covariance HAC, * p<0,10; ** p<0,05; *** p<0,01 | | |

Note: This table shows the coefficients of the estimates using the generalized method of moments (GMM). IBR is the Reference Banking Indicator of Banco de la República (Central Bank of Colombia); OIS is the Fed's Overnight Index Swap; BFCIUS is the financial conditions of the United States, calculated by Bloomberg; S&P are the monthly variations in the sovereign risk ratings of Standard & Poor's for Colombia; GBI (J.P. Morgan) is the monthly variation of the weighting of Colombia in the GBI-EM Global Diversified index of J.P. Morgan; Dummy (J.P. Morgan) is a binary variable that takes the value of 1 since March 2014, when J.P. Morgan announced the increase of Colombia's participation in its public debt indices for emerging markets; REER is the first difference of the logarithm of the real effective exchange rate calculated by the Bank of International Settlements (increases in the REER reflect a real appreciation of the Colombian peso); LATAM corresponds to the average of the index of exchange rate returns in Brazil, Chile, Colombia, Peru and Mexico. ***, ** and * represent statistical significance at 1%, 5% and 10% levels, respectively. We include one lag of the explanatory variables as instruments.
Source: Authors' calculations.

Figures 5 to 8 show the impulse response functions of the VAR-X model of TES flows for investment and pension funds using bootstrapped confidence intervals, since residuals do not display a normal probability distribution. We include as endogenous variables the IBR, the S&P credit ratings, and the REER and LATAM exchange rates, while we include as exogenous variables the external variables (OIS, BFCIUS) and the GBI index.

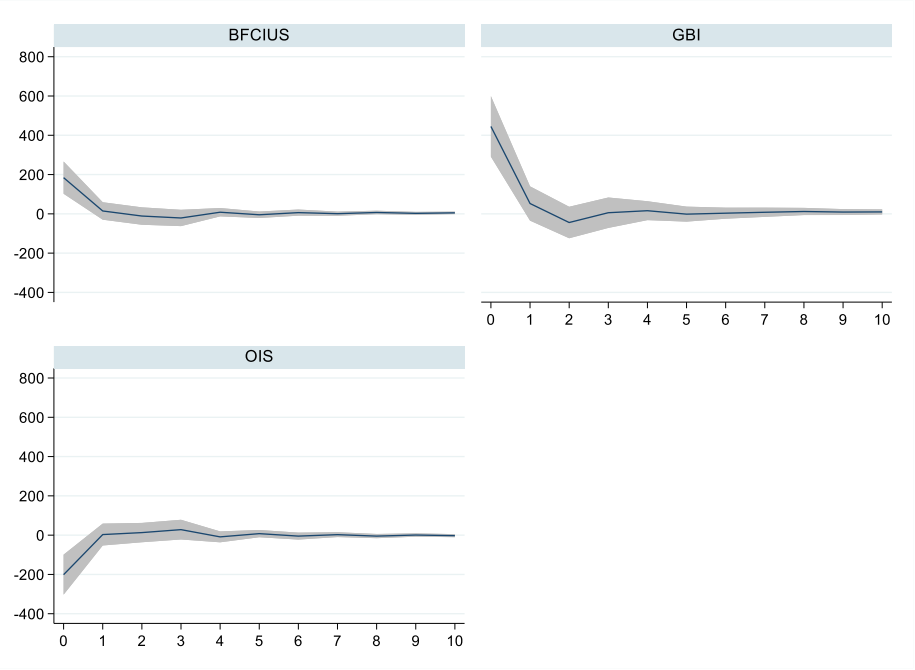
The results of the VAR-X model are robust to the GMM estimations. For instance, TES flows for mutual funds (Figures 5 and 6) respond to shocks in the external variables such as the OIS and the BFCIUS. Additionally, as found in the GMM estimations, investment in TES of mutual funds increases when there is a higher share of Colombia in the GBI, and when there is an improvement in credit ratings (S&P). However, the contemporaneous effect of shocks in credit ratings is lower in the VAR-X model than in the GMM. Local interest rate does not have any impact on flows according to the VAR-X estimations. In the case of pension funds their investments are not determined by the external variables except for the BFCIUS, and as in the GMM estimations they respond to changes in the GBI (Figure 8).

**Figure 5.** VAR-X impulse responses of TES flows for mutual funds under shocks in the endogenous variables.



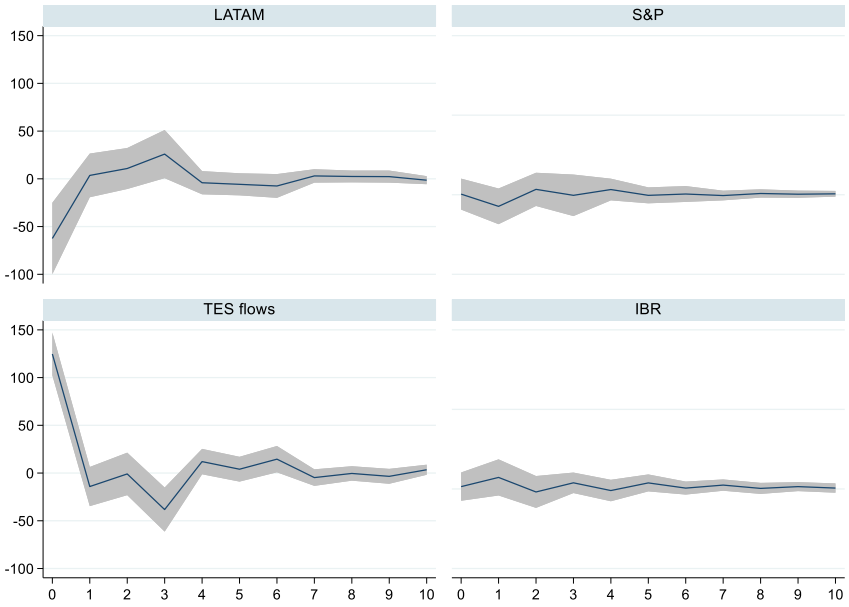

Note: The Y-axis corresponds to USD millions, while the X-axis indicates months.
Source: Authors' calculations.

**Figure 6.** VAR-X impulse responses of TES flows for mutual funds under shocks in the exogenous variables.




Note: The Y-axis corresponds to USD millions, while the X-axis indicates months.
Source: Authors' calculations.

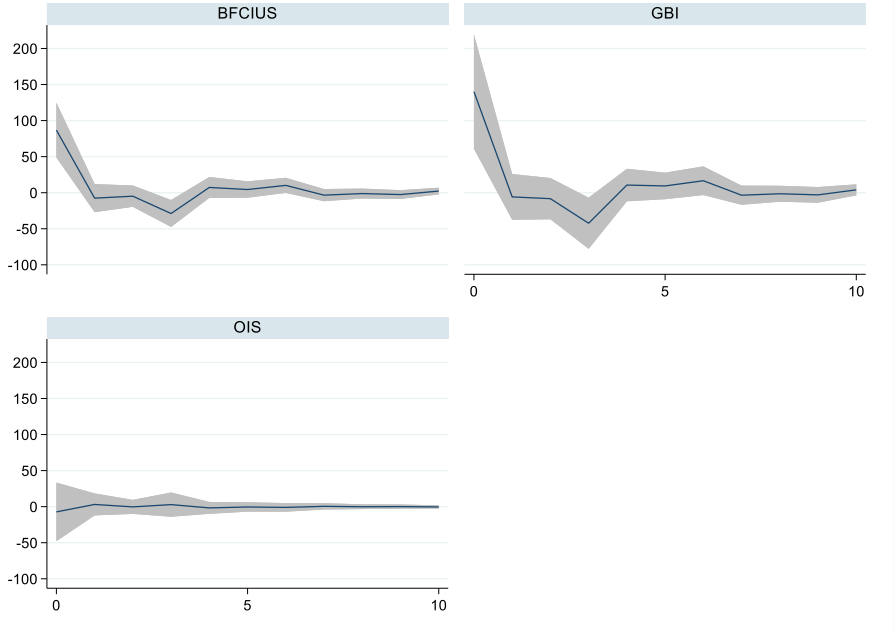
**Figure 7.** VAR-X impulse responses of TES flows for pension funds under shocks in the endogenous variables.




Note: The Y-axis corresponds to USD millions, while the X-axis indicates months.

Source: Authors' calculations.

**Figure 8.** VAR-X impulse responses of TES flows for pension funds under shocks in the exogenous variables.




Note: The Y-axis corresponds to USD millions, while the X-axis indicates months.
Source: Authors' calculations.

The results presented in this section have important implications for monetary authorities. First, they suggest that the composition of the foreign investor base affects the dynamics of portfolio flows in Colombia. While portfolio allocations by mutual funds are determined by external factors, pension funds show little sensitivity to changes in these factors, a fact that underlines the stabilizing role played by this type of investor in financial markets. Second, we find that changes in the domestic policy rate do not affect TES flows between foreigners, regardless of the type of investor considered.

The extensive participation of foreign mutual funds in the local public debt market, added to their sensitivity to changes in the external interest rate, sovereign risk, and financial conditions in advanced economies, exposes domestic vulnerabilities to external shocks. Our results suggest that, in the face of shocks to these factors, the Colombian economy may experience episodes of volatility in portfolio flows, even in the absence of local shocks. Given this risk, local monetary authorities can monitor the composition of the foreign investor base, since the participation of certain types of investors can affect the behavior of portfolio flows.

## 6. Conclusion

Our results underscore the elevated exposure of the Colombian sovereign debt market to investment strategies adopted by foreign mutual funds. Considering the increasing market share of these type of investors, coupled with their sensitivity to global shocks, they indicate that episodes of volatility in portfolio flows could arise in the future, which could in turn have negative effects on public revenue.

As mutual funds are more sensitive to external shocks, this could create important challenges for the economic authorities, by putting financial stability at risk, affecting economic activity, and compromising the fulfillment of inflation goals (Gelos et al. 2019). In this sense, the low sensitivity of pension funds to shocks in external factors suggests that a greater participation of this type of investor in the sovereign debt market would limit the exposure to this type of fluctuations.

Strengthening the local investor base could also mitigate episodes of volatility in portfolio flows as their investment decisions depend not only on external factors, but also on shocks to domestic economic factors (Toro et al., 2022). In Colombia, local agents concentrate the local currency outstanding public debt, with pension funds representing the biggest investor. In that sense, we could presume that the Colombian market exhibits less exposure compared to other emerging economies.

It is possible that the strengthening of foreign currency hedging for foreign investors will strengthen the portfolio channel, since there is no exchange risk, in such a way that decisions are based to a greater extent on the return on investments in local markets, which offer advantages between emerging economies. Nevertheless, this is only a hypothesis, and due to the importance of these agents in the public debt market, we acknowledge the relevance of examining and analyzing local pension funds and other domestic agents in a forthcoming research project.

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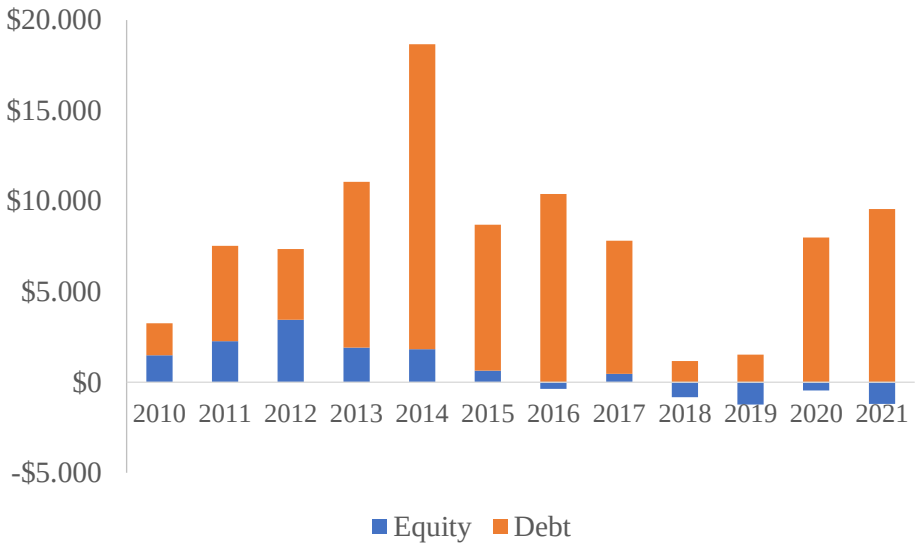
**Annex 1.** Offshore Net Portfolio Flows in Colombia — USD millions.




Source: Institute of International Finance.

**Annex 2.** Unit root tests.

| Variable | ADF | | PP | | KPSS | |
|---|---|---|---|---|---|---|
| | test | p-value | test | p-value | test | p-value |
| Flows investment funds | -8.560 | 0.000 | -8.792 | 0.000 | 0.1225 | NS |
| Flows pension funds | -7.270 | 0.000 | -11.065 | 0.000 | 0.3349 | NS |
| IBR | -2.267 | 0.184 | -1.398 | 0.581 | 0.2296 | NS |
| OIS | -1.390 | 0.586 | -1.423 | 0.569 | 0.7278 | ** |
| BFCIUS | -4.045 | 0.002 | -3.939 | 0.002 | 0.3949 | * |
| S&P | -1.972 | 0.299 | -1.972 | 0.299 | 0.371 | * |
| GBI | -1.844 | 0.358 | -1.832 | 0.364 | 0.7663 | *** |
| REER | -0.687 | 0.846 | -0.818 | 0.810 | 1.1707 | *** |
| LATAM | -0.148 | 0.941 | -0.267 | 0.926 | 1.3216 | *** |

Note: the null hypothesis for the ADF and PP tests is non-stationarity, while for the KPSS is stationarity. *, **, *** represent significance at 10%, 5% and 1% level, respectively. NS means non-significant. IBR and OIS variables are stationary when the unit root test performed considers breaks. Source: Authors' calculations.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