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Robust Assessment of External Vulnerabilities in an Emerging Market During Stress Scenarios

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Abstract

Foreign portfolio flows constitute a key component of economic activity in small open economies such as Colombia. The dynamics of these flows are subject to the influence of both external (*push*) factors and domestic (*pull*) factors. Consequently, economic crises and episodes of financial distress can severely undermine investor confidence, leading to a sharp decline in foreign capital inflows and the subsequent liquidation of local assets, commonly referred to as a *sudden stop* and *sudden start*. Such events can have lasting adverse effects on various facets of the economy, including GDP growth, employment rates, financial stability, and investor sentiment. This paper delves into the dynamics of portfolio external investment and which factors can explain them on major Latin American economies and quantifies the potential reduction in foreign investors' holdings of local assets under high external risk scenarios. For the Colombian case, we estimate a potential liquidation of 43.8% of total foreign investors portfolio under the most severe assumed scenario. Our work provides insights to be integrated into various exercises aimed at formulating precautionary policy measures, such as those entailed in the evaluation of adjustments to foreign exchange reserves and other external buffers by the central banks.

Keywords: Foreign Portfolio Flows, Small Open Economies, Economic Crises, Sudden Stop, Sudden Start, Financial Distress, Pull Factors, Push Factors.

JEL: F21, F31, F32, F34, G15, G17, E44.

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Introduction

Foreign portfolio flows are a key component of economic activity in small open economies such as Colombia, encompassing investments in stocks, bonds, and diverse financial assets. These flows provide essential external funding, particularly in scenarios where domestic savings are inadequate to meet investment demands, and they help diversify the investor base. Consequently, foreign portfolio flows play a pivotal role in financing development projects and stimulating investment, thereby fostering economic growth and development. Additionally, these flows significantly contribute to the development and liquidity of domestic financial markets, which are fundamental to economic resilience.

Moreover, foreign portfolio flows have a pronounced impact on exchange rate dynamics. Inflows of foreign capital often result in currency appreciation and help mitigate inflationary pressures stemming from pass-through effects. Conversely, sudden reversals in portfolio flows can trigger currency depreciation, increase exchange rate volatility, and pose substantial challenges to economic stability.

Despite their manifold benefits, portfolio flows entail inherent risks that policymakers must navigate with precision. These risks include volatility, currency mismatches, and susceptibility to external shocks. Striking a balance between capitalizing on the benefits and mitigating the risks is paramount for small open economies like Colombia to effectively leverage foreign portfolio flows as catalysts for sustained economic growth and development.

Therefore, identifying the vulnerabilities to which the Colombian economy may be exposed during a sudden stop and a potential sudden start from investors is a critical concern for those responsible for economic policy in Colombia. It is imperative for policymakers to understand the factors influencing these capital flows and to anticipate potential outflows under stressed scenarios, as these flows act as conduits for external shocks that can disrupt the internal functioning of the economy.

Global or local economic crises and episodes of financial distress have the potential to undermine investor confidence, leading to a sharp decline in foreign capital inflows—commonly referred to as a sudden stop. Such events can have enduring adverse effects on various aspects of the economy, including GDP growth, employment rates, financial stability, and overall investor sentiment.

Among the direct manifestations of external vulnerabilities during sudden stops are short-term external debt and current account deficits. During periods when access to financial markets is severely restricted or non-existent, policymakers have limited options for refinancing short-term obligations. Additionally, countries with current account deficits are prone to experience significant declines in imports due to the loss of external funding sources and sharp currency depreciation, which in turn can lead to inflationary pressures.

Following a sudden stop, a decline in investor confidence may precipitate a phenomenon known as a sudden start, characterized by the exodus of both local and offshore investors from domestic markets. This flight from local assets, such as stocks and bonds, can exert a detrimental wealth effect on households and companies, thereby dampening consumption.

In Colombia, government bonds (known locally as TES) constitute the most significant publicly traded assets, predominantly held by local pension funds and offshore investors. The substantial increase in offshore investors' positions in TES between 2014 and 2017 renders this asset class particularly susceptible to adverse shifts in foreign economic conditions. In line with this, foreign investors exert considerable influence on local stock markets, underscoring the importance of examining vulnerabilities arising from local capital markets.

In the Colombian context, assessments of external vulnerabilities to a sudden stop or sudden start traditionally rely on insights from previous episodes of significant capital outflows from other emerging markets and assumptions derived from periods of local market stress. These evaluations predominantly rely on observed data prints, such as the maximum observed depreciation of the Colombian peso or the decline in the value of Colombian assets under certain periods, building straightforward forecasts of foreign portfolio flow behavior.

However, there is an opportunity to develop robust models that adopt a comprehensive and holistic perspective on the multiple factors influencing portfolio flows in an emerging open economy like

Colombia, to provide more precise tools for policymaking. Such a tool would be valuable for economic policymakers, enabling them to assess potential outflows from local capital markets during and after an external crisis event, considering the underlying determinants of these portfolio flows.

Given these considerations, economic policymakers must incorporate accurate forecasts of future trends in foreign portfolio flows. Macroeconomic shifts can lead to fluctuations in the volume of investments held by various stakeholders in local markets, including foreign investors, thereby impacting the assessment of vulnerabilities to sudden stops. With these forecasts, policymakers can determine appropriate levels of foreign exchange reserves and other external buffers to ensure the country can meet its external debt obligations during stress scenarios. Maintaining adequate external buffers is crucial for preserving investor confidence in the local financial markets.

Consequently, our research aims not only to characterize foreign portfolio flows and identify their sensitivity to an economic shock but also to analyze their potential behavior over time to provide robust policy recommendations for mitigating economic risks. To achieve this objective, we will employ a linear model and a panel data approach, incorporating information from regional peers, along with the local projections' methodology proposed by Jordà (2005). This approach aims to provide a nuanced understanding of the dynamic interactions within foreign portfolio investment and both local and external financial conditions, thereby offering valuable insights for assertive policymaking.

Specifically, this paper will first present an approach to modeling portfolio investment flows by analyzing the potential factors that can influence their behavior using an Ordinary Least Squares (OLS) methodology. This initial analysis will provide preliminary results that will subsequently be contrasted with more robust findings derived from a panel data model (incorporating data from our regional peers). Finally, the study will examine the behavior of these flows in response to deteriorating external conditions and various influencing factors. This will facilitate the construction of stress scenarios and potential outcomes that could be observed in the Colombian context over a one-year period.

Accordingly, this document is structured into five sections. This first section serves as the introduction. The second section provides a comprehensive review of the literature pertaining to portfolio investment flows. The third section details the data and information sources utilized in the analysis. The fourth section presents the econometric models and their findings, and the document concludes with the fifth section, which synthesizes the main conclusions and policy implications derived from the study.

Literature Review

In the four years following the 2008 Global Financial Crisis (GFC), emerging markets experienced significant capital inflows, predominantly driven by the initial three phases of the Federal Reserve's quantitative easing program. These inflows substantially benefited these economies. However, the robustness of these flows diminished markedly as commodity prices declined and the Federal Reserve began to normalize its monetary policy. Starting in December 2015, the Federal Reserve initiated a reduction of the liquidity injected during the GFC and commenced a new cycle of interest rate hikes. More recently, these capital flows have exhibited considerable volatility, disrupted by events such as the COVID-19 pandemic, Russia's invasion of Ukraine, geopolitical tensions in the Middle East, the slowdown of the Chinese economy, and the pandemic itself (Fitch Ratings, 2024).

These turbulent periods have catalyzed extensive research into the determinants of capital flow dynamics. The literature on capital flow determinants underscores the influence of both international financial conditions (*push* factors) and the specific characteristics of recipient economies (*pull* factors) (Dornbusch et al., 1995; Calvo & Reinhart, 2000; Calvo, Izquierdo & Mejía, 2004). Push factors, driven by the global supply of capital, include interest rates and GDP growth rates in advanced economies, global risk factors such as the VIX (S&P 500 Volatility Index), and commodity prices. Pull factors, originating from recipient economies, encompass domestic interest rates, domestic GDP growth rates, and country-specific attributes such as the exchange rate regime, the degree of capital account openness, institutional quality, financial market depth, macroeconomic stability, and stages of economic development (Kang & Kim, 2019).

The interplay of push and pull factors highlights the complexity of capital flow dynamics. A comprehensive understanding of these determinants is essential for policymakers in emerging markets as they navigate the challenges posed by fluctuating capital inflows and strive to maintain economic stability amidst global financial uncertainties.

Furthermore, the debate over whether push or pull factors are the primary determinants of capital flows to emerging markets has been extensive. Koepke (2015) argues that push factors are most significant for portfolio flows, somewhat less so for banking flows, and least for foreign direct investment (FDI). Conversely, while pull factors are also pertinent, they are particularly influential in the context of banking flows. Kang and Kim (2019) identify both push and pull factors as significant drivers of capital flows to advanced economies; however, they note that push factors predominantly drive flows to emerging markets. Notably, there is substantial heterogeneity among emerging economies. For instance, in Asian countries, both push and pull factors are influential, akin to advanced economies, whereas in Eastern Europe, U.S. interest rates are the predominant factor.

Hannan (2018) provides a comprehensive review of the evolution of capital flows to emerging markets, underscoring that the relative importance of push and pull factors has varied over time and differs based on the type of capital flow (i.e., portfolio, banking, FDI). Hannan concludes that both types of factors are critical: while surges in capital flows are driven by external push factors, domestic pull factors determine whether a specific emerging market receives those inflows. Similarly, Cerutti, Claessens, and Puy (2019) find that aggregate inflows to emerging markets comove significantly, suggesting that global push factors largely explain these common dynamics. However, they also observe that the relevance of these factors varies by the type of flow.

Regarding the role of global risk as a primary push factor influencing the global capital flows cycle, Habib and Venditti (2019) demonstrate that not all global risk shocks impacting the global financial cycle have uniform effects on capital flows. Specifically, changes in global risk driven by pure financial shocks exert the largest impact on these flows, followed by shocks stemming from U.S. monetary policy.

Furthermore, in examining the transmission mechanism of global risk to capital flows, Habib and Venditti (2019) highlight a traditional trilemma: countries that are more financially open and maintain a strict exchange rate peg are more vulnerable to global risks. This trilemma is predominantly driven by one category of cross-border flows, termed "other investment," which underscores the critical role of cross-border banking loans in the context of the global financial cycle.

The literature on capital flow determinants further distinguishes between cyclical and structural pull factors. Cyclical factors include variables such as economic growth, fiscal deficits, foreign debt ratios, and yields on domestic assets. Structural factors encompass institutional quality, macroeconomic stability, financial openness, local financial market development, outstanding sovereign debt, trade openness, exchange rate regimes, and foreign reserves. Investors frequently focus on composite measures of these factors, such as credit ratings (López & Stracca, 2021). Historically, structural factors have been pivotal in determining long-term capital flow patterns (Byrne & Fiss, 2016). However, in the aftermath of the GFC, the significance of structural factors has diminished, as improvements in these areas became prerequisites for emerging market economies to be included in international bond and equity indexes and to attract a broader pool of portfolio investors. Currently, cyclical pull factors are perceived to have assumed greater importance in driving capital flows to emerging markets since the GFC (López & Stracca, 2021). Nevertheless, Koepke (2015) cautions that recent literature may have overemphasized the importance of cyclical factors at the expense of longer-term structural trends.

Research has demonstrated that sudden halts in capital inflows can have profound impacts on aggregate demand, employment, and the financial stability of firms, governments, and households (Cavallo et al., 2013). Forbes and Warnock (2012) note that the study of extreme capital flow episodes originated with Calvo (1998), who introduced the concept of "sudden stops," characterized by sharp declines in net capital inflows. This definition has since been expanded to encompass various forms of capital flow disruptions.

Bordo, Cavallo, and Meissner (2010) provide further elaboration, indicating that sudden stops are typically accompanied by downturns in economic activity and signify an abrupt cessation of foreign investors' willingness to finance a country's current account deficit. These events are frequently precipitated by external factors, such as increases in interest rates in lending countries, which diminish capital outflows, or sudden shifts in investor expectations regarding debt default risk in the borrowing country. The repercussions of such sudden stops can be severe, leading to significant economic contractions, financial crises, and enduring adverse effects on economic growth and stability.

Additionally, Cavallo and Frankel (2004) emphasize that the openness of an economy can significantly influence its vulnerability to sudden stops. More open economies may be more exposed to the volatility of international capital flows, highlighting the need for robust macroeconomic policies and external buffers to mitigate these risks.

This body of research underscores the critical importance of comprehensively understanding the triggers and consequences of sudden stops. Policymakers must consider both external and internal factors when formulating measures to mitigate the impact of capital flow volatility. Effective strategies might include maintaining adequate levels of foreign exchange reserves, robust macroeconomic policies, enhancing institutional quality, and fostering financial market development to bolster resilience against external shocks.

Numerous methodologies exist for identifying sudden stops in capital inflows (Calvo et al., 2004; Catão, 2007). The most prevalent approach involves identifying periods where inflow variations fall two standard deviations below their historical average. Alfonso and Osorio (2016) illustrate that applying Cavallo et al.'s (2015) methodology to Colombia reveals evidence of sudden stops in 2006 and between 1998 and 2000. These periods were characterized by low levels of portfolio investment, with sudden stops primarily driven by adjustments in other components of capital inflows, such as foreign direct investment. Our study, however, specifically focuses on foreign portfolio investment flows.

The degree of an economy's openness can significantly influence its vulnerability to sudden stops (Cavallo & Frankel, 2008), underscoring the importance of macroeconomic tools as external buffers to counteract these risks. Specifically, given the substantial growth of foreign portfolio investment inflows to Colombia since 2014, particularly in the public debt market, Vargas et al. (2019) proposed a novel liquidity coverage ratio-type methodology to assess foreign exchange reserve adequacy in the Colombian case. According to this methodology, the sum of international reserves (IR) and the International Monetary Fund (IMF) Flexible Credit Line (FCL) must cover the expected current account deficit, external debt amortizations, and estimated potential portfolio outflows from foreigners and non-residents over a one-year horizon. This approach extends the Guidotti-Greenspan rule, which stipulates that foreign exchange reserves should exceed debt obligations maturing within one year (Greenspan, 1999). Alongside the IMF's Assessing Reserve Adequacy framework, these are considered critical metrics for central banks to measure reserve adequacy (Arslan & Cantú, 2019).

This research focuses on foreign portfolio investment inflows, as their increase in the Colombian case has established a crucial linkage between local and international financial markets. Both pull and push factors significantly influence these flows, underscoring the necessity for a comprehensive understanding of their nature. Also, it is essential to quantify potential changes in these flows accurately to design appropriate measures that effectively mitigate associated risks and ensure economic stability.

By concentrating on foreign portfolio investments, this study aims to provide a nuanced understanding of the dynamics and implications of sudden stops within the emerging markets' specific context, particularly in Colombia. As mentioned, the significant increase in these inflows since 2014 underscores the importance of comprehending the interplay between local economic conditions and global financial factors, thereby offering insights into the resilience and vulnerabilities of local financial markets and the economy overall.

Data and Sources

The primary aim of this study is to identify the vulnerabilities encountered by the Colombian economy in the event of a sudden shift in foreign portfolio investment flows. This is accomplished by estimating the potential response of these flows over a policy-relevant horizon to changes in both internal and external conditions. While this topic can be approached in various ways, our current efforts focus on precisely characterizing these capital flows and providing a more comprehensive interpretation of their determinants.

Therefore, all models presented in this study utilize portfolio investment flows as the dependent variable. In the case of Colombia, these flows encompass net purchases of sovereign debt securities and equities, with monthly periodicity. We do not consider corporate debt flows due to data availability for the Colombian case. However, it can be reasonably assumed that the participation of foreign investments in this particular market in Colombia is quite limited. This assumption is based on the market's relative underdevelopment and lack of depth, especially when compared to more established markets such as the Colombian public debt market (Leiton-Rodríguez et al., 2014).

The dataset spans from February 2006 to December 2023, encompassing periods of adverse external events such as the 2008 financial crisis and the COVID-19 scenario. These flows are denominated in U.S. dollars and standardized to facilitate interpretation as deviations around the mean of these flows. This standardization eases comparison with our regional peers when extending the analysis.

The portfolio flow data for Colombia is sourced from information published by the Colombian Stock Exchange regarding the participation of investors in the local equity market. Additionally, data is extracted from the *Depósito Central de Valores* (DCV), which serves as the public debt custodian managed by the Central Bank of Colombia. Furthermore, further exercises incorporate select regional peers, utilizing estimates of monthly portfolio flow data provided by the Institute of International Finance (IIF) Capital Flows Tracker (which provides a broader approach to portfolio flows, including corporate debt).

The explanatory variables considered in our models include the following:

1. A synthetic indicator reflecting global risk conditions, which is essential as we will focus on the effect of external economic shocks or push factors on portfolio flows. This indicator is constructed using the principal components methodology, capturing the common variation among the following series:

    1.1. The CBOE Volatility Index (VIX), is a real-time indicator that captures the volatility of the S&P 500 Index, a stock market index that tracks the performance of the largest firms in the United States. This measure serves as an indicator of market sentiment, particularly the level of uncertainty among market participants.

    1.2. The VSTOXX, is analogous to the VIX but for the Euro Stoxx 50 index.

    1.3. The MOVE, which gauges price volatility in U.S. government bonds.

    1.4. The Institute for Supply Management (ISM) indicators for the U.S. manufacturing and services sectors, which are leading indicators capturing the monthly performance of the U.S. economy.

    1.5. The 5-year Credit Default Swaps (CDS) for Colombia, Brazil, Mexico, Peru, and Chile. CDS are financial derivatives that provide protection to investors in the event of a default by the issuer of a bond or other debt instrument. They serve as a key indicator of the credit risk associated with a particular country.

    1.6. The Emerging Markets Bond Indices (EMBI) for these countries, excluding Chile. These benchmark indices measure the total return performance of international government bonds of emerging markets relative to U.S. government bonds and, like CDS, are standard tools for evaluating country risk.

    1.7. Citibank's Macro Risk Index and Macro Risk Index for Emerging Markets, which incorporate indicators such as credit spreads, forex, and equity volatility to gauge risk aversion in global

financial markets. These indices range from zero, indicating extreme investor relaxation, to one, indicating intense risk aversion.

Most of this information is directly sourced from Bloomberg. For data with daily frequency, we compute monthly averages. Furthermore, when integrating the ISM indicators into the principal components analysis, they are multiplied by minus one (-1) to ensure that an increase of any of its components signifies a deterioration in economic conditions.

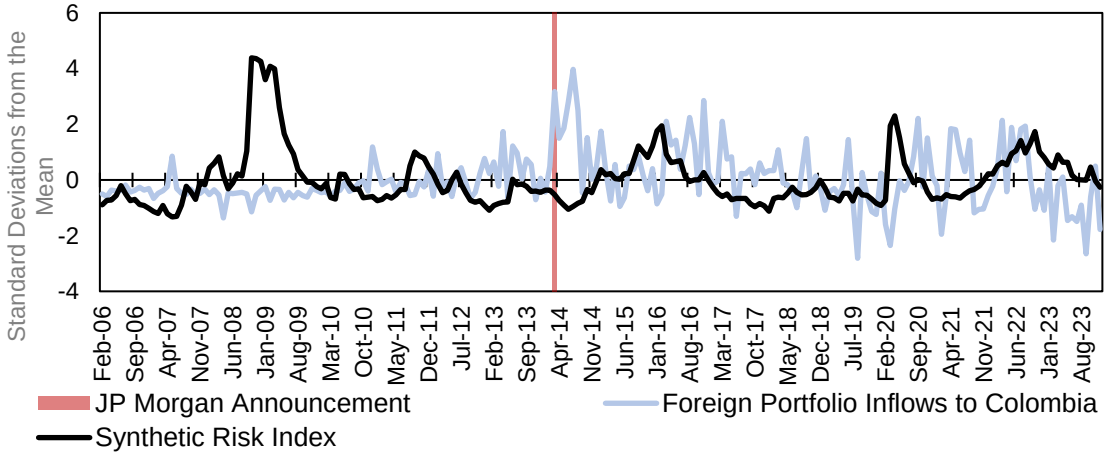
The first principal component extracted from this dataset, capturing approximately 59% of the total variability, is standardized and serves as the synthetic external risk indicator utilized in our analyses. *Table 1* presents the loadings for each original variable on the first principal component (PC1), which provides a notion of the informational contribution of each variable within PC1.

***Table 1*: PC1 Loadings**

VIX	VSTOXX	MOVE	ISM Services	ISM Manufacturing	Citi Macro Risk Index
0.2691056	0.2686045	0.2315535	0.2020851	0.2247192	0.1736021
CDS Colombia	**CDS Brazil**	**CDS Mexico**	**CDS Peru**	**CDS Chile**	**Citi Macro Risk Index EM**
0.2933450	0.2246514	0.2926158	0.2625639	0.2841284	0.2031958
EMBI Colombia	**EMBI Brazil**	**EMBI Mexico**	**EMBI Peru**		
0.2795869	0.2424920	0.1943562	0.3041310		

The high positive and close loadings indicate that all variables significantly contribute to PC1, likely sharing a common underlying factor or trend. These loadings demonstrate that PC1 is substantially influenced by factors affecting credit risk and bond yields in emerging markets. Consequently, PC1 could effectively represent a risk factor for emerging market credit conditions. Additionally, the positive loadings for VIX, VSTOXX, and MOVE indices underscore that market volatility indices are also significant contributors to PC1, suggesting a potential link between emerging market risk and overall market volatility. Furthermore, the loadings for ISM indices highlight that economic activity indicators are pertinent to the risk or trend captured by PC1, indicating a broader economic factor at play.

***Graph 1*: Synthetic Risk Index vs Colombia's Portfolio Inflows**



The indicator adeptly captures instances of heightened external risk, as demonstrated by its response during significant events such as the 2008 financial crisis, where it reached its historical maximum, and the COVID-19 crisis (*Graph 1*). Furthermore, it demonstrates a modest negative correlation coefficient with Colombia's foreign portfolio flow data. This correlation prompts us to further explore additional factors contributing to the behavior of these investors. Additionally, this chart presents a marker that coincides with JP Morgan's announcement in March 2014 regarding

the increase of Colombia's weighting in several of its emerging debt indices, which is essential to understanding the historical dynamics of portfolio investment flows in Colombia, as will be detailed later.

2. The spread between Colombia's 10-year sovereign bonds denominated in dollars and U.S. Treasuries of the same maturity, indicates investors' assessment of the country's risk.
3. One-year exchange rate volatility, estimated using a GARCH(1,1) model applied to daily peso-dollar exchange rate data. This metric is then smoothed by calculating a yearly moving average, which enhances our understanding of its impact on external investors' decisions. This variable is included in a lagged form to address potential endogeneity concerns.
4. The monthly exchange rate depreciation, is derived from daily exchange rate data and subsequently averaged monthly. This variable is instrumental in evaluating the impact of exchange rate fluctuations on the investment decisions of foreign investors.
5. The yield spread between Colombia's 10-year sovereign bonds denominated in local currency and U.S. Treasuries of comparable maturity. Serves as an indicator of yield differentials and potential incentives for carry trade strategies.
6. In line with the previous variable, a dummy variable is included, taking the value of 1 during two specific periods: from December 2008 to December 2015, and from March 2020 to March 2022. During these times, the lower bound of the federal funds rate range was set at 0%, leading interest rates in developed economies to reach historically low levels. This environment prompted investors to seek higher returns in emerging markets. Additionally, this dummy variable interacts with the spread between 10-year sovereign bonds denominated in local currency and U.S. Treasuries of comparable maturity.
7. Growth expectations for the forthcoming year, obtained from Bloomberg on a monthly basis. These projections provide valuable insights into investors' sentiment and optimism regarding Colombia's economic performance, thereby informing investment decisions.
8. The allocation of Colombia in the JP Morgan GBI-EM Global Diversified Bond Index (and the allocation of our peers in the corresponding analyses). This index was devised to monitor the performance of bonds issued by emerging market governments and denominated in their respective local currencies, and changes in country allocations could lead to significant portfolio flows to or from emerging economies by index-driven investors.

   It is pertinent to note that prior to 2014, Colombia experienced limited engagement from foreign investors in its domestic financial markets. During this period, which encompassed the financial crisis of 2008, the impact of external shocks on foreign portfolio flows was limited owing to the restricted presence of these investors in local financial markets.

   Between 2010 and 2014, Colombia embarked on significant reforms in tax regulations and enhanced accessibility for foreign investors to its financial markets. Consequently, JP Morgan notably augmented Colombia's weighting in various emerging debt indices between April and September 2014. This led to a substantial surge in foreign investor participation in the local public debt market, escalating from approximately 4% to 15% within that year, with further increments observed in 2015 and 2016. Subsequently, this involvement stabilized at approximately one-quarter of the total outstanding TES in subsequent years and currently stands at approximately 21%.

   It is noteworthy that JP Morgan's weightings adjustment was announced in March 2014, and this event marked a significant turning point in the dynamics of foreign portfolio investment in Colombia. This announcement signified a regimen change, establishing a new dynamic within the local financial markets due to the increased participation of foreign investors, mirrored in the increased dynamism of those flows after that date as depicted in *Graph 1*.

   In our models, which incorporate an extensive historical dataset, we account for this shift in foreign investor participation through the inclusion of Colombia's share in the GBI EM Global Diversified Index, as before 2014 the estimated impacts of several explanatory variables

included in our models, may have been attenuated due to the constrained offshore presence during that period.

9. A measure comparing net international reserves to the IMF's Assessing Reserve Adequacy (ARA) metric. This indicator serves as a gauge of the economy's resilience to adverse external shocks, thereby assuring external investors of its capability to fulfill foreign exchange obligations even amidst challenging conditions. The IMF considers this ratio adequate when it ranges between 1 and 1.5. These reserves play a critical role in assuring investors, as economies maintaining higher reserve levels typically exhibit reduced vulnerability to significant capital outflows stemming from economic shocks.
10. A binary variable set to 1 upon Colombia's receipt of a formal invitation to join the Organization for Economic Cooperation and Development (OECD) in May 2018. This inclusion underscores Colombia's dedication to fostering sustainable economic growth through adherence to OECD policy standards, potentially influencing investor sentiment. Additionally, an interaction term between this binary variable and the global risk indicator is integrated for further analysis.

All these explanatory variables, excluding the OECD inclusion indicator, undergo standardization. This process ensures comparability in the assessment of their effects alongside the standardized portfolio flow variable in subsequent analyses.

Methodology and Results

OLS Model

Expanding upon the preceding set of variables, our analysis begins with a linear regression model. This analytical framework is extended to include regional counterparts, facilitating insightful comparisons that elucidate the unique dynamics of portfolio investment flows in each country. It is important to note that the OECD inclusion variable reflects Brazil's invitation to join the OECD in January 2022 and Chile's invitation in December 2009. However, this variable cannot be applied to Mexico's model due to its membership since 1995; consequently, this indicator would remain constant at 1 throughout the entire sample period for Mexico.

***Table 2*: OLS Regressions per Country**

	Dependent variable			
	Foreign Net Portfolio Inflows			
	Colombia	**Brazil**	**Mexico**	**Chile**
External Risk Synthetic Indicator	-0.093	-0.272**	-0.156	-0.187
	(0.119)	(0.131)	(0.148)	(0.132)
Spread USD 10Y Bonds	0.011	-0.174	-0.024	0.060
	(0.172)	(0.157)	(0.178)	(0.116)
FX Volatility (Lagged)	-0.368***	0.094	0.200	-0.038
	(0.134)	(0.129)	(0.142)	(0.120)
FX Depreciation (Lagged)	0.167**	0.957***	0.363***	0.001
	(0.071)	(0.173)	(0.111)	(0.075)
Fed Zero Lower Bound	0.300** (0.144)	0.323* (0.193)	0.193 (0.214)	0.442** (0.220)
Rate Differential	0.599***	0.079	0.204	-0.144
	(0.164)	(0.105)	(0.187)	(0.168)
Fed × Rate Diff.	-0.516***	0.374*	-0.374**	0.524***
	(0.171)	(0.191)	(0.172)	(0.186)
Growth Expectations	0.068	0.341***	0.267*	-0.375***

	(0.136)	(0.120)	(0.147)	(0.120)
GBI Share	0.535***	-0.384	0.233***	0.050
	(0.122)	(0.393)	(0.090)	(0.112)
IR / ARA (Lagged)	0.271**	0.132	-0.018	0.049
	(0.106)	(0.115)	(0.107)	(0.113)
OECD Inclusion	-0.749***	0.009		-0.183
	(0.212)	(0.365)		(0.359)
OECD × Risk	-0.103	0.472		-0.373*
	(0.201)	(0.391)		(0.215)
Constant	0.337**	-0.361	-0.089	-0.146
	(0.145)	(0.219)	(0.119)	(0.298)
Observations:	215	215	215	215
R2:	0.224	0.393	0.269	0.210
Adjusted R2:	0.178	0.357	0.233	0.163
Residual Std. Error:	0.909 (df = 202)	0.906 (df = 202)	0.997 (df = 204)	0.974 (df = 202)
F Statistic:	4.871*** (df = 12; 202)	10.908*** (df = 12; 202)	7.512*** (df = 10; 204)	4.472*** (df = 12; 202)

Note: *p<0,1; **p<0,05; ***p<0,01

From the results presented in *Table 2*:

- The international risk variable aligns with expectations, indicating that an increase of one standard deviation in the external risk indicator is associated with a reduction in portfolio investment flows for Colombia by approximately 0.1 deviations, with even greater reductions observed in the other countries analyzed. However, in most cases, this factor lacks statistical significance, and its effect remains relatively small compared to the other estimations. These initial outcomes suggest that, for the countries analyzed, portfolio flows tend to be more closely aligned with regional or idiosyncratic factors. In other words, pull factors seem to be more relevant than push factors.

- The spread between 10-year USD rates exhibits a negative correlation with portfolio inflows in Brazil and Mexico and a positive one in Chile and Colombia, although without statistical or economic significance. Furthermore, the impact observed in the Colombian context is minimal. This relationship achieves a notable magnitude only in the case of Brazil, where an increase in country risk, indicated by a one standard deviation increase in this spread, corresponds to a decline in portfolio investment flows of approximately 0.2 deviations. In this case, the outcome aligns with expectations, as heightened risk perception in emerging economies is expected to dampen foreign investors' appetite.

- Exchange rate volatility emerges as a critical determinant of portfolio investment dynamics in Colombia. Our findings indicate that heightened volatility coincides with a reduction in portfolio investment flows by approximately 0.4 deviations. This outcome is consistent with the anticipated notion that increased volatility signifies greater investment risk, thereby discouraging foreign portfolio investments.

  In the Chilean context, the coefficient is also negative but approaches zero. This finding supports the hypothesis that investors tend to maintain their positions during periods of heightened FX volatility, opting to wait until market conditions stabilize rather than entering or exiting positions. This strategy underscores hedging against exchange rate risks.

  Conversely, in Brazil and Mexico, the relationship between exchange rate volatility and portfolio capital is positive, suggesting that increased volatility may attract portfolio investment. One possible explanation is that the more liquid and deep foreign exchange markets in Brazil and

Mexico accommodate more active investors who perceive higher volatility as an opportunity to capitalize on short-term gains from exchange rate fluctuations.

These results could also suggest that volatility indicates robust health in the foreign exchange market for some countries, while for others, it represents a risk factor. Therefore, a more robust approach is required to accurately identify the relation between foreign exchange market volatility on portfolio investment flows. As will be demonstrated later, once the country-specific heterogeneity is accounted for, foreign exchange market volatility appears to exhibit a positive relationship with portfolio investment flows for our countries' sample.

Note that this variable may be susceptible to endogeneity issues, hence its inclusion as a lagged factor in the model.

- The positive relationship between currency depreciation and portfolio inflows in most cases presents an intriguing observation (in Chile is practically zero). On one hand, currency depreciation diminishes the value of foreign investors' assets in these economies, potentially prompting a reduction in exposure. Conversely, currency depreciation renders assets in these economies more affordable, presenting an opportunity for investors who anticipate corrective trends. According to these initial estimations, it appears that the latter factor predominates in influencing investor behavior.

- The spread between local and external rates, which underpin carry trade strategies, significantly influences portfolio investment dynamics among foreign investors, particularly in Colombia. This finding aligns with market participants' views, as carry trading is a crucial factor in their investment strategies and asset allocations across Latin American markets, which tend to offer attractive relative returns. An increase of one standard deviation in this spread correlates with a rise of approximately 0.6 standard deviations in portfolio flows to Colombia.

  It is noteworthy to mention the negative effect of this variable in the case of Chile and its near-zero impact in Brazil. In these two cases, as we will demonstrate next with the interaction of the Federal Reserve's indicator, the interest rate differential appears to be very relevant for attracting capital in scenarios where developed economies do not present attractive investment opportunities. However, in different circumstances, as observed, this factor does not seem to attract capital flows.

- The indicator variable for the Federal Reserve's extremely dovish stance has a positive correlation, as anticipated, since low interest rates in the United States promote portfolio investment inflows to emerging economies such as those analyzed. This effect coincides with increases in these flows ranging from 2 to 4 standard deviations.

  Additionally, the interaction of this variable with the interest rate differential yields mixed results. In the cases of Colombia and Mexico, the interaction is negative, indicating that in these scenarios of low interest rates in developed economies, the increase in the differential is not as significant as estimated in isolation. Therefore, the flows seem to respond more to the decline in external rates rather than to an interest in investing in these economies due to a potential increase in local rates. When financial conditions are not as accommodative in developed economies, local interest rates in these emerging economies become more relevant, directing portfolio flows towards them.

  Conversely, in Brazil and Chile, the effect of the interaction is positive. In these cases, it appears that in scenarios of low interest rates in the United States, better local returns coincide with a greater impetus for portfolio inflows. This interaction suggests that in these scenarios of unusually low rates in developed economies, push factors dominate in Colombia and Mexico, while pull factors predominate in Chile and Brazil.

- Enhanced growth expectations typically coincide with increased portfolio flows in most countries, except for Chile. For instance, an increase in expected growth in Brazil and Mexico for the next year by one standard deviation correlates with a rise in portfolio inflows by nearly 0.3 deviations. In the Colombian case, this effect lacks statistical and economic significance.

- Colombia's weighting in JP Morgan's emerging market bond indices emerges as a significant factor influencing portfolio investment flows, as anticipated, followed by Mexico and Chile. Conversely, Brazil exhibits a notably negative impact, potentially attributable to its almost constant weighting at the maximum individual cap of 10% within the index, a level that Brazil has maintained since 2006, with minor deviations observed only between April 2020 and March 2022, which coincided with sustained inflows of portfolio investments.
- It is noteworthy that the positive and statistically significant impact of the reserves-to-ARA measure for Colombia (at the 10% level of statistical significance), followed by Brazil and Chile, is particularly notable, whereas in Mexico, this effect is negative but negligible. This observation underscores the paramount importance of upholding sufficient reserve levels, which serve as a reflection of the economy's capacity to withstand external shocks, thereby enhancing its appeal to foreign portfolio investments.
- Lastly, the impact of OECD membership appears to have a negative effect in all cases. It is important to consider that the forward-looking nature of markets may influence the effect of an OECD invitation on portfolio flows. Investors typically anticipate such developments, so the official inclusion in the OECD is unlikely to come as a surprise. Consequently, it is reasonable to expect that the buildup of inflows would occur before the official inclusion, rather than following it. This anticipation effect could diminish the observed impact of OECD membership in post-inclusion data.

  Furthermore, when analyzing the interaction of this dummy variable with the external risk variable, there is evidence that OECD membership acts as a buffer against the repercussions of external shocks in Brazil. However, in high-risk scenarios, it appears to promote outflows in Colombia and Chile.

Panel Data Model

Building upon this analysis, we explore a panel data model to capture the individual effects of each economy and discern the direct impact of each of our control variables, with a specific emphasis on external risk.

To ascertain the most appropriate functional form, we estimated models with both fixed effects and random effects, employing the same OLS specification. Only effects for each country were included, allowing for the incorporation of the synthetic external risk indicator, which varies over time but remains constant across countries. Subsequently, we conducted the Hausman test, which led to rejecting the null hypothesis, suggesting that individual effects are uncorrelated with explanatory variables. This indicates that the estimators derived from the fixed effects model are consistent and preferable. Additionally, Newey-West standard errors were employed to address potential issues of autocorrelation and heteroscedasticity in the model errors. Results are presented in *Table 3*.

***Table 3*: Panel Regression Results**

	Dependent variable			
	Foreign Net Portfolio Inflows			
Countries' Fixed Effects	*Colombia*	*Brazil*	*Mexico*	*Chile*
	-0.45359	-0.44064	-0.91853	-0.92317
External Risk Synthetic Indicator	-0.268***			
	(0.069)			
Spread USD 10Y Bonds	-0.131**			
	(0.053)			
FX Volatility (Lagged)	0.358***			
	(0.064)			
	-0.136***			

FX Depreciation (Lagged)	(0.044)
Fed Zero Lower Bound	0.169*
	(0.090)
Rate Differential	0.067
	(0.067)
Fed × Rate Diff.	0.123
	(0.095)
Growth Expectations	0.222***
	(0.059)
GBI Share	0.345***
	(0.055)
IR / AR (Lagged)	0.243***
	(0.049)
OECD Inclusion	0.827***
	(0.123)
OECD × Risk	0.055
	(0.102)
Balanced Panel:	n = 4, T = 214, N = 856 One way (individual) Effect Within Model
Residuals:	Min. 1st Qu. Median 3rd Qu. Max. -5.062392 -0.560609 -0.026771 0.492828 5.412799
Total Sum of Squares:	1029.4
Residual Sum of Squares:	764.42
R2:	0.25744
Adjusted R2:	0.24418
F Statistic:	24.2684 on 12 and 840 DF, p-value: < 2,22e-16

Note: *p<0,1; **p<0,05; ***p<0,01

The most salient aspect of these findings lies in the significant enhancement of both the magnitude and statistical significance of the external risk indicator's effect (compared with most individual results). Notably, an elevation of one standard deviation in the external risk indicator now correlates with a substantial decline of approximately 0.3 standard deviations in portfolio investment flows. Additionally, a heightened perception of country risk, as reflected in the spread between 10-year USD rates, is associated with a significant decrease in portfolio investment flows by 0.1 standard deviations.

These estimates underscore the pivotal role of external risk and country-specific risk perception assessments in shaping foreign portfolio investment dynamics. It suggests a heightened sensitivity among investors to both global economic uncertainties and country-specific risk factors, accentuating the importance of policymakers' robust risk management strategies.

The effect of the annual moving average of the exchange rate volatility aligns with trends observed in Brazil and Mexico from the OLS perspective, where heightened volatility corresponds to an increase in portfolio inflows. This phenomenon may be attributed to short-term return-seeking behavior amid exchange rate adjustments or a healthy FX market perception, as previously discussed[1]. However, it is noteworthy that FX depreciations now exhibit a negative relationship with

[1] Specifically, in the context of FX volatility, two additional exercises were conducted to assess whether the effect of volatility could be influenced by certain risk scenarios or the trajectory of the exchange rate. The first exercise involved identifying scenarios where risk levels were atypically high and interacting this dummy variable with volatility. The second exercise focused on identifying scenarios in which the currency was depreciating and interacting this variable with volatility, with the hypothesis that higher volatility might indicate greater risk conditions in

portfolio flows. This observation underscores the hypothesis that such depreciations prompt outflows of these assets as they lose value. Investors may perceive the potential for greater losses in the future if the exchange rate continues to depreciate, thus opting to reallocate their investments accordingly.

The nuanced shift in the relationship between exchange rate dynamics and portfolio flows underscores the multifaceted nature of investor responses to currency fluctuations, and emphasizes the significance of accounting for the inherent heterogeneity within each of these countries.

The effect of carry trade strategies driven by local-currency-denominated sovereign bond yield spreads persists, albeit with a diminished magnitude, resulting in a 0.07 standard deviation increase in portfolio flows. However, in lower interest rate scenarios in advanced economies, this spread becomes more significant, with the effect rising to 0.2 standard deviations. This suggests that in such scenarios, pull factors become more relevant.

Moreover, positive relationships persist for factors such as growth expectations, the countries' weighting in JP Morgan's GBI Index, and the reserves-to-ARA measure. These factors consistently exert a positive influence on portfolio investment flows, indicating that strong growth prospects, higher index weightings, and robust reserve adequacy enhance investor confidence and attract capital inflows.

Finally, and notably diverging from the initial findings, we discern a significant and positive impact of receiving an invitation to join the OECD on foreign portfolio flows. This effect emerges as the most prominent coefficient in the panel data model estimation, indicating a substantial positive influence on flows of approximately one standard deviation following a country's invitation to join the organization. This outcome reinforces the hypothesis that OECD membership signifies the macroeconomic resilience of these emerging economies, thereby fostering increased investor confidence in international markets. However, the interaction between this indicator and the risk variable yields minimal effect, suggesting that while OECD participation promotes investment in these countries, it does not necessarily mitigate the impact of external shocks. These overall results serve as the foundational model for the subsequent localized projections detailed below.

Annex 2 presents an additional analysis aimed at evaluating the robustness of these results. In this analysis, the model was re-estimated multiple times, each time excluding one of the countries from the dataset. Additionally, a model without fixed effects (pooling panel) was included for comparison.

The findings indicate that by excluding one country at a time and comparing the base model with each of these sub-models, as well as with the pooling panel model, the results remained consistent and retained their sign in nearly all cases. While variations in magnitude and statistical significance were observed, as anticipated, these results suggest that the methodology is effectively capturing the unobserved heterogeneity between countries. This heterogeneity may be otherwise biasing the results of the OLS models.

Local Projections

We extended our investigation to explore the medium-term effects, selecting a horizon of one year, following the local projection methodology proposed by Jordà (2005). The panel specification remains unchanged.

In general terms, the estimation of impulse response, as proposed by Jordà (2005), essentially involves estimating multiple panel models of the form:

$$y_{i,t+h} = \alpha_i + \beta_h s_t + \gamma_h \boldsymbol{x}_{i,t+h} + \varepsilon_{i,t+h}$$

Here, α_i represents the country-fixed effects (with time-fixed effects omitted in our case for estimation purposes), $\boldsymbol{x}_{it}$ denotes the set of exogenous variables included in the model, and $\beta_h s_t$ captures the shock of interest at time t (in our case, corresponding to a one-to-one shock on each of the exogenous variables included in the model). The coefficient β_h represents the response of y in period $t + h$ to the

depreciation scenarios, leading to portfolio capital outflows, while reflecting good health of the foreign exchange market in other scenarios. In both cases, no robust or significant results were found for the current study.

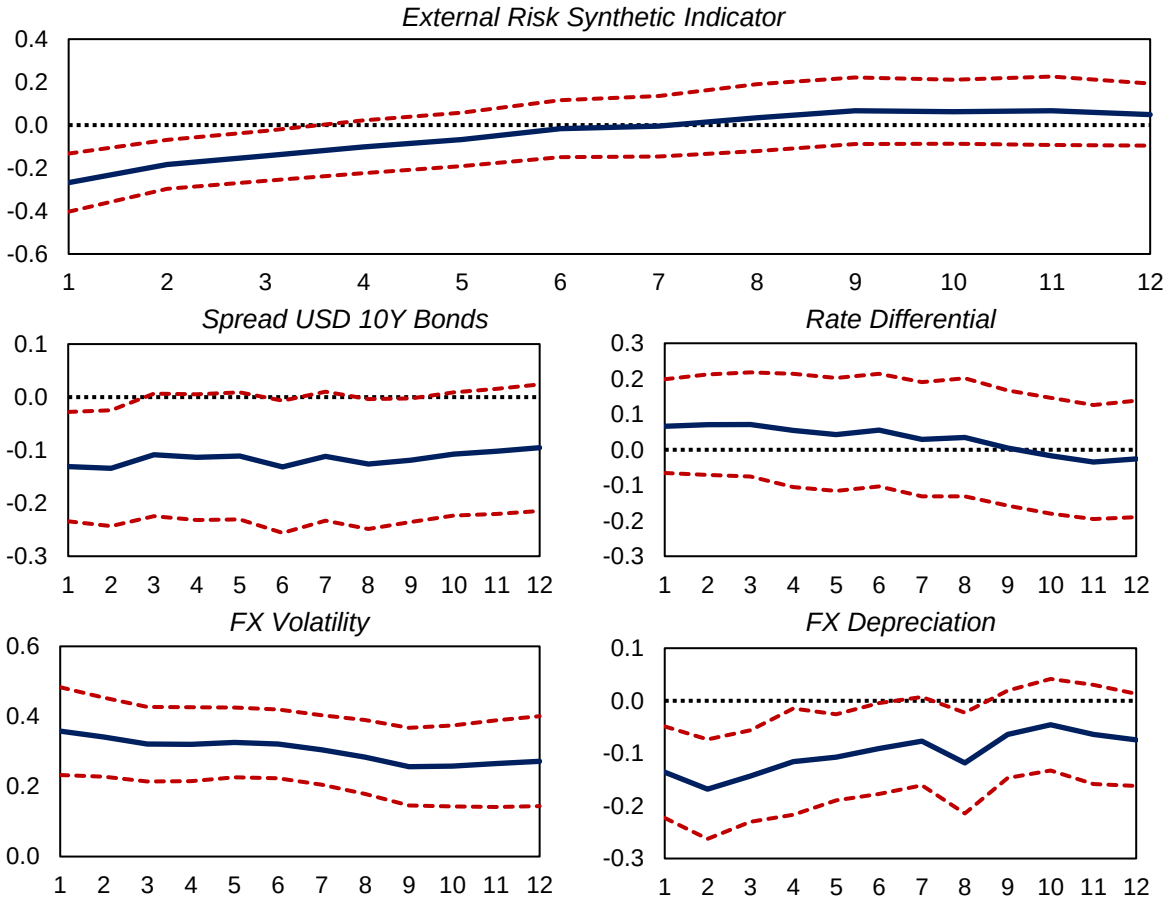
shock at time t. Consequently, we construct impulse-response functions as the sequence of β_h estimates in a series of regressions for each horizon h.

We employ the local projection methodology because, as noted by Jordà (2005), impulse responses for each time moment can be estimated equation by equation, facilitating the estimation of nonlinearities and stratifications. Each result provides a direct estimate of the impulse response; thus, standard errors do not necessitate the delta method or simulation-based methods. Moreover, this method is less sensitive to misspecification, as each impulse response coefficient is estimated using a different model, and it does not impose any restrictions on the form of the impulse-response function. Jordà (2023) delineates local projections as a semiparametric approach to estimating impulse responses.

However, Jordà's method entails the complication that successive leads of the dependent variable induce serial correlation of error terms. To address this issue, we adopt the semi-parametric solution proposed by Jordà (2005) and control for it using the Newey-West correction (Newey and West, 1987), although alternative methods are proposed in the literature according to Jordà (2023).

It is noteworthy that this methodology has its drawbacks. As it does not impose any restrictions linking impulse responses between h and $h+1$, the responses often appear erratic due to a loss of statistical efficiency, and the responses to shocks sometimes exhibit abrupt oscillations at very long horizons (Ramey, 2012). Additionally, as the horizon increases, observations from the end of the sample are lost.

***Graph 2*: Local Projections of Changes in Financial Variables of Foreign Portfolio Flows**



Observing *Graph 2*, it is notable that following a one standard deviation shock to the external risk indicator, a cumulative portfolio outflow of approximately 0.8 standard deviations is observed in the first-semester post-shock (and with a lower bound that points out outflows of 1.5 standard deviations).

For instance, referring to the 2008 crisis when this risk indicator historically peaked around 4.45, these findings suggest that a crisis scenario could coincide with outflows of roughly 3,5 standard deviations of portfolio investment flows (or outflows of 6,7 standard deviations when considering the lower bound as reference).

However, upon analyzing the whole-year effect, it becomes apparent that after the first semester following the shock, the flows partially recovered, resulting in total net outflows of approximately 0.5 standard deviations for the whole period.

The impact on inflows of exchange rate volatility shocks is particularly noteworthy due to its persistent effect over time. Similarly, the shock effects on USD 10-year bond spreads and FX depreciation also demonstrate relative persistence, producing outflows within the analyzed timeframe. In contrast, the positive impact of shocks on interest rate differentials, which could potentially promote carry strategies, gradually diminishes over the period under review. *Annex 1* presents local projections of portfolio investment flows in response to changes in one unit or one standard deviation, as applicable, of the other exogenous variables included in our model.

Stress Scenario Analysis

As a final step, building upon the findings from local projections, our next objective is to forecast the trajectory of foreign portfolio investment flows for Colombia under stress scenarios. These projections are intended to provide policymakers with critical insights to assess the resilience of the domestic economy and to evaluate the adequacy of capital buffers in anticipation of potential adverse developments. To accomplish this, we simulate multiple scenarios of external risk by perturbing all exogenous variables within our model, using their extreme values as the magnitude of shocks (*Table 4*).

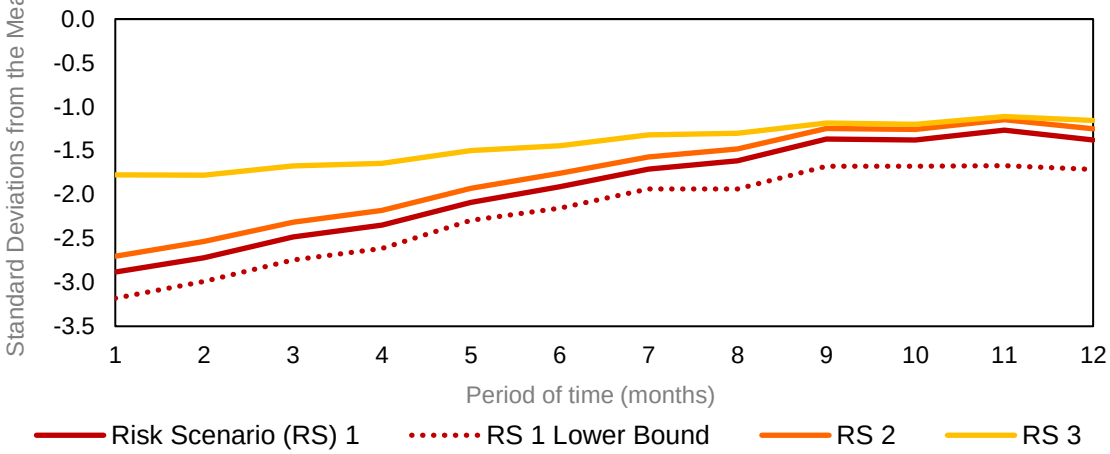
Specifically, we formulate an exceedingly adverse scenario wherein projections are computed based on the extreme values observed in each of the explanatory variables (highlighted in red in *Table 4*). Also, we devise a marginally less adverse scenario that encompasses the 1st or 99th percentiles from the distributions of these exogenous variables, as appropriate (highlighted in orange in *Table 4*). Finally, we construct a scenario that, while still adverse, is somewhat more lenient, incorporating shocks rooted in the 5th and 95th percentiles of these variables' distributions (highlighted in yellow in *Table 4*).

***Table 4*: Descriptive Statistics for Colombia's Indicators**

	Min	Max	Perc. 1%	Perc. 5%	Perc. 95%	Perc. 99%
External Risk Synthetic Indicator	-1,25	**4,45**	-1,16	-0,93	**1,71**	**4,29**
Spread USD 10Y Bonds	-2,38	**3,02**	-1,40	-1,11	**2,07**	**2,67**
FX Volatility	-1,26	**2,62**	-1,17	-0,89	**2,11**	**2,51**
FX Depreciation	-3,77	**2,18**	-3,24	-1,68	**1,37**	**1,97**
Rate Differential	**-1,78**	2,98	**-1,69**	**-1,20**	2,18	2,76
Growth Expectations	**-2,39**	1,70	**-2,19**	**-1,79**	1,30	1,40
GBI Share	**-2,37**	1,31	**-2,29**	**-2,10**	1,11	1,20
IR / ARA (lagged)	**-1,79**	2,23	**-1,73**	**-1,51**	1,84	2,14
Portfolio Flows	*-2,81*	*3,97*	*-2,33*	*-1,31*	*1,91*	*2,85*

The findings of this analysis are depicted in *Graph 3* below. Within the confines of each of the aforementioned stressed scenarios, a notable adverse impact on foreign portfolio investment flows is discerned, albeit with indications of attenuation over time. In sum, the ramifications of each scenario would entail reductions in foreign portfolio investment by 23.3, which increase to 26,9 when considering the local projection lower bound, dotted red line in *Graph 3*), 21.5, and 17.2 standard deviations, respectively.

***Graph 3*: Foreccasted Effect on Foreign Portfolio Flows in Colombia Under Multiple Stress Scenarios**



To provide a concrete magnitude of this effect in the case of Colombia and, considering the following details: *i*) as of December 31, 2023, investors held approximately USD $25.18 billion in public debt securities (ranking second after local pension funds in terms of market share) and USD 2.45 billion in local stocks, and *ii*) one standard deviation of flows from these entities in this market equates to approximately $455.67 million; the aforementioned impact would translate to liquidation of current holdings by these investors in local assets of approximately 38.2% under the most severe scenario (up to 43.8% when accounting for the lower bound of the local projection). Furthermore, estimates suggest a divestment of 35.2% and 28.2% in stressed scenarios 2 and 3, respectively.

Our findings indicate that, in developing models to determine appropriate capital buffer levels in Colombia for potential adverse scenarios where the country may struggle to meet its foreign currency obligations, it is essential to account for possible outflows of portfolio capital ranging from 30% to 40% of the total balance these agents hold in local assets.

In the Colombian case, these holdings are primarily concentrated in public debt securities, making the impact of such potential outflows particularly burdensome. The concentration of foreign investors' exposure to public debt means that any significant withdrawal of these funds could lead to a sharp increase in yields, escalating the cost of borrowing for the government. This, in turn, could exacerbate fiscal pressures, potentially leading to a vicious cycle of rising debt costs and increasing fiscal deficits.

Moreover, the outflows could induce volatility in the foreign exchange market, further complicating the economic landscape. A substantial withdrawal of foreign capital might lead to the depreciation of the local currency, increasing the cost of servicing foreign-denominated debt and importing goods. This could strain the country's balance of payments and undermine investor confidence, potentially triggering more capital flight and financial instability.

Therefore, it is critical for policymakers to incorporate these potential capital outflows into their risk assessment models and develop strategies to mitigate their impact. This might include maintaining higher levels of foreign exchange reserves (as described earlier), implementing measures to enhance market liquidity, and ensuring transparent communication with investors to maintain confidence.

Overall, these results underscore the susceptibility of local financial markets to external shocks, given the involvement of foreign investors, notably within the domain of public debt. Furthermore, the findings accentuate the imperative of monitoring both internal and external factors capable of exerting significant influence on the dynamics of these flows. Moreover, there exists a specific necessity to fortify instruments aimed at augmenting the economy's resilience against external shocks. Notably, the discernible impact of the international reserves-to-ARA ratio underscores its utility as a pertinent tool for policymakers. This observation also paves the way for prospective research endeavors aimed at delving deeper into this effect.

The provided projections of potential portfolio investment outflows in stressed scenarios furnish invaluable insights to be integrated into various exercises aimed at formulating precautionary policy measures, such as those entailed in the evaluation of adjustments to international reserves by the central banks. However, a comprehensive approach that also recognizes the interconnectedness of public debt management, fiscal stability, and foreign exchange market health is essential to safeguard economic stability in the face of these potential adverse scenarios, and future investigations built upon our findings could provide a better understanding of this interconnectivity.

Conclusions

This study has provided a comprehensive analysis of the determinants of foreign portfolio investment flows in selected Latin American countries, with a particular focus on Colombia. The empirical findings underscore several key insights relevant to policymakers and market participants.

The relationship between currency depreciation and portfolio inflows reveals a nuanced investor response. While currency depreciation might be expected to deter investment due to asset devaluation, at first glance, the prevailing factor appears to be the attractive pricing of assets, which can prompt increased investment if a correction is anticipated. This indicates that investors might be more inclined to capitalize on perceived undervaluations rather than withdraw due to immediate losses. However, our findings were not conclusive, and research in this direction could yield interesting results.

The spread between local and external rates, indicative of carry trade strategies, remains a significant determinant of portfolio investment dynamics, reaffirming the importance of interest rate differentials in investor decision-making processes across Latin American markets.

Enhanced growth expectations generally bolster portfolio flows. The weighting of these economies in JP Morgan's emerging market bond indices also emerges as a critical factor influencing investment flows, highlighting the role of benchmark indices in guiding investment allocations.

The reserves-to-ARA ratio demonstrates a positive effect on portfolio flows for Colombia, emphasizing the importance of maintaining adequate reserve levels to signal economic resilience to external shocks. This finding underscores the utility of robust reserves as a confidence-enhancing tool for foreign investors.

The analysis also highlights the positive impact of OECD membership on portfolio flows. Also, the benefits of OECD affiliation may become more apparent over a longer tenure of membership.

The local projection methodology reveals that shocks to variables such as OECD accession, exchange rate volatility, the weighting in JP Morgan indices, and growth expectations have sustained and structural effects on portfolio flows. Conversely, the effect of the reserves-to-ARA ratio, while positive, exhibits irregular behavior, and the impact of exchange rate depreciation shocks is not statistically significant over the analyzed horizon.

The final exercise, projecting the behavior of foreign portfolio investment flows for Colombia under stressed scenarios, underscores the high sensitivity of local financial markets to external shocks. Significant adverse effects on investment flows are observed under these scenarios, which highlight the importance of monitoring and managing both internal and external factors that influence these flows. The impact of the international reserves-to-ARA ratio further signals its importance as a tool for policymakers, opening avenues for future research.

Our findings indicate that, in developing models to determine appropriate capital buffer levels in Colombia for potential adverse scenarios where the country may struggle to meet its foreign currency obligations, it is essential to account for possible outflows of portfolio capital ranging from 30% to 40% of the total balance these agents hold in local assets. As these assets are primarily concentrated in public debt securities, such outflows could have significant fiscal implications.

The findings from this study provide valuable insights into the dynamics of foreign portfolio investment flows in Latin America. They underline the need for robust economic policies and tools to enhance resilience against external shocks, thereby fostering a more stable and attractive investment environment for foreign investors.

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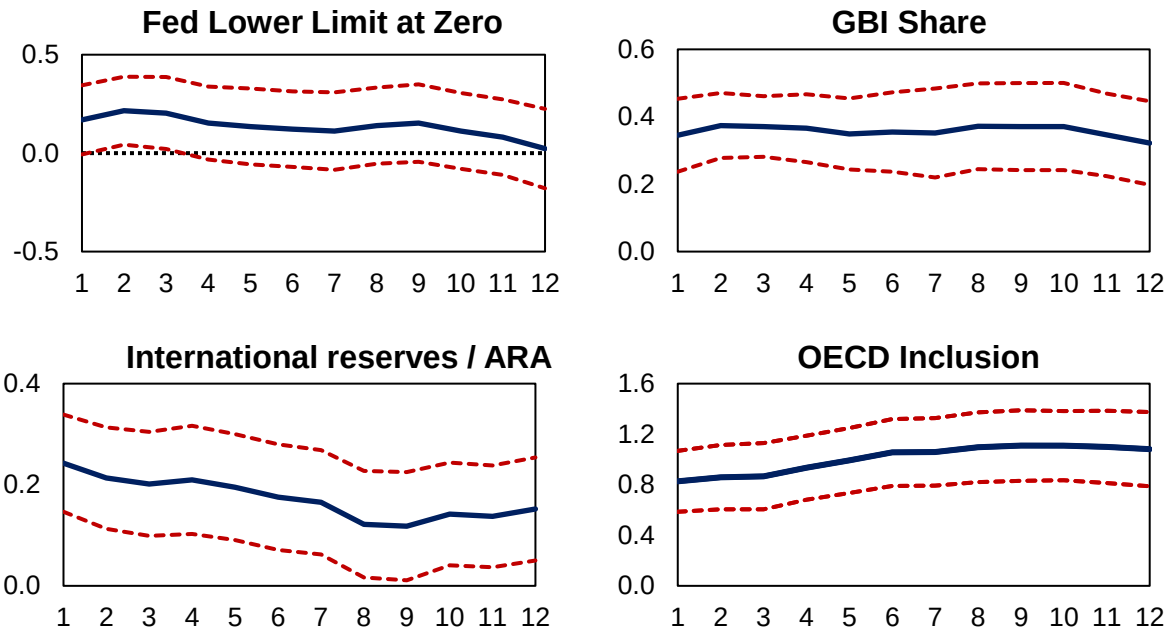
Annex 1



Annex 2

***Table A1*: Panel Regression Robustness Exercise**

	Dependent variable
	Foreign Net Portfolio Inflows

	Base Model	*Without Brazil*	*Without Mexico*	*Without Chile*	*Without Colombia*	*Without Fixed Effects*
External Risk Synthetic Indicator	-0.268***	-0.100	-0.313***	-0.271***	-0.359***	-0.368***
	(0.069)	(0.070)	(0.067)	(0.098)	(0.079)	(0.069)
Spread USD 10Y Bonds	-0.131**	-0.109*	-0.158***	-0.104	-0.077	-0.091
	(0.053)	(0.063)	(0.057)	(0.078)	(0.055)	(0.060)
FX Volatility (Lagged)	0.358***	0.288***	0.391***	0.452***	0.188**	0.386***
	(0.064)	(0.060)	(0.073)	(0.074)	(0.081)	(0.079)
FX Depreciation (Lagged)	-0.136***	-0.116**	-0.154***	-0.135***	-0.092	-0.144***
	(0.044)	(0.045)	(0.046)	(0.049)	(0.063)	(0.048)
Fed Zero Lower Bound	0.169*	0.062	0.082	0.158	0.468***	0.099
	(0.090)	(0.106)	(0.094)	(0.104)	(0.106)	(0.096)
Rate Differential	0.067	0.017	0.041	0.089	0.100	0.058
	(0.067)	(0.076)	(0.080)	(0.075)	(0.077)	(0.083)
Fed × Rate Diff.	0.123	0.100	0.344***	0.072	-0.012	0.254**
	(0.095)	(0.104)	(0.096)	(0.115)	(0.117)	(0.101)
Growth Expectations	0.222***	0.150**	0.184**	0.350***	0.132*	0.169**
	(0.059)	(0.068)	(0.073)	(0.066)	(0.070)	(0.076)
GBI Share	0.345***	0.309***	0.237***	0.410***	0.307***	0.243***
	(0.055)	(0.060)	(0.065)	(0.056)	(0.070)	(0.067)
IR / ARA (Lagged)	0.243***	0.270***	0.321***	0.294***	0.011	0.348***
	(0.049)	(0.051)	(0.054)	(0.063)	(0.058)	(0.057)
OECD Inclusion	0.827***	0.978***	0.697***	0.849***	0.427***	0.432***
	(0.123)	(0.132)	(0.127)	(0.142)	(0.141)	(0.110)
OECD × Risk	0.055	-0.096	0.186	0.050	0.053	0.227*
	(0.102)	(0.092)	(0.123)	(0.123)	(0.110)	(0.133)
Constant						-0.444***
						(0.091)

Note: *p<0,1; **p<0,05; ***p<0,01