GENEVA GRADUATE INSTITUTE

INSTITUT DE HAUTES ÉTUDES INTERNATIONALES ET DU DÉVELOPPEMENT

GRADUATE INSTITUTE OF INTERNATIONAL AND DEVELOPMENT STUDIES

Graduate Institute of International and Development Studies

International Economics Department

Working Paper Series

Working Paper No. HEIDWP02-2026

The Role of Investor Composition in Sovereign Bond Pricing: Evidence from an Emerging Market

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Abstract

This paper quantifies how demand and supply shocks transmit to yields in Colombia's sovereign bond market by estimating investor–level demand elasticities and translating them into equilibrium price effects. Using investor–security microdata and two complementary identification strategies, I recover elasticities for major investor groups within a structural demand-system framework. Pension funds and banks absorb a large share of marginal issuance and hold much of the outstanding stock, giving them substantial influence on yields despite their relatively elastic demand. Foreign investors, though absorbing less supply, still exert meaningful price effects. A 1% change in an investor group's holdings moves yields by roughly 2–5 basis points, while a 1% increase in total debt raises yields by about 37–47 basis points. Applying the estimates to recent dynamics shows that foreign divestment since 2022 generated gradual upward pressure on yields and that absorption capacity has tightened as marginal absorption shifted toward less elastic domestic investors.

Keywords: Capital flows; foreign investment; investor classification; J.P. Morgan GBI-EM index; emerging markets

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

The author thanks Georgios Georgiadis from the European Central Bank for the academic supervision of this paper. This research took place through the coaching program under the Bilateral Assistance and Capacity Building for Central Banks (BCC), financed by SECO, and the Graduate Institute in Geneva.
The views expressed in this paper are solely those of the author and do not necessarily reflect those of the Central Bank of Colombia.

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1 Introduction

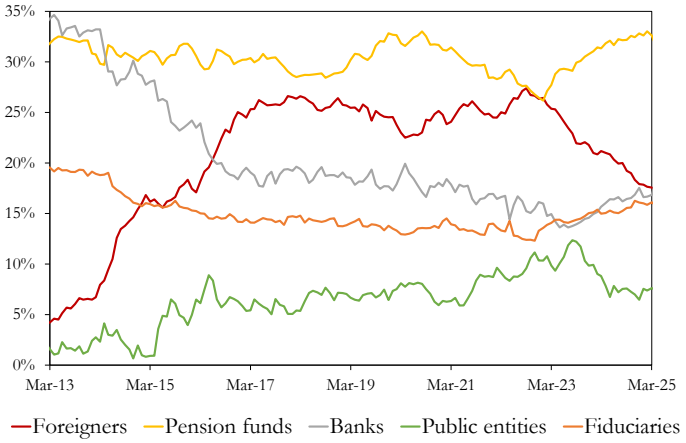
The behaviour of sovereign bond investors plays a central role in determining governments' borrowing costs, and thus their ability to finance themselves at sustainable levels. A growing literature shows that the way shocks transmit to yields depends critically on who holds the debt (Fang et al., 2025; Jansen et al., 2024), therefore shaping fiscal space, the speed of economic recoveries, and the resilience of the financial system (Panizza and Presbitero, 2014; Arellano and Ramanarayanan, 2012). In this context, understanding how different investors adjust their portfolios as conditions change becomes crucial not only fort market pricing but also for macroeconomic stability.

Investors differ in how they react to movements in global risk appetite, monetary policy expectations, and domestic macroeconomic news. In emerging markets, for instance, benchmark-driven foreign funds may adjust portfolios mechanically as index weights shift, whereas long-horizon institutional investors respond more to fundamentals and display more stable behaviour (Rey, 2015; Koepke, 2019; Arslanalp et al., 2020). These heterogeneous responses translate into distinct demand elasticities, making the composition of the investor base a key determinant of how shocks propagate into yields.

Colombia provides a clear illustration of how investor heterogeneity shape yields dynamics. Local-currency sovereign bonds are held mainly by pension funds, foreign investors, banks, and public entities (Figure 1). These groups differ markedly in mandates, investment horizons, balance-sheet structures, and regulatory constraints. Such heterogeneity shapes how demand adjusts when yields move or issuance patterns change, placing investor behaviour at the centre of price formation in the local sovereign bond market.

Domestic institutional investors often play a stabilizing role. Pension funds and insurers tend to increase their demand when yields rise, dampening price swings (Timmer, 2018; Fong et al., 2022; Ocampo et al., 2025). Banks can also absorb sovereign debt during stress episodes, though their ability to do so depends on liquidity positions and regulatory limits (Gambacorta and Marques-Ibanez, 2011; Khwaja and Mian, 2008; Chodorow-Reich, 2014). When liquidity pressures, regulatory constraints, or portfolio limits bind, this absorption capacity declines and yield adjustments become sharper (Önder et al., 2024; Branson and Henderson, 1985; Gabaix and Maggiori, 2015).

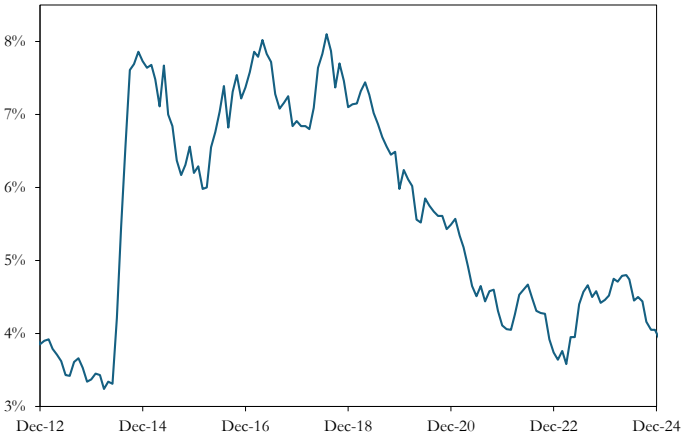
Figure 1: Sovereign bond balance by investor group (% of total outstanding)



Source: Central Bank of Colombia, Central Securities Depositary (DCV, by its Spanish acronym).

Foreign investors are likewise central participants in Colombia's market. Their presence grew rapidly after 2014, following the increase in Colombia's weight in the GBI–EM index (Figure 2) and regulatory reforms between 2010 and 2013 that strengthened the appeal of local-currency debt (Romero et al., 2021; Arslanalp et al., 2020; Raddatz et al., 2017). Greater foreign participation deepened liquidity, supported longer maturities, and reduced reliance on foreign-currency borrowing, consistent with the literature on overcoming the *original sin* (Eichengreen et al., 2022; Burger and Warnock, 2004; Peiris, 2010).

Figure 2: Colombia's weight in the GBI–EM index

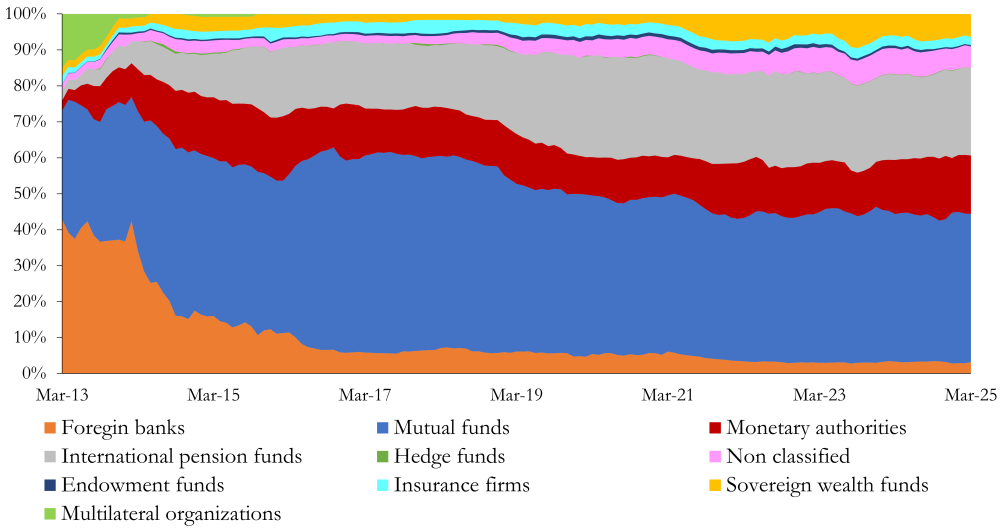


Source: J.P. Morgan.

At the same time, a larger foreign footprint increases sensitivity to global financial conditions, with movements in global risk appetite, international liquidity, and US monetary

policy translating more directly into local yields (Obstfeld, 2012; Cerutti et al., 2015; Ebeke and Lu, 2015). Yet this influence is highly heterogeneous: foreign holdings in Colombia span benchmark-driven mutual funds, long-horizon pension funds, and unconstrained asset managers (Botero et al., 2025; Arslanalp et al., 2020; Raddatz et al., 2017). These groups differ substantially in mandates and in their sensitivity to global shocks (Figure 3). Understanding which type of investor is adjusting positions is thus crucial for interpreting yield movements.

Figure 3: Sovereign-bond holdings by foreign investor group (% of total foreign investor sovereign-bond holdings)

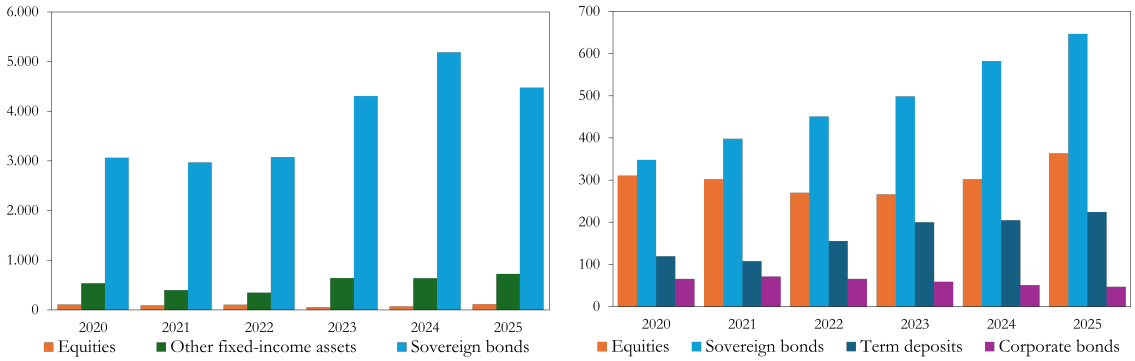


Source: Central Bank of Colombia, Central Securities Depositary (DCV, by its Spanish acronym).

Foreign investors remain important players despite having sold roughly 15% of their holdings since 2023. The yield impact of this adjustment depends critically on the identity and absorption capacity of the investors who accommodate the additional supply. This underscores the need for a framework capable of quantifying how shocks to specific investor groups translate into yield movements.

Colombia's sovereign debt market lies at the core of domestic financial conditions. Local-currency government bonds account for about 86% of secondary-market trading since 2020 and nearly half of the outstanding value of the domestic capital market (Figure 4). As of September 2025, they represent 37% of GDP (Figure 5). Their depth and liquidity make the sovereign curve the main benchmark for pricing term deposits, corporate bonds, and mortgage loans, and the principal source of collateral in repo and derivatives markets, with direct implications for financial stability.

Figure 4: Traded amount and total outstanding of local–currency sovereign bonds relative to other local assets

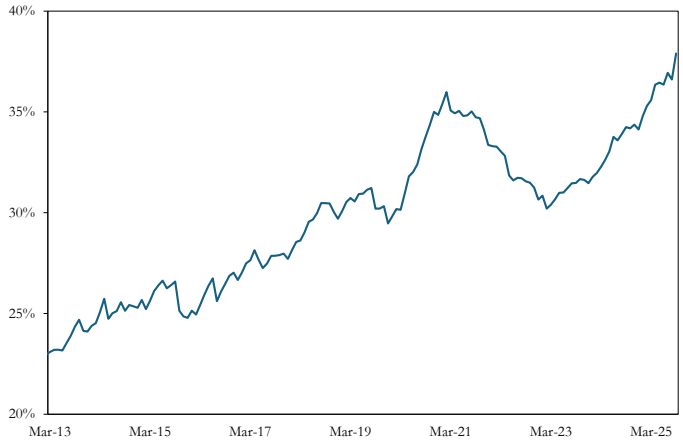


(a) Average daily traded amount in each securities markets (COP billion)

(b) Total outstanding in each securities markets (COP trillion)

Source: The Electronic Trading System (SEN, for its Spanish acronym), the Colombian Stock Exchange, and Deceval (Central Securities Depository).

Figure 5: Total outstanding of local–currency sovereign bonds (% of GDP)



Source: Central Bank of Colombia and DANE (National Administrative Department of Statistics)

The influence of investor heterogeneity extends beyond sovereign yields into domestic credit allocation. Disruptions in banks' balance-sheet liquidity can restrict credit supply and weaken firms' performance (Carranza and Moreno-Burbano, 2020). Recent evidence from Botero et al. (2025) shows that banks trading larger volumes of sovereign bonds with foreign investors reduce corporate lending more sharply when global financial conditions tighten. These interactions highlight why modelling investor-specific behaviour provides a powerful framework for understanding how shocks propagate through sovereign yields, financial markets, and the real economy.

A small but growing literature formalizes these mechanisms using structural demand systems. Fang et al. (2025) estimate demand elasticities across granular investor groups in emerging markets and show that private non-bank investors are substantially more price-sensitive than banks, implying larger yield effects when their portfolio share rises. Jansen et al. (2024) use security-level holdings to document systematic heterogeneity in how banks, insurers, pension funds, mutual funds, and foreign investors adjust positions in response to exchange-rate and global shocks. Together, these studies show that investor composition is not merely descriptive but a structural determinant of yield sensitivity to flow imbalances, an insight that motivates the empirical strategy of this paper.

This paper contributes to this literature by developing a granular framework to quantify how demand and supply shocks transmit to yields in Colombia's sovereign bond market. Using microdata from the securities depository managed by the Central Bank of Colombia, I estimate investor-specific demand functions and identify how each group reacts to changes in yields, bond characteristics, and macroeconomic conditions. The model provides a natural mapping from demand elasticities to yield sensitivities to demand or supply shocks[1], allowing us to evaluate the market's capacity to absorb shocks.

I address endogeneity between yields and investor demand using two complementary strategies. First, I implement the pseudo-yield approach of Fang et al. (2025) and Jansen et al. (2024), which isolates the component of yields explained by macro variables and bond characteristics, purging latent demand effects. Second, I construct a Granular Instrumental Variable (GIV) following Gabaix and Koijen (2024), aggregating idiosyncratic micro-level demand shocks into an exogenous instrument for aggregate yield movements. Together, these methods provide credible identification of demand elasticities and their implications for yield responses.

My contribution is threefold. First, I provide the first granular estimation of sovereign bond demand elasticities for Colombia, distinguishing major investor groups —domestic pension funds, banks, insurance firms, foreign investors, among others. Second, I adapt frontier methodologies from the international literature to an emerging-market setting with unusually rich microdata, allowing us to quantify how market microstructure shapes macro-financial dynamics. Third, the empirical components of the model form a set of tools that can be incorporated into a stress-testing framework, enabling the Central Bank to simulate

[1]Demand shocks refer to reductions in a given investor group's demand for sovereign bonds; supply shocks refer to increases in government bond issuance.

yield impacts under hypothetical issuance or withdrawal scenarios.

The remainder of the paper is organized as follows. Section 2 describes the data and institutional background. Section 3 outlines the empirical identification strategy and presents the main results on investor demand functions. Section 4 reports the estimation of yield sensitivities to demand and supply shocks. Section 6 concludes.

2 Composition of sovereign debt holders

My analysis starts by exploring who holds sovereign debt and which types of investors tend to step in when new bonds are issued. I first outline how the dataset is organized and how investors are categorized, emphasizing key patterns in their holdings over time. Next, I investigate which groups drive the marginal demand for sovereign securities.

2.1 Data

For the period between January 2013 and March 2025, I employ detailed monthly microdata on holdings of domestic currency sovereign bonds by 8 groups of investors: foreign investors, pension funds, banks, public entities, fiduciaries, insurances firms, brokerage firms and others. 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 Colombia pesos (COP) or indexed to inflation.

My focus is on sovereign bonds, as they represent the largest share of Colombia's public debt. For instance, as of March 2025, sovereign bonds accounted for 60% of the country's total debt, according to the Ministry of Finance. To the best of my 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 my research.

Descriptive statistics are presented in Table 1. The dataset includes roughly 460,000 observations at the investor-security level, meaning that each observation corresponds to a specific investor holding a specific bond security in a given month. As shown in the table, at the individual investor level, the average bond holding per observation is relatively small across investor groups, with foreign investors holding on average 0.04 trillion COP, pension funds around 1.20 trillion COP, and banks approximately 0.19 trillion COP. Public entities and trusts exhibit moderate average holdings of 0.63 and 0.14 trillion COP, respectively.

At the monthly aggregated level by investor group, average bond holdings are considerably higher. Pension funds stand out as the largest holders, with an average position of 9.6 trillion COP, followed by foreign investors (7.0 trillion COP) and banks (6.1 trillion COP). Fiduciaries and public entities maintain average monthly positions of 4.5 and 2.6 trillion COP, respectively, while insurance firms, brokerage firms, and others exhibit smaller average holdings, all below 1 trillion COP. These statistics underscore the dominant role of pension funds and foreign investors in the TES market and the significant heterogeneity in holding sizes across investor types.

Table 1: Descriptive statistics for transaction-level and monthly aggregated data

	Obs	Mean	Std	Min	Max
Panel A. Agent-level data (TES holdings)					
Foreign investors	279,399	0.04	0.13	0.00	5.00
Pension funds	11,801	1.20	1.65	0.00	14.77
Banks	45,871	0.19	0.36	0.00	5.56
Public entities	6,139	0.63	1.03	0.00	6.58
Fiduciaries	46,569	0.14	0.41	0.00	18.66
Insurance firms	21,586	0.07	0.18	0.00	3.57
Brokerage firms	25,152	0.15	0.03	0.00	0.56
Others	23,305	0.06	0.1	0.14	1.82
Total	462,113	0.10	0.41	0.00	18.66
Panel B. Group-level data (TES holdings)					
Foreign investors	1,470	7.0	8.1	0.0	48.6
Pension funds	1,470	9.6	14.3	0.0	121.2
Banks	1,470	6.1	7.1	0.0	39.2
Public entities	1,470	2.6	3.9	0.0	29.0
Fiduciaries	1,470	4.5	6.1	0.0	49.8
Insurance firms	1,470	1.0	2.3	0.0	19.2
Brokerage firms	1,470	0.3	0.3	0.0	2.1
Others	1,470	1.0	1.1	0.0	6.7
Total	11,760	4.0	7.6	0.0	121.2

Note: Authors' calculations. Panel A reports investor-level statistics from the Central Securities Depository (DCV), reflecting holdings by individual agents. Panel B summarizes monthly aggregated TES holdings by investor group. All values are expressed in COP trillions.

2.2 Marginal holders

As an initial step in estimating the capacity of each investor group to absorb increases in sovereign debt supply, I estimate the following system of regressions, following the approach outlined by Fang et al. (2025). In this setting, changes in sovereign bond holdings (as a percentage of the total outstanding) by investor group are regressed on the percentage change in the total outstanding of sovereign bonds:

$$\frac{Z_t^l(m) - Z_{t-1}^l(m)}{S_{t-1}(m)} = a^l(z) + b^l(z)\frac{S_t(m) - S_{t-1}(m)}{S_{t-1}(m)} + u_t^l(m), \qquad \forall l \tag{1}$$

Where $Z_t^l(m)$ denotes sovereign bond holdings by investor group l in maturity bucket m, and month t; $S_t(m)$ denotes total sovereign bond outstanding in maturity bucket m, and month t; and coefficients $b^l(m)$ are restricted so they sum to 1. Maturity buckets are defined as the term to maturity of each bond reference (1 to 9 years and >= 10 years). I include fixed effects by maturity and year-month. The coefficient of interest here is $b^l(z)$, which represents the share of additional debt in maturity bucket m that the investor group l is going to demand in a given month.

Table 2: Marginal holders (% of outstanding)

	Aggregate	Short end	Middle end	Long end
Foreigners	0.261***	0.115***	0.199***	0.299***
	(0.005)	(0.007)	(0.008)	(0.007)
Pension Funds	0.370***	0.261***	0.385***	0.384***
	(0.006)	(0.012)	(0.010)	(0.008)
Banks	0.149***	0.359***	0.186***	0.104***
	(0.004)	(0.007)	(0.006)	(0.003)
Public Entities	0.069***	0.106***	0.074***	0.060***
	(0.002)	(0.006)	(0.004)	(0.002)
Fiduciaries	0.115***	0.121***	0.121***	0.112***
	(0.001)	(0.003)	(0.002)	(0.002)
Insurance firms	0.028***	0.024***	0.025***	0.032***
	(0.001)	(0.001)	(0.001)	(0.001)
Brokerage Firms	0.009***	0.014***	0.010***	0.009***
	(0.000)	(0.001)	(0.000)	(0.001)
Observations	1.470.000	294.000	441.000	735.000
R^2	0.674	0.723	0.717	0.747

Note: Maturity buckets are defined as: short (less than 2 years to maturity), middle (2 to 5 years) and long (more than 5 years).

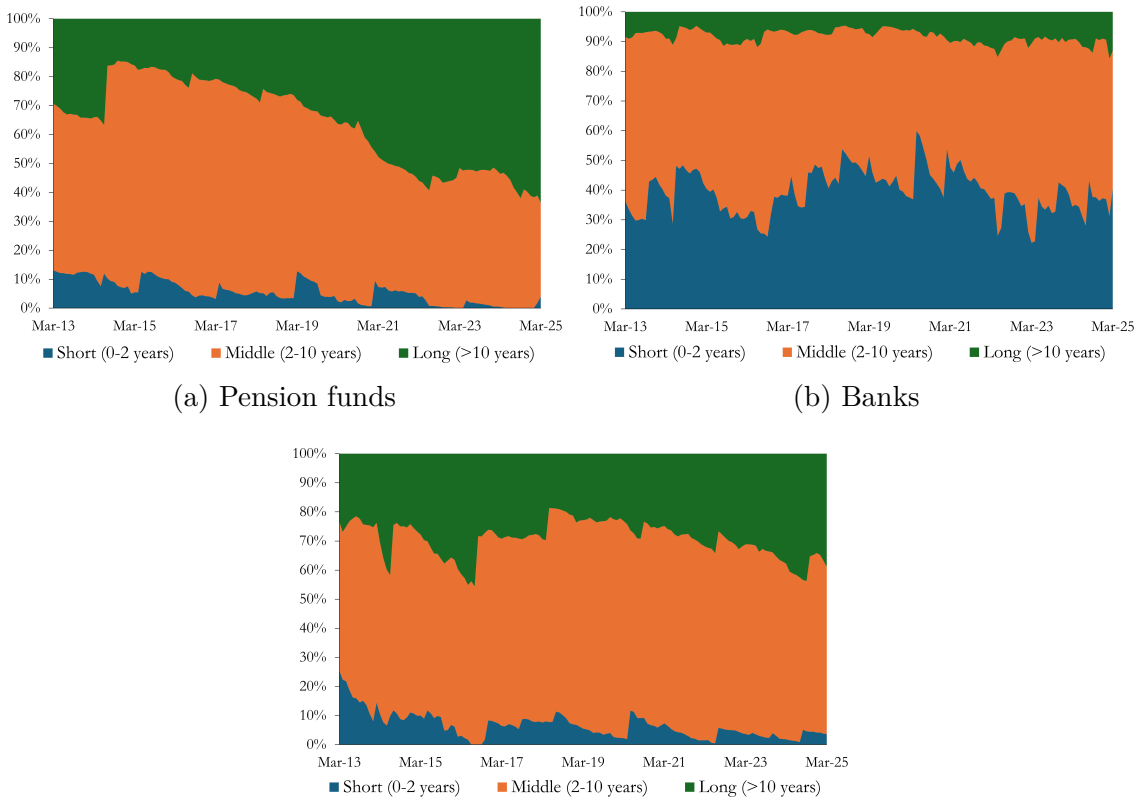
The results indicate clear differences across investor groups in how they adjust their holdings when sovereign debt supply increases. Pension funds absorb the largest share of new issuance—about one third in the aggregate—and their contribution is particularly notable at medium and long maturities. This aligns with evidence from Fang et al. (2025), who show that domestic non-bank private investors tend to account for a relatively large portion of marginal absorption in a broad sample of countries. The Colombian data display a similar

pattern: domestic long-term institutional investors appear to be the main source of marginal demand.

Banks also absorb a non-negligible share of issuance, though their demand is concentrated at the short end of the curve. They take up more than one third of short-maturity debt but much less at longer horizons. Comparable maturity segmentation appears in the cross-country evidence in Fang et al. (2025) and in the maturity-specific patterns documented for U.S. Treasuries by Jansen et al. (2024), where banks predominantly hold shorter-duration securities. The Colombian results are consistent with that broader regularity: banks contribute to marginal demand, but mainly at short maturities.

Foreign investors absorb roughly one quarter of new issuance. Their marginal demand is relatively balanced across maturities, with somewhat higher absorption in long-dated securities. In the BIS dataset analyzed by Fang et al. (2025), foreign non-bank investors play an important marginal role in advanced economies and, to a lesser extent, in emerging markets. Colombia fits within that range: foreign investors participate meaningfully, though their marginal absorption is smaller than that of domestic non-banks. These results align with the portfolio structure that these investor types have shown over time, where pension funds and foreign investors concentrate their holdings in longer-term maturities, while banks have a larger share of short-term bonds 6.

Figure 6: Sovereign-bond holdings by term to maturity and investor group (% of total sovereign-bond holdings of each investor group)



(a) Pension funds

(b) Banks

(c) Foreigners

Source: Central Bank of Colombia, Central Securities Depositary (DCV, by its Spanish acronym).

Other investor groups—public entities, trusts, insurers, and brokerage firms—contribute smaller shares. Trusts exhibit moderate and fairly uniform absorption across maturities, while insurers and brokerage firms add only small amounts of marginal demand. These magnitudes are comparable to the smaller elasticities typically found for these sectors in the international literature.

Overall, the distribution of marginal absorption in Colombia is broadly in line with patterns documented for other sovereign debt markets: domestic non-bank institutions absorb the largest share of new issuance; banks contribute mainly at short maturities; and foreign investors provide a secondary but still relevant share of marginal demand.

3 Indetification strategy

I began by examining how sovereign debt is distributed across investor groups and propensity of each group to absorb new issuances. This section introduces a framework to analyze the behavior of different investor types and to clarify why changes in the composition of holders are important. Section 3.1 sets out the analytical foundation for studying investors' demand for new sovereign debt as yields change.

3.1 Estimating demand functions

The approach presented in 2.2 does not account for investment restrictions specific to each investor group, nor does it incorporate the effects of other variables, such as the macroeconomic fundamentals or bond charaacteristics, among others, on these agents' demand decisions. To address these limitations, this section estimates demand functions that explicitly capture the heterogeneity of investors groups in the sovereign bond market.

Following the framework of Koijen and Yogo (2019) and its application by Jansen et al. (2024), I model the holdings of each investor group as a function of sovereign bond yields, yields on other maturities, bond characteristics, and macroeconomic fundamentals. This approach allows for a structural interpretation of investor behavior and provides an internally consistent measure of their demand elasticity to changes in bond yields. Specifically, the model takes the following form:

$$\ln Z_t^l(m) = \theta_0^l + b_1^l y_t(m) + b_2^l y_t(-m) + (b_3^l)' X_t(m) + (b_4^l)' Macro_t + u_t^l(m) \tag{2}$$

where $Z_t^l(m)$ denotes the holdings of investor group l in maturity bucket m at time t. The variable $y_t(m)$ represents the yield of bonds in that maturity bucket, and $y_t(-m)$ is the weighted-average yield of the remaining maturities, capturing substitution effects along the curve. $X_t(m)$ is a vector of bond characteristics, including coupon, bid-ask spread, and maturity fixed effects, while $Macro_t$ includes a set of macroeconomic controls such as the debt-to-GDP ratio, core inflation, Colombia's 5-y Credit Default Swap (CDS), GDP growth, and the fiscal deficit.

Estimating Equation (2) raises a potential endogeneity challenge between yields and investor holdings. Unobserved demand shocks —such as changes in risk appetite, benchmark

rebalancing, or portfolio constraints— may simultaneously influence both variables. In this case, the regression can be estimated with the Generalized Method of Moments (GMM) with an instrument for yields that satisfies the orthogonality condition with respect to the error term. To address this issue, I follow the instrumental-variable approach proposed by Koijen and Yogo (2019) and extended by Fang et al. (2025) and Jansen et al. (2024), which replaces observed yields with pseudo-yields that capture the equilibrium prices implied by exogenous components of demand and supply.

The intuition behind this identification strategy is straightforward. In equilibrium, bond yields adjust to balance aggregate demand and the supply of sovereign debt. If one can predict the portions of demand and supply driven purely by fundamentals, such as bond characteristics, macroeconomic variables, and monetary policy, then the yield that would clear this hypothetical, exogenous market can be interpreted as a pseudo-yield. This synthetic yield reflects the equilibrium price that would prevail in the absence of endogenous demand shocks. By instrumenting observed yields with these pseudo-yields, the estimation isolates the causal response of investors' bond holdings to changes in yields, providing consistent and interpretable elasticities across investor groups.

Pseudo-yields are estimated in several steps. First, for each investor group, predicted holdings are obtained as a function of bond and macroeconomic variables, excluding yields.

$$\hat{Z}_t^l(m) = \theta_0^l + (b_3^l)' X_t(m) + (b_4^l)' Macro_t \tag{3}$$

This provides an estimate of demand driven only by fundamentals and institutional characteristics.

Second, predicted sovereign bond supply by maturity is modeled as a function of macroeconomic conditions and monetary policy, proxied by the policy rate.

$$\hat{S}_t(m) = \gamma_0 + \gamma_1' Macro_t + \gamma_2 MP_t \tag{4}$$

where MP_t is a monetary policy indicator (e.g., policy rate).

Third, pseudo-yields are obtained by imposing market clearing, solving for the yield that equates the aggregate predicted demand across investors with the predicted market value of supply in each maturity bucket.

To obtain the pseudo yield $\tilde{y}_t(m)$, I solve for the value that sets the implied demand equal to the implied market value of supply:

$$\sum_l \hat{Z}_t^l(m) = \frac{\hat{S}_t(m)}{(1+\tilde{y}_t(m))^{\tau(m)}} \tag{5}$$

where $\tau(m)$ is the average duration of bonds in maturity bucket m.

Then, the weighted average pseudo yield for the other maturity buckets is calculated as

$$\tilde{y}_t(-m) = \text{weighted average of } \{\tilde{y}_t(j)\} \quad \text{for } j \neq m. \tag{6}$$

Finally, the original demand equation is re-estimated using two-stage least squares, where the observed yields $y_t(m)$ and $y_t(-m)$ are instrumented with their corresponding pseudo-yields $\tilde{y}_t(m)$ and $\tilde{y}_t(-m)$. The identifying assumption is that these pseudo-yields are orthogonal to the latent demand component embedded in the error term.

$$E\Big[u_t^l(m) \,|\, \tilde{y}_t(m), \tilde{y}_t(-m), X_t(m), Macro_t, MP_t\Big] = 0. \tag{7}$$

Table 3 reports the instrumental-variable estimates of the demand elasticities for each investor group. The coefficient on $y_t(m)$ is the main parameter of interest, as it captures the elasticity of demand with respect to yields in the corresponding maturity bucket —that is, how strongly each investor group adjusts its holdings when yields change in that segment of the curve. The coefficients on $y_t(-m)$, in turn, capture cross-maturity substitution effects, reflecting investors' reallocations in response to changes in yields at other maturities. The results display the theoretically consistent pattern of signs: positive coefficients for $y_t(m)$ and negative coefficients for $y_t(-m)$. This is precisely what economic intuition predicts —higher yields in a given maturity increase investors' demand for those bonds (own-yield effect), while higher yields in other maturities lead investors to reallocate away from the current bucket (substitution effect). Additionally, the first-stage Kleibergen–Paap statistics (about 11 across columns) exceed standard weak-IV cutoffs (10), supporting the relevance of the pseudo-yield instruments.

The estimated elasticities exhibit clear heterogeneity across investor types. Within this framework, public entities and foreign investors display the highest demand elasticities

Table 3: Demand System Results - IV

	Foreigners	Pension Funds	Banks	Public Entities	Fiduciaries	Insurance firms	Brokerage firms	Others
$y_t(m)$	4.011***	1.177***	1.813***	4.426***	2.693***	-0.173	1.661***	1.785***
	(0.929)	(0.451)	(0.418)	(1.061)	(0.604)	(0.261)	(0.434)	(0.500)
$y_t(-m)$	-3.494***	-1.076**	-1.541***	-3.374***	-2.394***	0.260	-1.396***	-1.230**
	(0.910)	(0.442)	(0.409)	(1.038)	(0.592)	(0.256)	(0.425)	(0.490)
Observations	1329	1329	1329	1329	1329	1329	1329	1329
Maturity F.E.	✓	✓	✓	✓	✓	✓	✓	✓
Bond characteristics	✓	✓	✓	✓	✓	✓	✓	✓
Macro controls	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Statistic (first stage)	11.163	11.202	11.202	11.010	11.202	11.202	11.202	11.202

with respect to yields, implying that they would act as stabilizing agents in response to yield fluctuations under this specification. By contrast, long-term domestic investors such as pension funds exhibit the lowest elasticity, indicating a more muted adjustment of their portfolios to yield changes.

This pattern is somewhat at odds with the findings of Fang et al. (2025), who show that non-bank investors tend to behave as stabilizers precisely because they exhibit higher demand elasticities with respect to yields. Moreover, the relatively high elasticity of foreign investors contrasts with a broader strand of the literature emphasizing that foreign participation in local sovereign debt markets is often associated with greater sensitivity to global financial conditions and local risk components (e.g., Ebeke and Lu, 2015).

Turning to cross-maturity effects, the negative and statistically significant coefficients on $y_t(-m)$ across most investor groups confirm the presence of substitution along the yield curve. When yields at other maturities increase, investors reduce holdings in the current segment and reallocate toward shorter or longer maturities. This behavior is most pronounced among foreign investors and public entities, consistent with their more flexible mandates and greater scope for opportunistic positioning. Regression results for the control variables in equation 2, under the pseudo-yield approach, are reported in Table A1. Overall, the signs of the macroeconomic and bond-specific controls are consistent with standard financial intuition regarding their role in shaping investment decisions.

In sum, while the results align with the main regularities emphasized in the demand-based literature —namely, that investor groups differ markedly in their yield elasticities— the finding that long-term domestic institutions are the least elastic is a notable and non-standard result. For this reason, the robustness of this pattern is examined using an alternative empirical approach in the following section.

3.2 Granular instrumental variable

The pseudo-yield strategy in the previous subsection provides valid instruments based on macroeconomic and bond-level fundamentals, but it does not take full advantage of the granular nature of my dataset. Because pseudo-yields rely on investor-group level aggregates, they capture only broad shifts in demand rather than the rich heterogeneity present in the underlying microdata. The availability of investor-security level holdings allows for a more refined identification approach.

To exploit this granularity, I implement the granular instrumental variable (GIV) framework of Gabaix and Koijen (2024). The idea is that, in markets where individual investors are large relative to the size of specific securities, their idiosyncratic trades generate small but measurable price pressures. These micro-level fluctuations are plausibly orthogonal to aggregate determinants of yields, and aggregating them across investors produces an instrument that isolates exogenous variation driven by granular demand shocks. In this way, the GIV approach complements the pseudo-yield specification by leveraging the full detail of the microdata rather than relying solely on group-level aggregates.

To construct the instrument, I begin by estimating a micro-level demand equation for each investor j, relating their holdings of bonds with maturity m to observed yields:

$$\ln \hat{Z}_t^j(m) = \alpha_0^j + \beta y_t(m) + u_t^j, \tag{8}$$

where u_t^j denotes the residual demand shock specific to investor j. These residuals capture idiosyncratic deviations in individual portfolio choices after controlling for common yield movements and other fundamentals. While they are assumed to be mean-zero and largely independent across investors, shocks from large investors can still affect equilibrium prices when market depth is limited.

The GIV is obtained by aggregating these residuals using investor portfolio shares as weights, so that larger investors exert proportionally greater influence on the instrument:

$$\tilde{u}_t = \sum_j s_t^j \, u_t^j, \tag{9}$$

where s_t^j is investor j's share of total holdings at time t. To remove common market-wide shocks, I subtract the simple cross-sectional average of residuals, yielding:

$$z_t^{GIV} = \tilde{u}_t - \frac{1}{I}\sum_j u_t^j. \tag{10}$$

By construction, z_t^{GIV} captures investor-specific fluctuations in demand that meet the two conditions required of a valid instrument. First, it is relevant: in markets where some investors are large relative to individual securities, idiosyncratic portfolio adjustments generate small but detectable price pressures, and aggregating these fluctuations across investors produces an instrument that is correlated with observed yield variation. Second, GIV shocks are exogenous to the common, group-wide forces embedded in the error term of the demand equation[2], as they arise from investor-level actions that do not reflect the underlying determinants of aggregate bond demand.

Table 4 reports the demand elasticities estimated using the granular instrumental variable (GIV). As in the pseudo-yield specification, the coefficient on $y_t(m)$ captures the own-yield elasticity, while $y_t(-m)$ measures cross-maturity substitution. The signs of these coefficients remain consistent with theoretical predictions: investors increase their demand when yields rise in the corresponding maturity bucket and reduce exposures when yields rise elsewhere. The first-stage Kleibergen–Paap statistics comfortably exceed standard weak-instrument thresholds, confirming the strength and relevance of the GIV instrument. As shown in Table A1, the signs of the coefficients on macro and bond controls remain aligned with standard financial intuition.

Table 4: Demand System Results - IV

	Foreigners	Pension Funds	Banks	Public Entities	Fiduciaries	Insurance firms	Brokerage firms	Others
$y_t(m)$	1.438***	3.529***	4.587***	6.556***	0.800***	2.927***	0.979***	5.983***
	(0.096)	(0.194)	(0.388)	(1.278)	(0.079)	(0.369)	(0.224)	(0.914)
$y_t(-m)$	-6.004***	-4.180***	0.262	1.864**	-1.144***	2.057	-0.414**	-2.068***
	(0.425)	(0.256)	(0.411)	(0.908)	(0.066)	(1.291)	(0.171)	(0.643)
Observations	196,354	10,604	44,481	13,995	46,010	21,332	24,442	8,770
Number of investors	369	5	29	10	30	18	24	13
Investor F.E.	✓	✓	✓	✓	✓	✓	✓	✓
Maturity F.E.	✓	✓	✓	✓	✓	✓	✓	✓
Bond characteristics	✓	✓	✓	✓	✓	✓	✓	✓
Macro controls	✓	✓	✓	✓	✓	✓	✓	✓

Figure 7 compares the demand elasticities obtained from the pseudo-yield and GIV specifications across investor groups. The overall ranking of elasticities remains broadly consistent across the two approaches, and differences in magnitudes are relatively contained.

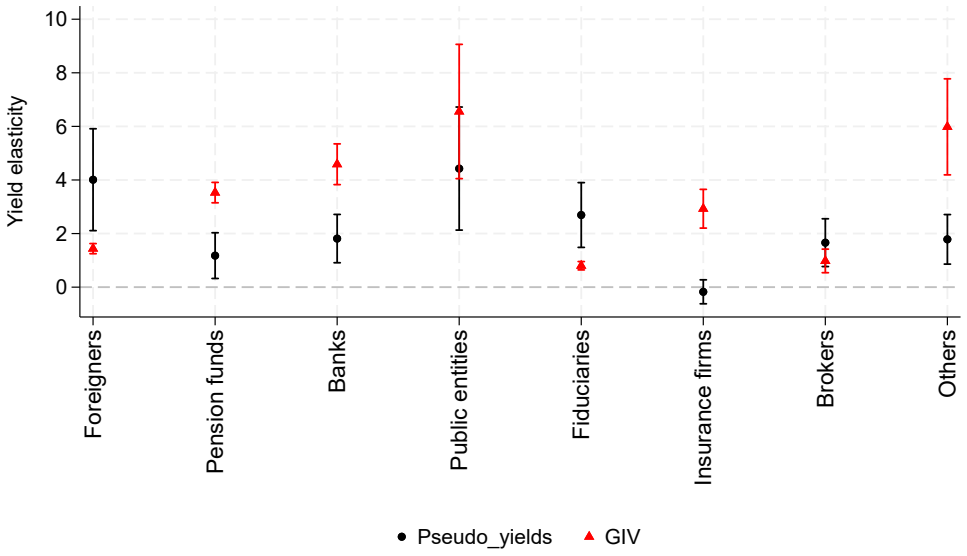
[2]Such as shifts in macro conditions, risk appetite, or regulatory constraints.

However, foreign investors and fiduciaries, stand out as notable exceptions, as their estimated elasticities decline under the GIV approach.

This adjustment results in a change in their relative position in the ranking, with long-term domestic investors such as pension funds moving toward the upper end of the elasticity distribution, while foreign investors and fiduciaries now exhibit structurally lower yield elasticities relative to other groups. Importantly, this ordering aligns more closely with theoretical and empirical expectations, according to which foreign investors are typically not regarded as stabilizing agents in local sovereign debt markets (e.g., Fang et al. (2025)).

Methodologically, this pattern may reflect the large number of individual agents within these categories and, in the case of foreign investors, the substantial mass of relatively small holders. By exploiting investor-level heterogeneity, the GIV approach captures a wider dispersion of idiosyncratic behavior within these groups that is averaged out when using pseudo-yields constructed from aggregated holdings and yields. As a result, intra-group heterogeneity that remains masked in the pseudo-yield specification becomes visible, leading to lower estimated elasticities for these groups despite the broad consistency in rankings and magnitudes across both identification strategies for other groups.

Figure 7: Yield elasticity of investor groups' demand for Colombian local-currency sovereign bonds



Source: Authors' calculations. **Note**: The graph depicts the estimated yield elasticity of the demand by investor group for Colombian sovereign bonds denominated in local currency, with robust confidence intervals significant at a 5% level.

Taken together, the pseudo-yield and GIV specifications provide complementary perspectives on demand behavior in Colombia's sovereign bond market. The pseudo-yield approach captures broad, market-wide sensitivities, reflecting how each investor group responds to aggregate movements in yields. The GIV specification, by contrast, exploits investor-level heterogeneity to isolate more localized price variation and recover demand responses that are less affected by aggregation. While the ranking of elasticities is not identical across the two approaches and some differences in magnitudes emerge, the overall patterns of demand responsiveness are broadly consistent. In particular, for most investor groups, the estimated elasticities remain within a comparable range across specifications, suggesting that the main conclusions are not driven by the choice of identification strategy.

At the same time, the differences that emerge for groups characterized by a large number of heterogeneous agents highlight the added value of the GIV approach. By leveraging within-group variation, the GIV uncovers intra-group dynamics that remain concealed when using pseudo-yields based on aggregated holdings and yields. In this sense, the GIV refines the pseudo-yield results by separating broad market responses from idiosyncratic investor behavior, without overturning the core empirical findings.

Overall, the GIV estimates complement and strengthen the pseudo-yield results by showing that investor demand responds not only to market-wide yield movements but also to micro-level shocks. The generally higher elasticities obtained under the GIV framework for several investor groups suggest that granular price variation can induce stronger marginal portfolio adjustments, underscoring the role of investor concentration and micro-level heterogeneity in shaping the transmission of yield changes in Colombia's sovereign bond market.

4 From Investor Demand to Yield Sensitivities

The demand elasticities estimated in the previous sections can be mapped into yield responses to shocks in investor behavior or debt issuance. In Sections 4.1 and 4.2, I follow the algebraic derivations of Fang et al. (2025), which are based on a general-equilibrium representation of the sovereign bond market, to obtain analytical expressions for the impact of both demand and supply shocks on yields. Having identified elastic demand parameters under both the pseudo-yield and GIV strategies, in Section 4.3 I quantify how sovereign bond yields react to changes in investor demand and debt supply, assuming everything else remains unchanged. This exercise provides a bridge between the micro-level demand estimation and the macro-financial implications for market stability and policy analysis.

4.1 Impact of Latent Demand Shocks on Yields

I first examine how sovereign bond yields respond to latent demand shocks originating from a particular investor group. Using the general-equilibrium framework developed by Fang et al. (2025), I derive an analytical expression linking such shocks to yield movements. Starting from the market-clearing condition:

$$P_t S_t = \sum_{i=1}^{I} P_t Z_{i,t} \tag{11}$$

where S_t denotes the outstanding supply of sovereign bonds, $Z_{i,t}$ the demand of investor group i, and P_t the bond price. I are interested in how yields respond to a shift in investor k's latent demand component u_k.

Differentiating the market-clearing condition with respect to u_k gives:

$$S_t P_t \frac{d \ln P_t}{du_k} = \sum_{i=1}^{I} \frac{\partial Z_{i,t}}{\partial \ln P_t} \frac{d \ln P_t}{du_k} + \frac{\partial Z_{k,t}}{\partial u_k} \tag{12}$$

Define the normalized demand shock:

$$\psi_k = \frac{(\partial Z_{k,t}/\partial u_k)}{S_t P_t} \tag{13}$$

Using the standard log–price demand derivative:

$$\frac{\partial Z_{i,t}}{\partial \ln P_t} = \gamma_i Z_{i,t} \tag{14}$$

I obtain:

$$\frac{d \ln P_t}{du_k} = \frac{\psi_k}{1 - \sum_{i=1}^{I} \psi_i \gamma_i} \tag{15}$$

Because shocks enter additively in log–holdings, $\partial Z_{k,t}/\partial u_k = Z_{k,t}$, the normalized shock reduces to:

$$\psi_k = \frac{Z_{k,t}}{S_t P_t} = s_k \tag{16}$$

where s_k denotes the market share of investor k.

Next, express γ_i in terms of the semi–elasticity of demand with respect to yields.

Since:

$$\gamma_i = \frac{\partial \ln Z_{i,t}}{\partial \ln P_t} = \left(\frac{\partial \ln Z_{i,t}}{\partial y_t}\right)\left(\frac{\partial y_t}{\partial \ln P_t}\right) \tag{17}$$

and using $\eta_i = \partial \ln Z_{i,t}/\partial y_t$ and $\partial y_t/\partial \ln P_t = -1/T$ I obtain:

$$\gamma_i = -\frac{\eta_i}{T} \tag{18}$$

Substituting into the denominator:

$$1 - \sum_{i=1}^{I} \psi_i \gamma_i = 1 - \sum_{i=1}^{I} s_i \left(-\frac{\eta_i}{T}\right) = 1 + \frac{1}{T}\sum_{i=1}^{I} s_i \eta_i \tag{19}$$

Finally, using the duration approximation $d \ln P_t = -T\, dy_t$, I arrive at:

$$\frac{dy_t}{du_k} = -\frac{1}{T}\,\frac{s_k}{1 + \frac{1}{T}\sum_{i=1}^{I} s_i \eta_i} \tag{20}$$

which captures the price impact of a 1% increase in investor group k's holdings, assuming all else remains equal.

This expression shows that the yield impact of a latent demand shock depends on the investor's market share, the yield elasticities of all participants (estimated in Section 3), and the average bond maturity. Intuitively, groups with large market shares exert stronger yield effects when their latent demand fluctuates. Moreover, a lower aggregate demand elasticity —that is, a smaller sum of the elasticities across all investor groups— implies a larger yield response to any group's reduction in holdings. The logic is straightforward: when the investor base as a whole is less sensitive to yield movements, it requires a higher compensation to absorb the excess supply created by the selling group.

4.2 Impact of Supply Shocks on Yields

I next evaluate how sovereign yields respond to changes in government debt issuance. Defining the elasticity of yields with respect to the market value of debt as:

$$\xi = \frac{dy_t}{d \ln(P_t S_t)} \tag{21}$$

and using the price-yield relationship $d\ln P_t = -T\, dy_t$, I obtain:

$$\xi = \frac{dy_t}{-T\, dy_t + d\ln S_t} = \frac{\frac{dy_t}{d\ln S_t}}{-T\frac{dy_t}{d\ln S_t} + 1} \tag{22}$$

Under market clearing, yields depend inversely on aggregate demand across investor groups:

$$y_t = \frac{1}{T}\left(\ln S_t - \ln \sum_{i=1}^{I} P_t Z_{i,t}\right) \tag{23}$$

Differentiating with respect to the logarithm of debt supply then implies:

$$\frac{dy_t}{d\ln S_t} = \frac{1}{T} - \frac{1}{T}\left(\frac{\sum_{i=1}^{I} \frac{d(P_t Z_i)}{dZ_i}\frac{dZ_i}{dS_t} S_t}{\sum_{i=1}^{I} P_t Z_i}\right) \tag{24}$$

Expressing the marginal demand responses as $b_i = dZ_{i,t}/dS_t$ (empircally estimated in Section 2.2, as $b^l(z)$ in equation 1) and using:

$$\frac{\partial y_t}{\partial Z_{i,t}} = \frac{1}{\tilde{\eta}_i Z_{i,t}} \tag{25}$$

where $\tilde{\eta}_i$ denotes the semi-elasticity of demand with respect to yields, I obtain:

$$\zeta \;\equiv\; \frac{dy_t}{d\ln S_t} = \frac{1}{T} - \frac{1}{T}\left(1 - T\sum_{i=1}^{I}\frac{b_i}{\tilde{\eta}_i}\right) = \sum_{i=1}^{I}\frac{b_i}{\tilde{\eta}_i} \tag{26}$$

Denoting the inverse semi–elasticity of demand to yields as:

$$\frac{1}{\eta_i} = \frac{dy_t}{d\ln(P_t Z_{i,t})} = \frac{dy_t}{-T\, dy_t + d\ln Z_{i,t}} \tag{27}$$

Given that $1/\tilde{\eta}_i = \partial y_t / \partial ln Z_{i,t}$:

$$\frac{dy_t}{-T\, dy_t + d\ln Z_{i,t}} = \frac{1/\tilde{\eta}_i}{(-T/\tilde{\eta}_i) + 1} \tag{28}$$

and re-expressing in terms of $\tilde{\eta}_i$:

$$\frac{1}{\tilde{\eta}_i} = \frac{1}{1 + T/\eta_i} = \frac{1}{T + \eta_i} \tag{29}$$

Finally, substituting $1/\tilde{\eta}_i$ into the expression for ζ yields:

$$\xi = \frac{\dfrac{dy_t}{d\ln S_t}}{-T\dfrac{dy_t}{d\ln S_t} + 1} = \frac{\displaystyle\sum_{i=1}^{I} \frac{b_i}{T + \eta_i}}{\displaystyle\sum_{i=1}^{I} \frac{b_i \eta_i}{T + \eta_i}} \tag{30}$$

which captures the price impact of a 1% increase in debt supply as a function of investors' marginal responses (b_i) and yield elasticities, assuming all else remains equal.

This expression shows that the elasticity of yields with respect to debt issuance depends on two key elements: (i) the marginal absorption capacity of each investor group, captured by $b_i = dZ_{i,t}/dS_t$, and (ii) the elasticity of demand with respect to yields, η_i, which reflects investors' demand sensitivity. A larger b_i raises the contribution of investor group i to both the numerator and the denominator, but its effect is proportionally larger in the denominator —where it is multiplied by η_i— thereby reducing the aggregate yield sensitivity to the supply shock.

Intuitively, when an investor absorbs a higher share of issuance (i.e. their demand becomes more responsive to increases in debt supply) it means the Government has it easier to allocate the same quantity of bonds, which therefore dampens the overall responsiveness of yields. Similarly, an increase in η_i —an investor group whose demand is more elastic to yields— reduces the numerator and increases the denominator in a way that lowers ξ, since a more yield-responsive group adjusts demand more aggressively when yields increase. Thus, the sensitivity of yields to a supply shock decreases when absorption becomes concentrated in investor groups with relatively elastic demand and higher responsiveness to debt issuance.

4.3 Quantifying Yield Sensitivities

With the demand elasticities in hand, I can now address the key quantitative question: how much do yields move when investors adjust their portfolios or when the government issues additional debt —that is, when the market is hit by demand or supply shocks. In this subsection, I translate the estimated pseudo-yield and GIV elasticities into concrete measures

of yield sensitivity, showing how differences across investor groups map into observable price effects in the Colombian sovereign bond market.

Using the elasticities estimated under the pseudo-yield and granular-IV approaches, I map the theoretical expressions in Sections 4.1 and 4.2 into empirical measures of price impact. Table 5 reports the results based on the pseudo-yield identification. A 1% reduction in foreign holdings raises average yields by roughly 2.8 basis points, while an equivalent decline in pension fund demand increases yields by about 4.4 basis points. Banks generate a similar effect to foreigners (2.9 bps), whereas trusts, public entities, and insurers produce more limited price adjustments. The implied supply elasticity suggests that a 1% increase in total sovereign debt outstanding is associated with a yield rise of 36 basis points. Overall, these magnitudes are consistent with a market where large domestic institutional investors, particularly pension funds, absorb a significant portion of marginal shocks and consequently exert a strong influence on yield dynamics.

Table 5: Yield Sensitivity to Demand and Supply Shocks (Pseudo-Yield Approach)

Group	Average share	Demand elasticity to yield	Yield sensitivity to a 1% decrease in holdings (bps)
Foreigner	20.5 %	4.01	2.8
Pension funds	31.8 %	1.18	4.4
Banks	20.9 %	1.81	2.9
Fiduciaries	13.4 %	2.69	1.8
Public entities	7.0 %	4.43	1.0
Insurance firms	2.6 %	-0.17	0.4
Brokerage firms	0.8 %	1.66	0.1
Others	3.1 %	1.79	0.4
			Yield sensitivity to a 1% increase in debt (bps)
Supply shock			46.7

Authors' calculations. Data from DCV. The sample period is 2013–2025. The table presents yield impact calculations based on equations 20 and 30.

Turning to the GIV-based results in Table 6, several important patterns emerge. First, the cross-sectional ordering of investors by price impact remains broadly unchanged relative to the pseudo-yield estimates. Pension funds continue to exert the strongest influence on yields, followed by foreigners and banks, while fiduciaries, insurers, and brokerage firms exhibit relatively smaller effects. This stability across identification strategies reassures the robustness of the results on the structure of demand responsiveness.

Second, the magnitude of the estimated sensitivities remains bounded across the two strategies. For most investor groups, the difference in predicted yield movements falls within a narrow range of 0.3–1 basis point. This close alignment indicates that aggregate yield adjustments are not highly sensitive to the source of identifying variation —pseudo-yields or GIV approach— and lends confidence to the interpretation of the elasticities. Supply elasticities also remain similar across specifications: between 37 bps under GIV to 47 bps with pseudo yields.

Table 6: Yield Sensitivity to Demand and Supply Shocks (Granular IV Approach)

Group	Average share	Demand elasticity to yield	Yield sensitivity to a 1% decrease in holdings (bps)
Foreigner	20.5 %	1.4	2.4
Pension funds	31.8 %	3.5	3.7
Banks	20.9 %	4.6	2.5
Fiduciaries	13.4 %	0.8	1.6
Public entities	7.0 %	6.6	0.8
Insurance firms	2.6 %	2.9	0.3
Brokerage firms	0.8 %	1.0	0.1
Others	3.1 %	6.0	0.4
			Yield sensitivity to a 1% increase in debt (bps)
Supply shock			37.3

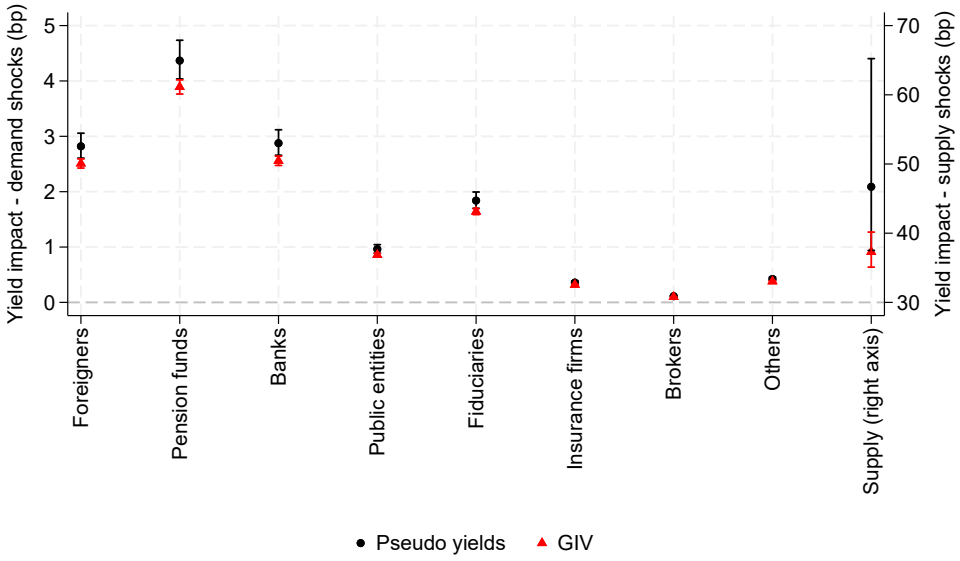
Authors' calculations. Data from DCV. The sample period is 2013–2025. The table presents yield impact calculations based on equations 20 and 30.

Figure 8 synthesizes these findings. Price impacts across investor groups are highly correlated across specifications, and the absolute differences are small relative to the overall dispersion in sensitivities across investors. The similarity of the two sets of results strengthens the empirical credibility of the demand elasticities and suggests that both macro-driven and granular identification strategies capture consistent aspects of the underlying demand curve.

Taken together, these results point to a market structure in which the identity of the marginal investor matters significantly for short-run yield adjustments. Large domestic institutions, particularly pension funds and banks, consistently emerge as pivotal price-setters across methods. Foreign investors exert a meaningful but somewhat less dominant influence once intra-group heterogeneity is accounted for. The overall picture is one of a market combining a stable domestic investor base with responsive marginal participants, where both

aggregate and granular shocks can shape yield dynamics, but in ways that remain remarkably consistent across identification strategies.

Figure 8: Yield impact of demand and supply shocks on Colombian local-currency sovereign bonds (bps)



Source: Authors' calculations. **Note**: The graph reports the estimated average increase in sovereign bond yields generated by demand shocks (defined as a 1% reduction in an investor group's holdings) and by supply shocks (defined as a 1% increase in government debt issuance) holding all else constant. Robust 95% confidence intervals are shown, based on 999 bootstrap replications.

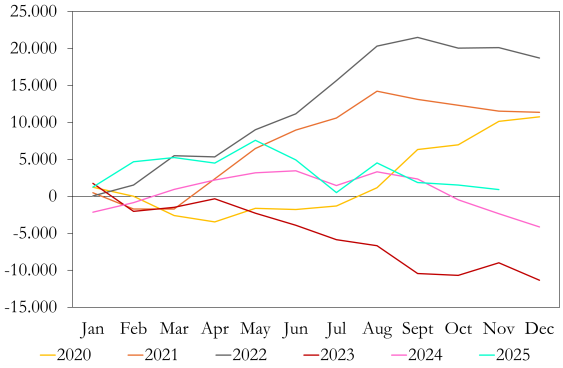
5 Implications for market pricing

The previous results underscore a key point: investor composition influences market pricing. The groups that hold the largest share of outstanding bonds, and those that absorb new issuance at the margin, determine the bond market's vulnerability to global and domestic shocks that prompt investor retrenchment. This is the strength of the framework, it provides a tool to quantify the impact of shocks that materialize through investor trading. In this section, I assess practical applications to realized shocks in the Colombian market, relying on the estimates obtained under the GIV approach, which is my preferred specification because it exploits the granular characteristics of my data and has produced consistent results across methods.

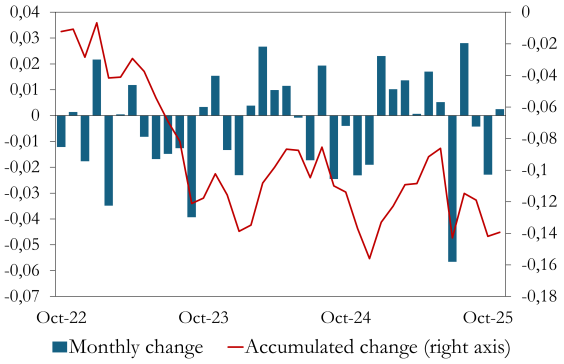
A clear illustration is the recent behavior of foreign investors in Colombia. Since 2023, they have gradually reduced their holdings of Colombian sovereign bonds, bringing their

market share down to around 15% by October 2025 (Graph 9). This withdrawal has occurred in a challenging macroeconomic environment, marked by fiscal deterioration, the temporary suspension of the fiscal rule, the downgrade of local-currency sovereign bonds from investment grade, and global conditions of high interest rates and heightened uncertainty.

Figure 9: Sovereign-bond market flows and holdings behaviour of foreign investors since October 2022



(a) Net flows (COP billion)



(b) Percentage change in holdings

Source: Central Bank of Colombia, Central Securities Depositary (DCV, by its Spanish acronym). Panel A depicts the net flows of foreign investors in the sovereign bond market, whereas Panel B shows the monthly percentage change in their holdings.

The key question is how much these sales have contributed to yield increases. Using the estimated yield impact of a demand shock under the GIV approach (Graph 8), together with the realized change in foreign investors' holdings over the period (Graph 9b), I construct an estimated yield-impact path of foreign-investor sovereign bond sales from October 2023 to November 2025 following the expression:

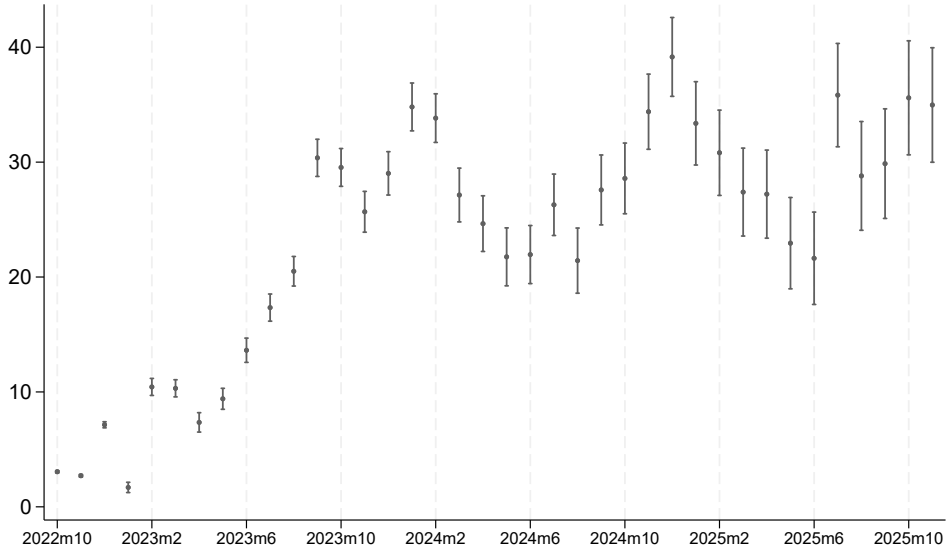
$$I_t = \sum_{t=1} YI_f \cdot \Delta\%\text{holdings}_{f,t} \tag{31}$$

where YI_f is the yield impact of a demand shock originating from the foreign investor group at time t, calculated as in equation 20 under the GIV approach, and $\Delta\%\text{holdings}_{f,t}$ is the monthly percentage change in foreigners' holdings.

The resulting path, shown in Figure 10, indicates that foreign-investor sales have exerted a meaningful and steadily increasing upward pressure on yields since late 2022. The estimated impact is modest in the early months, consistent with relatively small net sales. However, as foreign outflows intensified throughout 2023, and during some episodes in 2024 and 2025, the

estimated yield effect rises noticeably.

Figure 10: Yield response to post-2022 foreign sales in the Colombian sovereign bond market (bps)



Source: Authors' calculations based on equation 31. The figure depicts the yield response associated with the net selling trend by foreign investors since October 2022. Robust 95% confidence intervals are shown, based on 999 bootstrap replications.

A clear pattern emerges from the figure: the estimated price impact increases steadily over time, reaching levels above 20 basis points by the end of 2023 and surpassing 30 basis points toward the end of the sample. This escalation reflects the cumulative effect of sustained foreign divestment. The trajectory exhibits two distinct phases: i) a steep rise during 2023, when foreign investors engaged in persistent month-after-month selling, with virtually no interruptions to the trend; and ii) a plateau around 30 bps during 2024, consistent with a temporary moderation of outflows. The effect intensifies again in 2025 as foreign investors resume more aggressive net sales.

This dynamic illustrates a clear transmission mechanism linking investor trading activity to bond pricing. Even though Colombian yields declined by an average of 22 bps accross the peso-denominated yield curve over the full estimation period (October 2022–October 2025)[3], the counterfactual path suggests that foreign sales exerted material upward pressure on yields, offsetting part of this improvement.

[3]Estimated as the simple average of the point-to-point variation across all yield-curve nodes, calculated using the betas published by the Central Bank of Colombia.

Overall, the evidence indicates that the foreign-selling cycle since late 2022 has mechanically exerted an upward pressure on yields through increased net supply. By late 2025, the cumulative effect of persistent foreign outflows represents a significant contribution to the observed level of Colombian sovereign yields.

5.1 Assessing the market absorption capacity

To assess how the market's absorption capacity for demand and supply shocks has evolved over time (i.e., when an investor group decreases its bond holdings in a given month and/or when the government increases bond supply), I estimate equations 20 and 30 on a monthly basis.

For equation 20, which gives the yield impact associated with a demand shock from an investor group, I use the monthly shares (s_i) of each investor group in total bonds outstanding. Since this estimation is interpreted as the yield impact of a 1% decrease in a group's holdings, in order to obtain a common shock that can be interpreted as the yield impact of any group selling the equivalent of 1% of total bonds outstanding in a given month, I transform equation 20 by dividing it by the share of the k-th investor group. With this transformation, the shock is no longer group-specific and can be interpreted as the effect on yields of any investor group selling the equivalent of 1% of total bonds outstanding in a given month:

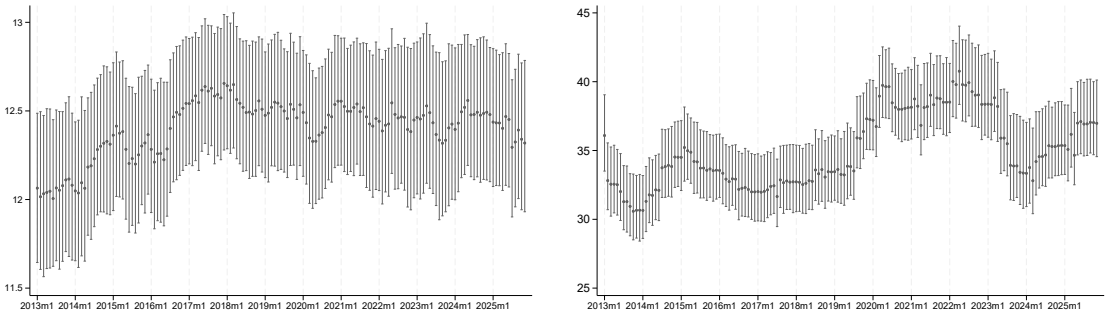
$$\left(-\frac{1}{T}\frac{s_k}{1+\frac{1}{T}\sum_{i=1}^{I} s_i\eta_i}\right)\frac{1}{s_k} = -\frac{1}{T}\frac{1}{1+\frac{1}{T}\sum_{i=1}^{I} s_i\eta_i} \tag{32}$$

For equation 30, which gives the yield impact associated with a supply shock and relies on the propensity of each investor group to absorb issuances (b_i), I estimate the specification in equation 1 using rolling 12-month windows and extract $b^l(z)$ (see B1). The time variation in s_i and b_i therefore allows us to compute the yield impact associated with an investor group selling an amount equivalent to 1% of total bonds outstanding in a given month and/or with a 1% increase in bond supply.

Graph 11 summarizes the evolution of both measures. Panel A shows that the yield impact of a 1% investor sale has changed over time and closely tracks shifts in the composition of the investor base. Before 2014, when foreign participation was low and the investor base was dominated by domestic institutions, the yield response to a demand shock was relatively muted. Between 2014 and 2022, as foreign participation expanded and became a key determinant of market depth, the yield impact of sales increased (i.e., absorption capacity declined)

and remained relatively stable, reflecting a period with little structural change in investor composition. This pattern is consistent with the higher participation of foreign investors in the market (see Graph 1), who exhibit a lower demand elasticity to yields under the GIV model, as shown in Graph 7.

Figure 11: Sovereign-bond market absorption capacity in response to demand and supply shocks over time (bps)



(a) Yield response to demand shocks (b) Yield response to supply shocks

Source: Authors' calculations based on equation 32 and 30. Panel A depicts the yield response to monthly investor sales equal to 1% of total bonds outstanding, whereas Panel B depicts the yield response to monthly 1% increases in total bonds outstanding. Robust 95% confidence intervals are shown, based on 999 bootstrap replications.

Although foreign investors have decreased their participation in the post-2022 period, absorption capacity has remained at levels similar to previous years. This may be the result of foreign investors reducing their holdings while domestic institutions —particularly banks, fiduciaries, and pension funds— absorbed the released supply. Since some of these domestic investors, especially fiduciaries, exhibit lower demand elasticities, the market has remained sensitive to demand imbalances.

Panel B reveals an analogous pattern for the absorption of new issuances. The yield impact of a 1% increase in bond supply is lower before the 2014 increase in the propensity of foreign investors to absorb bond issuance (see Graph B1), decreases again during the post-2022 period of foreign deinvestment, but rises sharply in 2025 as fiduciaries and banks take over as the marginal absorbers. This indicates that market absorption conditions tightened as the absorption of new issuances shifted toward less yield-elastic holders. Taken together, both panels suggest that the Colombian sovereign bond market has become more vulnerable to demand and supply shocks in recent years, driven primarily by structural changes in the investor base.

6 Concluding remarks

This paper examines how investor heterogeneity shapes the transmission of shocks in Colombia's sovereign bond market. Using investor–security microdata and two complementary identification strategies —the pseudo-yield approach and the granular instrumental variable (GIV)— I estimate demand elasticities across major investor groups and map them into yield impacts within a general-equilibrium framework.

The results show consistent patterns. Pension funds and banks absorb a large share of marginal issuance and hold a significant portion of the stock of debt, giving them substantial influence on equilibrium yields despite exhibiting relatively high demand elasticities. Foreign investors display lower own-yield elasticities but account for a smaller share of supply absorption, which nonetheless gives them a meaningful effect on yields. Translating these elasticities into yield effects shows that a 1% change in an investor group's holdings moves yields by roughly 2–5 basis points, while a 1% increase in total debt raises yields by around 37–47 basis points.

Applying these estimates to recent market dynamics illustrates their practical relevance. The foreign divestment episode since late 2022 has generated a gradual but non-negligible upward pressure on yields, exceeding 30 basis points by 2025. The time-varying analysis also shows that market absorption capacity has become more constrained as marginal absorption shifted toward groups with lower elasticities. As a result, sensitivity to both demand and supply shocks has remained elevated despite the decline in foreign participation.

These findings underscore the importance of the distribution of total outstanding holdings and issuance absorption across investor types. Shifts that reduce the role of relatively more elastic investors, such as pension funds, can amplify the market impact of episodes of foreign retrenchment or increases in government financing needs. Overall, Colombia's sovereign bond market operates in a structure where long-term domestic institutions anchor supply absorption, while more flexible investors shape marginal yield responses. Monitoring these dynamics is therefore essential for assessing market resilience and understanding yield movements.

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Appendix A Baseline regression results

The results in Tables A1 and A2 provide a complete view of the estimated coefficients for the bond-level and macroeconomic controls under the pseudo-yield and GIV specifications. Several regularities emerge across investor groups and identification strategies.

Regarding bond characteristics, liquidity, proxied by the bid-ask spread (BAS), consistently matters for portfolio decisions. Under the pseudo-yield approach, a narrower spread —indicating higher liquidity— is associated with larger holdings for nearly all groups. The GIV specification broadly confirms this pattern, though the magnitude of the BAS coefficients is larger for some groups (e.g., banks), reflecting the fact that GIV captures more localized price pressure and, therefore, stronger responses to security-level liquidity conditions. Coupon rates are also positively associated with demand across most groups in both specifications, indicating that carry incentives play a systematic role, especially for foreign investors, banks, and fiduciaries. There are few negative or insignificant coefficients —such as those for insurance firms in the pseudo-yield case.

On macroeconomic conditions, several macro controls show stable directional effects across specifications. A higher debt-to-GDP ratio increases demand for foreigners and public entities under both approaches, possibly reflecting the mechanical link between issuance and availability of investable cheaper-than-usual supply. Banks and insurers, by contrast, tend to reduce holdings when debt-to-GDP rises, consistent with more conservative risk-management frameworks. Core inflation generally reduces demand among fiduciaries, public entities, and some domestic intermediaries under both specifications, capturing the erosion of real returns and higher uncertainty about the monetary-policy outlook. The fiscal deficit coefficient is positive for foreigners and public entities in both approaches, suggesting that episodes of larger issuance may create reinvestment opportunities or provoke mechanical increases in exposure due to supply expansion. GDP growth plays a relatively limited role overall, but the signs are consistent across specifications: weaker growth is associated with lower demand for risk-sensitive intermediaries such as banks and insurers.

The coefficient on $IDOAM$, a financial conditions index where lower values indicate looser local conditions, is generally positive under the pseudo-yield approach for several investor groups. This implies that tighter domestic financial conditions are associated with higher bond demand by those institutions, a pattern consistent with periods in which local market stress induces domestic investors to rebalance toward safer, more liquid sovereign securities. Under the GIV specification, the pattern becomes more heterogeneous, with some groups (notably foreigners and fiduciaries) displaying negative coefficients. These negative signs indicate that, for investor groups characterized by substantial intra-group heterogeneity, episodes of looser local financial conditions may lead to heterogeneous investor-level responses that the granular instrument is able to reveal. The contrast across specifications reflects the nature of the instruments: pseudo-yields capture broad, market-wide fundamentals using aggregated data, whereas the GIV isolates localized responses to idiosyncratic investor-level shocks that may differ substantially within each investor group.

Overall, the patterns across the two specifications are broadly aligned. The sign and economic interpretation of most bond and macro-level controls remain stable, supporting

the view that both identification strategies isolate consistent drivers of portfolio decisions. Differences in magnitude —particularly for liquidity and macro variables under the GIV specification— reflect the ability of the granular instrument to capture investor-level heterogeneity and more localized responses to shocks. Despite these differences, the qualitative effects of the controls are robust across methods.

Table A1: Demand System Results - Pseudo yield apprach

	Foreigners	Pension Funds	Banks	Public Entities	Fiduciaries	Insurance firms	Brokerage firms	Others
$y_t(m)$	4.011***	1.177***	1.813***	4.426***	2.693***	-0.173	1.661***	1.785***
	(0.929)	(0.451)	(0.418)	(1.061)	(0.604)	(0.261)	(0.434)	(0.500)
$y_t(-m)$	-3.494***	-1.076**	-1.541***	-3.374***	-2.394***	0.260	-1.396***	-1.230**
	(0.910)	(0.442)	(0.409)	(1.038)	(0.592)	(0.256)	(0.425)	(0.490)
BAS	-0.068***	-0.030***	-0.025***	-0.099***	-0.035***	0.013***	-0.014**	-0.052***
	(0.016)	(0.008)	(0.007)	(0.018)	(0.010)	(0.004)	(0.007)	(0.008)
Coupon rate	0.488***	-0.035	0.177***	0.388***	0.230***	-0.026**	0.283***	0.323***
	(0.046)	(0.022)	(0.021)	(0.053)	(0.030)	(0.013)	(0.022)	(0.025)
CDS5Y	-0.008**	-0.001	-0.001	-0.013***	-0.004*	-0.001	-0.002	-0.005***
	(0.003)	(0.002)	(0.002)	(0.004)	(0.002)	(0.001)	(0.002)	(0.002)
Debt to GDP	0.098***	-0.000	-0.012*	0.188***	0.012	-0.007*	-0.007	0.032***
	(0.014)	(0.007)	(0.006)	(0.016)	(0.009)	(0.004)	(0.007)	(0.008)
Core inflation	-0.315	-0.092	-0.182**	-0.523**	-0.233*	0.069	-0.149	-0.407***
	(0.201)	(0.098)	(0.091)	(0.229)	(0.131)	(0.057)	(0.094)	(0.109)
Fiscal deficit	0.266***	0.063	0.014	0.518***	0.070	-0.028	-0.030	0.096*
	(0.094)	(0.046)	(0.042)	(0.107)	(0.061)	(0.026)	(0.044)	(0.051)
GDP Growth	0.026	-0.009	-0.004	-0.025	0.012	-0.026***	-0.002	0.009
	(0.020)	(0.010)	(0.009)	(0.023)	(0.013)	(0.006)	(0.009)	(0.011)
IDOAM	0.792**	0.160	0.278*	1.154***	0.496**	-0.171*	0.090	0.677***
	(0.316)	(0.154)	(0.142)	(0.359)	(0.206)	(0.089)	(0.148)	(0.171)
Observations	1329	1329	1329	1329	1329	1329	1329	1329
Maturity F.E.	✓	✓	✓	✓	✓	✓	✓	✓
Kleibergen-Paap Statistic (first stage)	11.163	11.202	11.202	11.010	11.202	11.202	11.202	11.202

Table A2: Demand System Results - Granular instrumental variable approach

	Foreigners	Pension Funds	Banks	Public Entities	Fiduciaries	Insurance firms	Brokerage firms	Others
$y_t(m)$	1.438***	3.529***	4.587***	6.556***	0.800***	2.927***	0.979***	5.983***
	(0.096)	(0.194)	(0.388)	(1.278)	(0.079)	(0.369)	(0.224)	(0.914)
$y_t(-m)$	-6.004***	-4.180***	0.262	1.864**	-1.144***	2.057	-0.414**	-2.068***
	(0.425)	(0.256)	(0.411)	(0.908)	(0.066)	(1.291)	(0.171)	(0.643)
BAS	0.203***	-0.016**	-0.148***	-0.262***	0.002	-0.153***	-0.013***	-0.093***
	(0.019)	(0.007)	(0.009)	(0.045)	(0.003)	(0.053)	(0.005)	(0.018)
Coupon rate	0.044***	0.104***	0.085***	0.070	0.076***	-0.010	0.004	0.147***
	(0.009)	(0.024)	(0.021)	(0.050)	(0.008)	(0.027)	(0.011)	(0.043)
CDS5Y	0.044***	0.003	-0.056***	-0.097***	0.004***	-0.055***	-0.007***	-0.049***
	(0.004)	(0.002)	(0.003)	(0.015)	(0.001)	(0.015)	(0.002)	(0.007)
Debt to GDP	0.143***	0.244***	0.411***	0.665***	0.043***	0.202***	0.087***	0.552***
	(0.008)	(0.015)	(0.033)	(0.116)	(0.007)	(0.026)	(0.021)	(0.081)
Core Inflation	3.676***	1.026***	-2.657***	-4.866***	0.296***	-3.153***	-0.223*	-1.625***
	(0.283)	(0.127)	(0.202)	(0.798)	(0.067)	(1.078)	(0.118)	(0.355)
Fiscal deficit	-0.865***	0.144***	1.301***	2.318***	-0.059**	1.195***	0.123**	1.253***
	(0.073)	(0.047)	(0.076)	(0.349)	(0.029)	(0.350)	(0.055)	(0.194)
GDP Growth	0.102***	-0.004	-0.193***	-0.334***	0.021***	-0.170***	-0.033***	-0.163***
	(0.008)	(0.007)	(0.011)	(0.052)	(0.004)	(0.049)	(0.009)	(0.028)
IDOAM	-4.987***	-1.349***	3.423***	6.404***	-0.429***	4.418***	0.152	1.832***
	(0.393)	(0.176)	(0.282)	(1.054)	(0.088)	(1.501)	(0.156)	(0.465)
Observations	196,354	10,604	44,481	13,995	46,010	21,332	24,442	8,770
Number of investors	369	5	29	10	30	18	24	13
Investor F.E.	✓	✓	✓	✓	✓	✓	✓	✓
Maturity F.E.	✓	✓	✓	✓	✓	✓	✓	✓
Bond characteristics	✓	✓	✓	✓	✓	✓	✓	✓
Macro controls	✓	✓	✓	✓	✓	✓	✓	✓

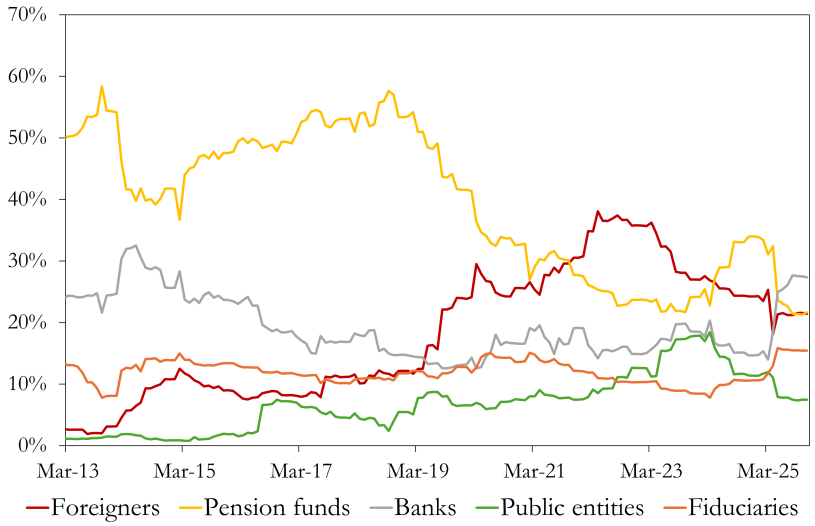
Appendix B Marginal absorption of bond issuance over time

To quantify how each investor group contributes to the absorption of new sovereign debt over time, I estimate the specification in equation 1 using rolling 12-month windows and extract the corresponding marginal absorption parameters $b^l(z)$. This procedure allows us to capture gradual changes in investor behavior and portfolio adjustments, while smoothing short-term fluctuations driven by market noise or temporary balance-sheet constraints.

Figure B1 reports the evolution of the estimated marginal absorption capacity by investor group. The patterns reveal substantial heterogeneity across groups. For instance, foreign investors exhibit a clear downward trend in their marginal contribution to absorbing new issuance, consistent with their gradual reduction in TES holdings after 2022. In contrast, banks and fiduciaries show a marked increase in their relative absorption role, reflecting their greater involvement in market activity during the period of foreign divestment. Pension funds display a more stable but still cyclical absorption pattern, aligned with their long-term portfolio dynamics.

Overall, the figure highlights pronounced shifts in the distribution of marginal absorption across the investor base, which in turn help explain the time variation in the price impact of supply shocks documented in the main text.

Figure B1: Marginal absorption of bond issuance by group over time (% of total debt issuance)



Source: Authors' calculations based on equation 1. The figure shows the estimated marginal absorption capacity by investor group in a given month, expressed as $b^l(z)$, obtained using 12-month rolling windows.