Foreign investment dynamics: The impact of benchmark-driven vs. unconstrained funds on local credit conditions*

Oscar Botero-Ramírez† Andrés Murcia‡ Mauricio Villamizar-Villegas§

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Abstract

This study investigates the dynamics of foreign investment in the Colombian sovereign bond market from 2014 to 2023. We introduce a novel classification of foreign investors into benchmark-driven and unconstrained groups based on their trading strategies, utilizing a granular bond-level dataset. Benchmark-driven investors replicate global indices, whereas unconstrained investors rely on idiosyncratic considerations. By combining this classification with credit registry data, we demonstrate that banks exposed to benchmark-driven investors reduce their credit supply during portfolio inflows. In contrast, those engaging with unconstrained investors expand credit more robustly. These differences have critical implications for financial stability, as benchmark-driven flows tend to transmit external shocks to local financial conditions, while unconstrained investment flows amplify procyclical responses to local shocks.

JEL Classification: F3, F4, G01, G11, G12, G15

Keywords: Capital flows; foreign investment; investor classification; portfolio choice; benchmark; investment index; emerging markets; regulation; credit markets; exchange rates

*We appreciate the comments received at the central bank of Colombia.

†central bank of Colombia, e-mail: oboterra@banrep.gov.co

‡central bank of Colombia, e-mail: amurcipa@banrep.gov.co

§central bank of Colombia, e-mail: mvillavi@banrep.gov.co

1 Introduction

From the Great Financial Crisis of 2008-2009 to the inflation surge of 2021-2023, persistently low interest rates in advanced economies prompted investors to seek higher returns in emerging market economies (EMEs). Studies by Prasad and Rajan (2008); Peiris (2010); Forbes and Warnock (2012) and Ocampo et al. (2020) suggest that these substantial portfolio inflows had positive effects on local financial conditions. These benefits included lower sovereign bond yields, reducing government financing costs, and a decline in fiscal debt currency mismatches due to decreased reliance on foreign currency debt.

However, a substantial body of literature highlights the risks associated with increased foreign participation in local markets, given the heightened sensitivity and pro-cyclicality of these flows.[1] For instance, a sudden shift in international investor sentiment can trigger large scale sell-offs of local assets, leading to price declines and currency depreciation. While the macroeconomic effects of these dynamics are well-documented, fewer studies examine their influence on banking sector lending. Among these, Williams (2018) finds, in the Colombian case, that unanticipated portfolio capital inflows reduce market makers' bond holdings while increasing their lending. Namely, as primary counterparts to foreign investors, banks adjust lending in response to inflows (or outflows), potentially amplifying the positive (negative) effects on firm investment. In the literature this is referred to as the crowding-out channel.

Our investigation contributes to this emerging literature by distinguishing between the types of foreign investors and, in particular, the trading strategies associated with each. Specifically, we classify these strategies as either active or passive depending on the use of international benchmark indices in their investment portfolio' decisions. Passive strategies, or *benchmark-driven strategies*, are highly responsive to global factors and changes in index weights, as their positions are designed to replicate specific indices. In contrast, active strategies, or *unconstrained strategies*, respond more to idiosyncratic factors. While active investors may also consider benchmark indices in their decisions, their primary objective is to outperform these indices consistently.

We argue that differences in trading strategies lead to distinct effects on the macroeconomic and financial conditions of EMEs. In response to a global financial shock, both

[1] See for example: Calvo and Talvi (2005); Obstfeld (2012); Ebeke and Lu (2015); Ebeke and Kyobe (2015) and Cerutti et al. (2015).

benchmark-driven and unconstrained investors are likely to react, but benchmark-driven investors tend to respond more rapidly. Conversely, in the case of an idiosyncratic shock, unconstrained investors typically react first. Thus, the origin of the shock influences whether these atomized strategies exacerbate booms and busts or instead act as macroeconomic stabilizers. In our analysis, we show that the banking sector takes into account the trading behavior of these flows –such as their volatility, frequency, and magnitude– and adjusts its balance sheets accordingly, with notable implications for lending decisions.

Our case study focuses on Colombia during the period 2014-2023, a country that serves as a representative example of a small open economy with foreign participation in its sovereign bond market comparable to the regional average. A key advantage of our setting is access to granular, bond-level data tracking individual foreign bondholders over time, an uncommon resource even for central banks. We also use the entire administrative corporate credit registry to assess how portfolio decisions influence credit conditions. By integrating these detailed micro-level datasets, we link banks with varying levels of exposure to foreign flows with the specific credit they provide to firms.

For identification, we first apply the method developed by Arslanalp et al. (2020) to separate the exogenous component from the valuation component of Colombia's weight in the J.P. Morgan Government Bond Index-Emerging Markets (GBI-EM). To provide context, the GBI-EM is the dominant benchmark in global markets for EMEs, with over $300 billion USD in assets tracking the index annually, according to the 2018 J.P. Morgan's Global Index Research. Colombia, as part of a 72-country portfolio, experiences significant capital flows influenced by its time-varying weight in the index (see Romero et al., 2021). Using this decomposition, we categorize foreign investors based on their degree of indexation. To validate this classification, we compare our findings with some in-house central bank surveys of foreign investors actively participating in this market. Additionally, we test whether the use of FX (USD-COP) forward positions is less prevalent among benchmark-driven investors, given that a key feature of the GBI-EM index is its unhedged nature, exposing investors to exchange rate risk in each country.

In a second step, we demonstrate that local banks serve as the primary counterparts to foreign agents in the sovereign bond market and that bank-investor relationships are typically sticky and concentrated within a few banks, a phenomenon known as *fund funneling*. We then turn to the credit market to test whether the crowding-out channel differs for banks exposed to benchmark-driven investors. To strengthen our identification when evaluating the

effects on firm credit, we employ firm-bank and firm-time fixed effects. The former control for time-invariant differences in bank-firm relationships, while the latter account for time-varying credit demand. Crucially, because we observe firms with multiple banking relationships, firm-time fixed effects eliminate any demand shock affecting the same firm, consistent with the approach of Khwaja and Mian (2008).

In a third step, we gain macro-financial insights by investigating whether banks respond differently to global financial conditions depending on the type of foreign investor they engage with. We also explore the role of macroprudential policies, specifically, foreign exposure limits, focusing on banks with greater exposure to benchmark-driven foreign investors.

Our analysis reveals that local banks adjust their bond holdings based on the type of foreign investor they engage with. Banks with higher exposure to benchmark-driven investors exhibit a limited lending response during periods of high portfolio inflows, reflecting a greater sensitivity to global factors associated with these investors. In contrast, banks with greater exposure to unconstrained investors significantly increase their lending during periods of capital inflows, in line with a more pronounced sensitivity to local factors.

These findings have important implications for financial stability. While flows from unconstrained investors exert a stronger influence on banks' balance sheets, they also exhibit greater procyclicality, amplifying fluctuations in loan issuance during periods of rapid inflows or outflows. Understanding these dynamics is essential for mitigating risks and ensuring the stability of the financial system.

Overall, our study confirms that financial globalization impacts domestic capital markets, particularly in EMEs. Investors reward or punish government bonds based on policies affecting debt repayment likelihood. More crucially, atomized foreign investors influence the domestic banking sector differently, depending on their trading strategy, which in turn affects loan decisions and balance sheet changes of local banks. Hence, we believe that our analysis offers valuable insights for financial regulators, supervisors and monetary authorities. The EMEs have become increasingly reliant on investors exposed to local currencies, amplifying capital flow volatility during stress periods. To be able to identify the type of investors present in local markets is quite relevant to understand the implications of changes in local or global conditions on credit behavior and financial stability.

Related Literature

Our investigation seeks to bridge two strands of literature. The first examines how banks

face balance sheet constraints and how, under certain conditions, the uptake of sovereign bonds can reduce lending. This crowding-out effect has been extensively documented by Cook and Yetman (2012); Ilzetzki et al. (2013); Chodorow-Reich (2014); Bruno and Shin (2015b), and Önder et al. (2024) which highlight heterogeneous lending effects. Namely, younger and smaller firms, firms with less workers, and firms with lower profits are more severely affected. One commonly proposed explanation is that capital tightening disproportionately impacts poorly capitalized firms (Holmstrom and Tirole, 1997).

The second strand of literature focuses on a comprehensive characterization of capital flows. The analysis of foreign investor composition in emerging public debt markets traditionally classifies agents based on their investment vehicles and sources of financing (Bertaut et al., 2023). However, a small but growing literature classifies foreign investors according to their reliance on external reference indices when investing in these markets. Notable examples include Balston and Melin (2013), Arslanalp and Tsuda (2015), Raddatz et al. (2017), and Arslanalp et al. (2020), which employ panel data on public debt holdings and aggregate global investments tracking the GBI-EM index. These studies generally find that benchmark-driven investments heighten the influence of external factors at the expense of domestic fundamentals, increasing the risk of outflows unrelated to a recipient country's economic conditions.

Nevertheless, some evidence in the literature suggests that passive investors also respond to local factors. For example, Balston and Melin (2013) show that while active flows respond exclusively to negative rating actions, passive flows react to both positive and negative ratings. An alternative perspective is offered in Cormier and Naqvi (2023), which suggests that a country's fundamentals (such as debt levels, fiscal deficits, GDP levels, and government partisanship) only significantly impact countries with low representation or excluded from benchmark indices. The authors argue that highly indexed countries tend to relax their fiscal discipline in the short term, as they can secure access to sovereign bond markets.

Our paper aims to bridge the gap between these two strands of literature by providing a comprehensive analysis of how different types of foreign investors impact local financial conditions and credit markets. By distinguishing between benchmark-driven and unconstrained investors, we offer a nuanced understanding of the mechanisms through which foreign capital flows influence domestic banking and lending behaviors.

This document is organized as follows: Section 2 provides an overview of the Colombian context and data sources, focusing on foreign investors' participation in the sovereign bond

market. Section 3 outlines the methodology for classifying benchmark-driven investors and their FX-hedging behaviors. Section 4.1 shows how local banks act as primary counterparts to foreign agents, with high portfolio inflows increasing bank liquidity. Section 4.2 examines whether this liquidity is redirected into corporate credit, confirming a crowding-out effect. Section 4.2.1 assesses how different foreign investor types influence the credit market. Section 4.2.2 analyzes banks' responses to global financial conditions based on the investor type they negotiate with, and Section 4.3 explores the interaction between investment strategies and macroprudential policies such as foreign exposure limits. Section 5 concludes.

2 Colombian Context and Data

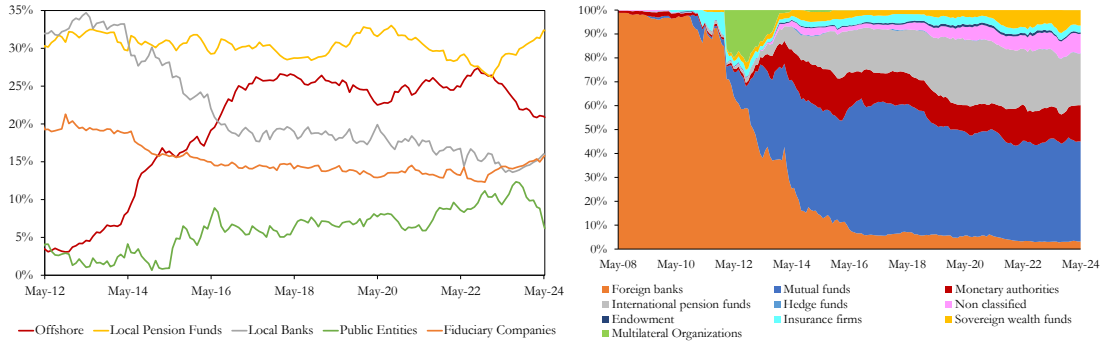
2.1 Colombian context

As illustrated in Figure 1a, foreign investment in Colombia's sovereign bond market experienced a substantial increase in 2014. Prior to this, foreign participation was minimal and primarily comprised foreign banks with steady but modest demand (Figure 1b). The significant rise in investment post-2014 can be attributed to three main factors:

- **Colombia's Investment-Grade Rating:** Colombia achieved an investment-grade rating in 2011 from agencies such as S&P, Moody's, and Fitch Ratings, which enhanced its attractiveness to international investors.
- **Reforms to Foreign Capital Investment Regulations:** Substantial changes to Colombia's General Regime of Foreign Capital Investments facilitated foreign investment. A 2012 tax reform reduced income tax on government bonds for non-resident investors (from 33% to 14%) and allowed investments through local managers. Further, in 2013, the withholding tax on fixed-income securities was simplified, easing entry barriers for foreign investors.
- **Increased Weight in the J.P. Morgan GBI-EM Index:** In 2014, Colombia's weight in the J.P. Morgan GBI-EM Index rose from 3.9% to 8.0%. This led to a surge in foreign demand for Colombian bonds, reshaping the portfolio composition of the entire banking system. Foreign investors expanded their market share from 3% before 2014 to over 25% by 2018, becoming the second-largest market group after local pension funds. According to Romero et al. (2021), this index adjustment led to approximately $9

billion USD in capital inflows during 2014, a year that notably recorded the highest-ever inflows to Colombia's sovereign bond market.

Figure 1: Foreign participation in the Colombian sovereign bond market



(a) Total bond holdings by entity (b) Bond holdings across foreign investors

Source: Central Securities Depository (DCV) at the central bank of Colombia. Panel A illustrates sovereign bond market participation across various entities, while Panel B focuses on the share held by foreign investors.

The increased participation of foreign investors has profoundly influenced local financial dynamics. One notable impact has been a reduction in bond yields, driven by heightened demand for Colombian bonds (Ocampo et al., 2020; Romero et al., 2021). Additionally, a crowding-out effect on lending has been observed, as local banks –serving as primary counterparts to foreign portfolio flows– adjust their bond holdings in response to foreign demand (Williams, 2018). This reallocation affects their lending capacity, with downstream effects on lending, investment, and spending decisions.

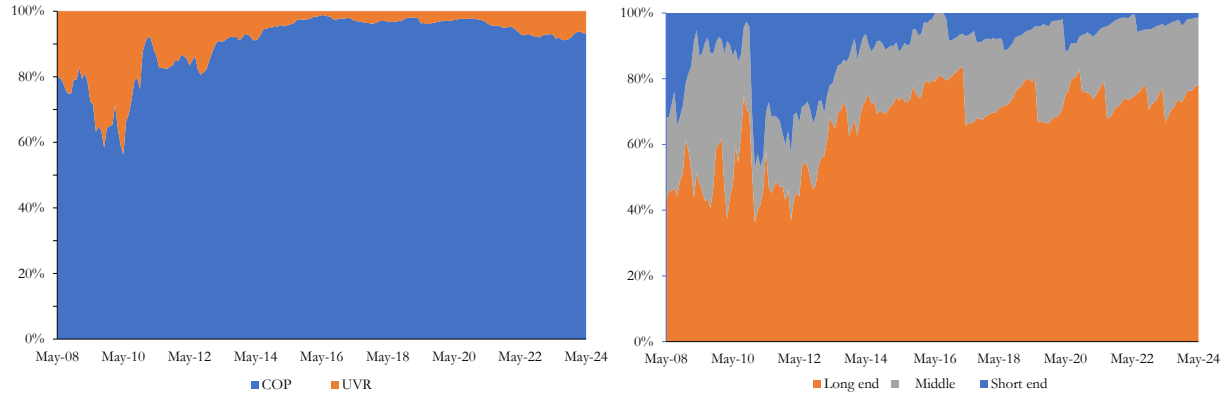
This interplay between debt market activity and credit conditions constitutes the foundation of our research, highlighting the broader financial implications of foreign participation in Colombia's sovereign bond market. Our study brings a novel perspective by distinguishing the effects of more consistent, "unconstrained", investments from those driven by benchmark-oriented flows. This distinction provides a more nuanced understanding of the financial impact of foreign investment in emerging markets.

An initial characterization of foreign investors is presented in Figure 2. Before 2014, foreign banks held the largest share of sovereign bonds among foreign investors, although their overall market participation was relatively low. Since 2014, mutual funds have emerged as the dominant investors, followed by international pension funds and monetary authorities. This shift in investor composition has significantly influenced investment strategies in at least two ways. First, as shown in Figure 2a, demand for Colombian peso (COP)-denominated

bonds has increased, while demand for inflation-indexed bonds has declined. Second, as illustrated in Figure 2b, bond maturities have shifted toward the longer end of the yield curve, specifically bonds with durations of five years or more.

Notably, investors can differ in their levels of indexation to benchmark indices, which heavily influence their decisions to enter or exit a market. This balance between unconstrained and benchmark-driven investors has critical implications for the domestic banking sector. In particular, banks consider the duration and consistency of portfolio capital flows when making lending and other financial decisions. These dynamics are explored further in Section 4.

Figure 2: Foreign investors' bonds holdings by currency and maturity



(a) By currency

(b) By segment of the curve

Source: DCV, authors' calculations. The long end of the yield curve includes securities with a term to maturity $\geq$ 5 years. The short end includes securities with a term to maturity of $\leq$ 2 years. The middle part includes the remaining references.

2.2 Data

For the period between January 2014 and August 2023, we employ detailed granular microdata on the purchases and sales of domestic currency sovereign bonds by foreign investors. This data, recorded at the individual bond and investor level, is maintained by the Central Securities Depository (DCV, for its Spanish acronym) at the central bank of Colombia. The bonds are denominated either in COP or indexed to inflation. All transactions take place through two main electronic platforms: (i) the Colombian Electronic Market (MEC), operated by the Colombian Stock Exchange, and (ii) the Electronic Trading System (SEN), exclusively used by primary dealer banks and managed by the central bank of Colombia.

Our focus is on sovereign bonds, as they represent the largest share of Colombia's public debt. For instance, as of April 2024, sovereign bonds accounted for 60% of the country's total debt, according to the Ministry of Finance. To the best of our knowledge, very few central banks worldwide have access to such detailed bond-level data on foreign bondholders over time, making this dataset particularly valuable for our research.

In addition, we use monthly credit registry data from the Colombian Financial Superintendence (SFC, for its Spanish acronym) on new corporate sector banking loans for the same period. While the data are collected quarterly, banks are required to report all active loans on a monthly basis.

Descriptive statistics are presented in Table 1. As shown in the table, the average amount that a foreign investor trades in sovereign bonds is approximately $33 billion COP, while the mean trading volume between a local bank and foreign investors in sovereign bonds is $347 billion COP. Regarding corporate loans, the average new bank-firm loan size is $1.2 billion COP, with a mean interest rate of 17.2%, and the monthly average of new bank-firm loans is 430.

Table 1: Descriptive statistics for monthly aggregated data

	Obs	Mean	Std	Min	Max
Sovereign bonds data					
foreign investor flows (COP billion)	13,144	33	104	0	3,349
bank-foreigners flows* (COP billion)	660	347	423	0	4286
Corporate loans data					
loan amount (COP billion)	228,212	1.2	10.5	0.0	1,869
loan rate (%)	228,212	17.2	9.8	0.0	49.6
monthly bank-firm loans**	228,212	434	864	1	7,756

Note: Authors' calculations. Data on sovereign bonds are from the Central Securities Depository (DCV) and data on commercial loans are from the Colombian Financial Superintendence (SFC).
* Denotes each bank's order book with foreign clients in sovereign bonds (with higher values indicating a bank that actively trades with foreign investors).
** This refers to the monthly count of new loans given by banks to firms.

3 Identification Strategy

3.1 Teasing out exogenous and valuation components

It is possible to observe the variations in the weights of an issuer within a reference index of sovereign bonds; however, it is difficult to understand the factors behind the movements in

the weights. For example, an appreciation of the currency of that country or a change in the yields of its bonds affects the weighting of the issuer within the index. There are also exogenous factors that can affect the weighting of the issuer, which may be associated with decisions made by the firm that produces the index.

Here, we will take the case of a relevant index in local-currency emerging debt markets, which is the J.P. Morgan GBI-EM Index. Arslanalp et al. (2020) propose that the changes in an issuer's weight within that index can be divided into two components: a valuation component and an exogenous component. Specifically, the variation in a country's weight for a given month is determined by:

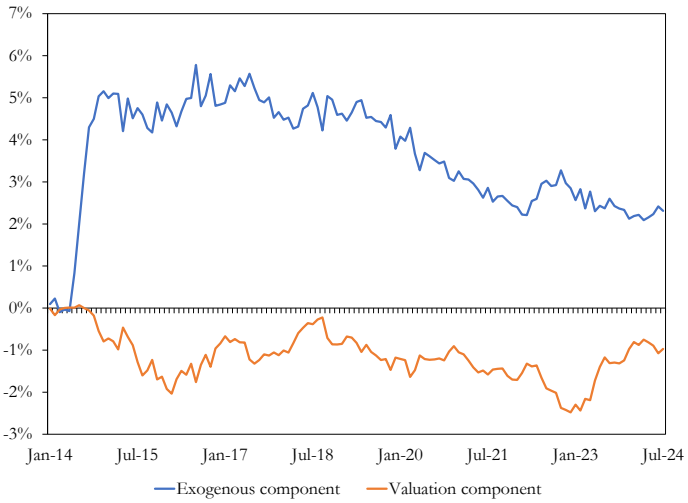
$$\Delta w_{ct+1} = \underbrace{(w_{ct} * \frac{R_{ct}}{R_{bt}} - w_{ct})}_{\text{valuation}} - \underbrace{(w_{ct+1} - w_{ct} * \frac{R_{ct}}{R_{bt}})}_{\text{exogenous}}, \tag{1}$$

where w_{ct} represents the weight of issuer c in month t, R_{ct} denotes the monthly returns of issuer c's references included in the index, and R_{bt} refers to the monthly returns of the references of all issuers within the index.

Intuitively, the first term of the expression represents the valuation component, capturing the portion of an issuer's monthly weight variation due to the relative appreciation or depreciation of its currency and bonds compared to other issuers in the index. The second term, the exogenous component, accounts for residual weight variations arising from the index's rebalancing rules.

In this context, a purely benchmark-driven investor would only trade bonds if weight changes were driven by the exogenous component, which can be calculated using publicly available J.P. Morgan data (Figure 3). The intuition behind this is that changes in the valuation component would be automatically reflected in the portfolio value, so the investor wouldn't need to trade bonds to adjust its exposure. We also compare foreign investor flows in the sovereign bond market with this component for Colombia. Some additional exercises to control for macroeconomic and financial variables that can influence these flows are included.

Figure 3: Cumulative components of the variation of Colombia's weight in the GBI-EM index



Source: J.P. Morgan and authors' calculations based on equation (1).

As an initial step, we estimate the following monthly panel regression where the dependent variable is the trading flows of each foreign investor in the sovereign bond market.[2]:

$$Bonds_{ft} = \alpha_f + \beta_1 \, GBI_exog_t + v_f \, GBI_exog_t + \sum_j \beta_j X_{jt} + e_{ft} \tag{2}$$

Let α_f denote investor fixed effects, and the term GBI_exog_t represents the exogenous component of Colombia's weight variation in the GBI-EM index, as described in equation (1). To capture the heterogeneity in how each investor f responds to GBI_exog_t, we use a mixed linear model with a random slope. This approach estimates both the average coefficients for each explanatory variable and the random effects associated with each of these betas. Specifically, the random effect term v_f captures how much investor f's response to GBI_exog_t deviates from the average slope (β_1) across all investors, as specified in equation (2).

This specification is selected to exploit the comprehensive nature of the panel data and to regulate the degree of indexation among all agents within the investor pool. By implementing this approach and controlling for macroeconomic and financial variables that impact portfolio flows, this model facilitates a nuanced classification of investors based on their sensitivity to index fluctuations. This methodology provides a framework to distinguish between individual

[2]The monthly net flows of each foreign investor f in the sovereign bond spot market are standardized by their standard deviation, with missing values assigned to months preceding the investor's entry.

investor reactions to the index and the average market response, thereby offering profound insights into the role of indexation in shaping individual portfolio decisions

For controls (X_{jt}), we include a group of variables widely used in the literature due to their importance as drivers of portfolio investment decisions: (i) the returns of the USD-expressed portfolio of Colombian sovereign bonds referenced in the GBI-EM index, (ii) the spread between the returns of the 10-year Colombian sovereign bonds and US Treasuries, (iii) monthly returns of the nominal COP-USD exchange rate, (iv) the monthly spread between Colombia's 5-year CDS and the average CDS of a pool of Latin American countries (Brazil, Chile, Mexico and Peru), and (v) the monthly average of the VIX index.

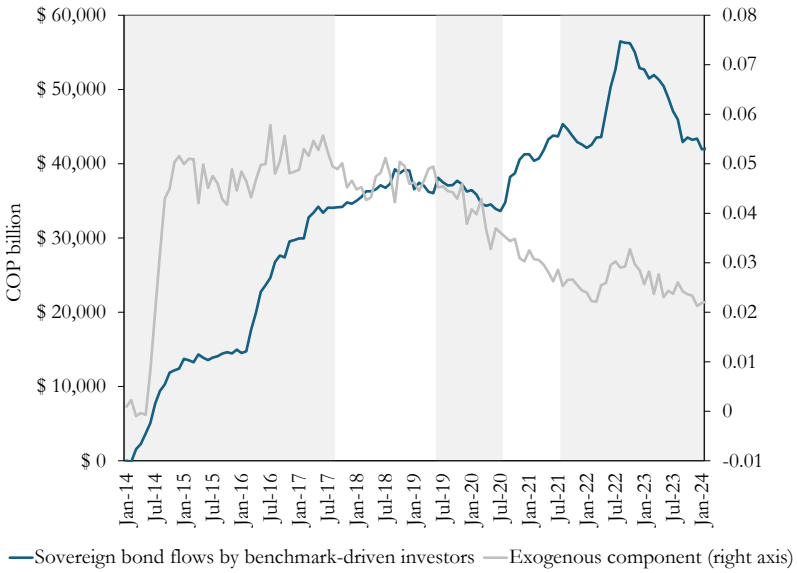
These variables are selected to control for financial factors that could influence portfolio allocation decisions. Regression results for equation (2) are presented in Appendix A. Overall, the signs of the coefficients for the control variables align with the financial intuition underlying their role as drivers of investment decisions.

3.2 Classification of investors

We now classify foreign investors based on their degree of indexation, using the estimated predictors of the random component for GBI_exog_t (v_f, as defined in equation (2)). Since v_f measures the extent to which investor f's response to GBI_exog_t deviates from the average slope (β_1, as defined in equation (2)) across all investors, we categorize investors with a positive v_f as benchmark-driven. The intuition behind this classification is that investors with a positive v_f are more sensitive to changes in GBI_exog_t, meaning they closely follow the index and thus are more likely to be benchmark-driven. Investors with a zero or negative v_f are classified as unconstrained.

Figure 4 illustrates that the sovereign bond positions of benchmark-driven investors typically align with Colombia's weight variation in the GBI-EM index (highlighted by the gray areas in Figure 4), with the exception of two brief periods in 2018 and 2021. This divergence may be due to exogenous factors, such as new benchmark-driven investors choosing to increase their exposure to Colombian sovereign bonds.

Figure 4: Cumulative sovereign bonds flows by benchmark-driven investors vs cumulative series of the exogenous component



Source: DCV and JP Morgan, authors' calculations. Grey areas correspond to periods during which both series present a high and positive correlation.

To further examine the types of investors classified as benchmark-driven, we analyze the distribution of each foreign investor type, as in the central bank's own classification[3], (rows in Table 2) between unconstrained and benchmark-driven agents. Results from the baseline panel regression (column 3 in Table 2) reveal that approximately 50% of mutual funds track the GBI-EM index. However, this 50% constitutes the majority of the benchmark-driven group due to their significant share (41%) of total foreign holdings (column 2 in Table 2). Additionally, we find that other major groups within the foreign investor base –such as international pension funds and monetary authorities– are more predominantly benchmark-driven.

A big portion of benchmark-driven investors are agents that could face higher liquidity risks and tend to adopt short-term return strategies under redemption pressures. Since mutual funds are primarily composed of retail investors, they are particularly susceptible to frequent and sometimes unexpected withdrawals, leading to pro-cyclical trading behavior (Timmer, 2018; Hui, 2019; Fong et al., 2022). Furthermore, mutual funds are the most reactive to both internal and external factors among foreign investors (Bertaut et al., 2023).

[3]The central bank of Colombia categorizes foreign investors based on the type of investment vehicle they use and the sources of their funds. This classification includes groups such as mutual funds, international pension funds, and monetary authorities, among others.

Additionally, since 2023, the International Affairs Unit at the Central Bank of Colombia has surveyed foreign investors on whether they follow any benchmark index when investing in sovereign bonds. According to these surveys (column 4 in Table 2), approximately 59% of foreign investors in sovereign bonds are indexed to the GBI-EM, which aligns with the results from the baseline panel regression.

Differences between the results from the central bank surveys and the baseline panel by type of foreign agent, could be attributed to the fact that the surveys were directed to a group of investors among the main participants in the sovereign bond market. Thus, they do not encompass the entire base of investors as the baseline panel does.

Table 2: Distribution of foreign-investors sovereign bonds holdings between benchmark-driven and unconstrained agents (% of holdings per group - as of April-2024)

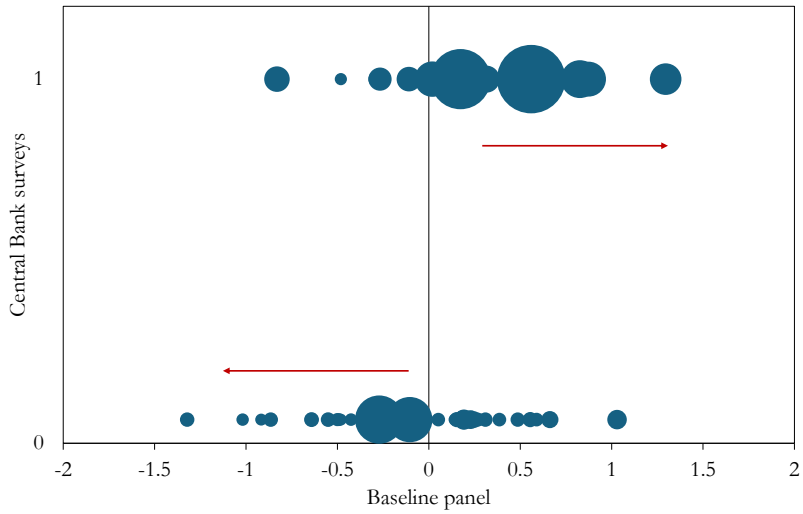
Type of foreign agent	% of total holdings	Benchmark-driven	
		Baseline panel	central bank surveys
Mutual funds	41%	51%	61%
Int. pension funds	21%	77%	59%
Monetary authorities	15%	62%	91%
Others	23%	32%	31%
Total	100%	53%	59%

Note: Authors' calculations. The table shows the participation of each type of foreign investor, as classified by the central bank, in the total holdings of foreign investors (second column). The last two columns display the participation of benchmark-driven investors within the total holdings of each type of foreign investor. Each row represents a different type of foreign investor, with the final row indicating the total sovereign bond holdings by foreigners. The results are based on our baseline panel and central bank surveys.

To evaluate the goodness of fit of the baseline panel, we plot each foreign investor's responses from the central bank surveys against their random component (v_f, as defined in equation (2)) extracted from the baseline panel estimation, as shown in Figure 5. The graph reveals a clear pattern: investors with positive random components are more likely to be classified as benchmark-driven according to the central bank surveys, while those with negative random components are typically classified as unconstrained investors[4].

[4]This relationship is further supported by a positive and statistically significant coefficient (at the 10% level) of the random component (v_f) on foreign investors' responses from the central bank surveys in a logit regression.

Figure 5: Clasification of foreign investors according to the central bank surveys and the baseline panel



Source: DCV and JP Morgan, authors' calculations. The Y-axis represents each foreign investor's response in the central bank surveys, where a value of 1 indicates the investor identified as benchmark-driven, and a value of 0 indicates otherwise. The X-axis shows the random component from our baseline specification: positive values correspond to investors classified as benchmark-driven, while negative values indicate those classified as unconstrained. Each point on the graph represents a foreign investor, with the size of the points proportional to the investor's bond holdings relative to the total holdings of all foreign investors.

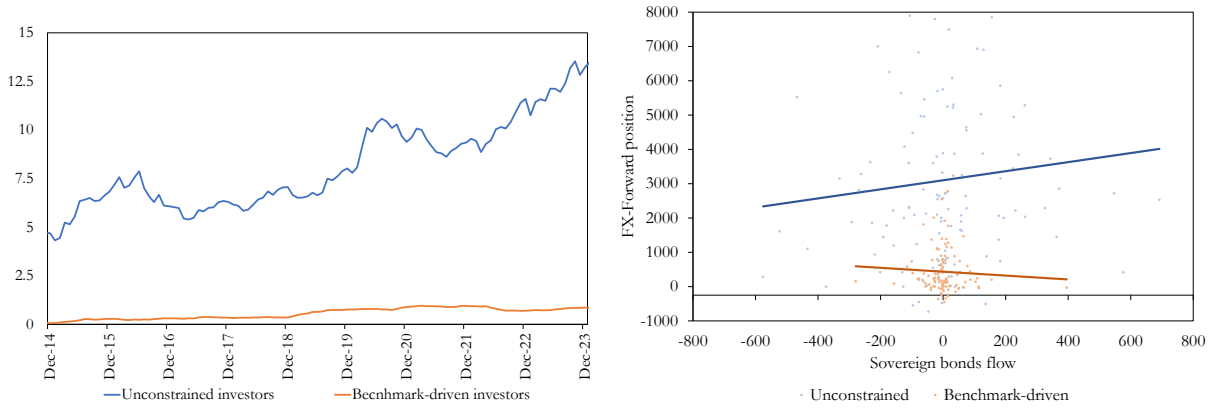
3.3 FX hedging analysis

We assess the robustness of the previous identification approach by examining how USD-COP forward positions respond differently to purchases of sovereign bonds by benchmark-driven versus unconstrained investors. In principle, benchmark-driven investors should not purchase USD-COP forwards when investing in sovereign bonds, as they are purely following an unhedged exposure in local currency. This is one of the main features of the GBI-EM Index, which exposes investors to each country's exchange rate risk. In practical terms, their net forward position (long minus short contracts) should not change significantly in response to bond purchases. Alternatively, we expect unconstrained investors to be more active in the forward market.

As shown in panel (a) of Figure 6, the ratio of USD-COP forward contracts to sovereign bond purchases is close to zero for benchamark-driven investors, while unconstrained agents keep a significantly higher ratio i.e., a net forward position between 5 - 13 times as large as their bond position. In a similar vein, panel (b) shows a significant upward slope between bond purchases and net forward positions for unconstrained investors, while benchamark-driven

investors show a non-significant downward slope.

Figure 6: Net FX forward position and sovereign bond flows by type of investor



(a) Ratio of FX-forwards to sovereign bonds (b) Slope of FX-forwards to sovereign bonds

Source: central bank of Colombia and authors' calculations. For comparability purposes, FX forwards are converted into COP using the average USD/COP exchange rate of each month.

To formally test this relationship, we regress the net USD-COP forward position of foreign agent i on its corresponding sovereign bond purchases, as follows:

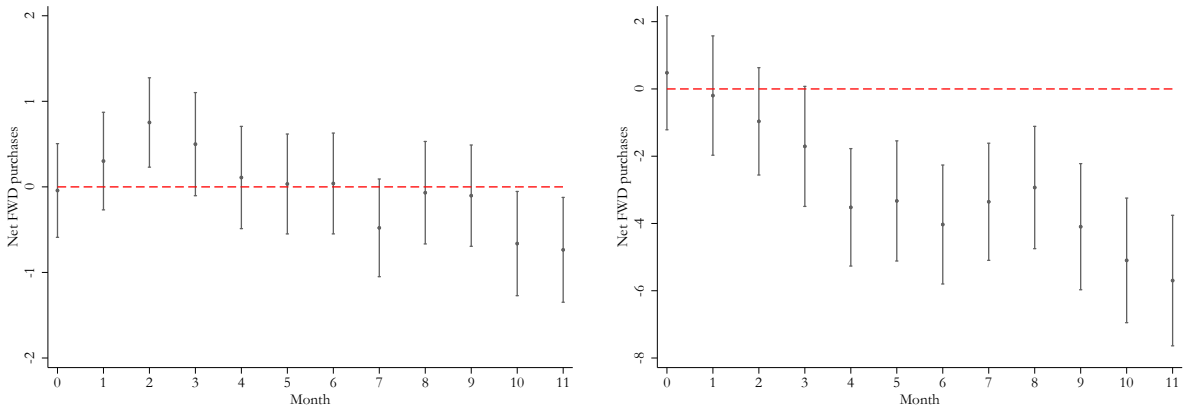
$$FXforward_{f,t+h} = \alpha_f^h + \beta_1^h Bonds_{f,t-1} + \beta_2^h (D_f^{indexed} * Bonds_{f,t-1}) + \sum_j \beta_k^h X_{k,t-1} + e_{f,t+h} \quad (3)$$

where $D_f^{indexed}$ is a dummy variable switched on if the foreign investor is benchmark-driven. We control for agent fixed-effects (α_f) and a set of control variables ($X_{k,t}$) that include: (i) the returns of the USD-expressed portfolio of Colombian sovereign bonds referenced in the GBI-EM index, (ii) the spread between the returns of the 10-year Colombian sovereign bonds and US Treasuries, (iii) monthly returns of the nominal COP-USD exchange rate, (iv) the monthly spread between Colombia's 5-year CDS and the average CDS of a pool of Latin American countries (Brazil, Chile, Mexico and Peru), and (v) the monthly average of the VIX index. Following Jordà (2005) method of local projections, we examine dynamic effects by estimating sequential regressions in which the dependent variable is shifted forward each month (for $h = 0 - 11$ months).

Results are plotted in Figure 7. Panel (a) shows the marginal effect of sovereign bond purchases (by all foreign investors) on forward positions, which in general show a positive and significant impact, albeit short-lived. More relevant to our identification strategy is panel

(b) which shows the incremental effect of bond purchases by benchmark-driven investors (β_2^h in equation 3). As shown, the effect of the interaction term is negative and statistically significant, which means that the hedging effect (positive forward position) is being driven by the group of unconstrained agents (i.e., for $D_f^{indexed} = 0$).

Figure 7: IRFs of FX-forward position of foreign agents



(a) Marginal effect of Bond purchases

(b) Incremental effect $D_i^{indexed}$

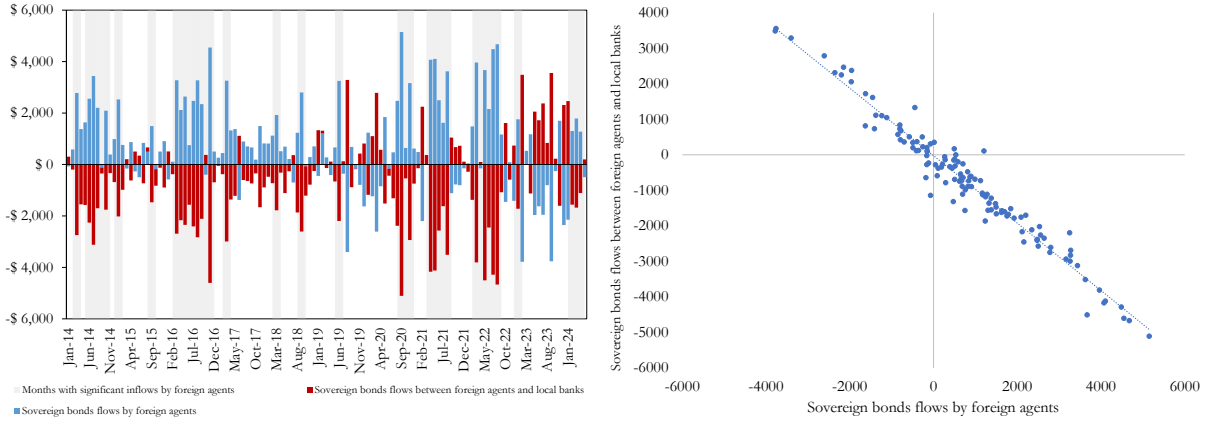
Note: Authors' calculations. The Figure shows coefficients from the regression as presented in equation (3), with robust confidence intervals significant at a 5 percent level.

4 Results

4.1 Foreign investor's counterparts

Since 2014, the primary counterparts in transactions conducted by foreign investors in the Colombian sovereign bond market have been local banking institutions. As a result, when a foreign agent buys sovereign bonds, there is often a corresponding transaction of nearly equal magnitude in the opposite direction by local banks, as shown in Figure 8a. This inverse relationship is reflected in a high negative correlation between foreign investor bond flows and offshore-bank transactions, as illustrated in Figure 8b. To give an order of magnitude, around one-third of the assets of local banks are invested in Colombian sovereign bonds, underscoring the significance of this market for banking institutions.

Figure 8: Sovereign bond flows by foreign agents and local banks



(a) Bond flows by offshore agents and banks. (b) Correlation of offshore and banks bond flows.

Source: Central bank of Colombia and authors' calculations. **Note:** Grey areas in panel (a) correspond to periods of high inflows by foreign investors in sovereign bonds.

More formally, to corroborate that local banks are the main counterpart of foreign agents in the sovereign bond market, we estimate the following regression:

$$Bonds_{i,t+h}^{banks} = \alpha_i^h + \alpha_t^h + \beta_1^h exposure_{it} + \beta_2^h D_t^{flows} + \beta_3^h (D_t^{flows} * exposure_{it}) + e_{i,t+h} \qquad (4)$$

where $Bonds_{i,t+h}^{banks}$ represents the net bond purchases (flows) by local banks, D_t^{flows} is a dummy variable activated during periods of sizable inflows by foreign agents in sovereign bonds (greater than the 75^{th} percentile), and $exposure_{it}$ denotes each bank's order book with foreign clients (with higher exposure indicating a bank that actively trades with foreign investors). For clarity, $exposure_{it}$ is standardized so that an impulse shock corresponds to a one standard deviation increase. We control for bank fixed effects (α_i^h) and time fixed effects (α_t^h).

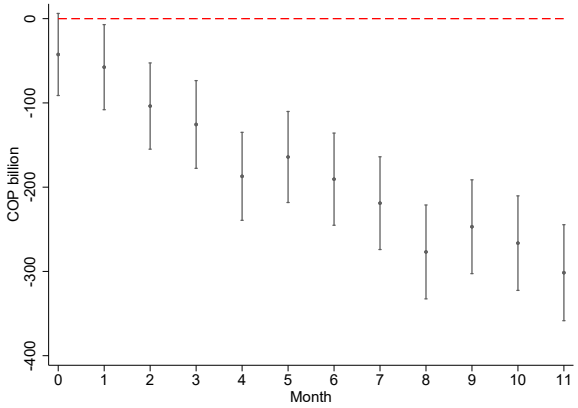
The coefficient of interest for this specification is β_3^h. Since β_3^h is the coefficient for the interaction term between D_t^{flows} and $exposure_{it}$, it captures the impact of an increased trading activity with foreigners on banks' bond flows, during periods of sizable portfolio inflows. In that sense a negative and statistically significant β_3^h would imply that banks actively adjust their bond portfolios in response to significant offshore inflows, reflecting their role as primary counterparts to these transactions.

Our findings reveal that local banks tend to sell significant amounts of bonds following substantial portfolio inflows. As shown in Figure 9, when banks increase their transactions

with foreign investors in sovereign bonds, the impact on their bond flows is both negative and statistically significant. Specifically, a 1-standard deviation increase in a bank's exposure to foreign investors, equivalent to $400 billion COP (approximately $95 million USD at an exchange rate of 4,200 COP/USD), predicts a bond sale of $300 billion COP ($75 million USD) on average over a 10-month period. This accounts for approximately 75% of the initial shock amount, representing a permanent reduction in the bank's bond portfolio. The discrepancy between this reduction and the initial magnitude of the shock may result from portfolio decisions by banks, which opt to retain part of their bond holdings even after significant sales to foreign investors.

In Appendix B, we explore whether the impact on sovereign bond flows varies depending on the type of foreign investor (benchmark-driven or unconstrained) the bank is trading with. Furthermore, as discussed in Appendix D, investor-bank relations tend to be sticky, with few banks accounting for the majority of foreign investors' trading volume.

Figure 9: Incremental effect of a bank's greater exposure to foreign investors in the sovereign bond market



Note: Authors' calculations. The figure shows the interaction term coefficient between D_t^{flows} and $exposure_{it}$ as presented in equation (4), with robust confidence intervals significant at a 5 percent level.

4.2 Effects on credit (crowding-out channel)

The previous subsection demonstrated a surge in bank liquidity following episodes of portfolio inflows. Building on this, we now investigate whether this additional liquidity is effectively redirected into corporate sector loans, thereby confirming the presence of a crowding-out effect in the credit market. Specifically, we analyze whether changes in sovereign bond holdings —either an increase or a decrease—by banks influence their lending behavior. To address this

question, we estimate the following specification:

$$Loan_{ji,t+h} = \alpha^h_{ji} + \alpha^h_{jt} + \beta^h_1 exposure_{it} + \beta^h_2 (D^{flows}_t * exposure_{it}) + e_{ji,t+h} \tag{5}$$

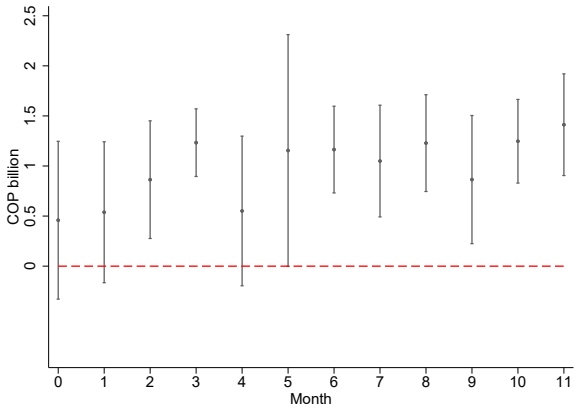
where $Loan_{ji}$ represents the monthly amount of new corporate loans issued by bank i to firm j, and D^{flows}_t and $exposure_{it}$ are the same as in equation 4. We control for firm-bank fixed effects (α_{ji}) and firm-time fixed effects (α_{jt}).

Here, the coefficient of interest is β^h_2. Since β^h_2 is the coefficient for the interaction term between D^{flows}_t and $exposure_{it}$, it captures the impact of an increased trading activity with foreigners on banks' lending behaviour, during periods of sizable portfolio inflows. In that sense a positive and statistically significant β^h_2 would imply that banks actively redirect the increased liquidity granted by offshore inflows into corporate sector loans.

Our findings, presented in Figure 10, confirm that banks that sell higher amounts of bonds to foreign investors provide more credit following periods of substantial portfolio inflows. When the average bank sells \$300 billion COP worth of bonds to foreign investors after a 1-standard deviation increase in its exposure to foreigners, as shown in Section 4.1, it leads to an increase of \$0.9 billion COP in its average loan issuance over a 10-month period.

As an illustrative example, to quantify the potential impact on the credit market, we assume that a bank extends new loans to the monthly average of new bank-firm loans in the sample period, which is 430. Scaling the average loan issuance increase (\$0.9 billion COP) by this number, the potential total effect on new corporate loans would be an increase of \$387 billion COP on average, assuming the bank extends loans to all 430 firms. This amount closely matches the initial shock in the bank's exposure, suggesting that credit conditions are highly sensitive to bond inflows.

Figure 10: IRFs of the amount of new loans



(a) Incremental effect of $exposure_{it}$

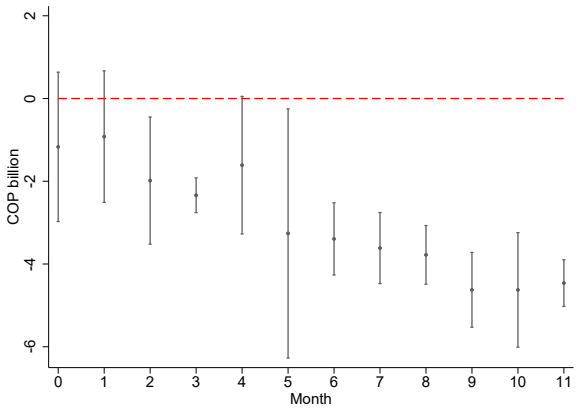
Note: Authors' calculations. The figure shows coefficients from the regression presented in equation (5), with robust confidence intervals significant at a 5 percent level.

We now evaluate how these results are affected during periods of outflows by foreign investors in sovereign bonds. To address this, we test an alternative specification of equation 5 where D_t^{flows} is activated when negative flows by foreign investors are exhibited in a specific month. Our results, presented in Figure 11, show that banks that buy more bonds from foreign investors tend to lend lower quantities of credit after periods of portfolio outflows. The interaction term between $exposure_{it}$ and D_t^{flows} is negative and statistically significant, providing evidence of a crowding-out effect. In Appendix C, we investigate whether these results might be influenced by balance sheet differences among banks.

In particular, we find that when the average bank purchases \$300 billion COP worth of bonds after a 1-standard deviation increase in its exposure to foreign investors, its average loan issuance decreases by \$3 billion COP over a 10-month period. Using the same illustrative example, the total reduction in new loans would amount to \$1,290 billion COP, given the monthly average of 430 bank-firm loans. This demonstrates that credit market contractions following capital outflows are of significantly greater magnitude than the expansions observed during capital inflows.

Specifically, periods of capital inflows enhance banks' capacity to issue new loans due to improved liquidity. In contrast, capital outflows amplify funding constraints, compelling banks to absorb sovereign bonds and generating a crowding-out effect in the credit market. This underscores the importance of understanding the composition of the investor base and the risks inherent in their market activity, as elaborated in the next section.

Figure 11: IRFs of the amount of new loans



(a) Incremental effect of $exposure_{it}$

Note: Authors' calculations. The figure shows coefficients from the regression presented in equation (5), with robust confidence intervals significant at a 5 percent level.

4.2.1 Investor-Based Heterogeneous Effects

Building on the classification of foreign agents outlined in Section 3.2, we now address whether the type of offshore agents —benchmark-driven or unconstrained —providing liquidity to local banks matters in the identification of potential impacts on the credit market. This distinction is critical for unravelling the nuanced mechanisms through which foreign participation influences domestic credit conditions. To investigate this, we estimate the following specification:

$$Loan_{ji,t+h} = \alpha^h_{ji} + \alpha^h_{jt} + \beta^h_1 Expo^U_{it} + \beta^h_2 Expo^{BD}_{it} + \beta^h_3 (D^{flows}_t * Expo^{BD}_{it}) + \beta^h_4 (D^{flows}_t * Expo^U_{it}) + e_{ji,t+h} \tag{6}$$

where $Expo^{BD}_{it}$ and $Expo^U_{it}$ represent the exposure of bank i to negotiations involving sovereign bonds with benchmark-driven and unconstrained investors, respectively. These variables denote each bank's order book with foreign clients, scaled by the share of benchmark-driven or unconstrained agents in the total pool of foreign investors.[5] We control for firm-bank fixed effects (α_{ji}) and firm-time fixed effects (α_{jt}).

The coefficients of interest for this specification are β^h_3 and β^h_4. Since β^h_4 is the coefficient for the interaction term between D^{flows}_t and $Expo^{BD}_{it}$, it captures the impact of an increased

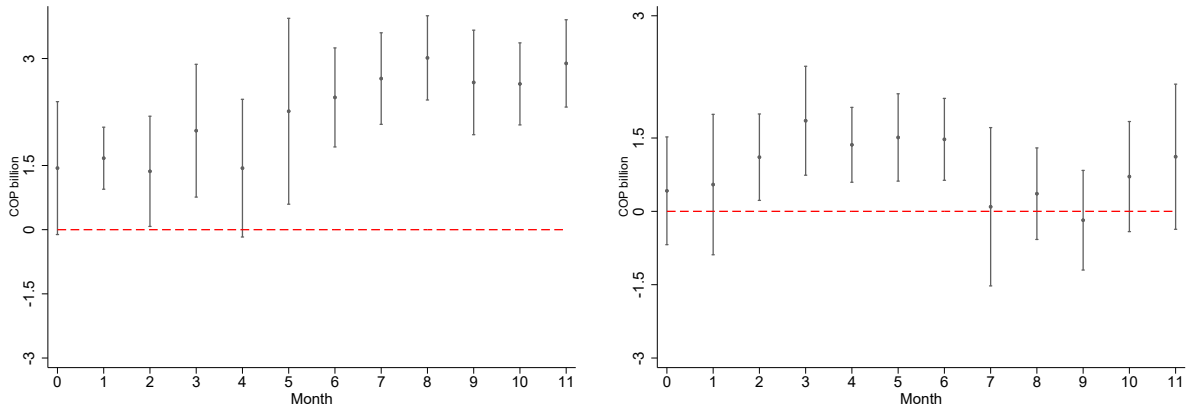
[5]We standardize these variables so that an impulse shock corresponds to a one-standard-deviation increase.

trading activity with benchmark-driven foreign investors on banks' lending behaviour, during periods of sizable portfolio inflows. Similarly, β_3^h captures this effect in the case of unconstrained foreign investors. Given this, both the sign and magnitude of β_3^h and β_4^h will reveal how the differing investment strategies of foreign investors influence the overall impact of portfolio inflows on local credit conditions.

To evaluate dynamic effects, we estimate local projections as specified in equation (6). The results reveal that the incremental effect on new loans from selling a higher volume of bonds to foreign investors varies depending on the type of investor involved. As shown in Figure 12, selling more to unconstrained investors amplifies the effect of D_t^{flows} depicted in Figure 10a. Conversely, selling more to benchmark-driven investors reduces this amplifying effect (Figure 12b).

Taking the same illustrative example as before, when a bank sells \$300 billion COP worth of bonds to unconstrained investors after a 1-standard deviation increase in its exposure to foreigners, it results in an increase of \$2.5 billion COP in its average loan issuance over a 10-month period. Scaling by the monthly average of 430 bank-firm loans, this corresponds to a total loan increase of \$1,075 billion COP on average. In contrast, selling the same amount to benchmark-driven investors results in a smaller increase of \$0.8 billion COP in its average loan issuance, totalling \$344 billion COP if we scale by the monthly average of 430 bank-firm loans. These findings indicate that banks' credit supply is less responsive when trading bonds with benchmark-driven investors, confirming a differential crowding-out effect in the credit market.

Figure 12: IRFs of the amount of new loans



(a) Incremental effect of $Expo_{it}^{U}$ (b) Incremental effect of $Expo_{it}^{BD}$

Note: Authors' calculations. The Figure shows coefficients from the regression as presented in equation (6), with robust confidence intervals significant at a 5 percent level.

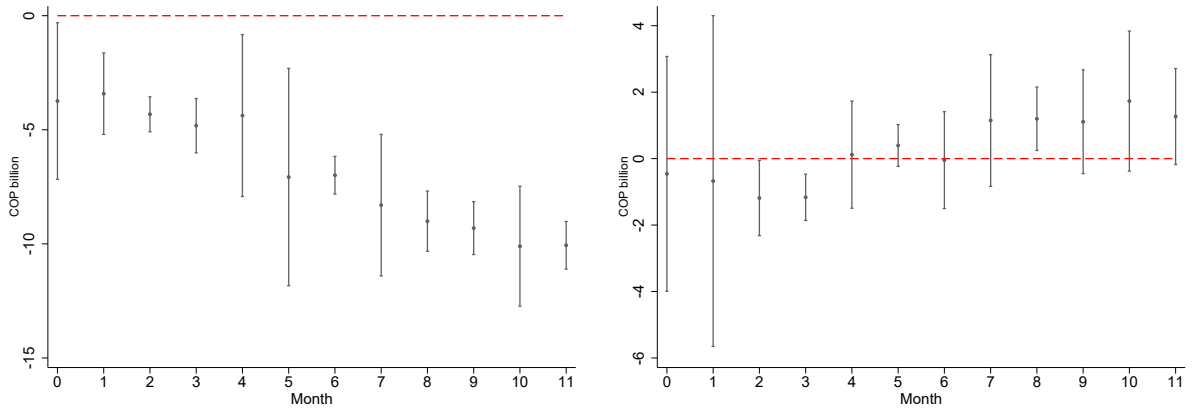
Additionally, we test an alternative scenario of Equation 6, where D_t^{flows} is activated during months with negative flows by foreign investors. The results show that when a bank purchases more bonds from unconstrained foreign investors after a 1-standard deviation increase in its exposure to foreigners, its average loan issuance decreases by $6.8 billion COP over a 10-month period (Figure 13a). Using the same illustrative example, the total reduction in new loans would amount to $2,924 billion COP, given the monthly average of 430 bank-firm loans. However, the results are not significant for banks that tend to purchase more bonds from benchmark-driven investors (Figure 13b).

This suggests that banks' credit supply is more sensitive to outflows involving unconstrained investors. This outcome can be attributed to the nature of unconstrained investors, who are more reactive to local variables and changes in risk aversion in response to local shocks. Under negative scenarios, unconstrained investors tend to react more quickly and intensively, adversely affecting local financial conditions and banks' capacity to extend credit.

Overall, the issuance of new corporate credit varies depending on the type of foreign investors with whom banks typically trade bonds. This has significant implications for financial stability, as flows from unconstrained foreign investors tend to be more persistent and have a greater impact on banks' balance sheet decisions. Additionally, flows from these types of foreign investors exhibit greater procyclicality, amplifying both increases and decreases in loan issuance, which can exacerbate economic volatility during periods of rapid inflows or outflows. Understanding these dynamics is crucial for managing risks and ensuring

the stability of the financial system.

Figure 13: IRFs of the amount of new loans



(a) Incremental effect of $Expo_{it}^{U}$ (b) Incremental effect of $Expo_{it}^{BD}$

Note: Authors' calculations. The Figure shows coefficients from the regression as presented in equation (6), with robust confidence intervals significant at a 5 percent level.

One natural question is what types of firms borrow from commercial banks during crowding-out episodes. To address this, we modify equation (6) so that it uses different loan variables as the dependent variable:

$$y_{ji,t+h} = \alpha_{ji}^{h} + \alpha_{jt}^{h} + \beta_{1}^{h} Expo_{it}^{BD} + \beta_{2}^{h} Expo_{it}^{U} + \beta_{3}^{h}(D_{t}^{flows} * Expo_{it}^{BD}) + \beta_{4}^{h}(D_{t}^{flows} * Expo_{it}^{U}) + e_{ji,t+h} \quad (7)$$

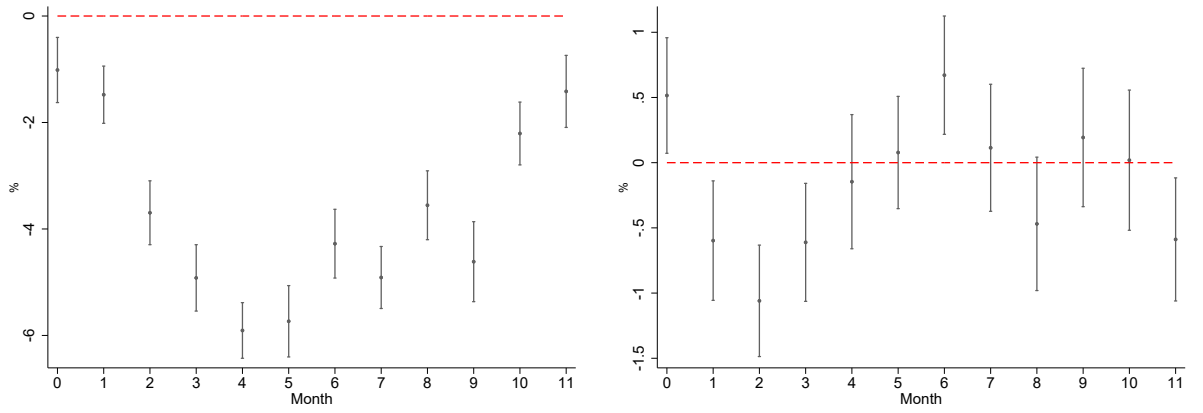
Here, $y_{ji,t+h}$ represents one of the loan variables: nominal interest rate or default probability. To capture dynamic effects, we estimate local projections as specified in equation (7).

The results indicate that banks selling more bonds to unconstrained investors tend to issue loans with lower interest rates following episodes of high portfolio inflows into the economy (Figure 14a). Additionally, these loans exhibit lower subsequent probabilities of default (Figure 15a). In contrast, for banks that sell more bonds to benchmark-driven investors, the effects are less pronounced. These banks tend to reduce interest rates less and experience higher probabilities of default on new loans (Figures 14b and 15b).

These findings suggest that banks' risk-taking behavior is influenced by their exposure to different types of foreign investors. Specifically, banks with greater exposure to benchmark-

driven investors appear more inclined to take on higher risks during capital inflow episodes. This behavior likely affects their ability to adequately assess debtors, impacting credit risk indicators such as default probability. On the other hand, banks more exposed to unconstrained investors significantly lower their interest rates during capital inflow episodes, reflecting a procyclical behavior of these agents.

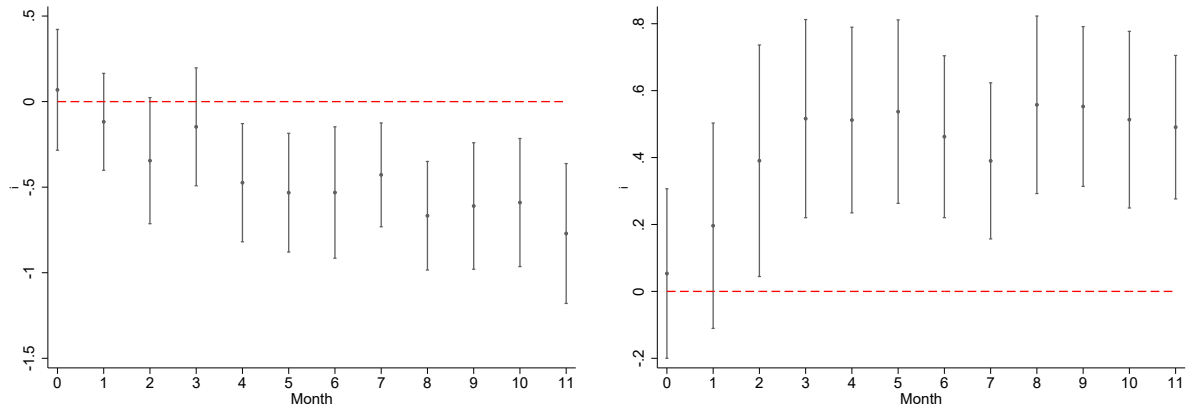
Figure 14: IRFs of new loan's interest rate



(a) Incremental effect of $Expo_{it}^{U}$ (b) Incremental effect of $Expo_{it}^{BD}$

Note: Authors' calculations. The Figure shows coefficients from the regression as presented in equation (7), with robust confidence intervals significant at a 5 percent level.

Figure 15: IRFs of new loan's default probability



(a) Incremental effect of $Expo_{it}^{U}$ (b) Incremental effect of $Expo_{it}^{BD}$

Note: Authors' calculations. The Figure shows coefficients from the regression as presented in equation (7), with robust confidence intervals significant at a 5 percent level.

4.2.2 Bank-based response to the global financial cycle

As a complement of the previous analysis on local credit conditions, in this section, we evaluate whether local banks respond differently to Global Financial Conditions (GFC) based on the type of foreign investor they engage with when negotiating sovereign bonds. We build on the literature that examines the effects of GFC (proxied by changes in the VIX index) on capital flows and credit growth, as pioneered by Forbes and Warnock (2012), Cerutti et al. (2015), Jordà et al. (2018), and others. These studies identify a transmission channel in which, during the boom phase of GFC (characterized by easing monetary policy cycles in the U.S.), low interest rates create abundant liquidity in dollar funding markets (Bruno and Shin, 2015a).

di Giovanni et al. (2017) show how global financial conditions influence domestic credit markets in Turkey. Their analysis, using bank and firm-level data, demonstrates that when GFC ease, as reflected by a lower VIX, borrowing costs decrease, and local lending increases. This highlights the critical role of domestic banks in transmitting global financial conditions. The underlying mechanism is that as global conditions improve and the VIX declines, firms seek more credit, and/or banks find it easier and cheaper to access foreign capital. These scenarios drive an expansion of local credit.

In this analysis, we build on the empirical framework established by di Giovanni et al. (2017) to investigate how global conditions differently affect banks with greater exposure to benchmark-driven portfolio flows.

As in di Giovanni et al. (2017), we estimate a monthly panel regression, from 2014 to 2023, of the amount and nominal interest rate of new coporate sector loans on the natural logarithm of the VIX index as a measure of the GFC:

$$
\begin{aligned}
y_{jit} =& \beta_1 log(VIX)_t + \beta_2 Expo_{it}^{BD} + \beta_3 Expo_{it}^{U} + \beta_4 (log(VIX)_t * Expo_{it}^{BD}) + \beta_5 (log(VIX)_t * Expo_{it}^{U}) \\
&+ \beta_6 log(CDS)_t + \beta_7 (log(CDS)_t * Expo_{it}^{BD}) + \beta_8 (log(CDS)_t * Expo_{it}^{U}) \\
&+ \beta_9 (log(VIX)_t * log(CDS)_t * Expo_{it}^{BD}) + \beta_{10} (log(VIX)_t * log(CDS)_t * Expo_{it}^{U}) \\
&+ \beta_6 MPR_t + \beta_7 \Delta\%GDP_t + \beta_8 Infla_t + \beta_9 \Delta\%FX_t + \beta_{10} \mathbf{Banks}_{it} + \beta_{11} Trend_t \\
&+ \alpha_{ji} + e_{jit} \qquad (8)
\end{aligned}
$$

where $y_{ji,t+h}$ is the monthly amount of new commercial loans from bank i to firm j or

its nominal interest rate. We use the VIX index in logs as the proxy for GFC, the natural logarithm of Colombia's 5-year CDS to control for country-specific risk aversion, and control for firm-bank fixed-effects (α_{ji}). As in di Giovanni et al. (2017), macro fundamentals are included in every specification, such as: (i) Domestic policy rate, (ii) GDP growth, (iii) fluctuations in the exchange rate (FX change), and (iv) inflation. In order to control for bank heterogeneity, a set of bank characteristics are added: (i)log(assets), (ii) capital ratio, (iii) liquidity ratio, (iv) return on total assets (ROA), (v) return on equity (ROE), (vi) total equity and (vii) solvency.

Table 3 reports estimates of the coefficients for the amount of new loans in the first column, and the nominal interest rate in the second column. In the first row, we report estimates for the marginal effect of log(VIX)[6], which is negative and statistically significant when employing the amount of new loans as the dependent variable. The estimated value suggests that a 1% decrease in VIX is associated with a 0.033% increase in the amount of new loans. In that sense, a reduction in log(VIX) equal to its interquartile range during the sample period (0.52), implies a 0.017% increase in the average amount of new loans.

Based on di Giovanni et al. (2017), this suggests that external risk aversion has an amplifying effect on local credit, explained both from a demand and supply channel. Under the demand channel, when VIX falls as global conditions improve, firms react by demanding more credit. On the other hand, the enhanced access of banks to foreign capital, with lower rates, under better global conditions, can also increase local credit from the supply side.

Moreover, the positive marginal effect of log(VIX) on the nominal interest rate suggests that movements in VIX affect supply factors in the Colombian credit market. That is, when banks offer less credit under worse global conditions, they create an upward pressure on lending rates, holding firms demand constant. The estimated value suggests that a 1% decrease in VIX is associated with a 0.00069% increase in the amount of new loans. A fall in log(VIX) equal to its interquartile range during the sample period, implies an increase equivalent to 0.0004% in the average interest rate of new loans.

Moving on to the differential response of those banks that tend to buy more bonds from benchmark-driven foreign investors during high portfolio inflows, in the first column of Table 3 we observe that the interaction term between log(VIX) and $Expo_{it}^{BD}$ is negative and statistically significant, while it has the opposite sign for those that tend to negotiate

[6]We report $\beta_1 + \beta_4 \overline{\text{Expo}}_{it}^{BD} + \beta_5 \overline{\text{Expo}}_{it}^{U}$.

more with unconstrained foreigners. This indicates that banks that are tightly related to benchmark-driven investors tend to be more procyclical to global factors, amplifying the effects of global shocks on local credit conditions. The opposite holds for banks that are more exposed to unconstrained investors, as the coefficient for $log(VIX)_t * Expo_{it}^U$ is negative and statistically significant. This confirms that a higher presence of benchmark-driven investors makes credit conditions more sensitive to external financial conditions.

Table 3: Global financial cycle analysis

	(1) Log loan amount		(2) Loan interest rate	
log(VIX)	-0.033***		0.00069***	
	(0.0078)		(0.00022)	
log(VIX)*Exp^U	0.32***	-0.048	0.0022	-0.084***
	(0.096)	(0.59)	(0.0027)	(0.018)
log(VIX)*Exp^{BD}	-0.35***	0.061	0.00031	0.087***
	(0.098)	(0.60)	(0.0028)	(0.018)
log(CDS)	-0.055***		-0.0013***	
	(0.016)		(0.00046)	
log(CDS)*Exp^U	0.25**	-0.26	0.079***	0.11***
	(0.10)	(0.69)	(0.0029)	(0.021)
log(CDS)*Exp^{BD}	-0.25**	0.26	-0.086***	-0.12***
	(0.11)	(0.70)	(0.0030)	(0.022)
Col policy rate	-0.0026		0.011***	
	(0.0042)		(0.00012)	
Real GDP growth	0.027***		0.00051***	
	(0.0055)		(0.00016)	
FX change	0.014***		-0.00049***	
	(0.0011)		(0.000032)	
Inflation	0.13***		-0.00054	
	(0.013)		(0.00038)	
Observations	228212	228212	228212	228212
Macro controls and trend	✓		✓	
Bank controls	✓		✓	
BankxFirm F.E.	✓	✓	✓	✓
FirmxTime F.E.	✓	✓	✓	✓

Authors' calculations. Data from JP Morgan and Bloomberg for the sample period is 2014-2023. The table shows panel regressions for equation (8) using monthly data. The VIX is the lagged quarterly average, FX change is the monthly COP/US dollar exchange rate change (%), and inflation is the annual CPI change in every month. A linear time trend is also included as a regressor. Further, the lagged values of the following bank-level characteristics are also controlled for (not reported): leverage, return on total assets (ROA), solvency and liquidity ratio. Robust standard errors in parenthesis. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.3 The role of macroprudential policies

4.3.1 Bank-based foreign exchange exposures

Delving deeper into the macro-financial implications of the different investment strategies by foreign agents, we explore its interaction with macroprudential policies, specifically, foreign exposure limits. Foreign exchange regulation in Colombia limits the exposure to FX risk for banks. In particular, banks cannot have a significant long or short position in FX in proportion of their capital. This limit is part of the macroprudential policy tools in charge of the central bank and has allowed to reduce the inception of currency mismatches in Colombia's banking system.

We now evaluate if the effect of these limits on the exchange rate risk is different for banks that have a higher exposure to benchmark-driven foreign investors. To do so we build upon the literature that shows the inner workings of the portfolio balance channel, pioneered by Henderson and Rogoff (1981), Kouri (1981), and Branson and W. (1985). In essence, the portfolio channel states that changes in the mix of different currency denominated assets are only optimally admissible with an accompanying exchange rate change. The main underlying assumption is for assets not to be perfect substitutes i.e., banks and investors should not be indifferent to changes in portfolio compositions.

Gabaix and Maggiori (2015) and Perez-Reyna and Villamizar-Villegas (2019) are recent contributions examining this channel, both of which resort to some financial friction that guarantees an imperfect asset substitutability. In Gabaix and Maggiori (2015) for instance, there is imperfect intermediation by financiers due to limited commitment. In Perez-Reyna and Villamizar-Villegas (2019), the financial friction is created by regulations on the amount of foreign currency held by banks.

In the following exercise, we extend the empirical framework found in Perez-Reyna and Villamizar-Villegas (2019), to include the differential impact of banks that tend to buy more bonds from benchmark-driven foreign investors during high portfolio inflows. In other words, we examine whether binding constraints have a greater effect on banks that have a tighter relationship with benchmark-driven investors. Hence, given the higher volatility of this type of foreign investor, we expect banks that buy more bonds from them to react more when in close proximity of regulatory constraints.[7]

[7]In the theoretical model found in Perez-Reyna and Villamizar-Villegas, this would entail categorizing

As in Perez-Reyna and Villamizar-Villegas (2019), we contrast exchange rate episodes when banks barely reached a binding limit, to episodes in which they barely missed it. Using a Regression Discontinuity Design, we estimate the following specification, based on a local non-parametric approach in which the outcome variable (y_t) represents the variation of the exchange rate. The sample period for this exercise is from January 2010 to October 2015, since the regulatory limit was in effect until this month. The sample period starts in January 2010 due to data availability reasons.

$$\arg\min_{\theta} \sum_{j=1}^{J}\sum_{i=1}^{I}\sum_{t=2}^{T-J} \Big(y_{i,t+j} - a_{i,j} - b_j(X_{i,t} - x_0) - \theta_j D_{i,t} - \gamma_j(X_{i,t} - x_0)D_{i,t} \\ - \psi_j \text{Expo}_t^U - \varphi_j \text{Expo}_t^{BD} - \delta_j D_{i,t}\text{Expo}_t^U - \eta_j D_{i,t}\text{Expo}_t^{BD}\Big)^2 K(\cdot) \tag{9}$$

where $\delta = (\delta_1, ..., \delta_j)'$ denotes the incremental impact of the exposure to unconstrained investors when banking limits hold, and $\eta = (\eta_1, ..., \eta_j)'$ denotes the incremental impact of the exposure to benchmark-driven investors. For comparability purposes, the marginal effect of banking limits in equation (9) is given by $\theta_j + \delta_j\overline{\text{Expo}_t}^U + \eta_j\overline{\text{Expo}_t}^{BD}$, where $\overline{\text{Expo}_t}^U$ and $\overline{\text{Expo}_t}^{BD}$ are the mean exposure to unconstrained and benchmark-driven investors during the sample period.

Figure 16 depicts the IRF of exchange rate changes in response to financial constraints imposed on the entire financial sector, as characterized by equation (9), employing Jordà (2005) method of local projections. Results show that the effects, measured as the marginal effect of banking limits (D_t) on exchange rate changes, are significant.

Moreover, Table 4 reports estimates for the marginal effect of D_t in the first column[8], and the estimate for the interaction term between banking regulations and the exposure of the financial sector to benchmark-driven investors ($D_t * Expo_t^{BD}$) in the second column. Similarly, we report the estimate in the case of the interaction with unconstrained investors ($D_t * Expo_t^U$) in column 3.

The second column of Table 4 indicates that banking constraints are amplified when

foreign assets into benchmark-driven and unconstrained. To generate a higher exchange-rate response by highly exposed banks, one could impose a smoothing function to unconstrained funds so they reflect more stability (less likelihood of sudden movements that would breach the regulatory cutoff).

[8]We report $\theta_j + \delta_t\overline{\text{Expo}_t}^U + \eta_t\overline{\text{Expo}_t}^{BD}$.

banks purchase more bonds from benchmark-driven investors. In contrast, these constraints are less pronounced for banks with higher exposure to unconstrained foreign investors. This finding is further supported by the third column of Table 4, which shows that banks buying more bonds from unconstrained investors are less responsive to regulatory constraints.

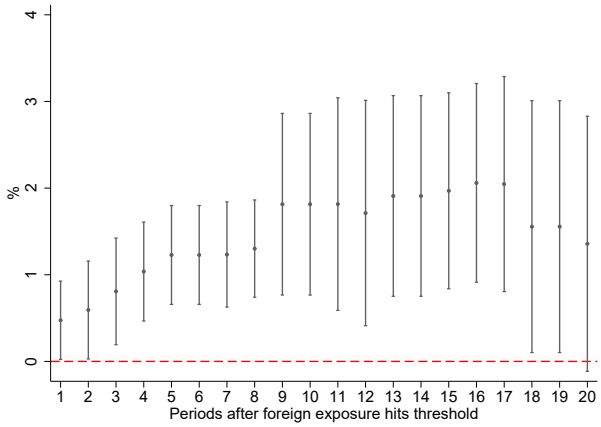
On average, a one-unit increase in bank exposure to unconstrained foreign investors reduces the exchange rate effect by 0.3 percentage points, whereas a one-unit increase in exposure to benchmark-driven investors amplifies the effect by 1.6 percentage points. These results confirm that financial conditions and the impact of banking constraints vary depending on the exposure to different types of investors.

Table 4: IRFs of exchange rate changes (%).

Periods	Marginal effect of D_t	Incremental effect of Expo_t^{BD}	Incremental effect of Expo_t^{U}
1	0.53**	0.65**	-0.12**
	(0.30)	(0.30)	(0.06)
2	0.83***	1.02***	-0.19***
	(0.31)	(0.30)	(0.06)
3	1.07***	1.31***	-0.25***
	(0.33)	(0.33)	(0.06)
4	1.21***	1.49***	-0.28***
	(0.24)	(0.23)	(0.04)
5	1.46***	1.80***	-0.34**
	(0.35)	(0.34)	(0.06)
6	1.01***	1.24***	-0.23***
	(0.35)	(0.34)	(0.06)
7	1.23***	1.52***	-0.28***
	(0.23)	(0.23)	(0.04)
8	1.66***	2.05***	-0.38***
	(0.28)	(0.27)	(0.05)
9	2.39***	2.94***	-0.55***
	(0.52)	(0.51)	(0.10)
10	1.84***	2.26***	-0.42***
	(0.73)	(0.72)	(0.13)
15	1.94***	2.39***	-0.45***
	(0.43)	(0.42)	(0.08)
20	1.09**	1.34**	-0.25**
	(0.78)	(0.76)	(0.14)

Note: Authors' calculations. Each coefficient results from a separate regression discontinuity model implemented using local linear regression on daily data with optimal bandwidth from Calonico et al. (2014) Heteroskedastic-robust standard errors in parentheses. ***, **, * denote statistical significance at the 1, 5, and 10 percent level respectively.

Figure 16: IRFs of exchange rate changes (%).



Note: Authors' calculations. The Figure shows coefficients from the regression as presented in equation (9), with robust confidence intervals significant at a 5 percent level.

5 Concluding Remarks

Our study introduces a novel strategy to distinguish between benchmark-driven and unconstrained foreign investors. This approach enhances our understanding of how different investor types impact financial stability and credit conditions in emerging markets, specifically in Colombia. By distinguishing between these investor types, we uncover significant differences in their influence on the financial landscape. Benchmark-driven investors, who follow passive strategies, make investment decisions primarily influenced by changes in index weights and global factors. In contrast, unconstrained investors are more responsive to idiosyncratic factors and aim to consistently outperform benchmarks, typically reacting first to local shocks.

We find that local banks adjust their bond holdings in response to foreign investor demand, which in turn affects their lending capacity, reflecting a crowding-out effect. This dynamic is particularly pronounced for banks with higher exposure to foreign investors. Increased foreign participation in the sovereign bond market can lead to amplified lending by local banks. However, this effect varies depending on the type of foreign investor. Banks more exposed to unconstrained investors tend to lend more during periods of high inflows, while those exposed to benchmark-driven investors show a more muted response. We also found an asymmetric effect during inflows and outflows episodes, suggesting that the response of credit conditions during outflows is more pronounced highlighting the presence of potential

crowding out effects in the credit market.

We also found that banks that are tightly related to benchmark-driven investors tend to be more reactive to global factors, amplifying the effects of global shocks on local credit conditions. The opposite holds for banks that are more exposed to unconstrained investors. In that way, we confirmed that the bigger presence of benchmark driven investors make the conditions of credit more sensitive to external financial conditions.

These findings underscore the importance of understanding the heterogeneity of foreign investors and their trading strategies. Policymakers should consider these differences when designing macroprudential policies to mitigate potential risks and enhance financial stability. Specifically, policies should account for the varying impacts of benchmark-driven and unconstrained investors to better manage the risks associated with foreign portfolio inflows.

Future research could extend this analysis to other emerging markets to validate the generalizability of these findings. Additionally, exploring the long-term effects of different types of foreign investment on economic growth and financial stability would provide further insights into the broader implications of foreign portfolio flows.

6 Bibliography

Arslanalp, Serkan and Takahiro Tsuda, "Emerging Market Portfolio Flows: The Role of Benchmark-Driven Investors," *IMF Working Paper*, 2015, *263.*

_ , Dimitris Drakopoulos, Rohit Goel, and Robin Koepke, "Benchmark-Driven Investments in Emerging Market Bond Markets: Taking Stock," *IMF Working Paper*, 2020, *192.*

Balston, Marc and Lionel Melin, "Foreign Demand for EM Local Currency Debt," *Deutsche Bank EM Monthly: Diverging Markets*, 2013.

Bertaut, Carol, Valentina Bruno, and Hyun Song Shin, "Original sin redux: role of duration risk," *BIS Working Papers*, 2023, *1109.*

Branson, William H. and Henderson Dale W., "The specification and influence of asset markets," *Handbook of International Economics*, 1985, *2.*

Bruno, Valentina and Hyun S. Shin, "Cross-Border Banking and Global Liquidity," *Review of Economic Studies*, 2015, *82.*

_ and Hyun Song Shin, "Capital flows and the risk-taking channel of monetary policy," *Journal of Monetary Economics*, 2015, *71* (C), 119–132.

Calonico, Sebastian, Matias D. Cattaneo, and Rocío Titiunik, "Robust Data-Driven Inference in the Regression-Discontinuity Design," *Stata Journal*, 2014, *114.*

Calvo, Guillermo A. and Ernesto Talvi, "Sudden stop, financial factors and economic collapse in Latin America: Learning from Argentina and Chile," NBER Working Papers 11153, National Bureau of Economic Research, Inc February 2005.

Cerutti, Eugenio, Stijin Claessens, and Damien Puy, "Push Factors and Capital Flows to Emerging Markets: Why Knowing Your Lender Matters More Than Fundamentals," *IMF Working Paper*, 2015, *15.*

Chodorow-Reich, Gabriel, "The employment effects of credit market disruptions: Firm-level evidence from the 2008-9 financial crisis," *The Quarterly Journal of Economics*, 2014, *129* (1), 1–59.

Cook, David and James Yetman, "Expanding central bank balance sheets in emerging Asia: a compendium of risk and some evidence," in Bank for International Settlements, ed., *Are central bank balance sheets in Asia too large?*, Vol. 66 of BIS Papers chapters, Bank for International Settlements, december 2012, pp. 30–75.

Cormier, Ben and Natalya Naqvi, "Delegating Discipline: How Indexes Restructured the Political Economy of Sovereign Bond Markets," *The Journal of Politics*, 2023, *85* (4), 1501–1515.

di Giovanni, Julian, Sebnem Kalemli-Ozcan, Mehmet Fatih Ulu, and Yusuf Soner Baskaya, "International Spillovers and Local Credit Cycles," *National Bureau of Economic Research*, 2017, *23149.*

Ebeke, Mr Christian and Annette Kyobe, "Global financial spillovers to emerging market sovereign bond markets," IMF Working Papers 2015/141, International Monetary Fund June 2015.

_ and Yinqiu Lu, "Emerging market local currency bond yields and foreign holdings in the post-Lehman period -a fortune or misfortune?," *Journal of International Money and Finance*, 2015, *59* (C), 203–219.

Fong, Tom Pak Wing, Angela Kin Wan Sze, and Edmund Ho Cheung Ho, "Do long-term institutional investors contribute to financial stability?–Evidence from equity investment in Hong Kong and international markets," *Journal of International Financial Markets, Institutions and Money*, 2022, *77*, 101521.

Forbes, Kristin J. and Francis E. Warnock, "Capital Flow Waves: Surges, Stops, Flight, and Retrenchment," *Journal of International Economics*, 2012, *88.*

Gabaix, Xavier and Matteo Maggiori, "International Liquidity and Exchange Rate Dynamics," *Quarterly Journal of Economics*, 2015, *130.*

Gambacorta, Leonardo and David Marques-Ibanez, "The bank lending channel: lessons from the crisis," May 2011, (345).

Henderson, Dale W. and Kenneth S. Rogoff, "New foreign asset positions and stability in a world portfolio balance model," *International Finance Discussion Papers*, 1981, *178.*

Holmstrom, Bengt and Jean Tirole, "Financial intermediation, loanable funds, and the real sector," *The Quarterly Journal of Economics*, 1997, *112* (3), 663–691.

Hui, Cho-Hoi, "Emerging market bond funds: flow-performance relationship and long-term institutional investors," *BIS Paper*, 2019, (102o).

Ilzetzki, Ethan, Enrique G. Mendoza, and Carlos A. Vegh, "How big (small?) are fiscal multipliers?," *Journal of Monetary Economics*, 2013, *60*, 239–254.

Khwaja, Asim Ijaz and Atif Mian, "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market," *American Economic Review*, September 2008, *98* (4), 1413–42.

Kouri, Pentti J.K., "Balance of Payments and the Foreign Exchange Market: A Dynamic Partial Equilibrium Model," *NBER Working Papers*, 1981, *0644.*

Önder, Yasin Kürşat, Sara Restrepo-Tamayo, Maria Alejandra Ruiz-Sanchez, and Mauricio Villamizar-Villegas, "Government Borrowing and Crowding Out," *American Economic Journal: Macroeconomics*, January 2024, *16* (1), 286–321.

Obstfeld, Maurice, "Financial flows, financial crises, and global imbalances," *Journal of International Money and Finance*, 2012, *31* (3), 469–480.

Ocampo, José Antonio, Mauricio Villamizar-Villegas, Germán Orbegozo-Rodríguez, Nicolás Fajardo-Baquero, Oscar Botero-Ramírez, and Camilo Orozco-Vanegas, "Post-graduation from the original sin problem The effects of investor participation on sovereign debt markets," *(Working Papers Banco de la Republica*, 2020, *1113.*

Peiris, Shanaka J, "Foreign participation in emerging markets local currency bond markets," IMF Working Papers 2010/088, International Monetary Fund April 2010.

Perez-Reyna, David and Mauricio Villamizar-Villegas, "International Liquidity and Exchange Rate Dynamics," *Journal of International Money and Finance*, 2019, *96.*

Prasad, Eswar and Raghuram G. Rajan, "A pragmatic approach to capital account liberalization," IZA Discussion Papers 3475, Institute of Labor Economics (IZA) April 2008.

Raddatz, Claudio, Sergio Schmukler, and Tomas Williams, "International asset allocations and capital flows: The benchmark effect," *Journal of International Economics*, 2017, *108.*

Romero, Jose Vicente, Hernando Vargas, Pamela Cardozo, and Andres Murcia, "How foreign participation in the Colombian local public debt market has influenced domestic financial conditions," *Latin American Journal of Central Banking*, 2021, *2.*

Òscar Jordà, "Estimation and Inference of Impulse Responses by Local Projections," *America Economic Review*, 2005, *95.*

__ , **Moritz Schularick, Alan M. Taylor, and Feliz Ward**, "Global Financial Cycles and Risk Premiums," *National Bureau of Economic Research Working Paper*, 2018, *24677*.

Timmer, Yannick, "Cyclical investment behavior across financial institutions," *Journal of Financial Economics*, 2018, *129* (2), 268–286.

Williams, Tomas, "Capital Inflows, Sovereign Debt and Bank Lending: Micro-Evidence from an Emerging Market," *The Review of Financial Studies*, 03 2018, *31* (12), 4958–4994.

Appendix A Baseline panel regression results

The results for the baseline panel regression in equation 2 are summarized in Table A1. Rows show the average coefficients for GBI_exog_t and the control variables. In column 1, we show the coefficient for GBI_exog_t with no controls. The positive and statistically significant coefficient indicates a high degree of indexation among the sampled investors.

The second column incorporates control variables, whose coefficients generally align with financial intuition, reflecting their expected impact on investment decisions. Most coefficients are statistically significant, except for the VIX. Specifically, the positive coefficient for the returns of the dollar-denominated portfolio of Colombian sovereign bonds referenced in the GBI-EM index (Ret_TES_USD) indicates that investor demand for sovereign bonds increases as these bonds appreciate, making them a more attractive investment.

The positive coefficient for the spread between the returns of 10-year Colombian sovereign bonds and U.S. Treasuries ($Spread_TES_Tsy$) suggests that foreign demand for sovereign bonds is influenced by rate differentials, as this spread reflects the attractiveness of Colombian bonds over U.S. risk-free Treasuries.

In contrast, the negative coefficient for the monthly returns of the nominal COP-USD exchange rate (Ret_FX) implies that foreign investors aim to maintain a stable allocation of Colombian sovereign bonds in their overall portfolios. As the COP appreciates, sovereign bonds represent a larger share of their total portfolios, prompting investors to sell bonds to rebalance their holdings.

Finally, the negative coefficient for the monthly spread between Colombia's 5-year CDS and the average CDS of a group of Latin American countries ($Spread_CDS$) is consistent with expectations. A higher perceived risk of Colombia relative to its peers reduces foreign investors' appetite for Colombian assets.

Table A1: Baseline panel regression results

	(1)	(2)
GBI_exog	0.0552***	0.0542***
	(0.0241)	(0.0242)
Ret_TES_USD		0.0248***
		(0.00495)
Spread_TES_Tsy		0.000969***
		(0.000121)
Ret_FX		-0.0227***
		(0.00637)
Spread_CDS		-0.00330***
		(0.000462)
VIX		-0.00151
		(0.00152)
Constant	0.611**	-0.344
	(0.193)	(0.304)
Observations	13144	13144
Controls		✓
InvestorF.E.	✓	✓
TimeF.E.	✓	✓

Authors' calculations. Standard errors in parenthesis.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Appendix B Investor-based crowing out effects

Bearing in mind the classification of foreign agents presented in Section 3.2, we now assess if there is a differential impact on bank's bond portfolios, depending on the type of offshore agent (benchmark-driven or unconstrained) that they negotiate with.

To formally corroborate this, we estimate the following extension of equation (4):

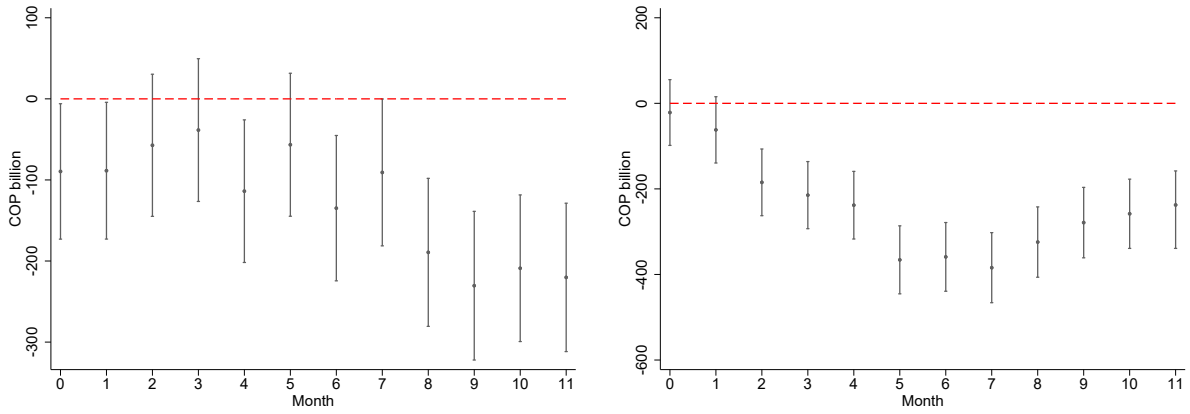
$$Bonds_{i,t+h}^{banks} = \alpha_i^h + \alpha_t^h + \beta_1^h expo_{it}^U + \beta_2^h expo_{it}^{BD} + \beta_3^h (D_t^{flows} * expo_{it}^U) + \beta_4^h (D_t^{flows} * expo_{it}^{BD}) + e_{i,t+h} \tag{B1}$$

where $Bonds_{i,t+h}^{banks}$ represents the net bond purchases (flows) by local banks, D_t^{flows} is a dummy variable activated during periods of sizable inflows by foreign agents in sovereign bonds (greater than the 75^{th} percentile), and $Expo_{it}^{BD}$ and $Expo_{it}^{U}$ represent the exposure of bank i to negotiations involving sovereign bonds with benchmark-driven and unconstrained investors, respectively. These variables denote each bank's order book with foreign clients, scaled by the share of benchmark-driven or unconstrained agents in the total pool of foreign investors. We control for bank fixed effects (α_i) and time fixed effects (α_t).

The coefficients of interest for this specification are β_3^h and β_4^h. Since β_4^h is the coefficient for the interaction term between D_t^{flows} and $Expo_{it}^{BD}$, it captures the impact of an increased trading activity with benchmark-driven foreigners on banks' bond portfolio, during periods of sizable portfolio inflows. Similarly, β_3^h captures this effect in the case of unconstrained foreign investors. Given this, both the sign and magnitude of β_3^h and β_4^h will reveal how the differing investment strategies of foreign investors influence the overall impact of portfolio inflows on banks' bond portfolio.

The results show that the impact of selling a higher volume of bonds to foreign investors on banks' bond portfolios varies depending on the type of foreigner involved. As illustrated in Figure B1a, transactions with unconstrained investors result in a more substantial and lasting effect on banks' bond portfolios compared to benchmark-driven investors, where the effect appears to reverse and ultimately becomes smaller (Figure B1b). These findings suggest that the effect of portfolio inflows on banks' bond portfolios is more consistent when they trade with unconstrained foreginers, making their impact on banks' liquidity more significant.

Figure B1: IRFs of sovereign bonds flows by local banks



(a) Incremental effect of $Expo_{it}^{U}$ (b) Incremental effect of $Expo_{it}^{BD}$

Note: Authors' calculations. The Figure shows coefficients from the regression as presented in equation (B1), with robust confidence intervals significant at a 5 percent level.

Appendix C Bank-based heterogeneous effects

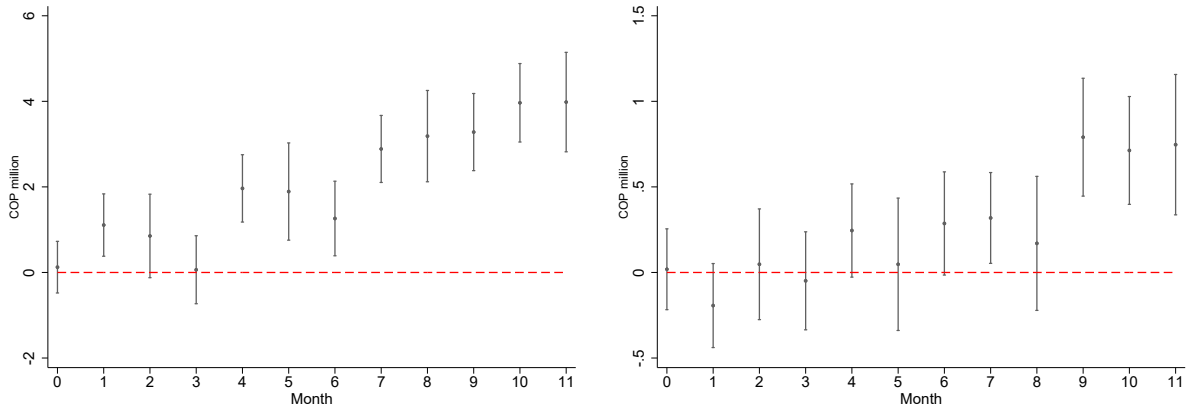
The results presented in equation (5) may be influenced by balance-sheet differences among banks. As it is highlighted in the literature of the bank lending channel, the supply of credit is directly influenced by different bank characteristics (Gambacorta and Marques-Ibanez, 2011). In order to control for some of these factors, in the following specification, some interaction terms between D_t^{flows} and a group of balance sheet variables of commercial banks are included. In particular, we estimate the following specification:

$$\begin{aligned} Loan_{ji,t+h} =& \beta_1^h Expo_{it} + \beta_2^h (D_t^{flows} * Expo_{it}) + \beta^h \mathbf{Banks}_{it} \\ &+ \beta^h (D_t^{flows} * \mathbf{Banks}_{it}) + \beta^h (D_t^{flows} * Expo_{it} * \mathbf{Banks}_{it}) \\ &+ \alpha_{ji}^h + \alpha_{jt}^h + e_{ji,t+h} \end{aligned} \tag{C2}$$

Where $\mathbf{Banks}_{it}$ represents one of the following balance-sheet variables as banks' dimensions that affect credit supply according to the bank lending channel literature: (i) bank's return on total asset (ROA), and (ii) solvency ratio. In Figures C1a and C1b, we evaluate dynamic effects by estimating local projections for the interaction term between $\beta(D_t^{flows} * Expo_{it})$ and $\mathbf{Banks}_{it}$, as exemplified in equation (C2).

The results show that the interaction of bank characteristics, such as ROA and solvency, with D_t^{flows} amplifies the increase in credit supply during periods of significant portfolio inflows (Figures C2a and C2b). The positive and statistically significant coefficients for these interactions, indicate that banks with higher profitability and stronger capital buffers tend to expand their loan issuance to a greater extent after receiving increased liquidity from offshore inflows into sovereign bonds.

Figure C1: IRFs of the amount of new loans



(a) Incremental effect of ROA

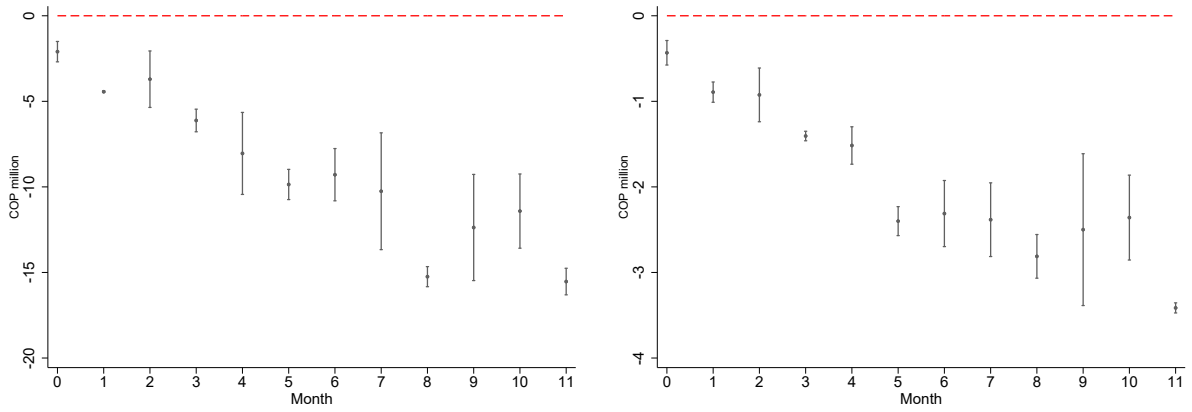
(b) Incremental effect of Solvency

Note: Authors' calculations. The Figure shows coefficients from the regression as presented in equation (C2), with robust confidence intervals significant at a 5 percent level.

Additionally, we estimate an alternative specification of equation (C2) where D_t^{flows} is activated when a certain month presents negative flows by foreign investors. With this, we investigate how the effects of portfolio outflows on the credit market are influenced by balance-sheet differences among banks.

The analysis underscores how foreign capital outflows influence credit supply, with the extent of the impact depending on banks? balance-sheet characteristics. As shown in Figure C2b, banks with stronger solvency levels experience smaller credit contractions following portfolio outflows compared to those with higher profitability (Figure C2a). This resilience can be attributed to their robust capital buffers, which enable them to sustain lending activity despite the economic pressures of capital withdrawal.

Figure C2: IRFs of the amount of new loans



(a) Incremental effect of ROA

(b) Incremental effect of Solvency

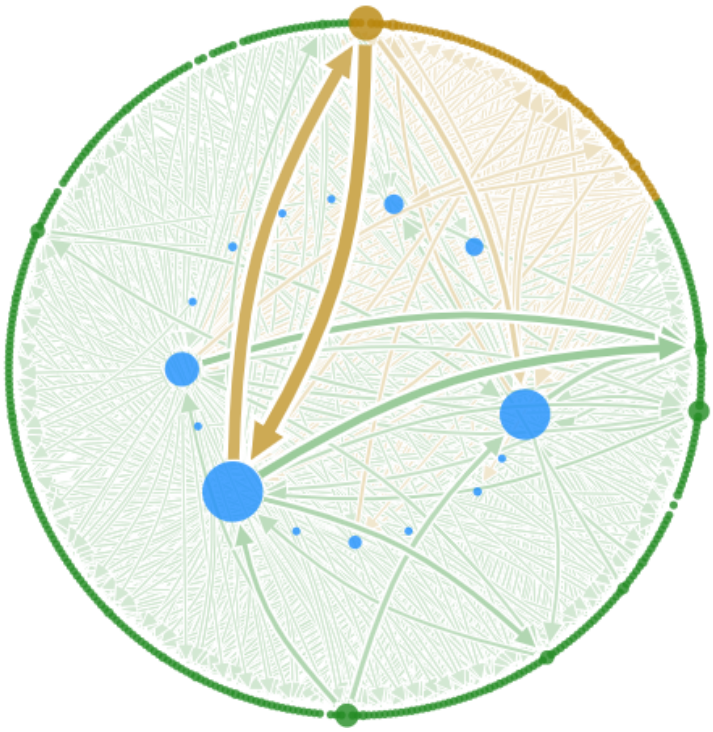
Note: Authors' calculations. The Figure shows coefficients from the regression as presented in equation (**??**), with robust confidence intervals significant at a 5 percent level.

Appendix D Relations between foreign investors and banks

One explanation for the crowding-out effect observed in the credit market is the persistence of bank-investor relationships in the sovereign bond market. Foreign investors, on average, negotiate sovereign bonds with only a few banks, which serve as their primary counterparts and remain consistent over time. Consequently, when investors inject (withdraw) liquidity into these banks by purchasing (selling) sovereign bonds, it directly impacts the banks' balance sheets and, subsequently, the volume of new loans they issue.

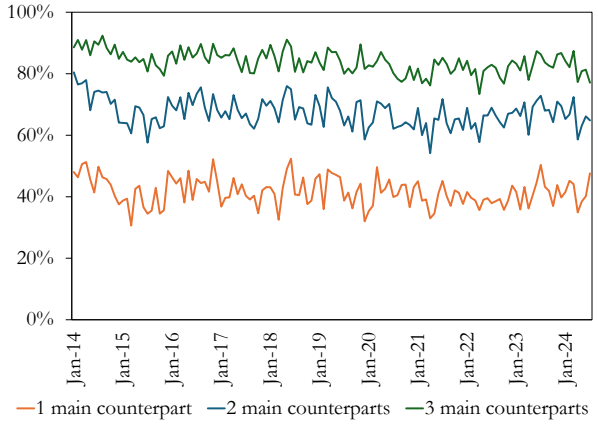
To illustrate this, Figure D1 depicts the network of relationships between banks and foreign investors in the sovereign bond market over a brief period within our sample. While the network shows that multiple transactions occur, most activity is concentrated among a few banks, with flows consistently directed toward the same counterparts over time (indicated by thicker arrows). Additionally, Figure D2 demonstrates the stickiness of these relationships: the amount-weighted average probability of foreign investors negotiating with their primary bank counterparts remains high over time (D2a), and the majority of investors transact with only one banking counterpart (D2b).

Figure D1: Network of transactions between foreign investors and their (bank) counterparts in the sovereign bonds market (June to August 2023)



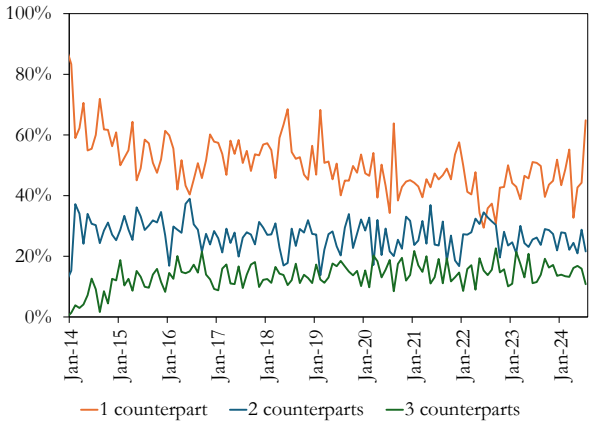
Note: Authors' calculations. The figure depicts all sovereign bond transaction between foreign investors (brown points and arrows for benchmark-driven investors, and green points and arrows for unconstrained foreigners) and local banks (blue points). Thicker arrows represent higher-volume transactions.

Figure D2: Foreigner-bank transactions in sovereign bonds



(a) Average probability of a foreign investor trading with their main bank counterparts.

Note: Authors' calculations. The series is calculated by dividing the monthly traded amount, of each foreign investor with their main counterparts, by the total traded amount of that foreign investor over a given month. Main counterparts are identified as those with which the foreign investor negotiates the highest amount over the whole sample.



(b) Share of foreign agents making transactions with bank counterparts.

Note: Authors' calculations. Referes to the share of foreigners that trade with 1, 2 and 3 bank counterparts over the whole pool of foreign agents.