Private vs. Official Absorption of Global Financial Cycle in Emerging Markets

Junhyeok Shin*

July 21, 2026

Abstract

This paper studies why domestic private investors absorb global financial shocks more strongly in some emerging market economies than in others. The key object is the semi-elasticity of residents' gross portfolio outflows to expected excess currency returns. This elasticity measures how strongly domestic investors retrench from foreign assets when domestic returns rise. The paper develops a demand-system model in which the same elasticity determines both the transmission of foreign demand shocks and the need for foreign exchange intervention (FXI). Using a panel of 19 emerging market economies, I find that gross portfolio outflows are more return-elastic among floaters than interveners and that country-level semi-elasticities are negatively associated with FXI intensity. The model further predicts that private absorption is stronger when investors with flexible international portfolios hold more wealth. Using novel security-level data on Colombian pension funds, I show that pension funds reduce their net purchases of foreign securities when domestic excess currency returns rise, consistent with the model's retrenchment mechanism. Cross-country evidence also shows that economies with larger pension fund and insurance company sectors have more return-elastic gross portfolio outflows. Finally, accounting for this institutional capacity increases the estimated difference in excess-return sensitivity to the VIX between floaters and interveners, although this evidence remains suggestive.

JEL Classification: F31, F32, G23.

*Department of Economics, Johns Hopkins University. Email: jshin77@jhu.edu.

Contents

1 Introduction

Who are the marginal domestic investors that fill the gap left by a systematic retreat of foreign investors in emerging market economies (EMEs)? This paper explores how private domestic investors respond differently to global financial shocks across EMEs and what explains this variation. We find evidence that suggests domestic institutional investors with international portfolios, such as pension funds and insurance companies, are an important source of private absorption capacity in EMEs. In addition, we show that the responsiveness of these investors helps explain why some economies rely more heavily on foreign exchange intervention (FXI) than others. Finally, we present how this link matters for evaluating FXI effectiveness.

Existing works on external financial shocks in EMEs have emphasized either official intervention in response to them or the origin of such shocks. Several papers study private agents' international portfolio rebalancing in advanced economies. However, studies on EME gross outflow dynamics remain underexplored. This paper puts domestic private savers at the center of the external adjustment of these economies. The key object is the responsiveness of residents' gross portfolio outflows to changes in excess currency returns: when domestic returns rise, to what extent do investors with foreign portfolios rebalance toward home assets? This private absorption margin determines not only by how much prices and exchange rate should move to compensate home saver's rebalancing towards home assets, but also the extent of optimal official intervention.

To organize the analysis, we develop a model in which home savers, foreign investors, and the central bank jointly determine how foreign demand shocks are absorbed. The model yields three predictions. First, private absorption is stronger when more wealth is held by domestic investors with larger international portfolios and flexible mandates. Second, stronger private absorption dampens the response of excess currency returns to foreign demand shocks and thus reduces needs for FXI. Third, because central banks intervene more aggressively where private absorption is weak, comparisons across FXI regimes that omit this margin understate the stabilizing effect of intervention. Using a panel of EMEs and security-level data on Colombian pension funds, we provide empirical evidence consistent with each prediction.

Table 1 motivates the paper by comparing how gross portfolio outflows and net portfolio inflows comove with the VIX across economies with different FXI policies. The first two columns compare non-reserve-currency advanced economies (AEs) with EMEs as a whole. In both groups, gross portfolio outflows negatively correlate with the VIX, but the correlation is weaker in EMEs. Net portfolio inflow is negatively correlated with the VIX only in EMEs. This suggests retrenchment is weaker in EMEs than in AEs and insufficient to absorb foreign demand shocks, which is in line with findings of Avdjiev et al. (2022).

The last two columns show that this EME net-flow pattern is concentrated in interveners. Floaters resemble advanced economies: gross outflows retrench when the VIX rises, and net inflows are not significantly correlated with the VIX. In interveners, by contrast, gross outflows do not significantly respond to the VIX, while net inflows fall strongly when the VIX rises. This suggests that private retrenchment is weaker in interveners, which rely more on FXI.

Table 1. Correlation of Capital Flows and Excess Currency Return with the $\%\Delta VIX$

Variable	G10 x Reserve	EM All	EM Floaters	EM Interveners
Gross PF Outflow	-0.190*	-0.097**	-0.132**	-0.066
Net PF Inflow	-0.045	-0.158***	-0.092	-0.217***

Note: This table shows correlation of gross portfolio outflow, and net portfolio flow (gross inflow minus gross outflow) with the VIX index for a panel of 19 EMEs and 5 advanced economies that are not reserve currency issuers. The capital flow variables are defined as a share of GDP. Emerging market economies are classified as floaters and interveners following Blanchard et al. (2015). Table 2 lists countries by group. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

These correlation patterns are robust to alternative proxies for global financial cycle, and can be interpreted in two different ways. For one, the retrenchment can be weak in the intervener economies because their private sector is unable to absorb foreign shocks, and FXI is used to complement this weak private absorption. Alternatively, the weaker retrenchment can be due to the FXI policy reducing the change in return differentials in response to foreign demand shocks while private sector has the same capacity to absorb shocks across two groups. This reveals that the key object to study is not the comovement of gross outflow with the global financial cycle itself, but the responsiveness of home savers' gross outflow to excess currency return. If the responsiveness is the same across floaters and interveners, the second interpretation holds. If gross portfolio outflow is more responsive to excess currency return in floaters than in interveners, the first interpretation holds.

To formalize this argument, we model a market of home bonds where home savers with international portfolios, foreign investors, and a central bank interact. In the model, foreign investors' demand shocks move excess currency return, while home savers and the central bank absorb the shock through retrenchment and FXI. The private absorption capacity of the home economy is therefore summarized by the elasticity of home savers' gross outflow to excess currency return.

The model delivers two predictions that guide the empirical analysis. First, a more elastic gross outflow reduces the spillover of foreign demand shocks to excess currency return. When excess currency return rises after a foreign demand shock, home savers with more elastic portfolios retrench more strongly from foreign assets, so the shock is absorbed more by private flows and less by prices. Second, if FXI is costly, optimal FXI is less responsive to excess currency return when home savers' gross outflow is more elastic. Thus, the same private elasticity determines both the transmission of global financial shocks and the intensity of FXI policy. We test this prediction by estimating the semi-elasticity of gross portfolio outflow to excess currency return for a panel of EMEs. The estimates show that gross portfolio outflow is more return-elastic in floaters than in interveners, and that country-level semi-elasticity is negatively related to a continuous measure of FXI intensity. This evidence supports the model's interpretation that FXI is used more aggressively where home private absorption is weaker.

The model also suggests where to look for the home savers that generate private absorption. In the model, the elasticity of gross outflow is higher when home savers with international portfolios are larger. This points to pension funds and insurance companies, which are large institutional investors that exist in most EMEs and allocate across domestic and foreign assets. We provide two pieces of evidence. First, using a novel fund-security level dataset on Colombian pension funds' portfolios, we show that pension funds reduce their net purchases of foreign securities when excess currency return rises. This behavior is consistent with the retrenchment of home savers in the model. Second, using cross-country variation, we show that economies with larger pension fund and insurance company assets have more return-elastic gross portfolio outflow. These results indicate that domestic institutional investors with international portfolios are an important source of private absorption capacity in EMEs.

Finally, this paper revisits the evaluation of FXI effectiveness. The model shows that FXI is used more extensively in economies where home private absorption is limited. This negative relation makes unconditional comparisons understate the stabilizing effect of FXI, because stronger FXI is observed precisely where excess currency return would be more exposed to foreign shocks without intervention. Consistent with this prediction, we show that the difference in excess currency return's sensitivity to the VIX between floaters and interveners becomes larger once we account for private absorption capacity, proxied by pension fund and insurance company assets. These results imply that FXI effectiveness cannot be evaluated separately from the domestic private investors that absorb the same shocks. More broadly, they suggest that the development of institutional investors with international portfolios can strengthen private shock absorption and reduce reliance on official intervention.

Related Literature

This paper speaks to four strands of literature in international finance. It is closest to the recent inelastic-demand and portfolio-balance view of asset prices. In this literature, shifts in desired holdings move equilibrium prices because investor demand curves have finite slopes (Gabaix and Koijen, 2024; Koijen and Yogo, 2019). This mechanism has been applied to international portfolios and exchange rates by Koijen and Yogo (2026) and Jiang et al. (2024), and is closely related to preferred-habitat models of bond and currency markets (Greenwood et al., 2023; Gourinchas et al., 2025). Under this view, price change in response to shifts in demand of a group of investors is pinned down by the elasticity of the demand curve of the other investors in the market. This paper examines home savers' retrenchment elasticity to excess currency returns in this framework and reveals that the elasticity is associated with FXI policy and spillover of global financial shocks to excess currency return.

This perspective gives a natural interpretation of capital retrenchment in response to external shocks. When foreign investors reduce demand for domestic assets, home savers can absorb the shock by retrenching from foreign assets and reallocating toward domestic assets to exploit higher expected returns on domestic assets. Their return elasticity governs the strength of this retrenchment, which in turn determines how much foreign demand shocks pass through to excess currency returns and exchange rates. This paper therefore relates to the literature on capital retrenchment and private shock absorption.

The literature documents that domestic investors retrench from foreign assets as the global financial cycle tightens. Forbes and Warnock (2012) identify retrenchment as a sharp decline in residents' gross capital outflows and show that such episodes become more likely when global risk rises. Using quarterly flows disaggregated by domestic sector, Avdjiev et al. (2022) show that responses to global risk are highly heterogeneous. A few papers model gross capital outflow and its retrenchment in response to global financial shocks. Caballero and Simsek (2020) models retrenchment of domestic investment overseas in response to foreign exits and shows that free capital flow's implication for stability depends on symmetry of expected return and financial development across countries. Jeanne and Sandri (2023) models the stabilization role of private retrenchment in a small open economy and shows that the usefulness of FXI and capital controls depends on financial development. Davis and van Wincoop (2024) develop a model of symmetric economies in which a rise in global risk aversion lowers risky-asset prices and shifts wealth from internationally diversified investors toward more home-biased investors, generating a simultaneous retrenchment in gross capital inflows and outflows. This paper contributes to this literature by providing systematic empirical evidence that the retrenchment capacity varies with domestic institutional investors. In particular, we highlight the role of investors with external positions, rather than the depth itself of domestic financial markets, in shaping the retrenchment capacity.

Third, this paper contributes to the literature on foreign exchange intervention and its effectiveness. Theoretical literature studies what FXI can achieve when financial frictions introduce incomplete risk sharing and limit private arbitrage (Cavallino, 2019; Itskhoki and Mukhin, 2026; Fanelli and Straub, 2021). They show that FXI can improve welfare by mitigating financially driven distortions in capital flows and exchange rates. Jeanne and Sandri (2023) connects FXI policy with financial development. They show that FXI is relatively more attractive in less financially developed economies. Empirical work faces a central identification challenge because intervention responds endogenously to exchange-rate and macroeconomic conditions. The empirical literature uses higher-frequency time series data or exploits cross-country variation to identify the effect of FXI. Kuersteiner et al. (2018) exploit a discontinuous intervention rule, while Fratzscher et al. (2019) use daily intervention data from 33 countries. Blanchard et al. (2015) compare policy and exchange rate responses to exogenous global capital inflow shocks across countries. They suggest that FXI succeeds in mitigating the shock's impact on nominal and real exchange rates by presenting that exchange rate response to a global capital inflow shock is smaller in countries where FXI responds more to the shock. Beltran and He (2024) examine how the exchange rate response to an exogenous currency-demand shock identified by mechanical rebalancing of a local-currency government-bond index varies with FXI policy. These studies find that FXI affects exchange rates, although its magnitude and persistence vary. This paper is closest to the cross-country approach but shows that the evaluation of FXI effectiveness should account for the domestic private absorption capacity. In addition, our empirical evidence suggests that FXI policy is used less intensively when private absorption by investors with international portfolios is stronger.

Lastly, this paper relates to the literature on exchange-rate dynamics driven by international portfolio flows. The seminal work of Gabaix and Maggiori (2015) shows that exchange rate can be moved by the portfolio choices of international investors due to incomplete risk sharing across countries. Empirical results in Hau and Rey (2005) and Camanho et al. (2022) show that portfolio rebalancing under incomplete FX-risk trading links asset returns, capital flows, and exchange rates. Recent studies on emerging market securities further reveal that transmission of global financial shocks depends on who holds domestic assets and what risks those investors bear. Zhou (2025) shows that foreign investor composition matters: investment funds amplify global-risk spillovers, while banks, insurers, and pension funds remain relatively stable. Bertaut et al. (2025) shows that local-currency EME borrowing shifts currency risk to foreign investors, and that duration risk can amplify portfolio outflows when the dollar appreciates. Relative to these papers, this paper shifts attention from foreign investors' portfolio demand and risk exposure to home savers in EMEs, showing that their gross-outflow elasticity is a domestic absorption margin that shapes exchange-rate dynamics, FXI policy, and measured FXI effectiveness.

The rest of the paper is organized as follows. Section 2 describes the model and its predictions. Section 3 presents empirical evidence on private absorption and FXI policy. Section 4 studies pension funds and insurance companies as the source of private absorption. Section 5 revisits FXI effectiveness conditional on private absorption capacity. Section 6 concludes.

2 Demand System Model of Excess Currency Returns

In this section, we develop a partial equilibrium model of a bond market where excess currency return is determined by the portfolio balance channel. The model clarifies how foreign demand shocks are absorbed by home savers and the central bank. Home savers and a representative foreign investor demand home bonds, and their demand functions are not fully elastic to the return differential, in the spirit of Jiang et al. (2024) and Koijen and Yogo (2026). Foreign demand for home bonds is subject to a shock that captures global financial conditions. Because demand is inelastic, this shock moves the equilibrium excess currency return.

The model delivers three results. First, home savers' gross outflow responds to excess currency return, and this response summarizes private absorption capacity. Second, this elasticity dampens the response of excess currency return to foreign demand shocks. Third, when FXI is costly, the central bank intervenes more aggressively when private absorption is weaker.

A negative foreign demand shock is $\varepsilon < 0$. It raises expected excess currency return, $\widehat{rx} > 0$. Home savers' retrenchment corresponds to a decline in foreign bond holdings, $P_* \widehat{B}^* < 0$.

2.1 Model Environment

The model is a two-period discrete-time model of a small open economy. Home and foreign bonds are traded in the first period and pay off in the second period. Home savers, foreign investors, and the central bank trade home bonds, while home savers also hold foreign bonds. Bonds are denominated in their respective currencies, so the equilibrium in the home bond market determines the excess currency return.

2.1.1 Bonds and Excess Currency Return

Bonds — Home and foreign bonds are zero-coupon bonds that pay one unit of their respective currency in the second period. A unit of home bond costs $P_H = 1/(1+r)$ units of home currency in the first period and pays one unit of home currency in the second period. Similarly, a unit of foreign bond costs $P_* = 1/(1+r^*)$ units of foreign currency in the first period and pays one unit of foreign currency in the second period. The interest rates r and r^* are exogenous and constant throughout the model. The nominal exchange rate S is defined as units of home currency per unit of foreign currency, and S' denotes the second-period exchange rate. Hence, the home-currency gross return on the foreign bond is $(1+r^*)S'/S$.

Exchange Rate and Returns — Let $s = \log S$ and $s' = \log S'$. The second-period exchange rate is stochastic, and we normalize the long-run expected future exchange rate to one, so that $\mathbb{E}s' = 0$.

The excess currency return on the home bond relative to the foreign bond is

$$rx = r - r^* - (s' - s)$$

With exogenous interest rates and $\mathbb{E}s' = 0$, the expected excess currency return pins down the current exchange rate:

$$s = r^* - r + \mathbb{E}[rx] \tag{1}$$

The foreign bond provides a convenience yield to home savers. The convenience yield captures the non-pecuniary benefit from holding foreign bonds, such as liquidity services, and is denoted by ν^*.[1] Thus, home savers evaluate the foreign bond return as $r^* + \nu^*$. Equivalently, they evaluate the excess return on foreign bonds relative to home bonds as $-rx + \nu^*$.

2.1.2 Agents and Demand Functions

The economy is populated by a unit measure of home savers, a representative foreign investor, and a central bank. Home savers allocate wealth between home and foreign bonds. The foreign investor demands home bonds for their excess return, and her demand is subject to a shock in the first period. The central bank also demands home bonds through sterilized foreign exchange intervention. The equilibrium excess currency return clears the home bond market.

Home Savers — Following the inelastic markets hypothesis of Gabaix and Koijen (2024), we model domestic savers as investors with portfolio mandates. In this framework, an investor or fund is characterized by a target equity share, which determines both its baseline asset allocation and its marginal propensity to allocate new wealth to that asset. We adapt this logic to home savers in a small open economy by treating foreign bonds as the risky asset from the perspective of domestic savers, since their home-currency value fluctuates with the exchange rate.

A home saver i enters the first period with wealth $\overline{W}_{i0}$, $\theta_i \in [0,1]$ of which is allocated to foreign bonds and $1-\theta_i$ to home bonds. Specifically, θ_i is the target share of foreign bonds in her portfolio, and $\overline{B}^*_{Hi}$ and $\overline{B}_{Hi}$ are the quantities of each bond that achieve this target:

$$\theta_i = \frac{\overline{S} P_* \overline{B}^*_{Hi}}{\overline{W}_{i0}}, \qquad 1 - \theta_i = \frac{P_H \overline{B}_{Hi}}{\overline{W}_{i0}}$$

[1]See Bianchi et al. (2023) for a microfoundation of the convenience yield.

Thus, θ_i is the foreign-bond analogue of the equity share in Gabaix and Koijen (2024): absent return-induced rebalancing, a marginal dollar assigned to saver i is allocated with share θ_i to foreign bonds and share $1 - \theta_i$ to home bonds.

We assume that saver i's foreign-bond share responds to the expected excess return on home bonds:

$$\frac{SP_* B^*_{Hi}}{W_{i0}} = \theta_i \exp\{-\kappa_i (E[rx] - \overline{rx}^e)\}, \qquad \kappa_i \geq 0 \tag{2}$$

The parameter κ_i captures the flexibility of saver i's mandate. $\overline{rx}^e$ denotes the steady-state expected excess return on home bonds, which is the equilibrium level of expected excess return in the absence of foreign demand shocks. At this equilibrium, home savers maintain their initial bond holdings, $\overline{B}^*_{Hi}$ and $\overline{B}_{Hi}$. When $\kappa_i = 0$, the saver behaves like a fixed-share investor: exchange-rate movements change wealth, but the saver keeps the foreign-bond share fixed at θ_i. When $\kappa_i > 0$, savers retrench from foreign bonds as expected excess return on home bonds rises over the steady-state level.

Foreign Investors — The representative foreign investor demands home bonds for their expected excess return. We specify foreign demand as

$$B_F = \overline{B}_F \left(1 + \gamma^F (\mathbb{E}[rx] - \overline{rx}^e) + \varepsilon\right) \tag{3}$$

where $\gamma^F > 0$ is the elasticity of foreign demand to excess currency return. The shock ε captures exogenous shifts in foreign investors' demand for home bonds. A negative shock, $\varepsilon < 0$, represents a foreign retreat from home bonds, as in a tightening of global financial conditions. The finite value of γ^F captures inelastic foreign demand, in the spirit of Gabaix and Koijen (2024), Koijen and Yogo (2026), and Jiang et al. (2024).

2.2 Laissez-faire Equilibrium

We first study the laissez-faire equilibrium without foreign exchange intervention. We normalize the total supply of home bonds to one, so market clearing is

$$B_H + B_F = 1. \tag{4}$$

Thus, all bond holdings are measured as shares of total home-bond supply. Change in foreign demand for home bonds is absorbed by home savers' increased demand for home bonds, which is funded by retrenchment from foreign bonds. The expected excess currency return adjusts to clear the market. Since the bond demands are not fully elastic, the magnitude of change in expected excess return is determined by the elasticity of retrenchment with respect to expected excess return. We first characterize this elasticity and then derive how it determines the equilibrium expected excess return.

The equilibrium is solved as a deviation from the steady state where foreign demand shock is zero, $\varepsilon = 0$, and is approximated to first order in ε. We denote the steady-state value of a variable X by $\overline{X}$, deviations from the steady state by $\widehat{X} = X - \overline{X}$, and log deviations by $x = \log X - \log \overline{X}$.

2.2.1 Home Saver's Retrenchment

We log-linearize the home saver i's demand in equation (2) around the steady state to obtain linear demand functions for home and foreign bonds in log deviations.

$$b_{Hi} = \frac{\theta_i}{1-\theta_i}\gamma_{Hi} \cdot \widehat{rx} \tag{5}$$

$$b^*_{Hi} = -\gamma_{Hi} \cdot \widehat{rx} \tag{6}$$

where $\gamma_{Hi} \equiv 1 - \theta_i + \kappa_i$ denotes the elasticity of home saver i's foreign-bond demand with respect to expected excess currency return. The elasticity can be broken down into two components. First, the term $1-\theta_i$ captures the wealth effect of exchange-rate changes on home-currency wealth. When expected excess return rises, the home currency depreciation increases the home-currency value of foreign bonds and the saver's wealth. The home saver i should move $1-\theta_i$ of the increased wealth from foreign bonds to home bonds to match the target share of foreign bonds, θ_i. Second, the term κ_i captures the rebalancing for higher return on home bonds. When expected excess return rises, a home saver rebalances toward home bonds as much as its mandate allows, which is κ_i.

A home saver reduces the foreign-bond holdings in response to a larger expected excess return on home bonds. The reduction in foreign-bond holdings is larger when the target share of foreign bonds is smaller (smaller θ_i) and when the mandate is more flexible (larger κ_i). Appendix A.1.1 shows the derivation of these demand functions and the expression for γ_{Hi}.

Integrating individual demands across home savers gives aggregate domestic demands for home and foreign bonds as a deviation from the target level:

$$b_H = \frac{\Gamma_H}{P_H \overline{B}_H} \cdot \widehat{rx} \tag{7}$$

$$b_H^* = -\frac{\Gamma_H}{\overline{S} P_* \overline{B}_H^*} \cdot \widehat{rx} \tag{8}$$

where Γ_H denotes the aggregate semi-elasticity of home savers' demand for bonds with respect to expected excess currency return. The same parameter in equation (8) captures semi-elasticity of retrenchment with respect to expected excess currency return. Γ_H is characterized as:

$$\Gamma_H \equiv \int \theta_i \overline{W}_{i0} \gamma_{Hi} di \tag{9}$$

Characterization of Γ_H shows what makes home savers' retrenchment more return-elastic. First, the retrenchment is more elastic when home savers are wealthier, holding flexibility (κ_i) and target foreign-bond share (θ_i) fixed. Second, the retrenchment is more elastic when wealth is concentrated among home savers with more flexible mandates (larger κ_i). Lastly, foreign-bond share's effect on the elasticity is more subtle. Larger target foreign-bond share (θ_i) increases the elasticity up until $\theta_i = (1 + \kappa_i)/2$. This non-monotonicity arises because the wealth effect and size effect work in opposite directions. The wealth effect, captured by $1 - \theta_i$ in γ_{Hi}, decreases with larger foreign-bond share, while the size effect, captured by θ_i, increases with larger foreign-bond share. Noticeably, when $\kappa_i \geq 1$, the size effect dominates the wealth effect, and the aggregate semi-elasticity monotonically increases with more concentration of wealth among savers with larger target foreign-bond shares.

Following prediction summarizes this observation.

Prediction 1. *The aggregate semi-elasticity of retrenchment with respect to expected excess currency return is larger when home investors with more flexible mandates and larger target foreign-bond shares hold more wealth.*

2.2.2 Equilibrium Expected Excess Currency Return

We now solve for the equilibrium response of expected excess currency return to a foreign demand shock as deviation from the steady state. In laissez-faire, the shock is absorbed by two margins: home savers' retrenchment from foreign bonds and foreign investors' own return-elastic demand for home bonds. Equivalently, because the supply of home bonds is fixed, any increase in domestic demand for home bonds must be offset by an equal decline in foreign demand. Formally,

$$\widehat{B}_H + \widehat{B}_F = 0 \tag{10}$$

Combining equation (7), (3), and (10) yields the equilibrium expected excess currency return:

$$\widehat{rx} = -\frac{\overline{B}_F}{A^{LF}}\varepsilon, \qquad A^{LF} \equiv \frac{\Gamma_H}{P_H} + \gamma^F \overline{B}_F \tag{11}$$

Because $A^{LF} > 0$, a negative foreign demand shock, $\varepsilon < 0$, raises the expected excess return on home bonds. By equation (1), this corresponds to a depreciation of the home currency. The response is smaller when home savers' retrenchment is more elastic, i.e., when Γ_H is larger for a given level of foreign investors' demand elasticity and foreign holdings of home bonds.

2.3 Equilibrium with Endogenous FXI

In this section, we introduce foreign exchange intervention (FXI) into the model. FXI is implemented by the central bank's purchase (sale) of home bonds and sale (purchase) of foreign reserves. The central bank adjusts excess currency return by buying and selling home bonds. We assume that the central bank desires to close the excess return gap while minimizing the cost of intervention. Using a stylized objective function, we capture this trade-off and derive the optimal FXI policy function. The optimal FXI policy is linear in expected excess return, and the slope of the policy function is negatively correlated with home savers' retrenchment elasticity.

2.3.1 Optimal FXI Policy

We endogenize the central bank's linear FXI policy rule by assuming the central bank wants to close the excess return gap while minimizing the intervention cost. A full-fledged open economy models such as Cavallino (2019) and Itskhoki and Mukhin (2026) describe how the two motives coexist. The excess return induces incomplete international risk sharing, which diverts consumption from its optimal path. Hence, the central bank uses foreign reserves to close the excess return. Yet, maintaining reserves is costly because reserves (i.e., foreign bonds) yield lower return than the interest rate at which the central bank borrows to finance reserve accumulation.

This objective can be represented by a stylized objective function of the central bank in equation (12). We assume the central bank chooses its optimal FXI policy function ex-ante and follows the policy in the first period in response to change in expected excess return due to foreign demand shock.

$$\mathcal{J} \equiv b_{CB}^2 + \theta \left(\widehat{rx}\right)^2 \tag{12}$$

Notice that the quadratic form of the objective function is a single-period version of the loss function in Itskhoki and Mukhin (2026). The first term captures the cost of intervention and the second term captures the welfare loss due to incomplete risk sharing.

b_{CB} is the dollar-deviation demand for home bonds generated by the central bank's intervention. The FXI policy is the choice of b_{CB} as a function of expected excess return, $\widehat{rx}$. We assume that the policy problem concerns the response of intervention to deviations in expected excess return, not the level of the central bank's steady-state balance sheet. The policy boils down to choosing how the central bank reacts to changes in expected excess return. The optimal policy function is as follows:

$$b_{CB} = \gamma_{CB}^{opt} \widehat{rx} \tag{13}$$

where $\gamma_{CB}^{opt} = \frac{\theta}{\frac{1}{P_H}\Gamma_H + \gamma^F \overline{B}_F}$. See appendix A.2 for derivation of the optimal policy.

The optimal policy function in equation (13) shows that the FXI policy is more responsive to change in excess currency return when the semi-elasticity of retrenchment is smaller, other things equal. In other words, the central bank's intervention policy is more aggressive when the private sector cannot absorb much of the foreign shocks through retrenchment. Following prediction summarizes this result.

Prediction 2. *Aggregate semi-elasticity of retrenchment and optimal FXI policy intensity are negatively correlated.*

We provide empirical evidence that support this prediction in section 3.3.

2.3.2 Bias in FXI Effectiveness Evaluation

The FXI policy effectiveness can be defined as the extent to which FXI reduces the excess currency return's response to a foreign demand shock. Prediction 2 reveals that the return elasticity of home savers' retrenchment should be accounted for when evaluating FXI effectiveness. Specifically, direct comparison of excess currency return response to foreign demand shocks across different FXI practices involves an omitted variable bias. The omitted variable bias biases the estimate of FXI effectiveness towards zero because the FXI policy is negatively correlated with home savers' retrenchment elasticity. In other words, FXI policy effectiveness examined without accounting for variation in home demand elasticity should be considered as a lower bound of the true effectiveness of FXI policy.

The cross-derivative of equilibrium excess return with respect to the foreign demand shock and the FXI policy parameter, γ_{CB}, captures FXI effectiveness. We formalize the omitted variable bias in equation (14), which shows that the cross-derivative is composed of two terms: a direct effect of FXI and a correlation term that captures the negative correlation between FXI policy and home demand elasticity.

$$\frac{\partial^2 \widehat{\mathbb{E}rx}}{\partial \gamma_{CB} \partial(-\varepsilon)} = -\frac{\overline{B}_F \overline{B}_H}{A^2}\left(1 + \frac{1}{P_H}\frac{\partial \Gamma_H}{\partial \gamma_{CB}}\right) = \underbrace{-\frac{\overline{B}_F}{A^2}}_{\text{Direct effect}} + \underbrace{\frac{\overline{B}_F}{A^2}\frac{(\Gamma_H/P_H + \gamma^F \overline{B}_F)^2}{\theta}}_{\text{Correlation term}} \tag{14}$$

$$A \equiv \frac{1}{P_H}\Gamma_H + \gamma^F \overline{B}_F + \overline{B}_{CB}\gamma_{CB}$$

The negative direct effect in the equation indicates that FXI restrains increase of excess return in response to a negative foreign demand shock. And FXI does more shock-mitigation (larger absolute value of the direct effect) when the aggregate home demand semi-elasticity is smaller (smaller A), everything else equal. However, since optimal FXI policy is negatively correlated with private absorption, a stronger FXI policy accompanies a smaller private absorption. The second term captures this correlation effect, which is positive and diminishes the observed FXI effectiveness. This term shows that omitting home demand elasticity introduces the bias in FXI effectiveness evaluation. Prediction 3 summarizes the finding in this subsection.

Prediction 3. *The endogeneity of FXI policy to home savers' retrenchment elasticity introduces an omitted variable bias in evaluating FXI effectiveness. The bias can be corrected by accounting for private capacity to absorb foreign shocks.*

3 Private Semi-Elasticity and FXI: Empirical Evidence

In this section, we present empirical evidence for correlation between private capacity to absorb foreign shocks and FXI policy using a panel of emerging market economies. The panel covers 19 EMEs whose currencies are not pegged to another currency according to the classification by Ilzetzki et al. (2019), and sample period from 2001Q1 to 2024Q2. Appendix D elaborates on the data sources and construction of variables.

3.1 FXI Regime Classification

We compare expected excess returns and gross portfolio flow dynamics across two groups of EMEs that differ in the extent of their foreign exchange market intervention. We classify the 19 EMEs in the sample into floaters and interveners using the methodology by Blanchard et al. (2015). The classification method categorizes economies based on how FXI policy responds to global financial shocks. This approach is more suitable for our study than alternative methods such as relying on official statements by monetary authorities or unconditional moments of exchange rate. Classification based on monetary authorities' claims can be misleading, as many economies are known to manage their exchange rates in effect despite their claims of being a floater. Relying on unconditional correlation between two currencies for classification as in Ilzetzki et al. (2019) is also insufficient for this study because it is how FXI policy responds to foreign shocks that should be the focus of classification.

The classification method by Blanchard et al. (2015) uses a vector autoregression (VAR) to investigate how foreign exchange intervention responds to global financial shocks. The VAR is estimated for each individual country, and cumulative impulse response of FXI to a global financial shock is compared across countries. Countries whose FXI exhibits more than median cumulative response are classified as interveners ("interveners" in the original paper), and the rest are classified as floaters.

In the vector, we include sum of gross capital inflow across all countries in the sample excluding the country of VAR estimation as the most exogenous variable. Formally,

$$GKF_{i,t} = \frac{\sum_{j \neq i} \text{Gross Inflow}_{j,t}}{\sum_{j \neq i} \text{GDP}_{j,t}} \tag{15}$$

The full set of vector includes the GKF, policy interest rate differential, gross private capital outflow, inflow, net sales of foreign reserve, and log nominal exchange rate, from the most to the least exogenous variable. Policy rate differential between country i and the US controls for stabilization policy by moving interest rates, in other words, unsterilized interventions. Gross capital flows and foreign reserve are scaled by lagged GDP. Net sales of foreign reserve captures the FXI policy and are measured as the sum of change in foreign reserve and off balance sheet FX position. As jump in GKF implies an increase in gross inflow, an FXI policy that 'leans against the wind' should exhibit a negative response in net sales of foreign reserve. Appendix B elaborates the estimation of VAR and presents results from the VAR estimation.

Classifying the 19 EMEs into two groups among themselves may lead to erratic labeling as most EMEs are known to intervene to the foreign exchange market to some extent. To avoid such biased classification, we include all sample economies from the original Blanchard et al. (2015) paper in this classification exercise, including advanced economies that are not issuers of reserve currency (Australia, Canada, New Zealand, Norway, Sweden). We extend the sample period of the original paper, which allows us to capture the recent trend of FXI policy in EMEs. Among the 19 EMEs in our sample, 9 are classified as floaters and 10 are classified as interveners. Table 2 reports the list of countries in each group.

Table 2. List of Countries in the Sample

Regime	Countries									
Floaters	CHL	COL	CZE	HUN	IDN	ISR	KOR	MEX	ZAF	
Interveners	BRA	IND	LKA	MYS	PER	PHL	POL	RUS	THA	TUR

Note: The table shows the list of countries in the sample and their FXI regime classification. The classification is based on the cumulative response of net sales of foreign reserve to a global financial shock, as estimated from a VAR à la Blanchard et al. (2015).

3.2 Empirical Model: Aggregate Semi-Elasticity of Gross Portfolio Outflow

In this section, we estimate the aggregate semi-elasticity of gross portfolio outflow with respect to expected excess currency return. This corresponds to Γ_H in equation (8) of the model. The semi-elasticity captures how private portfolio outflow expands and retrenches in response to change in expected excess currency return. The statistic provides a structural illustration of domestic private savers' behavior in response to foreign shocks. This approach is more rigorous than a reduced-form correlation between gross portfolio outflow and a proxy of foreign shocks because retrenchment (expansion) decisions depend on the excess currency return, which is determined in equilibrium subject to a foreign shock.

By definition of balance of payment (BPM6) statistics, gross portfolio outflow excludes capital flow due to change in reserve assets, and measures flows originating from private savers.[2] We define expected excess currency return as the difference between returns on domestic and foreign bonds with one year maturity. We directly measure the ex-ante excess return on home bond with a survey-based measure of expected exchange rate. Specifically, the expected return on foreign bond is converted to domestic currency terms using the Consensus Forecast of exchange rate one year ahead. This measure of expected excess return is often used in the empirical literature on uncovered interest rate parity (UIP) deviation. Kalemli-Özcan and Varela (2025) examine its properties and find that it is closely related with global financial conditions.

The empirical model used to estimate Γ_H is a regression of gross portfolio outflow, normalized by lagged GDP, on the first-difference of expected excess currency return ($rx^e_{i,t}$). The coefficient on expected excess currency return is the empirical counterpart of Γ_H in the model. Formally, we estimate a pooled regression with country fixed effects in equation (16):

$$\text{Gross Portfolio Outflow}_{i,t} = \delta_i + \lambda \Delta rx^e_{i,t} + \eta \text{Gross Portfolio Outflow}_{i,t-1} + \nu_{i,t} \tag{16}$$

A lag of gross portfolio outflow is controlled for to capture the persistence in gross portfolio out-

[2]This measure may include flows from government or quasi-government entities such as sovereign wealth funds that are not classified as reserve assets. Though they are technically not changes in reserve assets, they may be driven by motives to affect the exchange rate. We find our results to be robust to using an alternative measure of gross portfolio outflow that explicitly excludes government and central bank flows constructed by Avdjiev et al. (2022). Their breakdown of international capital flows by sector provides portfolio debt outflow from banks and other private sectors ('corporate' in the original name). We use the sum of flows from both private sectors as an alternative measure of gross private portfolio outflow.

flow.[3]

The estimation of λ is subject to endogeneity because change in gross portfolio outflow moves the excess currency return in equilibrium. We address the endogeneity of expected excess return using instrumental variable. In particular, we use a proxy of foreign demand shock, which is assumed to be exogenous to $\nu_{i,t}$. The foreign shock should be relevant for expected excess return, as they shift foreign demand for home bonds and thus move the excess return, as shown in section 2. We use a common proxy of global financial condition, the VIX index, as the instrumental variable. The literature, such as Kalemli-Özcan and Varela (2025), finds high correlation between the VIX index and the excess currency return, which supports the relevance of the VIX index as an instrument.

Table 3 reports the estimation results of equation (16) for the full sample of 19 EMEs and for five non-reserve currency advanced economies (AEs): Australia, Canada, New Zealand, Norway, and Sweden. The estimated semi-elasticity of gross portfolio outflow is negative and statistically significant for both samples of EMEs and AEs. This implies that private savers decrease purchases of, or retrench from, foreign financial assets when the expected excess currency return on domestic securities increases. Yet, the elasticity is smaller in absolute value for the sample of EMEs than for the sample of AEs. In EMEs, a one standard deviation increase in expected excess return, 2.5%p, is associated with a change in gross portfolio outflow of -0.2%p of GDP, equivalent in magnitude to 0.3 standard deviations of gross portfolio outflow. In AEs, a one standard deviation increase in expected excess return, 2.4%p, is associated with a change in gross portfolio outflow of -0.6%p of GDP, equivalent in magnitude to 0.4 standard deviations of gross portfolio outflow. Such difference in semi-elasticity between EMEs and AEs is consistent with our motivating evidence in table 1 as well as stronger retrenchment documented in the literature (Avdjiev et al. (2022) and Forbes and Warnock (2012)). The model predicts that the error term ν_{it} is negatively correlated with the expected excess return, so the OLS estimate is biased towards zero. As expected, the IV estimate of λ is larger in absolute value than the OLS estimate.

[3]The regression model is a dynamic panel data model with autoregressive term. Yet, the long time dimension (~ 80) relative to the cross-sectional dimension (19) relieves us from the Nickell bias (Nickell, 1981).

Table 3. Home Elasticity Estimates

	EME		AE	
	IV	OLS	IV	OLS
Δrx^e	-0.084***	-0.023***	-0.251*	-0.044
	(0.023)	(0.004)	(0.132)	(0.046)
Lag Dep. Var.	0.255***	0.243***	0.256**	0.233***
	(0.056)	(0.049)	(0.123)	(0.078)
No. Observations	1335	1335	440	440
Country FE	Yes	Yes	Yes	Yes
First-stage F-statistic	49.68		196.97	

Note: The table reports estimates of regression (16) separately for 19 emerging market economies (EMEs) and five non-reserve-currency advanced economies (AEs): Australia, Canada, New Zealand, Norway, and Sweden. Gross portfolio outflow is measured as a share of GDP. In the IV columns, Δrx^e is instrumented with $\Delta \ln VIX$; the OLS columns estimate the same specification without instrumenting Δrx^e. All regressions include country fixed effects and lagged gross portfolio outflow. Standard errors are clustered by country; IV standard errors incorporate the finite-sample adjustment for absorbed country fixed effects. First-stage F statistics are reported for the IV specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

3.2.1 Robustness: Alternative Instrument Variables

As a robustness check, we replace $\Delta \ln VIX$ with a quantity-based proxy for foreign demand shocks constructed from the Bertaut–Judson TIC data (Bertaut and Judson, 2022). We normalize estimated U.S. net purchases of each destination country's bonds and equities by lagged U.S. holdings and extract the common component of the resulting monthly series using a dynamic factor model. Appendix C describes the construction of this instrument in detail. Appendix Table C.5 reports the corresponding IV estimates. The results are qualitatively consistent with the baseline estimates: the semi-elasticity is negative and statistically significant for the full EME sample and for floaters, but smaller and statistically insignificant for interveners. The first stage remains strong for the full sample and floaters but is weaker for interveners, whose estimate should therefore be interpreted with a grain of salt. We retain $\Delta \ln VIX$ as the baseline instrument because it has a stronger first-stage relationship with Δrx^e.

In addition, we show that our results are robust to using alternative proxies of global financial cycles: the global financial cycle factor from Miranda-Agrippino and Rey (2020) and the dollar index. Table C.3 and Table C.4 in the appendix report estimation results using these two alternative instruments. They also exhibit lower first-stage F statistics for interveners, but the results are qualitatively consistent with the baseline estimates.

3.3 Correlation between Semi-Elasticity and FXI

In this subsection, we show that the semi-elasticity of gross portfolio outflow is negatively correlated with the intensity of FXI policy. First, we contrast semi-elasticities across groups of countries with different FXI regime, floaters and interveners. The estimated semi-elasticity is smaller for the sample of interveners than for the sample of floaters, which is consistent with the model's prediction that stronger FXI policy is associated with less return-elastic retrenchment behavior. Then we extend our analysis to cross-country variation in the semi-elasticity and its relation with a continuous measure of FXI intensity.

Table 4. Home Elasticity Estimates

	IV		OLS	
	Floater	Intervener	Floater	Intervener
Δrx^e	-0.095***	-0.061	-0.031***	-0.012***
	(0.013)	(0.060)	(0.005)	(0.004)
Lag Dep. Var.	0.261***	0.237**	0.250***	0.223**
	(0.068)	(0.112)	(0.057)	(0.103)
No. Observations	738	597	738	597
Country FE	Yes	Yes	Yes	Yes
First-stage F-statistic	98.14	9.20		

Note: The table reports estimates of regression (16) separately for nine floaters and ten interveners, classified using the updated procedure based on Blanchard et al. (2015). Gross portfolio outflow is measured as a share of GDP. In the IV columns, Δrx^e is instrumented with $\Delta \ln VIX$; the OLS columns estimate the same specification without instrumenting Δrx^e. All regressions include country fixed effects and lagged gross portfolio outflow. Standard errors are clustered by country; IV standard errors incorporate the finite-sample adjustment for absorbed country fixed effects. First-stage F statistics are reported for the IV specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The left two columns in Table 4 compare the semi-elasticity of floaters against interveners' estimated from the instrumental variable regression. The point estimates indicate that gross portfolio outflow is more elastic among floaters than interveners. These results are consistent with the model's prediction (prediction 2) that stronger FXI policy is associated with less return-elastic retrenchment behavior. The right two columns in the table show the estimation results from the OLS regression, which are also biased towards zero due to the endogeneity of expected excess return. IV estimation results for interveners come with a caveat as the first-stage F statistic is a bit lower than the rule-of-thumb threshold of 10. The lower relevance of the instrument for interveners can be interpreted as a result of stronger FXI policy, which reduces the response of expected excess return to foreign shocks by intention.

We strengthen the link between FXI practices and the semi-elasticity of gross capital outflows using cross-country variation in the semi-elasticity. To this end, we estimate country-specific semi-elasticities of gross capital outflows and compare them with a continuous measure of FXI intensity. We measure FXI intensity as the cumulative impulse response of FXI to an exogenous capital inflow shock, estimated from the VAR employed for the FXI regime classification. The country-wise semi-elasticities are estimated from the following regression equation (17) for each i:

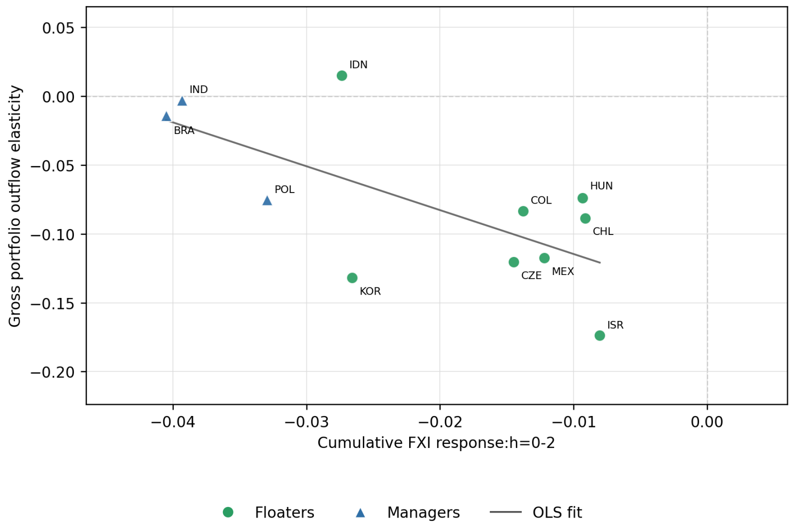
$$\text{Gross Portfolio Outflow}_{i,t} = \delta_i + \lambda_i \Delta rx^e_{i,t} + \eta_i \text{Gross Portfolio Outflow}_{i,t-1} + \nu_{i,t} \qquad (17)$$

Figure 1 plots the country-wise semi-elasticity, λ_i, against the cumulative response of FXI to a global financial shock for each country. As the first-stage regression of country-wise semi-elasticity estimation is not as strong as the pooled regression, we exclude countries with low first-stage F statistics from the scatter plot in Figure 1. Table C.1 in the appendix shows the estimation results for individual countries. The comparison shows that lower semi-elasticity (smaller in absolute value) is associated with stronger FXI policy (larger cumulative FXI response to GKF shock in absolute value). This supports the model's prediction that stronger FXI policy is associated with less return-elastic retrenchment behavior of private savers.

4 Pension Funds as Private Stabilizer

The model emphasizes that home savers with international portfolio absorb foreign demand shocks and thereby characterize optimal FXI policy. Empirical evidence in section 3.3 supports the negative relation between aggregate semi-elasticity of gross portfolio outflow and FXI policy shown in the model. A natural question that follows is who the empirical counterpart of the home savers in the model is. Given larger role institutional investors have in international capital allocation, we investigate if development of pension funds and insurance companies explains the variation in home demand elasticity across economies. We focus on pension funds and insurance companies because they are large institutional investors that exist across most EMEs, as opposed to more sophisticated institutional investors such as hedge funds and mutual funds that are not as developed

Figure 1. Semi-Elasticity and FXI Policy



Note: This figure shows country-wise gross portfolio outflow semi-elasticity plotted against a measure of FXI intensity. The measure of FXI intensity is the cumulative impulse response of FXI to a global financial shock up to $h = 2$ from the VAR à la Blanchard et al. (2015). The scatter plot excludes LKA, MYS, PER, PHL, THA, and ZAF for low first-stage F statistics (under 5) in the country-wise semi-elasticity estimation, and RUS and TUR for short sample period.

in EMEs as in advanced economies.

We demonstrate the relevance of pension fund and insurance company assets to the aggregate semi-elasticity through two sets of evidence. First, using a novel microdata on Colombian pension funds' portfolio, we show that pension funds behave just like home savers in the model. To the best of our knowledge, this dataset is yet to be explored in the literature, and we are the first to use it to study pension funds' behavior in response to foreign shocks. In addition to the micro-evidence, we exploit cross country variation of semi-elasticity and pension funds-insurance company assets. The cross country study supports our claim that aggregate semi-elasticity is larger where pension funds-insurance company assets are larger.

These findings suggest that allowing pension funds and other institutional investors to hold internationally diversified portfolios can generate a macro-financial benefit beyond the private gains from diversification. Foreign asset holdings enable these investors to retrench when global financial conditions tighten, helping absorb external selling pressure and reducing the need for FXI. Regulations that restrict overseas investment may therefore weaken this private stabilization margin. This implication is suggestive rather than prescriptive, since the paper does not quantify the welfare trade-off between exchange-rate stabilization and other objectives of pension regulation.

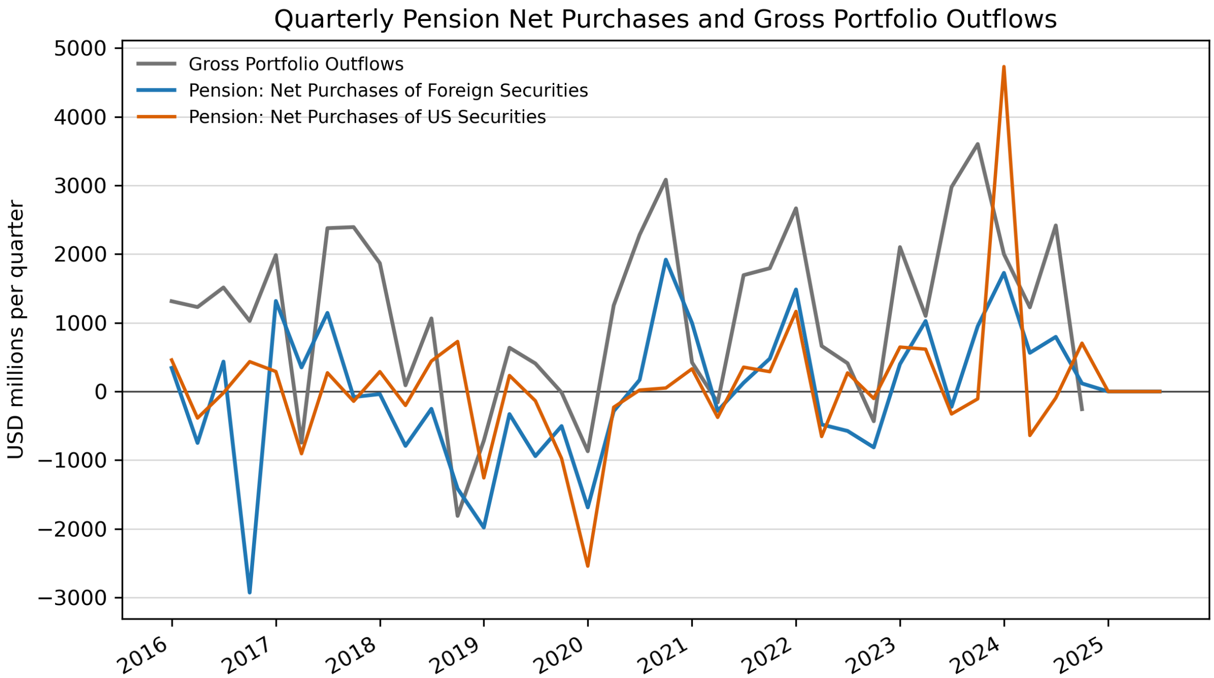
4.1 Micro Evidence: Colombian Pension Funds

We use security-level portfolio data on Colombian pension funds from the Financial Superintendence of Colombia (Superintendencia Financiera de Colombia), the country's financial regulator. Pension funds are required to report composition of their investment portfolio, including the quantity and value of each security they hold, on a monthly basis. Using these data, we compute each pension fund's net purchases of foreign securities, a measure that is unaffected by valuation effects. We find pension funds' net purchases of foreign securities comove with the expected excess currency return and the VIX index in a way similar to home savers in the model.

Colombian pension fund system consists of three major types: mandatory pension funds, programmed withdrawal funds, and the severance funds. We focus on the three mandatory pension funds (Fondos de Pensiones Obligatorias), which are the largest and most representative segment of the system. The regulatory dataset records the purchase date of each security, and each holding is tracked separately by purchase date. This data structure allows us to track purchases and sales of foreign securities over time as fund-security-purchase date pairs. A security exits a fund's portfolio when it is sold or matures. Because maturity dates are recorded in the dataset, we identify matured securities by their disappearance from a fund's portfolio after their maturity dates. Sales are identified either by a decline in the quantity of a fund-security-purchase-date combination or by its disappearance before maturity. Some fund-security-purchase date pairs disappear and reappear immediately. We consider this as re-labeling and not actual sales and purchases. We compute the net purchases of foreign securities as purchases minus sales and securities that mature, and then aggregate these flows across funds and securities to obtain the total net purchase flow into foreign securities. We scale the resulting net purchase flow by pension funds' assets under management (AUM) at the end of the previous month.

To assess the magnitude of pension fund flows, we compare pension funds' net purchases of foreign securities with gross portfolio outflows reported in the Balance of Payments (BoP) statistics. Figure 2 plots both series, measured in millions of U.S. dollars. Pension fund flows are comparable in magnitude to gross portfolio outflows in the BoP statistics, and the two series closely co-move over time. Table C.2 in the appendix reports the mean and quantiles of the ratio of pension funds' net purchases to gross portfolio outflows.

Figure 2. Colombian Pension Fund Net Purchases and BoP Gross Portfolio Outflow



Note: This figure plots the net purchase flow of foreign securities by Colombian pension funds and the gross portfolio outflow from Balance of Payment statistics in millions USD. The monthly net purchase flow is computed from the regulatory dataset on Colombian pension funds' portfolio and summed within a quarter.

Pension fund-driven outflows are not only significant in magnitude but also comove with the expected excess currency return and the VIX index. To make the flows comparable over time, we scale net purchases of foreign securities by pension funds' assets under management (AUM) at the end of the previous period. Table 5 shows that Colombian pension funds' net purchases of both foreign and U.S. securities co-move with expected excess currency returns and the VIX index. The negative correlation between net purchases and expected excess currency returns implies that pension funds reduce their purchases of foreign and U.S. securities when expected excess returns increase, consistent with the behavior of home savers in the model. The outflows also exhibit the relationship with the VIX implied by the model: pension funds reduce their purchases of foreign and U.S. securities when global financial conditions deteriorate and a negative foreign demand shock hits the domestic financial market.

Table 5. Correlation of Colombian Pension Fund Net Foreign Security Purchase with VIX and Δrx^e

Net Purchases	Δlog VIX	Δrx^e
Net Purchases of US Securities / AUM	-0.085	-0.114
Net Purchases of Foreign Securities / AUM	-0.166	-0.307

Note: The table shows the correlation of Colombian pension funds' net purchase of US/foreign securities with the excess currency return and the VIX index.

4.2 Cross-Country Evidence

In the previous subsection, we show that pension funds retrench from foreign securities when expected excess currency return increases. To close our argument that development of institutional investors with international exposure contributes to private absorption of external shocks, we show its relevance to the aggregate semi-elasticity of gross portfolio outflow. In particular, we show that the semi-elasticity is larger in economies with larger pension fund and insurance company assets. We connect the size of pension fund and insurance company assets to the semi-elasticity using a regression model with an interaction term between expected excess currency return and pension fund and insurance company assets. Specifically, we estimate the following regression model that includes an interaction of first-differenced excess currency return (Δrx^e) with pension fund and insurance company assets (X_i^c).

$$\text{Gross Portfolio Outflow}_{i,t} = \delta_i + \zeta_0 \Delta rx^e_{i,t} + \zeta_1 \Delta rx^e_{i,t} \cdot X_i^c + \eta \text{Gross Portfolio Outflow}_{i,t-1} + \nu_{i,t} \quad (18)$$

We instrument $\Delta rx^e_{i,t}$ and its interaction with X_i^c using first-differenced VIX index and its interaction with X_i^c to address the endogeneity of expected excess return. The coefficient ζ_1 captures how the semi-elasticity of gross portfolio outflow changes with pension fund and insurance company asset size. We measure pension fund and insurance company assets in terms of GDP, using World Bank data on financial sector development. In order to focus on cross-country variation of these assets, we use the country-average size of pension fund and insurance company assets over the sample period, X_i. We center the variable by cross-country mean, $X_i^c = X_i - \bar{X}$, to make the coefficient on excess currency return (ζ_0) show semi-elasticity for a country with average pension fund and insurance company asset size.

Table 6 shows the estimation results of regression (18). The IV column shows the estimation

Table 6. Semi-Elasticity and Pension Fund · Insurance Assets

	IV	OLS
Δrx^e_{it}	-0.084***	-0.023***
	(0.022)	(0.004)
$X^c_i \times \Delta rx^e_{it}$	-0.001**	-0.000
	(0.000)	(0.000)
Lag gross portfolio outflow	0.271***	0.248***
	(0.061)	(0.051)
Observations	1335	1335
Countries	19	19
L-M Statistics	32.40	
Relative CV ($\alpha = 0.1, \tau = 0.1$)	29.28	

Note: The table reports estimates of regression (18) for the full sample of 19 EMEs. The dependent variable is gross portfolio outflow as a share of GDP. Column IV instruments Δrx^e_{it} and $X^c_i \times \Delta rx^e_{it}$ using the first difference of log VIX and its interaction with X^c_i. Column OLS estimates the same specification without instrumenting. X^c_i is each country's average pension fund plus insurance company assets as a share of GDP, measured in percentage points and centered at the cross-country mean. Both specifications include country fixed effects and lagged gross portfolio outflow; standard errors are clustered by country. L-M Statistics reports the generalized weak-IV statistic from Lewis and Mertens (2025), and Relative CV reports its 10% critical value under a 10% relative-bias tolerance. A statistic above the critical value rejects the weak-instrument null. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

results from the instrumental variable regression, while the OLS column shows the estimation results without instrumenting for expected excess return as a reference. We find ζ_1 to be negative for the full EME sample, which implies gross portfolio outflow is more elastic to excess currency return when pension fund and insurance company assets are larger, consistent with our prediction. When a country's pension fund and insurance company assets are larger than cross country average by 10%p of GDP, the semi-elasticity is about 10% larger (0.084/0.01). The table reports the generalized weak-IV statistic from Lewis and Mertens (2025) and its 10% critical value under a 10% relative-bias tolerance. The L-M statistic implies that the instruments are not weak for the IV regression. The OLS results show that estimation without using the IV is biased towards zero, as expected from the endogeneity of expected excess return to gross portfolio outflow.

The baseline measure of pension fund and insurance company assets may confound the effect of development of the internationally-exposed portfolio investors with the depth of financial market, as they are often correlated. To address this concern, we check the robustness of our results by normalizing pension-insurance asset size by the size of outstanding domestic and public and private debt securities, a measure of financial market depth. The elasticity-augmenting role of pension-insurance assets remains robust to this alternative measure, albeit with less statistical significance. Table C.6 in the appendix presents this result. This confirms that development of pension funds and insurance companies, not just the sheer size of financial market, contributes to private stabilization capacity.

5 FXI Effectiveness: Conditional on Private Absorption Capacity

Prediction 3 reveals that FXI policy looks less effective because FXI policy is endogenous to private absorption capacity of the economy. In other words, since FXI policy is more aggressive in economies where gross capital outflow is less elastic to excess currency return, unconditional comparison of correlation between excess currency return and global financial shocks across FXI regimes underestimates FXI policy effectiveness. In this section, we contrast the correlation between excess currency return and the VIX index across FXI regimes, conditional on private absorption capacity. We rely on our findings from section 4 to proxy the private absorption capacity with pension fund and insurance company assets size. We find that larger pension fund and insurance company assets reduce the correlation between excess currency return and the VIX, and that the difference in correlation between floaters and interveners is larger when we control for pension-insurance asset size.

Specifically, we regress changes in the excess currency return (Δrx_{it}) over a proxy of global financial shock, first-differenced VIX index, and its interaction with an indicator for interveners. And we add an interaction term of the first-differenced VIX index with the pension and insurance company asset size to control for the role of home absorption capacity. We use average pension fund and insurance company assets over the sample period for each country, centered by cross-country mean, to focus on cross-country variation of these assets. In addition, we control for previous quarter's gross capital inflow, following Kalemli-Özcan and Varela (2025), to account for the direct effect of capital inflow on excess currency return. Formally, we estimate the following regression:

$$\begin{aligned}\Delta rx^{e}_{i,t} =& \alpha_i + \beta_0 Z_t + \beta_M Z_t \times Intervener_i + \beta_X Z_t \times X^c_i \\ &+ \delta GrossInflow_{it-1} + \varepsilon_{it} \end{aligned} \tag{19}$$

where Z_t is change in VIX index, and X_i^c is pension funds and insurance assets centered by cross-country mean, scaled in terms of GDP. β_0 captures the correlation between excess currency return and VIX index for a country with average pension fund and insurance company asset size. Coefficients β_M captures difference in the correlation between interveners and floaters, while β_X captures how the correlation changes with pension fund and insurance company asset size.

Table 7. Correlation of Excess Currency Return with VIX changes: Across FXI Regimes

	VIX only	+ Intervener	+ Wealth
$\Delta \ln VIX$	3.751***	4.467***	4.610***
	(0.504)	(0.420)	(0.465)
$\Delta \ln VIX \times Intervener$		-1.590*	-1.918**
		(0.948)	(0.971)
$\Delta \ln VIX \times Wealth$			-0.015*
			(0.009)
Gross inflow	0.018***	0.016***	0.016**
	(0.006)	(0.006)	(0.006)
R-squared	0.111	0.116	0.118
No. observations	1342	1342	1342
Countries	19	19	19
Country FE	Yes	Yes	Yes

Note: The table shows the estimation results of regression (19). The dependent variable is the change in excess currency return, Δrx_{it}^e. The key independent variables are bold. The standard errors are country-clustered.

Table 7 reports the estimation results for equation (19). Column (1) presents the baseline specification without interaction terms. Expected excess currency returns increase with the VIX index, consistent with the model's prediction in equation (11) and the empirical evidence in Kalemli-Özcan and Varela (2025). Quantitatively, a one-standard-deviation increase in the VIX raises expected excess currency returns by 0.83%p, approximately one-third of a standard deviation of excess currency returns.

Column (2) adds the interaction between the VIX and the intervener indicator. The coefficient is negative but only marginally significant, providing weak evidence that expected excess currency returns are less sensitive to global financial conditions in interveners than in floaters. Column (3) further interacts the VIX with pension fund and insurance company asset size. After accounting for this measure of private absorption capacity, the estimated difference between interveners and floaters becomes larger and more precisely estimated. The interaction with pension-insurance asset size is also negative, although only marginally significant. Quantitatively, a 10-

percentage-point increase in pension fund and insurance company assets relative to GDP reduces the estimated sensitivity of expected excess currency returns to the VIX by 3.34% relative to the sample average.

These estimates should therefore be interpreted as suggestive rather than conclusive evidence. Their joint pattern is consistent with the paper's central mechanism: stronger private absorption directly dampens the response of expected excess currency returns to global financial shocks, while central banks intervene more intensively where private absorption is weaker. Consequently, the observed response of expected excess currency returns reflects the combined roles of private absorption and official intervention, and comparisons across FXI regimes that omit private absorption capacity may understate the stabilizing role of intervention.

Breaking Down Excess Currency Return

It is useful to examine through which component of expected excess currency returns—the interest rate differential or expected depreciation—the VIX index affects excess currency returns, and how FXI policy and private stabilization mitigate these effects. To this end, we decompose expected excess currency returns into these two components. For this exercise, we estimate the following pooled regression with country fixed effects:

$$y_{i,t} = \alpha_i + \beta_0 Z_t + \beta_M Z_t \times Intervener_i + \beta_X Z_t \times X_i^c + \delta GrossInflow_{it-1} + \varepsilon_{it} \tag{20}$$

where $y_{i,t}$ is either the change in the interest rate differential or the change in expected depreciation.

Table 8 reports the estimation results. The left panel presents the regression for the change in the interest rate differential, while the right panel presents the regression for the change in expected depreciation. The VIX index has a significant effect on both components of expected excess currency returns. However, deteriorating global financial conditions are associated with a larger increase in expected appreciation than in the interest rate differential. Being an intervener reduces the effect of the VIX on expected depreciation, but does not mitigate the effect on the interest rate differential. This finding is consistent with the objective of FXI policy, which is primarily to stabilize exchange rates. Finally, larger pension fund and insurance company sectors mitigate the

Table 8. Breakdown of Excess Currency Return: Interest Rate Differential and Expected Depreciation

	$\Delta(i - i^{*})$			$\Delta(s^{e} - s)$		
	VIX only	+ Intervener	+ Wealth	VIX only	+ Intervener	+ Wealth
$\Delta \ln VIX$	1.044***	0.838***	0.947***	-3.371***	-4.232***	-4.337***
	(0.185)	(0.148)	(0.124)	(0.580)	(0.444)	(0.476)
$\Delta \ln VIX \times Intervener$		0.456	0.208		1.909*	2.150*
		(0.394)	(0.321)		(1.108)	(1.129)
$\Delta \ln VIX \times X_i^c$			-0.012***			0.011
			(0.004)			(0.010)
Gross inflow	0.020***	0.021***	0.020***	0.004	0.006	0.006
	(0.006)	(0.006)	(0.006)	(0.012)	(0.012)	(0.013)
R-squared	0.051	0.053	0.058	0.088	0.095	0.096
No. observations	1342	1342	1342	1342	1342	1342
Countries	19	19	19	19	19	19
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: The table shows the estimation results of regression (20). The dependent variable in the first panel is the change in interest rate differential, $\Delta(r_{it} - r_t^{*})$, and the dependent variable in the second panel is the change in expected depreciation, $\Delta\mathbb{E}(s_{i,t+1} - s_t)$. The standard errors are country-clustered.

effect of the VIX on both components of expected excess currency returns. The mitigating effect is stronger for the interest rate differential than for expected depreciation, contrary to the effect of being an intervener. Quantitatively, a 10-percentage-point increase in pension fund and insurance company assets relative to GDP reduces the effect of the VIX on the interest rate differential by about 10%.

Comparison with Blanchard et al. (2015)

Blanchard et al. (2015) identify global capital flow shocks using country-specific structural VARs and find that nominal and real exchange rates respond less in economies whose central banks intervene more strongly. Whereas their outcomes are the exchange rates themselves, our primary outcome is the expected excess currency return, which more directly measures the time-varying risk premium on home-currency assets through which global financial shocks are transmitted. The decomposition in Table 8 nevertheless connects our results to theirs. The estimates suggest that the expected-depreciation component of excess currency returns responds less to the VIX among interveners than among floaters, albeit the statistical significance is weak. Their cross-country evidence relates estimated country-level exchange rate responses to estimated intervention responses, while our panel framework directly compares FXI regimes and allows private absorption capacity to enter the analysis. Once we account for pension fund and insurance company asset size, the estimated difference between interveners and floaters becomes more significant. Although this evidence remains suggestive, it indicates that unconditional cross-country comparisons may understate the stabilizing role of FXI because intervention tends to be stronger where private absorption is weaker.

6 Conclusion

This paper shows that domestic private absorption is a central margin through which emerging market economies offset the global financial cycle. In the model, the return elasticity of home savers' international portfolios determines both how strongly foreign demand shocks affect excess currency returns and how intensively the central bank intervenes. The cross-country estimates are consistent with more intensive FXI where private absorption is weaker. Security-level evidence from Colombia shows that pension funds retrench from foreign securities when domestic excess currency returns rise, while the cross-country analysis associates larger pension fund and insurance company sectors with more elastic gross portfolio outflows. The estimates further suggest that accounting for this private absorption capacity reveals a stronger stabilizing role for FXI than unconditional comparisons across policy regimes imply. Taken together, the results indicate that private portfolio adjustment and official intervention jointly determine how economies absorb global financial shocks.

These findings have implications for both FXI and financial-sector policy. Economies can reduce their reliance on official intervention by fostering domestic institutional investors that hold substantial and flexible international portfolios. Restrictions on pension funds' foreign investment may therefore weaken private absorption capacity. Policymakers should account for this macro-financial role when regulating institutional investors and evaluating the need for FXI.

The analysis also points to a positive externality from overseas investment by domestic institutional investors. Decentralized funds choose their foreign exposure based on private risk-return considerations, but their capacity to retrench during downturns in the global financial cycle stabilizes the exchange rate, a benefit they may not internalize. This raises the question of whether policy should encourage overseas investment, including through targeted subsidies or the relaxation of regulatory constraints. Future research can embed this externality in a welfare framework and assess whether the resulting stabilization gains justify the fiscal costs and additional portfolio risks associated with such policies.

A Proofs

A.1 Derivation of Equilibrium Excess Return

A.1.1 Home-Saver Demand Equations

We derive equations (5) and (6). Let $\widehat{rx} \equiv \mathbb{E}[rx] - \overline{rx}^e$. Since P_H, P_*, and $\mathbb{E}s'$ are fixed, equation (1) implies $s - \overline{s} = \widehat{rx}$. The home-currency value of home saver i's initial wealth changes with the exchange rate through her steady-state foreign-bond exposure:

$$w_{i0} = \theta_i \widehat{rx}. \tag{A.1}$$

Log-linearizing the portfolio mandate in equation (2) gives

$$\widehat{rx} + b^*_{Hi} - w_{i0} = -\kappa_i \widehat{rx}. \tag{A.2}$$

Combining equations (A.1) and (A.2) yields the foreign-bond demand equation:

$$b^*_{Hi} = -(1 - \theta_i + \kappa_i)\widehat{rx} = -\gamma_{Hi}\widehat{rx}. \tag{A.3}$$

The budget constraint implies that the home-currency value of the home-bond purchase is the mirror image of the foreign-bond sale. In log deviations,

$$(1 - \theta_i) b_{Hi} + \theta_i b^*_{Hi} = 0. \tag{A.4}$$

Using the foreign-bond demand equation above, the home-bond demand equation is

$$b_{Hi} = \frac{\theta_i}{1 - \theta_i} \gamma_{Hi} \widehat{rx}. \tag{A.5}$$

A.1.2 Stochastic Equilibrium

We derive equation (11). In laissez-faire, the deviation of home-bond market clearing is

$$\widehat{B}_H + \widehat{B}_F = 0. \tag{A.6}$$

Equation (7) implies

$$\widehat{B}_H = \frac{\Gamma_H}{P_H}\widehat{rx}. \tag{A.7}$$

The foreign investor's demand in equation (3) implies

$$\widehat{B}_F = \overline{B}_F(\gamma^F \widehat{rx} + \varepsilon). \tag{A.8}$$

Substituting these two demand equations into market clearing gives

$$\left(\frac{\Gamma_H}{P_H} + \gamma^F \overline{B}_F\right)\widehat{rx} + \overline{B}_F \varepsilon = 0. \tag{A.9}$$

Therefore,

$$\widehat{rx} = -\frac{\overline{B}_F}{A^{LF}}\varepsilon, \qquad A^{LF} \equiv \frac{\Gamma_H}{P_H} + \gamma^F \overline{B}_F, \tag{A.10}$$

which is equation (11).

A.1.3 Gross Flow in Response to Shock

We can express home savers' gross flow response by plugging equation (11) into equations (7) and (8):

$$P_H \widehat{B}_H = -\frac{\Gamma_H \overline{B}_F}{A^{LF}}\varepsilon, \tag{A.11}$$

$$\overline{S} P_* \widehat{B}_H^* = \frac{\Gamma_H \overline{B}_F}{A^{LF}}\varepsilon. \tag{A.12}$$

When $\varepsilon < 0$, home savers increase home-bond holdings and reduce foreign-bond holdings.

A.2 Optimal Central Bank Intervention Rule

We derive equation (13). Because the home-bond market-clearing condition is written in dollar deviations, let b_{CB} denote the central bank's dollar-deviation demand for home bonds. Consider a linear intervention rule:

$$b_{CB} = \gamma_{CB}\widehat{rx}. \tag{A.13}$$

With FXI, the market-clearing condition includes the central bank's intervention:

$$\widehat{B}_H + \widehat{B}_F + b_{CB} = 0. \tag{A.14}$$

Substituting the home-saver demand, foreign-investor demand, and intervention rule into equation (A.14) gives

$$\left(A^{LF} + \gamma_{CB}\right)\widehat{rx} + \overline{B}_F\varepsilon = 0, \qquad A^{LF} \equiv \frac{\Gamma_H}{P_H} + \gamma^F\overline{B}_F. \tag{A.15}$$

Thus, for a given policy slope γ_{CB}, the equilibrium expected excess return is

$$\widehat{rx} = -\frac{\overline{B}_F}{A^{LF} + \gamma_{CB}}\varepsilon. \tag{A.16}$$

Using $b_{CB} = \gamma_{CB}\widehat{rx}$, the central bank's expected loss in equation (12) becomes a function of γ_{CB}:

$$\mathbb{E}\mathcal{J}(\gamma_{CB}) = \left(\gamma_{CB}^2 + \theta\right)\left(\frac{\overline{B}_F}{A^{LF} + \gamma_{CB}}\right)^2 Var(\varepsilon). \tag{A.17}$$

Since $A^{LF} > 0$, the first-order condition is

$$\frac{\gamma_{CB}}{\gamma_{CB}^2 + \theta} = \frac{1}{A^{LF} + \gamma_{CB}}. \tag{A.18}$$

Solving this condition yields

$$\gamma_{CB}^{opt} = \frac{\theta}{A^{LF}} = \frac{\theta}{\frac{\Gamma_H}{P_H} + \gamma^F\overline{B}_F}. \tag{A.19}$$

The optimal intervention rule is therefore less aggressive when home savers' retrenchment is more elastic, as summarized by a larger Γ_H.

B VAR-Based Classification of Foreign Exchange Intervention Regimes

In this appendix, we elaborate on the VAR-based classification of foreign exchange intervention regimes from Blanchard et al. (2015). For each economy j, I classify the exchange rate regime using the response of foreign exchange intervention to an identified global capital flow shock. The classification is based on country-level vector autoregressions (VAR) estimated separately for each economy. The endogenous vector is ordered as

$$Y_{j,t} = (GKF_{j,t}, INT_{j,t}, GPKO_{j,t}, GPKI_{j,t}, FXI_{j,t}, ER_{j,t})' \,. \tag{B.20}$$

The variables are ordered from most exogenous to least exogenous and the VAR is identified using a Cholesky decomposition. The country-level VAR is

$$Y_{j,t} = a_j + \sum_{\ell=1}^{p_j} A_{j,\ell} Y_{j,t-\ell} + u_{j,t}, \qquad E(u_{j,t}u'_{j,t}) = \Sigma_j. \tag{B.21}$$

The lag length p_j is chosen country by country by AIC over the admissible lag range. The impulse responses are computed to a one-standard-deviation innovation in the first structural shock, corresponding to $GKF_{j,t}$.

The variables entering the VAR are constructed as

$$GKF_{j,t} = \frac{4 \cdot \sum_{k \neq j} \text{Gross private inflows}_{k,t}}{\sum_{k \neq j} GDP_{k,t-1}} \tag{B.22}$$

$$GPKI_{j,t} = \frac{4 \cdot \text{Gross private inflows}_{j,t}}{GDP_{j,t-1}}, \qquad GPKO_{j,t} = \frac{4 \cdot \text{Gross private outflows}_{j,t}}{GDP_{j,t-1}} \tag{B.23}$$

$$FXI_{j,t} = \frac{4 \cdot (-\Delta Reserves_{j,t} + \Delta \text{Off BS}_{j,t})}{GDP_{j,t-1}} \tag{B.24}$$

$$INT_{j,t} = i_{j,t} - i_{US,t}, \qquad ER_{j,t} = -\log\Big(\text{local currency per U.S. dollar}_{j,t}\Big) \tag{B.25}$$

With this convention, a positive value of $ER_{j,t}$ denotes an appreciation. A positive value of $FXI_{j,t}$ denotes reserve sales, while a negative value denotes reserve accumulation. As a positive GKF shock implies a surge in global capital inflows, a stabilizing response of FXI to the shock should be a negative response.

Let $\widehat{\Theta}_j(h)$ denote the cumulative impulse response of FXI in country j at horizon h to the global capital flow shock. The classification uses responses at horizon $h = 2$. Then the estimated regime group is

$$j \in \text{Intervener} \quad \text{if} \quad \widehat{\Theta}_{j,FXI}(2) \leq c, \tag{B.26}$$

$$j \in \text{Floater} \quad \text{if} \quad \widehat{\Theta}_{j,FXI}(2) > c \tag{B.27}$$

with c being the cross-country median response, formally:

$$c = \text{median}_{j \in \mathcal{S}}\, \widehat{\Theta}_{j,FXI}(2) \tag{B.28}$$

C Additional Results and Robustness Check

Table C.1. Countrywise Semi-Elasticity

Country	FXI group	λ_i	s.e.	1SFS
CHL	Floater	-0.089	0.147	28.318
COL	Floater	-0.083	0.036	10.485
CZE	Floater	-0.120	0.067	7.174
HUN	Floater	-0.074	0.047	12.555
IDN	Floater	0.015	0.011	7.151
ISR	Floater	-0.174	0.114	10.376
KOR	Floater	-0.132	0.048	13.929
MEX	Floater	-0.118	0.046	48.417
ZAF	Floater	-0.199	0.162	1.557
BRA	Intervener	-0.014	0.009	14.387
IND	Intervener	-0.003	0.003	6.511
LKA	Intervener	0.395	0.377	1.160
MYS	Intervener	-0.069	0.274	0.514
PER	Intervener	0.755	1.230	0.569
PHL	Intervener	0.123	0.170	2.029
POL	Intervener	-0.075	0.039	8.251
THA	Intervener	-1.709	3.228	0.367

Note: The table shows countrywise estimates of the semi-elasticity of gross capital outflow to GDP ratio to expected excess return, $\mathbb{E}rx$ using two-stage least squares (2SLS). Column λ_i shows the estimate, and column 's.e.' shows the standard error of the estimate. Column 1SFS shows the first stage F-statistic of 2SLS regressions.

Table C.2. Magnitude of Colombian Pension Fund Net Foreign Security Purchase relative to BoP flow

	Mean	Median	P25	P75	N
Net Purchases of US Securities / BOP	206.09	15.77	-7.21	46.79	36
Net Purchases of Foreign Securities / BOP	92.62	26.25	-29.18	69.30	36

Note: The table shows the ratio of Colombian pension funds' net purchase of US and overall foreign securities to the gross portfolio outflow from Balance of Payment statistics. All numbers except the last column are in percentage. Monthly net purchases are summed by quarter to be comparable with quarterly BoP flow.

Table C.3. GFCy Factor as an Instrument for Elasticity Estimation

	Panel A: IV				Panel B: OLS			
	EM	AE	Floater	Intervener	EM	AE	Floater	Intervener
Δrx^e	-0.489*	-1.023**	-0.588*	0.020	-0.023***	-0.044	-0.031***	-0.012***
	(0.259)	(0.435)	(0.316)	(0.392)	(0.004)	(0.046)	(0.005)	(0.004)
Lag Dep. Var.	0.335***	0.344*	0.345**	0.214	0.243***	0.233***	0.250***	0.223**
	(0.106)	(0.187)	(0.137)	(0.144)	(0.049)	(0.078)	(0.057)	(0.103)
No. Observations	1335	440	738	597	1335	440	738	597
Countries	19	5	9	10	19	5	9	10
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic	4.65	10.51	7.68	0.24				

Note: The table reports IV estimates of regression (16) for the full sample of 19 EMEs and separately for nine floaters and ten interveners. Gross portfolio outflow is measured as a share of lagged GDP, and Δrx^e is instrumented with the GFCy factor from Miranda-Agrippino and Rey (2020). All specifications include country fixed effects and lagged gross portfolio outflow. Standard errors are clustered by country. First-stage F statistics are reported at the bottom. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table C.4. Dollar Index as an Instrument for Elasticity Estimation

	Panel A: IV				Panel B: OLS			
	EM	AE	Floater	Intervener	EM	AE	Floater	Intervener
Δrx^e	-0.109**	-0.269*	-0.096***	-0.146	-0.026***	-0.039	-0.034***	-0.012**
	(0.043)	(0.142)	(0.035)	(0.151)	(0.004)	(0.059)	(0.005)	(0.005)
Lag Dep. Var.	0.241***	0.319***	0.239***	0.252*	0.223***	0.289***	0.228***	0.209*
	(0.065)	(0.101)	(0.076)	(0.135)	(0.053)	(0.063)	(0.062)	(0.111)
No. Observations	1050	340	599	451	1050	340	599	451
Countries	19	5	9	10	19	5	9	10
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic	22.75	395.87	44.12	2.85				

Note: The table reports IV estimates of regression (16) for the full sample of 19 EMEs and separately for nine floaters and ten interveners. Gross portfolio outflow is measured as a share of lagged GDP, and Δrx^e is instrumented with the dollar index. All specifications include country fixed effects and lagged gross portfolio outflow. Standard errors are clustered by country. First-stage F statistics are reported at the bottom. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Alternative Instrument for rx

TIC-Common Factor as an Instrument

Table C.5. TIC-Common Factor as an Instrument for Elasticity Estimation

	EM	Floater	Intervener
Δrx^e	-0.174**	-0.247**	-0.068
	(0.075)	(0.117)	(0.064)
Lag Dep. Var.	0.273***	0.287***	0.239**
	(0.063)	(0.088)	(0.116)
No. Observations	1335	738	597
Country FE	Yes	Yes	Yes
First-stage F-statistic	41.27	79.46	8.29

Note: The table reports IV estimates of regression (16) for the full sample of 19 EMEs and separately for nine floaters and ten interveners. Gross portfolio outflow is measured as a share of lagged GDP, and Δrx^e is instrumented with the quarterly TIC common factor described in Appendix C. All specifications include country fixed effects and lagged gross portfolio outflow. Standard errors are clustered by country. First-stage F statistics are reported at the bottom. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Construction of an Alternative IV: Common Factor from TIC Flows

In this appendix, we elaborate on the construction of the TIC common factor, which is used as the secondary proxy for global financial conditions in the empirical analysis. The TIC instrument is constructed from the Bertaut-Judson monthly TIC data, which provides more accurate description of U.S. portfolio flows to foreign securities than TIC survey on purchases (see Bertaut and Judson (2022) for details). The factor is constructed from 45 country series and spans 1994M4 through 2025M7 in monthly frequency. Then quarterly average of this factor is used in the empirical analysis. For each destination country i and month m, we first construct a normalized U.S. portfolio outflow measure using estimated U.S. purchases of foreign bonds and equities relative to lagged U.S. holdings of the same assets:

$$s_{i,m} = \frac{\text{Purchase of Bonds}_{i,m} + \text{Purchase of Equities}_{i,m}}{\text{Holdings of Bonds}_{i,m-1} + \text{Holdings of Equities}_{i,m-1}}. \tag{C.29}$$

The numerator is the estimated net U.S. transaction flow into country i's bonds and equities. The denominator is the lagged stock of U.S. holdings of those foreign securities. Thus $s_{i,m}$ measures U.S. net purchases of country i securities as a share of the previous month's U.S. portfolio holdings in that country. We exclude tax havens and offshore financial centers, and countries with less than 60 monthly observations. Each retained country series is then standardized by its own mean and standard deviation, denoted $z_{i,m}$.

Finally, the common TIC factor is estimated from the country-month panel $\{z_{i,m}\}$ using a one-factor dynamic factor model specified as follows:

$$z_{i,m} = \lambda_i f_m + e_{i,m}, \tag{C.30}$$

$$f_m = \phi f_{m-1} + \eta_m, \tag{C.31}$$

$$e_{i,m} = \rho_i e_{i,m-1} + \nu_{i,m}. \tag{C.32}$$

Here f_m is the latent common component in U.S. portfolio outflows to foreign securities, λ_i is the country-specific loading, and $e_{i,m}$ is an idiosyncratic country component. The factor model has a single AR(1) latent factor and AR(1) idiosyncratic errors, and is estimated by maximum likelihood using the Kalman filter.

We orient the factor so that it has a nonnegative correlation with the cross-country average of the standardized TIC series. The quarterly TIC factor used in the empirical analysis is then the average of the oriented monthly smoothed factor within each quarter.

Alternative Measure of Pension Fund and Insurance Company Assets

Table C.6. Debt-Security Normalized Pension Fund and Insurance Company Assets

	IV	OLS
Δrx^e_{it}	-0.113***	-0.021***
	(0.028)	(0.004)
$X^c_i \times \Delta rx^e_{it}$	-0.078	-0.011*
	(0.049)	(0.006)
Lag gross portfolio outflow	0.330***	0.273***
	(0.108)	(0.083)
Observations	933	933
Countries	13	13
L-M Statistics	9.43	
Relative CV ($\alpha = 0.1, \tau = 0.1$)	27.47	

Note: The table shows the estimation results of regression (18) using an alternative measure of pension fund and insurance company assets, which is normalized by the size of outstanding domestic and public and private debt securities. The dependent variable is the gross portfolio outflow to GDP ratio, and the key independent variable is the interaction between expected excess currency return and the normalized pension-insurance asset size. All specifications include country fixed effects and lagged gross portfolio outflow. Standard errors are clustered by country. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

D Data Appendix

The data for empirical exercises cover 19 emerging market economies from 2001Q1 to 2023Q2 in quarterly frequency.

D.1 Definition of Variables

Expected Excess Currency Return

The expected excess currency return is defined as follows:

$$\mathbb{E}rx = r - r^* - (\mathbb{E}s' - s) \tag{D.33}$$

where r is the home bond return, r^* is the foreign bond return. The returns r are market yields on one-year zero coupon government bonds, which are from Bloomberg. r^* is the return on one-year U.S. Treasury bonds. We use the 12-month ahead exchange rate forecasts from Consensus Economics to compute the expected exchange rate change, $\mathbb{E}s' - s$. s is defined as 100 times the log of the nominal exchange rate, defined as local currency per U.S. dollar.

Gross capital flows

The gross portfolio flows are from the IMF's balance of payments statistics. Annual nominal GDP data are from the World Bank's World Development Indicators. The gross flows are scaled by individual country's GDP in the previous year, to avoid endogeneity between the flow and GDP.

FXI policy measures

We follow Blanchard et al. (2015) in constructing a measure of FXI policy. The measure is the sum of net reserve sales and changes in the central bank off balance sheet FX positions. The variable is scaled by GDP in the previous year. We download the level of international reserves excluding gold from the IMF's International Reserves and Foreign Currency Liquidity dataset, and compute the net reserve sales by taking the first difference of the level. The data on central bank off balance sheet FX positions are from the same dataset. A positive value of the measure indicates net sales of foreign currency by the central bank, which corresponds to policy actions to appreciate the home currency.

Pension Fund, Insurance Company Asset

We obtain data on pension fund and insurance company assets from the World Bank's Global Financial Development Database. The time series are defined as the total assets of pension funds and insurance companies in terms of GDP. We use these data to explore the source of cross-country variation in home demand elasticity.

Gross Portfolio Asset

The baseline measure of gross portfolio asset is the quarterly gross portfolio investment asset position from the IMF's balance of payments statistics. For quarters where the baseline measure is missing, we complement the data with gross portfolio positions from the External Wealth of Nations dataset by Lane and Milesi-Ferretti (2018). We normalize the gross portfolio asset by GDP in the previous year, to be comparable with the flow measures.

Table D.7. Data Source

Variable	Source	API variable name / ticker
Gross PF Outflow	IMF IFS	`BFPA_BP6_USD`
Gross PF Inflow	IMF IFS	`BFPLXF_BP6_USD`
Net PF Inflow	IMF IFS	`BFPLXF_BP6_USD - BFPA_BP6_USD`
FXI	IMF IFS; IMF IRFCL	`RAXG_USD; RAPFAFFL_USD; RAPFAFFS_USD` with `S1X`
Net PF and Official Inflow	IMF IFS; IMF IRFCL	
GDP	World Bank WDI	`NY.GDP.MKTP.CD`
Short interest rate	Bloomberg	`ir_1y`; fallback `ir_3m`
U.S. one-year Treasury yield	FRED	`DGS1`
Spot exchange rate	Bloomberg	
One-year-ahead FX forecast	Consensus Economics	
UIP Deviation / Excess Currency Return	Bloomberg; FRED; Consensus Economics	`DGS1`
VIX	CBOE/FRED	`VIXCLS`
TIC Common Factor	Bertaut-Judson TIC	`BT399_US_FOR_BOND_ESTTRANS; BT399_US_FOR_STK_ESTTRANS; BT99_US_FOR_BOND; BT99_US_FOR_STK`
Foreign Portfolio Assets / GDP	IMF IIP; EWN; World Bank WDI	`Assets: Portfolio investment; Portfolio equity assets; Portfolio debt assets; NY.GDP.MKTP.CD`
Pension Fund Assets / GDP	World Bank GFD	`GFDD.DI.13`
Insurance Company Assets / GDP	World Bank GFD	`GFDD.DI.11`

References

Avdjiev, Stefan, Bryan Hardy, Şebnem Kalemli-Özcan, and Luis Servén, "Gross Capital Flows by Banks, Corporates, and Sovereigns," *Journal of the European Economic Association*, October 2022, *20* (5), 2098–2135.

Beltran, Paula and Chang He, "Inelastic financial markets and foreign exchange interventions," June 2024. Working paper; revise and resubmit at American Economic Journal: Macroeconomics.

Bertaut, Carol and Ruth Judson, "Estimating U.S. Cross-Border Securities Flows: Ten Years of the TIC SLT," FEDS Notes, Board of Governors of the Federal Reserve System February 2022. Data updated September 2025; page last updated October 2025.

_ , Valentina Bruno, and Hyun Song Shin, "Original sin redux: Role of duration risk," NBER Working Paper 33816, National Bureau of Economic Research May 2025.

Bianchi, Javier, Saki Bigio, and Charles Engel, "Scrambling for Dollars: International Liquidity, Banks and Exchange Rates," NBER Working Paper 29457, National Bureau of Economic Research March 2023. Revised March 2023.

Blanchard, Olivier, Gustavo Adler, and Irineu Carvalho Filho, "Can Foreign Exchange Intervention Stem Exchange Rate Pressures from Global Capital Flow Shocks?," IMF Working Paper 2015/159, International Monetary Fund July 2015.

Caballero, Ricardo J and Alp Simsek, "A Model of Fickle Capital Flows and Retrenchment," *Journal of Political Economy*, June 2020, *128* (6), 2288–2328.

Camanho, Nelson, Harald Hau, and Hélène Rey, "Global Portfolio Rebalancing and Exchange Rates," *The Review of Financial Studies*, October 2022, *35* (11), 5228–5274.

Cavallino, Paolo, "Capital flows and foreign exchange intervention," *American Economic Journal: Macroeconomics*, April 2019, *11* (2), 127–170.

Davis, J Scott and Eric van Wincoop, "A theory of capital flow retrenchment," *Journal of International Economics*, July 2024, *150*, 103952.

Fanelli, Sebastián and Ludwig Straub, "A Theory of Foreign Exchange Interventions," *The Review of Economic Studies*, March 2021, *88* (6), 2857–2885.

Forbes, Kristin J and Francis E Warnock, "Capital flow waves: Surges, stops, flight, and retrenchment," *Journal of International Economics*, November 2012, *88* (2), 235–251.

Fratzscher, Marcel, Oliver Gloede, Lukas Menkhoff, Lucio Sarno, and Tobias Stöhr, "When Is Foreign Exchange Intervention Effective? Evidence from 33 Countries," *American Economic Journal: Macroeconomics*, January 2019, *11* (1), 132–156.

Gabaix, Xavier and Matteo Maggiori, "International Liquidity and Exchange Rate Dynamics," *The Quarterly Journal of Economics*, March 2015, *130* (3), 1369–1420.

_ **and Ralph S J Koijen**, "In search of the origins of financial fluctuations: The inelastic markets hypothesis," NBER Working Paper 28967, National Bureau of Economic Research August 2024. Revised August 2024.

Gourinchas, Pierre-Olivier, Walker Ray, and Dimitri Vayanos, "A Preferred-Habitat Model of Term Premia, Exchange Rates, and Monetary Policy Spillovers," *American Economic Review*, November 2025, *115* (11), 3788–3824.

Greenwood, Robin, Samuel Hanson, Jeremy C Stein, and Adi Sunderam, "A Quantity-Driven Theory of Term Premia and Exchange Rates," *The Quarterly Journal of Economics*, November 2023, *138* (4), 2327–2389.

Hau, Harald and Hélène Rey, "Exchange Rates, Equity Prices, and Capital Flows," *The Review of Financial Studies*, October 2005, *19* (1), 273–317.

Ilzetzki, Ethan, Carmen M Reinhart, and Kenneth S Rogoff, "Exchange Arrangements Entering the Twenty-First Century: Which Anchor Will Hold?," *The Quarterly Journal of Economics*, January 2019, *134* (2), 599–646.

Itskhoki, Oleg and Dmitry Mukhin, "Optimal Exchange Rate Policy," NBER Working Paper 31933, National Bureau of Economic Research April 2026. Revised April 2026.

Jeanne, Olivier and Damiano Sandri, "Global Financial Cycle and Liquidity Management," *Journal of International Economics*, December 2023, *146*, 103736.

Jiang, Zhengyang, Robert J Richmond, and Tony Zhang, "A portfolio approach to global imbalances," *The Journal of Finance*, 2024, *79* (3), 2025–2076.

Kalemli-Özcan, Şebnem and Liliana Varela, "Five Facts about the UIP Premium," NBER Working Paper 28923, National Bureau of Economic Research January 2025. Revised January 2025.

Koijen, Ralph SJ and Motohiro Yogo, "A demand system approach to asset pricing," *Journal of Political Economy*, 2019, *127* (4), 1475–1515.

— **and** — , "Exchange rates and asset prices in a global demand system," *Journal of Political Economy*, August 2026, *134* (8). Forthcoming.

Kuersteiner, Guido M., David C. Phillips, and Mauricio Villamizar-Villegas, "Effective sterilized foreign exchange intervention? Evidence from a rule-based policy," *Journal of International Economics*, July 2018, *113*, 118–138.

Lane, Philip R and Gian Maria Milesi-Ferretti, "The external wealth of nations revisited: international financial integration in the aftermath of the global financial crisis," *IMF Economic Review*, 2018, *66*, 189–222.

Lewis, Daniel J. and Karel Mertens, "A Robust Test for Weak Instruments for 2SLS with Multiple Endogenous Regressors," *The Review of Economic Studies*, 2025. Advance online publication.

Miranda-Agrippino, Silvia and Hélene Rey, "US monetary policy and the global financial cycle," *The Review of Economic Studies*, 2020, *87* (6), 2754–2776.

Nickell, Stephen, "Biases in dynamic models with fixed effects," *Econometrica*, 1981, *49* (6), 1417–1426.

Zhou, Haonan, "The fickle and the stable: Global Financial Cycle transmission via heterogeneous investors," *SSRN Electronic Journal*, September 2025.