Speculation, Forward Exchange Demand, and CIP Deviations in Emerging Economies*

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Abstract

We argue that currency speculation drives forward exchange demand and CIP deviations in emerging economies. We present a model in which global investors, segmented out of short-term local bonds and spot markets, rely on forwards to chase predictable excess currency returns. Local intermediaries, benefitting from segmentation but constrained by position limits, supply forwards at a premium—resulting in CIP deviations. The model explains several defining properties of CIP deviations in emerging economies, including their dynamics around periods of global distress, their relationship with excess currency returns, as well as with the positions of global investors and local intermediaries in Peru's forward exchange market.

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Deviations from covered interest parity (CIP)—gaps between the forward premium and the interest rate differential—have important implications for financial stability and monetary policy effectiveness. These implications are especially relevant in emerging economies, where CIP deviations are not only more volatile but also much larger, averaging around 100 basis points compared with just 20 in advanced economies (Du et al., 2018b; Cerutti and Zhou, 2024). In particular, these deviations directly determine the cost of borrowing in synthetic domestic currency—a key financing channel when local corporates and financial institutions raise funding in dollars while simultaneously covering their dollar exposure. Crucially, when CIP deviations are elevated in emerging economies, as during periods of global financial stress, the effective cost of covering dollar funding increases, and, as a result, the domestic monetary policy transmission weakens (Cerutti et al., 2021; De Leo et al., 2024; Keller, 2024).

Understanding CIP deviations requires a characterization of the demand and supply forces in the forward exchange market. Most existing studies either do not explicitly model forward demand or attribute it mainly to hedging motives, where investors aim to reduce currency risk associated with their foreign asset holdings (*e.g.*, Liao and Zhang, 2021; Du and Huber, 2023). In contrast, we argue that in emerging economies, forward exchange demand and resulting CIP deviations are primarily driven by currency speculation, where investors manage their exposure to currency risk in order to capture expected excess returns, even in the absence of underlying foreign asset positions. Although policymakers often highlight this channel when designing regulation (BIS, 2015), it has been largely overlooked in the academic literature.

Our argument rests on two key features common to these economies, detailed in Section 1. First, regulatory barriers prevent global investors—those based abroad—from *directly* accessing *short-term* local bond and spot exchange markets. Without these restrictions, global investors could pursue excess currency returns through forward trading or a combination of spot and short-term bond transactions. Instead, market segmentation makes the forward market their primary avenue for chasing excess currency returns, such as conducting carry trades. Second, domestic intermediaries face balance-sheet regulations that constrain their ability to arbitrage between forward and spot markets. These financial regulations constrain the supply of forward contracts, and CIP deviations emerge to compensate local intermediaries for absorbing the forward demand from global investors. We develop a theoretical

framework that formalizes these mechanisms. The framework provides novel predictions on the equilibrium properties of forward positions and CIP deviations, the relationship between CIP deviations and excess currency returns, and the behavior of CIP deviations during periods of global financial distress. The model's predictions find wide empirical support.

First, we provide direct evidence on the patterns of financial flows and prices in Peru's bond, spot, and forward markets. Consistent with local intermediaries supplying forwards to global investors, we find that the forward balances of these two groups closely mirror each other. Moreover, the behavior of local intermediaries aligns with CIP arbitrage, as in Keller (2024): their long dollar forward positions are negatively correlated with CIP deviations, suggesting banks consistently earn CIP profits when intermediating forward contracts. When they supply dollars forward (i.e., sell dollars to global investors), their net dollar holdings decrease. To compensate, they set a higher forward dollar price than the cost of later repurchasing dollars in the spot market. This makes CIP deviations positive. Conversely, when they supply soles forward (i.e., buy dollars forward), their net dollar holdings increase. In this case, they buy these at a lower forward dollar price than the value they would obtain by unwinding in the spot market, making CIP deviations negative. In both cases—selling dollars forward or selling soles forward—the forward premia are set so that banks earn positive arbitrage profits.[1] Furthermore, we show that global investors' forward positions in Peru reflect speculative motives: they are related to expected excess currency returns but exhibit no systematic relationship with holdings of local-currency-denominated assets—a behavior inconsistent with hedging.[2]

Second, we show that in emerging economies, currencies with systematically higher expected excess returns tend to exhibit more negative CIP deviations. Our model naturally rationalizes this pattern: high-return currencies attract greater forward demand from global investors, prompting local intermediaries to require greater compensation, reflected in lower forward premia and more negative CIP deviations.[3] Across a broad cross-section of emerg-

[1] We estimate these profits using data on banks' forward purchases and sales, including notional values, transaction prices, settlement spot rates, and the funding and investment rates of the assets used for arbitrage.

[2] Currency derivative usage in Peru aligns with patterns observed elsewhere. De Leo et al. (2025) show that global investors' purchases of Colombian sovereign bonds are not offset by hedging in the forward market. Similarly, Chen and Zhou (2025) document that U.S. mutual funds frequently use FX derivatives to amplify exposure to emerging market currencies, especially in countries with stricter capital controls.

[3] Intermediaries effectively sell local currency (buy dollars) at a less favorable rate relative to spot unwinding

ing economies, we document that 3-month CIP deviations are negatively correlated not only with excess currency returns, but also with traditional predictors of such returns, including interest rate differentials and net external deficits (see also Cerutti and Zhou, 2024). The distinction between speculative and hedging forward demand matters in this context. When forward demand reflects hedging, countries with larger net external deficits or higher interest rates experience excess demand for dollar forwards—leading to more positive, rather than more negative, CIP deviations (Liao and Zhang, 2021; Dao et al., 2025).

Third, we document that CIP deviations in emerging economies increase (*i.e.*, become less negative) during periods of heightened global risk aversion. In the model, greater risk aversion reduces global investors' forward demand for emerging economies' currencies; with lower demand to absorb, local intermediaries supply fewer forwards, pushing CIP deviations upwards. Empirically, we show that CIP deviations in emerging economies are higher during days in which the VIX is elevated. In addition, the first principal component of 3-month CIP deviations of emerging economies is positively correlated with several global risk factors, including the U.S. dollar index. Focusing again on Peru, we show that when the VIX is elevated global investors' forward demand for Peruvian soles is lower and an CIP deviations are higher. We discuss how these patterns of CIP deviations cannot be rationalized by changes in perceived emerging market government default risk.

CIP deviations exhibit different properties in emerging and advanced economies. As mentioned above, CIP deviations are significantly larger in emerging economies relative to advanced ones. Moreover, CIP deviations display different dynamics around periods of global financial stress: during these periods, CIP deviations in emerging economies move upwards, whereas they move downwards in advanced economies.

We offer formal extensions of our baseline framework to highlight how structural and institutional factors may explain these differences. First, in emerging economies, market segmentation can sustain large and persistent CIP deviations, as global investors face frictions in accessing short-term bond markets. Instead, in advanced economies, where global investors can exploit carry-trade opportunities similarly through short-term bonds and for-

costs—depressing the forward premium and producing negative CIP deviations.

wards, it is natural that CIP deviations are significantly smaller.[4] Second, a key difference between emerging and advanced economies is the importance of the local investors demanding forwards to hedge dollar exposure (Du and Huber, 2023). If local investors' demand for U.S. dollar hedging plays a key role in shaping forward market dynamics, and if this hedging demand rises during periods of heightened risk aversion, then global risk aversion could increase the overall demand for home-currency forwards, leading to a decline in CIP deviations.

Related Literature A growing literature in international finance, initiated by Du et al. (2018b), shows that banking regulation constrains intermediaries' ability to conduct CIP arbitrage (see also Cenedese et al., 2021; Barbiero et al., 2024). When forward supply is constrained, fluctuations in the volume of currency forwards that intermediaries must absorb—that is, shifts in forward demand—can influence CIP deviations. There is mounting evidence that identified demand shocks in the forward market indeed affect CIP deviations (Abbassi and Bräuning, 2020; Aldunate et al., 2023; Ben Zeev and Nathan, 2024a,b; Borio et al., 2018; Bush, 2019; Kekre and Lenel, 2023).

The paper makes three main contributions to this literature. First, we formalize the role of global investors' currency speculation, through forwards, in segmented foreign exchange markets. Instead, existing models have primarily focused on hedging motives or treated forward demand as exogenous (Liao and Zhang, 2021; Bacchetta et al., 2023, 2024, 2025; Du and Huber, 2023; Dao et al., 2025), with the exception of Chen and Zhou (2025). Our approach explicitly integrates the segmentation structure that characterizes emerging economies, where speculative forward demand arises naturally from global investors' return-maximizing behavior.

Second, we provide a systematic account of the distinctive properties of CIP deviations of emerging economies, and explain why they differ from those observed in advanced economies (Avdjiev et al., 2019; Cerutti and Zhou, 2024; Du and Schreger, 2022). In particular, we document and rationalize the empirical regularities of CIP deviations both in the cross-section of countries and during episodes of global distress. These empirical patterns shed

[4] When market segmentation is attenuated, as in advanced economies, CIP deviations may primarily reflect other forces, such as time-varying convenience yields on U.S. assets (Jiang et al., 2021), which naturally generate a negative comovement between CIP deviations and U.S. dollar.

light on how institutional features and investor composition shape demand forces across forward exchange markets.

Third, we offer new evidence on the behavior of forward market positions and prices using granular data from Peru. We document that local intermediaries supply forwards primarily to global investors, whose demand is associated with fluctuations in expected currency returns. We also show that, in supplying these forwards, local intermediaries consistently earn CIP deviations as compensation. These findings highlight the central role of local intermediaries in transmitting global shocks to emerging markets through CIP deviations. Our paper therefore connects to a broader literature showing how intermediaries in emerging economies influence the transmission of global financial shocks—by shaping credit supply (Gonzalez et al., 2022), loan rates across currencies (di Giovanni et al., 2022), the link between loan and deposit rates (Gutierrez et al., 2023), the currency composition of lending (Keller, 2024), and the comovement between bond yields and exchange rates (De Leo et al., 2025).

1 Institutional Framework of Emerging Economies

We begin by outlining the restrictions that lead to market segmentation in the short-term bond and foreign exchange markets of emerging economies, the role of large offshore and integrated non-deliverable forward markets, and the regulatory framework shaping local banks' exchange rate risk management. These features provide the motivation for the model developed in Section 2.

1.1 Market Segmentation in Emerging Economies

A central premise of our analysis is that global investors face restrictions in accessing the *short-term bond* markets of emerging economies. These restrictions are consistent with the regulatory frameworks observed in several countries. Drawing on data and institutional details from Peru, as well as examples from other emerging markets, we highlight a set of financial regulations that impose substantial costs—and in some cases outright barriers—on foreign investors seeking to participate in local short-term bond and spot exchange markets. These constraints, which are common across emerging economies, provide local banks with a distinct advantage in money and spot exchange markets, thereby reinforcing their role as

key intermediaries.

Crucially, these barriers channel global investors' pursuit of predictable excess currency returns primarily into forward contracts, which are not subject to the same regulatory restrictions. In the model of Section 2, global investors seeking to engage in carry trades—borrowing in one currency to invest in another—must therefore operate through forward contracts rather than the short-term bond market.

A. Restrictions to trading money-market instruments. In Peru, global investors face two major restrictions when attempting to trade money-market instruments.

First, participation in the Central Bank's primary auctions—where key money-market instruments used for carry trade and CIP arbitrage are issued—is limited exclusively to local banks.

Second, access to short-term government securities in the secondary market is costly for global investors. In early 2008, amid strong carry trade inflows, the Central Bank tightened restrictions by limiting foreign participation in the secondary market for its certificates of deposit (CDs). As the safest short-term sol-denominated securities, CDs had been the preferred vehicle for carry trades and CIP arbitrage. Following the new measures, however, global investors were pushed into sovereign bonds with longer maturities, thereby exposing them to greater price risk. Appendix Figure C.1 shows that after the Central Bank introduced a 4% fee on the notional amount of CD purchases by foreign investors, their holdings of these instruments gradually fell to zero as outstanding CDs matured. This decline did not reflect waning demand for sol-denominated assets. On the contrary, foreign investors substantially increased their positions in long-term government bonds once capital inflows resumed in 2010. Yet, reentry into the CD market remained prohibitively expensive.

These restrictions are not unique to Peru. Many emerging economies restrict foreign investment in short-term bonds (Heenan et al., 2011; Patnaik et al., 2013; BIS, 2015; Patel and Xia, 2019; Schmittmann and Teng, 2020). For instance, India imposes strict quotas on foreign holdings of Treasury bills (Patnaik et al., 2013), Indonesia bans direct foreign purchases of short-term central bank instruments and enforces minimum holding periods (Heenan et al., 2011), Brazil applies a 6% tax to deter inflows (BIS, 2015), South Korea has intermittently imposed a withholding tax on interest income and capital gains from foreign

holdings of Treasury and Monetary Stabilization Bonds (IMF, 2011), and similar restrictions exist in Chile and Colombia (BIS, 2015).

B. Restrictions to participate in the spot currency market. In Peru, participation in the interbank USDPEN spot market—the primary reference for spot exchange rates—is restricted to local banks. Global investors must therefore transact through domestic intermediaries to buy or sell currency in the spot market.

This arrangement is not unique to Peru. In Brazil and Colombia, interbank venues are likewise accessible only to domestic dealers, requiring all spot foreign exchange transactions to be intermediated by them (Dodd and Griffith-Jones, 2007; Baker McKenzie, 2022). Comparable restrictions are also prevalent in Asia. In India, despite gradual financial market integration, foreign investors continue to face limits on onshore access (BIS, 2022). Malaysia maintains strict prohibitions on foreign participation in its onshore currency market (Schmittmann and Teng, 2020; Euromoney, 2020), while in China, access is confined to approved domestic institutions and foreign investors operate only through quota programs and designated channels (BIS, 2022).

C. Restrictions to borrowing local currency. When global investors anticipate a depreciation of an emerging-market currency that exceeds the interest rate differential—implying negative excess returns—they would need to borrow in the local currency and invest in U.S. dollars to exploit such opportunities.

In practice, however, accessing emerging-market currency funding is difficult and often costly. Consider Peru as an example. First, soles can only be liquidated domestically, requiring global investors to maintain a sol-denominated account in Peru. Second, banking regulations prohibit any institution other than local banks from accepting deposits from households and firms, effectively preventing foreign investors from obtaining sol deposits directly. The alternative is to borrow from local banks, but this typically involves paying a markup over the market rate—particularly when sol funding is scarce, precisely at times when the borrow-soles–lend-dollars trade is most attractive (Keller, 2024).

Similar restrictions are present across many emerging economies. Following the Asian financial crisis, numerous countries imposed limits on global investors' ability to borrow in

local currency. Thailand, Indonesia, and Malaysia introduced explicit restrictions, while in the Philippines the supply of local currency to foreign investors was made subject to central bank approval (Watanabe et al., 2002).

1.2 Large Non-Deliverable Forward Markets

The restrictions on onshore markets discussed above have contributed to the expansion of foreign exchange non-deliverable forwards (NDFs) (Patel and Xia, 2019; Schmittmann and Teng, 2020; Euromoney, 2020). These derivative contracts enable investors to take currency positions without physically exchanging funds, as only the net payoff (*i.e.*, the profit or loss) is settled in U.S. dollars.

For global investors, NDFs provide several advantages. They bypass the constraints outlined in Section 1.1, while also reducing counterparty risk since only the net difference is exchanged at maturity in U.S. dollars, rather than the full notional amount. Further, NDFs require less upfront capital.[5] For example, to conduct a bond-based carry trade, an investor would normally need to borrow the full amount in currency A to invest in currency B. By contrast, with an NDF, the investor can simply sell currency A forward to obtain equivalent exposure. In the event of losses, only the net payoff must be covered, rather than the full notional value.

Given these benefits, together with the difficulty that global investors face in accessing onshore spot markets, NDF trading has expanded rapidly across emerging economies and often surpasses spot market volumes. Since 2016, global NDF volumes have more than doubled (Schmittmann and Teng, 2020). In December 2024, offshore trading of Indian rupee NDFs reached $161 billion (Reuters, 2025). The NDF market is also highly liquid; for instance, Brazil's NDF market—among the largest outside Asia—is now the primary venue for BRL FX transactions, even exceeding spot volumes (BIS, 2015; Duo, 2025). Peru exhibits similar patterns. As detailed below, our dataset shows that in 2017–2018—the final years of our sample—the average daily volume of forward contracts supplied by local intermediaries was around $400 million, nearly 90% of which were NDFs. This figure exceeded the

[5] Low counterparty risk in the NDF market arises from (i) notional netting and (ii) limited exposure faced by local intermediaries when unwinding positions in the money market. Banks typically rely on very short-term instruments and fund themselves through large institutional investors, other banks, and Central Bank repos.

corresponding average daily volume of FX spot transactions (The Trade, 2024).

1.3 Regulation on Local Intermediaries' Currency Risk Exposure

Another central feature of our analysis is that local intermediaries fully hedge their exchange rate risk, a practice common across emerging economies due to regulatory requirements. Canta et al. (2007) documents that banking regulations impose strict limits on exchange rate exposure in a broad sample of emerging markets. More recent evidence confirms this pattern in Peru (Keller, 2024, Online Appendix), Chile (Alfaro et al., 2023), Brazil (Bradesco, 2023), Colombia (Autorregulador del Mercado de Valores, 2023), and Mexico (IMF, 2022), as well as in several Asian economies such as India (Reserve Bank of India, 2010; Lexsite.com, 2024), Indonesia (Bank of Indonesia, 2005), and the Philippines (Business World, 2021).

In Peru, data on local banks' forward, swap, and spot positions (Appendix Figure C.2) show that FX spot positions are systematically offset by opposite forward and swap positions, resulting in minimal net FX exposure. [6] This pattern reflects regulatory requirements that compel local banks to hedge the bulk of their exchange rate exposure.

2 A Model of Forward Markets in Emerging Economies

Our model consists of a continuum of small open economies, indexed by $c \in [0, 1]$, over two time periods, t and $t + 1$. The institutional framework described in Section 1 motivates the structure of forward and spot markets of the small open economies.

2.1 Forward Exchange Market

In each forward market c, a continuum of local intermediaries supplies forwards to global investors. We next formally characterize these sets of agents—the constraints they face and the maximization problem they solve. For clarity, we omit the country subscript "c" throughout the remainder of this section, reintroducing it later when extending the analysis to the multi-country setting. Variables associated with the foreign economy, represented by the U.S., are denoted with the superscript $\star$.

[6] In 2015, FX swaps were heavily used in transactions with the Central Bank of Peru, which temporarily relied on swaps rather than spot interventions. This explains the divergence in the balance between banks' forward and swap positions during that period. Appendix Figure C.3 provides a detailed decomposition.

2.1.1 Global Investors

Global investors are agents domiciled outside small-open economy c such as global hedge funds or trading desks of global banks. Motivated by the regulatory framework described in Section 1.1, we impose the following restriction on global investors' holdings of short-term bonds in the small open economy.[7]

Assumption 1 *Global investors cannot hold positions in the short-term bond market of the small open economy.*

This assumption, consistent with the relatively small short-term bond holdings of global investors in emerging economies compared to their positions in the forward market, allows us to abstract from hedging-related motives for forward demand in the baseline model. Importantly, and in line with Section 1.2, these restrictions do not apply to forward exchange markets, where global investors are free to trade. Appendix A.1 formalizes how these features jointly imply the following global investors' optimization problem.

Global investors actively trade in the forward market by choosing a long home-currency (short dollar) forward position (H_{t+1}), where the position is expressed in dollars. A 1 dollar short forward position (long home-currency forward position) returns ${}^{F_t}/_{S_{t+1}} - 1$ dollars (or $F_t - S_{t+1}$ home currency). Thus, the realized excess return from a H_{t+1} short forward dollar position is $H_{t+1}\left({}^{F_t}/_{S_{t+1}} - 1\right)$ dollars.

Global investors choose forward position H_{t+1} to maximize their mean-variance utility:

$$\max_{H_{t+1}} \quad E_t\left(H_{t+1}\left(\frac{F_t}{S_{t+1}} - 1\right)\right) - \frac{\gamma_t}{2}\operatorname{var}_t\left(H_{t+1}\left(\frac{F_t}{S_{t+1}} - 1\right)\right),$$

where γ_t governs the global investors' aversion to risk. Forward demand by global investors is therefore:

$$\frac{\left(E_t\frac{F_t}{S_{t+1}} - 1\right)}{\gamma_t \operatorname{var}_t\left(\frac{F_t}{S_{t+1}}\right)} = H_{t+1}. \tag{1}$$

Global investors' forward demand responds to expected currency returns in proportion to

[7] We abstract from global investors' *long-term* bond positions. Unlike short-term bonds, long-term bonds carry price risk and are therefore less suitable for exploiting short-run excess currency returns. Henceforth, all references to "bonds" pertain exclusively to short-term bonds.

their risk-bearing capacity. Since open forward positions entail risk, risk-averse global investors will take only finite positions, oriented toward capturing positive expected returns.[8]

2.1.2 Local Intermediaries

A continuum of local intermediaries, indexed by $j \in [0, \infty)$, supply forwards, while also operating in the spot market.

Each individual intermediary j holds a zero-capital portfolio in home and foreign bonds $(G_{j,t+1}, G^{\star}_{j,t+1})$ such that: $G^{\star}_{j,t+1}/R^{\star}_t + G_{j,t+1}/(S_t R_t) = 0$. A $(G_{j,t+1}, G^{\star}_{j,t+1})$ position in the bond market delivers $G^{\star}_{j,t+1}\left(1 - R_t/R^{\star}_t S_t/S_{t+1}\right)$ dollars. The intermediary also holds a $K_{j,t+1}$ short forward dollar position. A $K_{j,t+1}$ short forward dollar position delivers $K_{j,t+1}\left(F_t/S_{t+1} - 1\right)$ dollars. Thus, the overall return on the intermediary's portfolio is:

$$G^{\star}_{j,t+1}\left(1 - \frac{R_t}{R^{\star}_t}\frac{S_t}{S_{t+1}}\right) + K_{j,t+1}\left(\frac{F_t}{S_{t+1}} - 1\right). \tag{2}$$

Consistent with prevailing regulation on financial institutions in emerging economies, described in Section 1.3, we make the following two assumptions:

Assumption 2 *Local intermediaries cannot hold exchange rate risk.*

Assumption 3 *Local intermediaries are subject to position limits and participation costs.*

Intermediaries investment decisions are subject to two sets of restrictions. First, intermediaries cannot hold exchange rate risk. Assumption 2 implies a specific relationship between intermediaries spot and forward market positions that guarantees a deterministic portfolio return. Second, each intermediary is subject to a net open position limit and face idiosyncratic participation costs, as per Assumption 3, similar to Alvarez et al. (2009) and Fanelli and Straub (2021). In Appendix A.2, we show that these restrictions imply the following total supply of forward (*i.e.* short-dollar forward for the local intermediary):

$$K_{t+1} = \frac{1}{\kappa}\underbrace{\left(\frac{R^{\star}_t}{R_t}\frac{F_t}{S_t} - 1\right)}_{\text{CIP Deviation}_t}. \tag{3}$$

[8] Realized profits of global investors are $\left(E_t[F_t/S_{t+1}] - 1\right)\left(F_t/S_{t+1} - 1\right)/\left(\gamma_t \operatorname{Var}_t(F_t/S_{t+1})\right)$, which are positive only if realized forward market returns turn out to have the same sign of expected forward market returns.

Due to position limits, local intermediaries demand compensation to provide forwards, which gives rise to CIP deviations. We denote by κ the stringency of participation costs, which governs the elasticity of CIP deviations with respect to changes in intermediaries' forward supply. When $\kappa > 0$, forward supply is upward sloping, consistent with empirical evidence on the implications of bank regulation (Du et al., 2018b; Abbassi and Bräuning, 2020; Cenedese et al., 2021).[9] We further assume that κ is constant, reflecting the idea that regulatory changes occur at lower frequencies than the horizon of this paper's analysis.

The relationship between the CIP deviation and local intermediaries' forward supply is intuitive. To understand this relationship, let us express CIP deviations in log, that is $r_t^\star - r_t + f_t - s_t$, conventionally defined as the difference between cash dollar and synthetic dollar rates. When $K_{t+1} > 0$, local intermediaries sell dollars forward, while unwinding this short dollar position in the spot market (*i.e.* buying dollars spot). CIP deviations represent the profit from this trade. In fact, the revenue from selling dollars forward is f_t, while the cost of buying dollars spot is $s_t + r_t - r_t^\star$. In particular, buying dollars spot would require local intermediaries to borrow in the home-currency at a rate r_t, buying dollars with the home-currency, costing s_t dollars, and investing those dollars at a rate $r_t^\star$. To the contrary, when $K_{t+1} < 0$, local intermediaries supply home-currency forwards (*i.e.* take a long dollar forward position) and benefit from a negative CIP deviation.

For these reasons, the combined spot/forward positions of local intermediaries always deliver positive profits (revenues net of participation costs) for the intermediaries' sector, which are increasing in the size of the position that they take in their intermediation activity:

$$\frac{1}{2\kappa}\left(\underbrace{\frac{R_t^\star}{R_t}\frac{F_t}{S_t} - 1}_{\text{CIP Deviation}_t}\right)^2. \tag{4}$$

[9] Although we model frictions in forward supply as position limits, other sources—such as intermediation costs (Liao and Zhang, 2021) or imperfect competition in financial intermediation (Wallen, 2022)—can also generate an upward-sloping supply of forwards.

2.1.3 Equilibrium in Forward Exchange Market

Forward market clearing requires that short-dollar forward position of local intermediaries (supply of dollars, K_{t+1}) equals of long-dollar forward position of global investors (demand of dollars, $-H_{t+1}$):

$$K_{t+1} = -H_{t+1} \tag{5}$$

Equations (1), (3) and (5) describe the equilibrium in the forward market. Figure 1a depicts the supply and demand diagram of the forward market after taking the first-order approximation of these equations around a risky steady state (Coeurdacier et al., 2011) where period-$t+1$ log exchange rate is drawn from a normal distribution with $\text{var}_t(\Delta s_{t+1}) = \sigma_s^2$.

Equation (3) represents the supply of dollar forward, with its slope determined by the tightness of local intermediaries' position limits, parameterized by κ. When $\kappa = 0$, there are no position limits resulting in zero CIP deviations regardless of local intermediaries' position in the forward market—a flat forward supply curve. To the contrary, when local intermediaries are subject to position limits ($\kappa > 0$), the forward supply is upward sloping, and local intermediaries demand a higher CIP deviation to supply more dollars forward.

Equation (1) represents the demand of dollar forward. When global investors' risk-bearing capacity is unlimited ($\gamma_t = 0$), their position in the forward market drives average returns on the forward trade to zero—a flat forward demand curve. Instead, if the risk-bearing capacity of global investors is limited ($\gamma_t > 0$), the forward demand curve is downward sloping. Everything else equal, global investors demand less dollar forwards when CIP deviations are larger.

Two factors shift the forward demand curve of global investors. First, larger UIP deviations—higher returns on the home currency, determined in equilibrium—push investors to demand more home currency forward, resulting in a left-ward shift in the demand curve for dollar forward and thus lower equilibrium CIP deviations. Indeed, log expected returns from the forward-trade are the sum of UIP deviations and CIP deviations:

$$f_t - E_t(s_{t+1}) = \underbrace{r_t - (r_t^\star + (E_t(s_{t+1}) - s_t))}_{\text{UIP deviation}_t} + \underbrace{r_t^\star - (r_t - (f_t - s_t))}_{\text{CIP deviation}_t}. \tag{6}$$

Even when restricted from trading short-term bonds, global investors can still exploit predictable excess home-currency returns (UIP deviations) through forward market positions. In the presence of CIP deviations, however, the expected return on forward trades no longer coincides with that of a standard UIP trade implemented via direct bond positions. Consequently, global forward demand is jointly shaped by both UIP and CIP deviations. As equation (6) makes clear, investors may still take long home-currency forward positions even when CIP deviations are negative—implying an excessively appreciated forward rate—provided UIP deviations are sufficiently large.

Second, fluctuations in global investors' risk bearing capacity also shift forward demand. The direction of these shifts depends on the original position of global investors, which is determined by equilibrium UIP deviations. If UIP deviations are positive, tighter risk-bearing capacity leads global investors to require higher compensation on their forward trade. This results in a right-ward shift of the forward demand curve: to reduce their exposure to the forward trade, global investors demand less local-currency forward (more dollar forward).

We summarize a set of related empirical predictions in the following proposition.

Proposition 1 *Local intermediaries' long-dollar position in the forward market:*

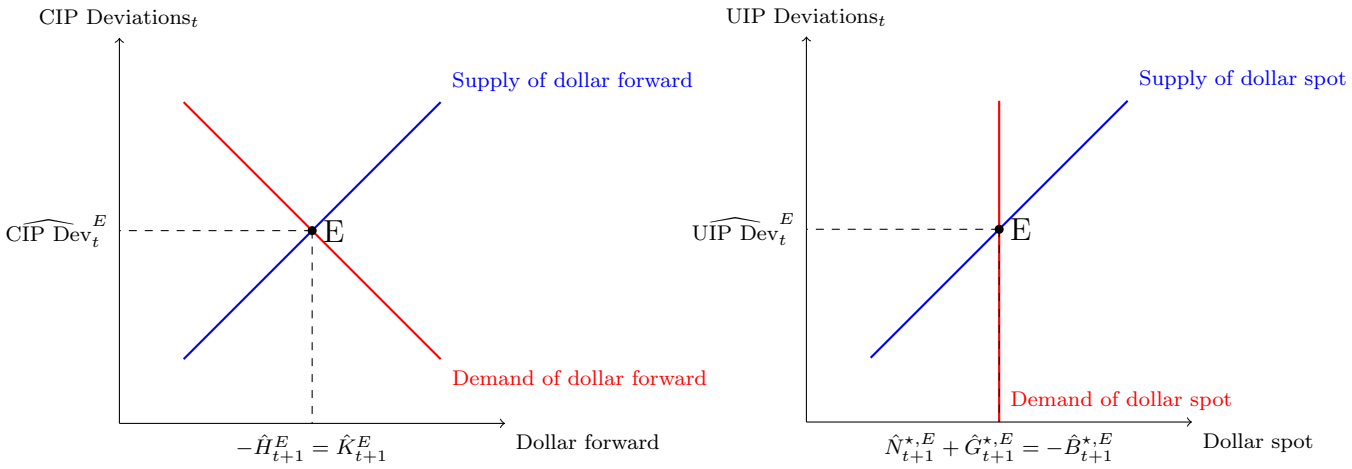
(a) is negatively correlated with the position of global investors in the forward market;

(b) is negatively correlated with the CIP deviation;

(c) delivers positive profits on their CIP-trade.

Proof. See Appendix A.5 ■

Since global investors determine forward demand, their positions are directly tied to those of domestic intermediaries—the suppliers of forwards. In our baseline model, forward market clearing (5) implies that the two are exact mirror images. Moreover, because CIP deviations arise as compensation for the costs borne by intermediaries in supplying forwards, intermediaries' forward dollar positions are negatively correlated with CIP deviations (eq. (3)) and must consistently yield positive profits (eq. (4)). The predictions in Proposition 1 hold without specifying how UIP deviations are determined in equilibrium. We now turn to the spot market, characterize its equilibrium, and derive additional predictions.



(a) Equilibrium in the Forward Market **(b)** Equilibrium in the Spot Market

Figure 1: Equilibrium in Forward and Spot Markets

Note: The graphs depict the equilibrium in the forward market (Panel (a)) and in the spot market (Panel (b)). We take the first-order approximation of the relevant equilibrium conditions to depict these equilibrium relationships, as we describe in Appendix A.3.

2.2 Spot Exchange Market

We now describe the equilibrium in the spot market, the determinants of equilibrium UIP deviations, and the interaction across spot and forward markets. The spot market includes short-term bonds in home and foreign currency.

Domestic Currency-Spot Traders We assume that a subset of local investors (*e.g.* firms, households, and other investors) can hold currency risk subject to limited risk bearing capacity, similar to the "arbitrageurs" in Gabaix and Maggiori's (2015) model of foreign exchange spot market.

They hold a zero-capital portfolio in home and foreign bonds $(B_{t+1}, B_{t+1}^\star)$ such that $B_{t+1}^\star/R_t^\star + B_{t+1}/(S_t R_t) = 0$. A $(B_{t+1}, B_{t+1}^\star)$ position in spot market delivers $B_{t+1}^\star \left(1 - R_t/R_t^\star S_t/S_{t+1}\right)$ in dollars. Currency-spot traders maximize mean-variance utility of returns in dollars:

$$\max_{B_{t+1}^\star} \quad B_{t+1}^\star E_t \left(1 - \frac{R_t}{R_t^\star}\frac{S_t}{S_{t+1}}\right) - \frac{\lambda}{2}\left(B_{t+1}^\star\right)^2 \text{var}_t \left(1 - \frac{R_t}{R_t^\star}\frac{S_t}{S_{t+1}}\right),$$

where λ denotes their risk aversion. The first-order condition reads:

$$\frac{\overbrace{\left(E_t \frac{R_t}{R_t^\star} \frac{S_t}{S_{t+1}} - 1\right)}^{\text{UIP Deviation}_t}}{\lambda \operatorname{var}_t \left(\frac{R_t}{R_t^\star} \frac{S_t}{S_{t+1}}\right)} = -B_{t+1}^\star. \tag{7}$$

Equation (7) states that domestic currency-spot traders' home-currency position is increasing in excess home-currency returns (UIP deviations), in proportion to their risk bearing capacity.[10]

Inelastic Spot Investors A set of inelastic domestic investors holds a zero-capital position in home and foreign bonds:

$$S_t \frac{N_{t+1}^\star}{R_t^\star} + \frac{N_{t+1}}{R_t} = 0. \tag{8}$$

The inelastic demand of currency spot is meant to capture the currency demand of domestic investors such as domestic pension funds or firms that export or import. It could also capture the central bank's currency demand.

2.2.1 Equilibrium in Spot Exchange Market

Bond market clearing requires that the demand for foreign currency spot equals its supply:

$$N_{t+1}^\star + G_{t+1}^\star = -B_{t+1}^\star, \tag{9}$$

where local intermediaries' demand for dollar spot (derived in Appendix A.2) is:

$$G_{t+1}^\star = \frac{1}{\kappa} \left(\frac{R_t^\star}{R_t} \frac{F_t}{S_t} - 1\right) \frac{R_t^\star}{R_t} \frac{F_t}{S_t}. \tag{10}$$

Equations (7), (8), (9), and (10) determine the equilibrium in the spot market, also depicted in Figure 1b. If currency-spot traders are risk averse, the supply curve for dollar spot is upward sloping. Higher supply of dollar spot—to meet the demand of inelastic investors and local intermediaries—increases currency-spot traders' exposure to the possibility of a local currency depreciation. Thus, they require higher excess home currency returns (UIP

[10] We note that equation (7) characterizes the behavior of some firms in emerging economies whose spot currency positions respond to the size and sign of expected excess returns (Bruno and Shin, 2017).

deviations, eq. (7)).

2.3 UIP and CIP Deviations in Equilibrium

Bringing back the country indicators "c", we now discuss the relationship between equilibrium UIP and CIP deviations across countries. Appendix A.4 shows that one can express equilibrium CIP and UIP deviations in closed form as:

$$\underbrace{\left(r_t^\star - r_t^c + f_t^c - s_t^c\right)}_{\text{CIP Deviation}_t^c} = \frac{\Lambda\kappa}{\Gamma_t + \kappa + \Lambda}(\xi_t^c); \qquad \underbrace{\left(r_t^c - r_t^\star - E_t s_{t+1}^c + s_t^c\right)}_{\text{UIP Deviation}_t^c} = -\frac{\Lambda(\Gamma_t + \kappa)}{\Gamma_t + \kappa + \Lambda}(\xi_t^c), \quad (11)$$

where lower-case letters denote the logarithm of the respective upper-case variables, $\Gamma_t \equiv \gamma_t \sigma_s^2$ and $\Lambda \equiv \lambda \sigma_s^2$ are global investors' and domestic currency-spot traders' risk-bearing capacity, respectively, while ξ_t^c denotes a shock to the demand for country-c currency bonds.[11] We assume that the exogenous processes, ξ_t^c, Γ_t, and s_{t+1}^c are independent.

We can then use eq. (11) to express the expected return in the forward market:

$$\underbrace{\left(f_t^c - E_t s_{t+1}^c\right)}_{\substack{\text{expected} \\ \text{forward-market returns}_t^c}} = -\frac{\Lambda\Gamma_t}{\Gamma_t + \kappa + \Lambda}(\xi_t^c). \quad (12)$$

Our portfolio-balance model pins down only CIP and UIP deviations, and thus the expected forward market return, but not the individual components separately. To determine the time-t values of spot and forward exchange rates, one must additionally specify a process for the interest rate differential.

The proposed mechanism implies a negative cross-country covariance between UIP and CIP deviations. To understand why, first note that cross-currency differences in CIP deviations persist because only domestic intermediaries are able to perform CIP arbitrage in their local currency (Rime et al., 2022; Siriwardane et al., 2022). In a given country, domestic intermediaries must absorb the forward demand arising from excess currency returns anticipated by global investors on the local currency—that is, UIP deviations. The relevant driver of the cross-country variation in UIP deviations is the country-specific component of foreign

[11] The shock to home-currency bond demand ξ_t^c is formally defined as $\xi_t^c = -\left(R_t^c/R_t^\star S_t^c/F_t^c\right)^2 N_{t+1}^{c,\star}$, which rescales the demand for foreign-currency bonds of country-c inelastic investors, $N^{c,\star}$.

currency demand shocks from inelastic investors, denoted ξ_t^c. In contrast, global risk aversion shocks, Γ_t, do not generate such dispersion in the cross-country ranking of UIP or CIP deviations. As a result, when a country offers high excess currency returns (*i.e.*, a positive UIP deviation), it attracts greater forward demand for its currency from global investors. To incentivize local intermediaries to meet this demand by supplying home-currency forward ($K_{t+1} < 0$), CIP deviations in that country must be lower (*i.e.*, a negative CIP deviation, which benefit intermediaries when $K_{t+1} < 0$).[12] The mechanism is further illustrated in Appendix Figure A.1. The proposition below formalizes this cross-country relationship.

Proposition 2 *Consider a continuum of small-open economies, indexed by $c \in [0, 1]$, with idiosyncratic levels of currency imbalances, ξ^c. In equilibrium, the cross-currency correlation between average UIP deviations and average CIP deviations is negative.*

Proof. See Appendix A.5 ■

2.4 CIP Deviations during Global Financial Disruptions

We characterize the effects of a tightening in global investors' risk-bearing capacity—modeled as an increase in Γ_t—on both CIP deviations and investor positions. Our focus is on countries where UIP deviations are, on average, positive—a condition that holds for nearly all emerging markets (see, *e.g.*, Kalemli-Ozcan and Varela, 2024).

When global risk-bearing capacity tightens, CIP deviations increase unambiguously. Given the same positive expected return on their risky forward trades, global investors reduce their demand for home-currency forward contracts to limit exposure to home-currency risk. This decrease in demand leads to a movement along the forward supply curve, resulting in higher CIP deviations.[13,14] Appendix Figure A.2 illustrates these dynamics. The following proposition formalizes the effects of a tightening in global risk bearing capacity.

[12] Heterogeneity in global investors' bond holdings can also result in an inverse relationship between CIP and UIP deviations (Chen and Zhou, 2025).

[13] In the baseline model, if UIP deviations are positive (and thus CIP deviations are negative), changes in global risk aversion can only increase CIP deviations until they reach zero (when global risk aversion becomes infinite). A simple extension of the model—where global investors maintain a *non-zero*, constant position in emerging market bonds—allows CIP deviations to rise above zero in response to global financial disruptions. Such extension would not alter the core mechanisms or conclusions of the analysis.

[14] In equilibrium, UIP deviations also rise, as local intermediaries reduce their spot demand for foreign currency due to the decline in forward supply. By contrast, the unconditional time-series comovement between UIP and CIP deviations is ambiguous in this framework, as shown in equation (11).

Proposition 3 *Consider the first-order approximation of economy c around a risky steady state with positive UIP deviations (i.e. $\xi^c < 0$). Global financial disruptions ($\hat{\Gamma}_t \uparrow$) cause an increase in CIP deviations, along with a reduction in currency-c forward demand by global investors. These effects apply to the average emerging economy as long as the average UIP deviation across emerging-economies currencies is positive (i.e. $\xi \equiv \int \xi^c \, dc < 0$).*

Proof. See Appendix A.5 ■

3 Data

To test the model's predictions, we draw on two types of data. First, we assemble a large panel of forward and spot exchange rates together with interest differentials, which enables us to construct CIP deviations and excess currency returns across a broad set of advanced and emerging economies. Second, we use micro-level data from Peru, including confidential supervisory records on forward trades and money-market books. These provide detailed information on net forward positions, forward flows, and arbitrage profits of local intermediaries—variables that are central to evaluating the predictions of our portfolio-balance model.

3.1 Data on CIP Deviations and Excess Currency Returns

Our baseline sample focuses on 19 emerging economies from January 2002 to December 2022, while Appendix C reports empirical evidence for advanced economies (G10). The frequency of the data is daily.

Primary quotes are retrieved from *Bloomberg* (tickers in Table C.2), while we resort to *Datastream* for patching missing observations. We follow Du et al. (2018a) and Cerutti and Zhou (2024) to construct the main variables of interest.

CIP deviations. For each currency c we compute the annualized 3-month cross-currency basis:

$$\text{CIP}_{c,t}^{(3M)} = \frac{360}{ACT}\left[\left(f_{c,t}^{(3M)} - s_{c,t}\right) - \left(r_{c,t}^{(3M)} - r_{\$,t}^{(3M)}\right)\right],$$

where $f^{(3M)}$, s and $r^{(3M)}$ are the logarithm of 3-month forward exchange rates, spot exchange rates, and 3-month interbank interest rates, respectively. ACT is the number of days in the

3-month period. In addition, the forward premium is defined as the logged 3-month forward exchange rate minus the logged spot exchange rate, quoted in domestic currency per U.S. dollar. The interest rate differential is defined as the logged 3-month domestic interbank rate minus the logged 3-month U.S. LIBOR rate. Both the forward premium and the interest rate differential are annualized.

Excess currency returns and forward-trade returns. Excess domestic currency returns (relative to the U.S. dollar), and the returns from the "forward trade" are, respectively:

$$rx_{c,t+3M} = r_{c,t}^{(3M)} - r_{\$,t}^{(3M)} - \Delta s_{c,t+3M};$$

$$rx_{c,t+3M}^{FWD} = f_{c,t}^{(3M)} - s_{c,t+3M}.$$

where Δs_{t+3M} is the 3-month difference in the logged exchange rate.[15]

Proxies of global risk aversion Our preferred proxy for the risk aversion of global investors is the CBOE Volatility Index (VIX). Our analysis also uses other global risk factors, such as the CBOE Emerging Markets Volatility Index (VXEEM) and the broad Dollar index.

3.2 Data on Investors' Forward Positions (Peru)

Peru is a relevant case study due to its similarities with other emerging economies, as highlighted in Section 1. Like many other emerging economies, Peru is partially dollarized, with local intermediaries, or "banks", acting as market makers in both spot and forward exchange markets. These banks play a central role in liquidity provision and operate under regulatory constraints similar to those in other emerging markets, as described in Section 1.3.

These local intermediaries, which we refer as "local banks" or "Peruvian banks", may be subsidiaries of global banks. However, to operate as a local bank in Peru, they must establish offices within the country and comply with Peruvian regulations, just as domestic

[15] To construct 3-month excess return at *daily* frequency, we first, for each date t with available spot rate, search the date that is 3-month ahead according to ACT, as $t + 3M$. If $t + 3M$ is Saturday or Sunday, we use the values on the nearest Friday. We then compute the 3-month change Δs_{t+3M} as the difference of logged spot rates between the two dates. We then add the daily 3-month interest rate differential to compute the 3-month excess currency returns. Table C.3 reports the summary statistics of 3-month cross-currency basis and excess currency returns across emerging market currencies. Over the sample period, cross-currency bases among emerging economies are generally negative, while excess currency returns are mostly positive.

banks do.[16] Crucially, they cannot bypass these regulations when trading with their foreign headquarters, which are treated as separate entities by the regulatory agencies.

Beyond their role in the FX market, Peruvian banks serve as key financial intermediaries in the broader economy. Most function as commercial lenders, accepting deposits and extending loans in both soles (PEN, the internationally recognized abbreviation for Peru's currency) and U.S. dollars. As noted in Keller (2024), these deposits—particularly term deposits—are an important funding source for CIP trading activities.

Our data consist of market data as well as rich foreign exchange and money market data that provides a detailed picture of the forward market positions of local banks, global investors, and other market participants, as well as banks' CIP arbitrage transactions.[17] The sample goes from 2005 to 2018.

Market Data We collect foreign-exchange data on spot and forward transactions from *Bloomberg*. We also retrieve Peru's official closing spot foreign-exchange data from Peru's banking regulator, *Superintendencia de Banca y Seguros* (SBS). We complement this data with banks' interbank funding from Peru's Central Bank, as well as reserve requirements applicable to each bank.

We also gather data on global investors' holdings of fixed income securities in Peru. The safest short-term sovereign-risk security in Peru are Central Bank's certificates of deposit, which typically have maturities of less than one year.[18] We manually collected the data for these holdings from various reports published by the Central Bank of Peru. For longer-term sovereign bonds issued by *Ministerio de Economia y Finanzas* (Peru's finance ministry), we manually extract the number of sovereign bonds held by global investors from PDFs in Ministerio de Economía y Finanzas (2023).

Forward Data To obtain forward holding positions of both banks and global investors, we use confidential (and mandatory) foreign exchange trading reports submitted by local

[16] Local banks with foreign headquarters are, *e.g.*, *Scotiabank Peru*, *BBVA Continental*, and *Citibank Peru*.

[17] Throughout the paper, we consider exclusively short-term CIP deviations on interbank money market instruments. Unlike CIP deviations on long-term government bonds (Du and Schreger, 2016), these short-term deviations are unlikely to capture local-currency sovereign risk, as we argue in Section 6.3.

[18] Global investors once held these securities, but regulation made these positions prohibitively costly. Since October 2010, their holdings of certificates of deposit have been zero (see Section 1.1).

banks to the SBS. Our primary dataset consists of weekly snapshots of all forward contract holdings of local banks, including details such as the bank name, trade date, maturity, trade direction, notional amount, forward price and counterparty information. Additionally, banks must report the spot price at the time they closed the forward contract—a key input to computing trade-level forward premia.

Investment and Borrowing Data. In addition to forward contract-level data, local banks report information on their money-market assets and liabilities to the SBS, allowing us to compute banks' CIP profits. Following Keller (2024), we focus on the assets and liabilities that are most probably used when arbitraging CIP deviations. For soles and dollar funding, we use rates and balances of new term deposits. For soles investments, we use a dataset containing monthly snapshots of banks' fixed-income holdings. While the snapshots are monthly, the dataset includes the transaction date, enabling us to approximate daily investments. From this dataset, the relevant asset in soles we use for CIP arbitrage is Peru's Central Bank's certificates of deposit. For dollar investments, on the other hand, we use another confidential dataset from the SBS which contains the rates at which local banks in Peru invest in dollar deposits at the Central Bank of Peru.

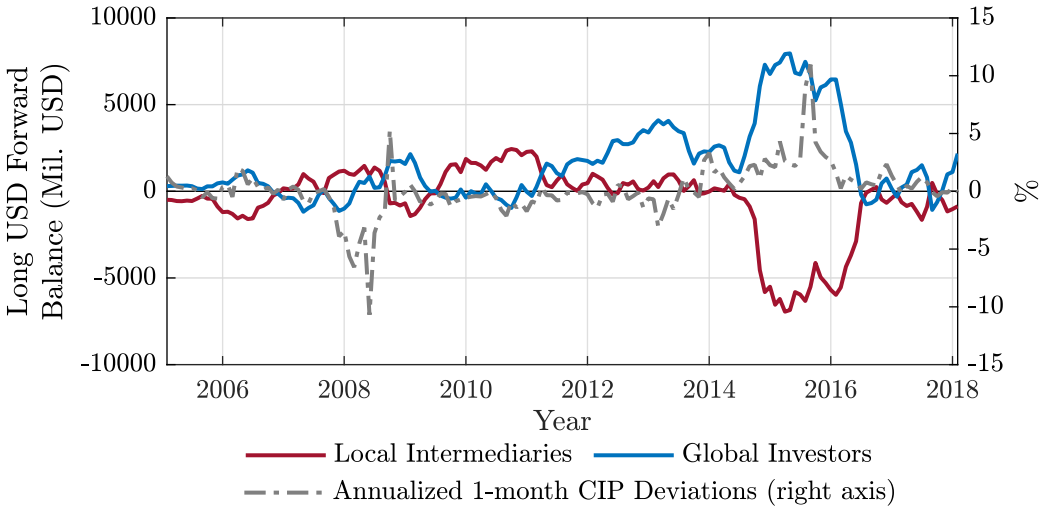
Exchange Rate Expectations. We also obtain exchange rate expectations for the PEN/USD exchange rate from *Consensus Economics*, spanning January 2002 to December 2022. It includes monthly observations on the exchange rate on the survey date, as well as forecasts for 3 months, 12 months, and 24 months ahead.

4 Positions, CIP Deviations, and CIP Profits

We now proceed with testing the model's three main propositions. We begin with Proposition 1, which characterizes the model's relationship between global investors' forward demand, local banks' forward supply, CIP deviations, and arbitrage profits.

Proposition 1(a) states that local banks' positions should be negatively correlated with those of global investors, as global investors are the primary counterparties driving banks' positions. Using forward contract-level data from Peru, we document a correlation of -0.80 between the forward balances of global investors and banks (the correlation is -0.88 when

Figure 2: Forward balances of local intermediaries and global investors



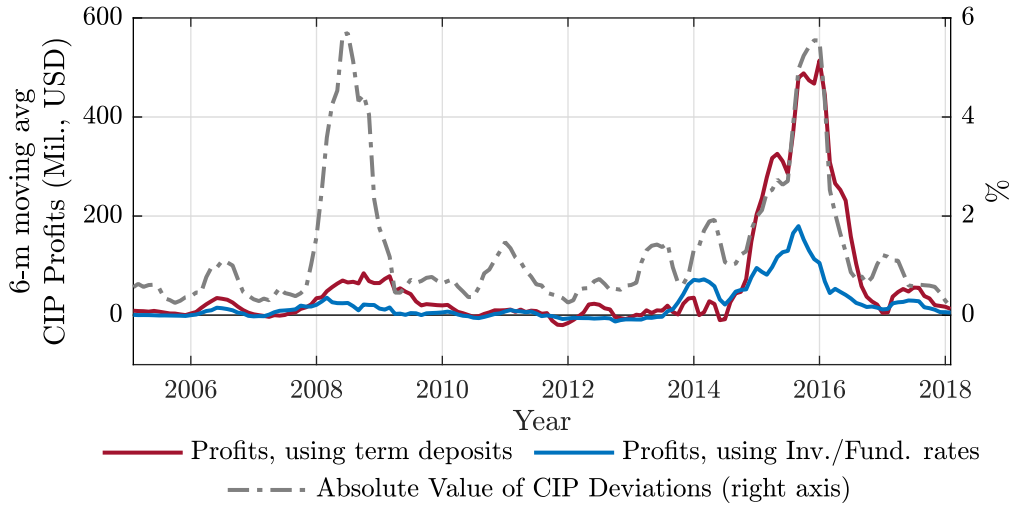
Note: The solid lines depict global investors and local intermediaries' net long dollar forward balances. The dashed lines depict the 1-month USDPEN cross-currency basis. The correlation between global investors and local banks' net long dollar forward balances is −80%. The correlation between local banks' net long dollar forward balances and the 1-month USDPEN cross-currency basis is −63%.

computed with flows instead of balances). As illustrated in Figure 2, global investors' long dollar forward balances and banks' long dollar forward balances move in opposite directions. A regression of banks' forward positions on those of global investors shows that a 1 dollar increase in global investors' long forward dollar position is associated with a 0.8 dollars decrease in banks' long forward positions (not reported).[19] Hence, forward balances of local intermediaries are nearly the mirror image of those of global investors, even though local intermediaries also trade forwards with local corporates, pension funds, and, occasionally, the central bank. This evidence highlights the key role of global investors in shaping forward demand.

Proposition 1(b) states that CIP deviations should be negatively correlated with banks' forward holdings. When local banks face position limits and, thus, an upward-sloping forward supply curve, they require positive CIP deviations as compensation for supplying (*i.e.* selling) more dollars forward and maintaining a negative net long dollar forward position. Figure 2 conforms to this prediction: in Peruvian data, the correlation between local banks'

[19] Before the 2013 Taper Tantrum, this relationship was even stronger. After that, as the sol and other emerging-market currencies depreciated, local firms increased their forwards usage, weakening the correlation. Still, global investors remain the main counterparties for local banks in the forward market.

Figure 3: CIP deviations and profits of local intermediaries



Note: The table reports the six-month moving averages of CIP trading profits (covering the past five months plus the current month) of local intermediaries (solid lines) as well as Peru's absolute annualized 1-month CIP deviations (dashed lines). The computation of the two measures of CIP arbitrage profits is described in Appendix B.1. The correlations between the two measures of CIP arbitrage profits with absolute CIP deviations are 70% and 65%, respectively.

net long dollar forward balance and CIP deviations is around −63%. Similar results hold when analyzing flows instead of balances.

Proposition 1(c) states that local banks—arbitraging CIP deviations and subject to position limits—should earn positive profits, in every period, from their CIP trades. Below, we show that banks' profits from trading CIP deviations are consistently positive, and higher when CIP deviations are higher (in absolute value).

We measure local banks' profits from arbitraging CIP deviations by first computing for each bank the approximate CIP deviations they obtain for each trade, and multiplying this by the volume of the trade. This would give the CIP profit of the trade.[20] We then aggregate these profits for the banking system. Since the specific funding and investment instruments used for CIP arbitrage are not directly observable, we compute profits using two approaches. The first assumes investment and funding rates are term deposit rates, adjusted for reserve requirement costs. The second follows Keller (2024), using the most likely investment and funding rates for each currency. Appendix B.1 provides further details

[20] Note that in this calculation we have not annualized CIP deviations. We are calculating the exact profits obtained by banks for the contracted forward tenors.

on the profit calculation, including trade direction and rate selection.

Figure 3 presents the results of these calculations. The dashed line depicts the de-trended six-month moving average of the absolute value of CIP deviations. The two CIP arbitrage profit measures are depicted by the solid lines. The moving average incorporates the previous five months and the current one. The red line represents profits calculated using only deposit rates, while the blue line corresponds to the proxy adjusted for investment and funding rates. Appendix Table C.1 shows that profits across CIP regimes (positive or negative CIP deviations) have always been positive for banks. For completeness, Appendix Table C.1 also shows summary statistics across various samples.

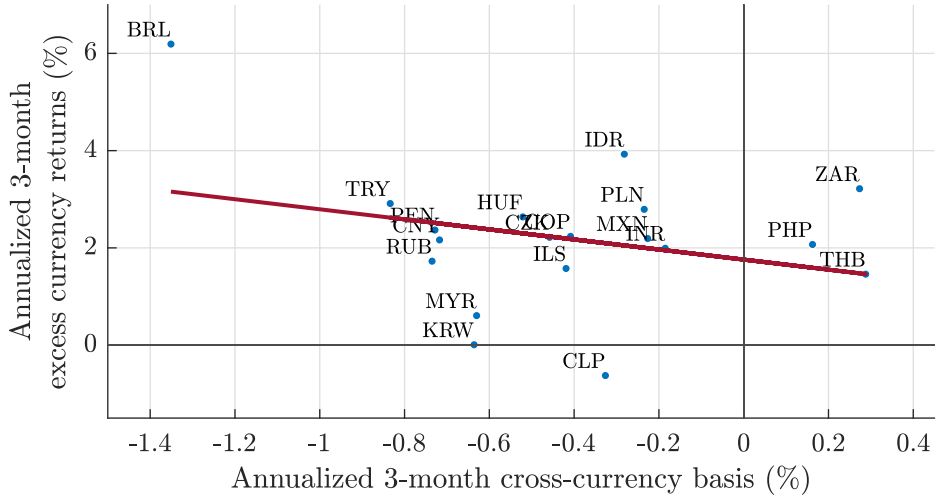
5 UIP and CIP Deviations across Currencies

We now turn to testing Proposition 2, which points to a negative correlation between CIP deviations and excess currency returns across countries. To this end, Figure 4 plots each country's average 3-month excess home-currency returns against its average 3-month CIP deviations. Among emerging market currencies, currency returns and CIP deviations exhibit a negative relationship. Relatedly, the regression $rx_{c,t+3M} = \delta_t + \beta \text{CIP Deviation}_{c,t}^{3M} + \varepsilon_{c,t+3M}$, where δ_t is the time fixed effect, produces $\hat{\beta} =$ -1.01 with standard error 0.29.[21]

Moreover, Figure C.8 report the cross-sectional relationship between the mean 3-month CIP deviation and the mean 3-month interest rate differentials as well as the net international investment positions (Net IIP), scaled by GDP, excluding FX reserves. In line with Cerutti and Zhou (2024), 3-month CIP deviations of emerging economies exhibit a negative correlation with interest differentials and a positive correlation with net international investment positions. Speculative forward demand offers a clear interpretation of these findings. Since interest differentials and net international investment positions are well-established predictors of future excess currency returns (Lustig et al., 2011; Della Corte et al., 2016), our mechanism naturally implies that CIP deviations should be linked to these variables. Specifically, countries with higher interest differentials and lower net international investment positions—both indicating higher expected excess currency returns—tend to have lower CIP

[21] The time period is a day. We use Driscoll and Kraay (1998) standard errors to account for the overlapping observational periods.

Figure 4: CIP deviations and excess currency returns across emerging markets



Note: The figure depicts scatter plots of mean cross-currency basis with 3-month excess home-currency returns across emerging economies, based on 3-month interbank rates, annualized, and quoted in percentage points. For illustration, variables are winsorized at the 5% level. The correlation coefficient is −29%

deviations. Distinguishing between speculative and hedging forward demand is relevant in this context. Hedging-driven forward demand, in fact, implies that countries with larger net external deficits or interest rates feature excess demand for dollar forward. As a result, they exhibit higher—rather than lower—CIP deviations (Liao and Zhang, 2021; Dao et al., 2025).

6 Forward Demand and CIP Deviations during Global Financial Disruptions

Proposition 3 states that during periods of heightened global risk aversion, CIP deviations increase and global investors retract their open forward positions in emerging market currencies. To empirically assess this proposition, we use the VIX index as a proxy for global risk aversion—denoted as Γ_t in our model—and estimate the dynamic responses of CIP deviations and forward positions of global investors at daily frequency. We use our panel data to construct the response of emerging economies CIP deviations to a VIX innovation. We rely on data from Peru to construct the response of global investors' forward positions to a VIX innovation.

6.1 Global Financial Disruptions and CIP Deviations

We estimate the dynamic responses of 3-month CIP deviations to innovations in the VIX index at the daily frequency. Specifically, we employ a local projection on panel data of emerging market currencies, estimating the following regression separately for each horizon $h \in [-30, +30]$ trading days:

$$CIP_{i,t+h} - CIP_{i,t-1} = \alpha + \gamma_i + \beta_h^{CIP} \Delta \log(VIX)_{t-1,t} + \epsilon_{i,t+h},$$

where CIP_{it+h} is the annualized 3-month cross-currency basis for currency i at time $t+h$, and $\Delta \log(VIX)_{t-1,t}$ is the daily change in the logarithm of the VIX index from $t-1$ to t. The term γ_i denotes currency fixed effects. The coefficients β_h^{CIP} trace out the responses of CIP deviations to a one-day tightening (*i.e.* decrease) in global risk bearing capacity. We adjust standard errors following Driscoll and Kraay (1998).

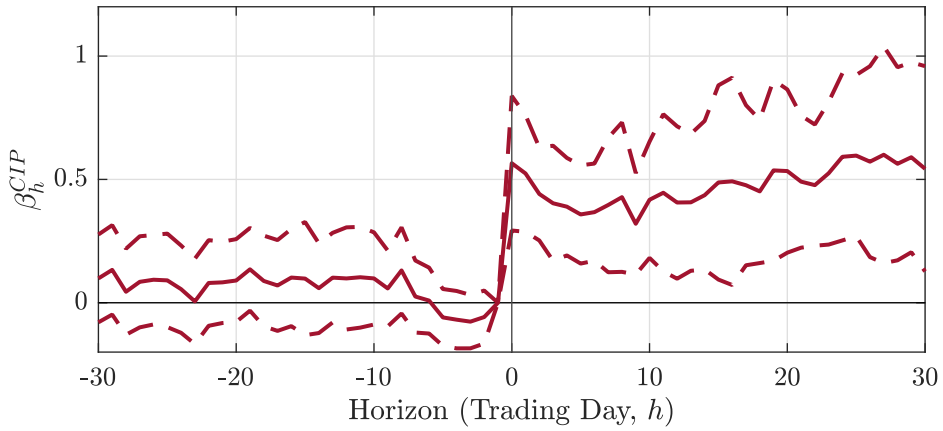
Figure 5 presents the estimated dynamic responses ($\{\beta_h^{CIP}\}$) and 95% confidence intervals. An increase in the VIX is associated with an immediate, statistically significant increase in CIP deviations for emerging market currencies. Specifically, a 1 standard deviation increase in the VIX index corresponds to 4 basis-point rise in the cross-currency basis. The response peaks within a few trading days and persists over several weeks. These findings are consistent with Proposition 3: a tightening of global risk bearing capacity reduces global investors' incentive to take open forward positions in emerging market currencies, putting downward pressure on forward prices (and thus upward pressure on CIP deviations).

We further examine the comovement between CIP deviations of emerging economies and broader measures of global risk factors. We isolate the common variation in CIP deviations through a principal component (PC) analysis of the monthly changes in 3-month cross-currency bases of emerging economies. Then, we document the properties of the first principal component of emerging-market CIP deviations, in relationship to variables that, broadly speaking, proxy for global risk.

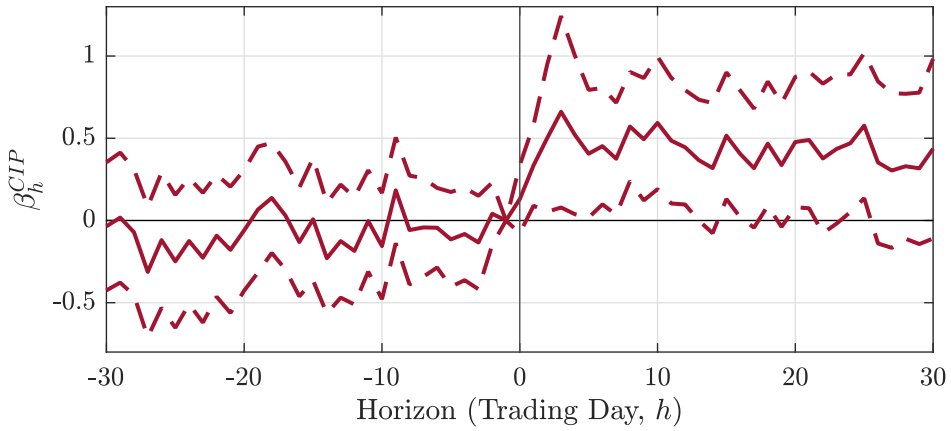
Table 1 reports the correlations between the first principal component of the monthly changes in 3-month CIP deviations and selected global risk factors.[22] Emerging economies'

[22] The first principal component is highly correlated (91%) with changes in emerging markets' mean CIP

Figure 5: Dynamic responses of CIP deviations in emerging economies to VIX changes



(a) All emerging economies



(b) Peru

Note: Panel (a) plots the coefficients β_h^{CIP} and corresponding 95% confidence intervals from the regression: $CIP_{i,t+h} - CIP_{i,t-1} = \alpha + \gamma_i + \beta_h^{CIP} \Delta \log(VIX)_{t-1,t} + \epsilon_{i,t+h}$, where $CIP_{i,t+h}$ is the annualized 3-month cross-currency basis for emerging economy i, and $\Delta \log(VIX)_{t-1,t}$ is the daily change in the log VIX. Currency fixed effects γ_i are included. The horizon h ranges from -30 to +30 trading days. Confidence intervals use Driscoll and Kraay (1998) standard errors. Panel (b) reports the coefficients for the regression that only includes Peru CIP deviations.

CIP deviations comove positively with the U.S. dollar and proxies of tight global financial conditions such as implied market volatility (VIX and VXEEM). In addition, CIP deviations are negatively correlated with variables that signal positive global market conditions such as Fama and French (1993) and He et al. (2017) factors. Broadly construed, these results are also consistent with the notion that tightening of global financial conditions is associated with and increase in emerging-market CIP deviations.[23]

deviations. The latent factor that captures the most common variations in CIP deviations across emerging markets thus resembles a level factor.

[23] In a complementary empirical analysis, Cerutti and Zhou (2024) find a similar difference in how CIP deviations move with global risk factors in emerging relative to advanced economies. Unlike our paper, they do

Table 1: Correlation between first Principal Component (PC1) of emerging-market CIP deviations and global risk factors

	PC1	CIP-AE	CIP-EME	Dollar	VIX	VXEEM	US Market	HKM
PC1	1.00							
CIP-AE	-0.25	1.00						
CIP-EME	0.91	-0.08	1.00					
Dollar	0.55	-0.17	0.60	1.00				
VIX	0.47	-0.18	0.41	0.38	1.00			
VXEEM	0.49	-0.12	0.39	0.40	0.92	1.00		
US Market	-0.38	0.19	-0.40	-0.45	-0.67	-0.65	1.00	
HKM	-0.29	0.13	-0.33	-0.43	-0.55	-0.58	0.78	1.00

Note: The table shows the correlations between the first principal (PC) component of the monthly changes in the 3-month cross-currency basis of emerging market currencies *vis-a-vis* the USD and the monthly changes in selected global risk factors. PC1 is the first principal component. CIP-AE and CIP-EME are respectively the monthly changes in the average CIP deviations across G10 and emerging currencies. Dollar denotes the monthly percentage change in the Federal Reserve Board broad dollar index (DTWEXBGS). VIX is the monthly change in the logarithm of implied volatility of the S&P options. VXEEM denotes the monthly change in the logarithm of implied volatility of the MSCI Emerging Market Index. US Market denotes the monthly excess return of the US market from Fama and French (1993), and HKM is the monthly innovations to the intermediary capital ratio in He et al. (2017). The data range from 2002-2022.

6.2 Global Financial Disruptions and Forward Positions

We now examine how forward positions of global investors in Peru respond to innovations in the VIX index. We estimate the following local projection regression separately for each daily horizon $h \in [-30, +30]$:

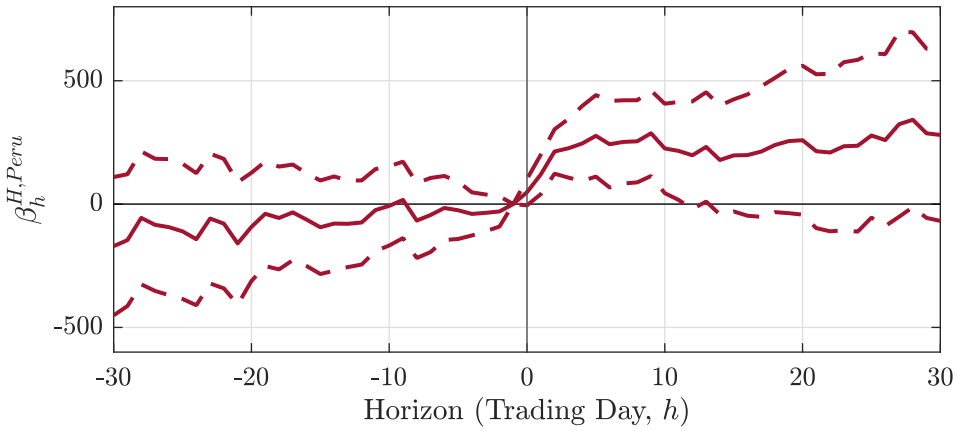
$$H_{t+h}^{Peru} - H_{t-1}^{Peru} = \alpha_h + \beta_h^{H,Peru} \Delta \log(VIX)_{t-1,t} + \epsilon_{Q,t+h}, \tag{13}$$

where H_t^{Peru} corresponds to the net long U.S. dollar forward balances held by foreign investors in Peru at date t. $\Delta \log(VIX)_{t-1,t}$ is the daily change in the logarithm of the VIX index from $t-1$ to t. The coefficients $\beta_h^{H,Peru}$ capture the responses of Peru's dollar forward demand from foreign investors to a one-day increase in global risk bearing capacity. We adjust standard errors following Newey and West (1986) with lag of 30 trading days.

Figure 6 shows the estimated dynamic responses ($\{\beta_h^{H,Peru}\}$) with 95% confidence intervals. A rise in the VIX is associated with an increase in global investors' net long dollar forward positions, consistent with a reduction in their forward exposure to emerging market

not provide a mechanism that explains these property of CIP deviations of emerging economies.

Figure 6: Dynamic responses of global investors' forward positions to VIX changes



Note: The figure plots the coefficients $\beta_h^{H,Peru}$ and corresponding 95% confidence intervals of regression equation (13). The response variable is Peru's net long dollar forward balances from foreign investors. The horizon h ranges from -30 to +30 trading days. Newey and West (1986) standard errors are used to compute the confidence intervals. The regressions are conducted with daily estimates from 2005 to 2018.

currencies. Specifically, a 10% VIX increase is associated with a $15 million rise in net long dollar balances in the next three days, with effects persisting for several weeks. These findings support Proposition 3: heightened global risk aversion leads to a pullback in forward positioning by global investors.

6.3 CIP Deviations and Default Risk

In this context, the reader may wonder whether these results could be driven by CIP deviations potentially reflecting emerging-market default risk (Du and Schreger, 2016; Dao and Gourinchas, 2025). We argue that default risk is unlikely to be a major driver of fluctuations in the specific context we examine—namely, short-term (1- to 3-month) money-market instruments. First, CIP deviations frequently fluctuate in sign over time. If emerging market default risk were the primary driver, we would expect deviations to be persistently negative, reflecting a consistent premium required by investors.[24] Second, during episodes of global financial stress—such as the Global Financial Crisis, the Taper Tantrum, and the COVID-19 pandemic—CIP deviations in emerging markets tend to become more positive rather than more negative. This pattern, documented in Figure 5 and Table 1, is inconsistent with a default-risk explanation, as sovereign risk premiums typically rise in such periods, which

[24] Appendix B.2 presents a framework to spell out why one would expect deviations to be persistently negative if emerging market default risk was responsible for CIP deviations.

should push deviations further into negative territory.[25] Third, the observed profit patterns of local intermediaries run counter to a default-risk interpretation. If CIP deviations reflected rising default risk, local banks would occasionally incur losses when defaults or restructurings occur. Yet, in the case of Peru, intermediaries consistently earn positive profits from CIP arbitrage regardless of market conditions (see Figure 3). Fourth, the funding leg of CIP trades involves ultra-short-term, low-risk instruments. In Peru, for instance, banks use Central Bank certificates of deposit (CDBCRPs), which are monetary policy tools with minimal default risk—even during market stress. More broadly across emerging markets, the short-term government securities used in CIP trades lie at the safest end of the sovereign yield curve, further reducing the plausibility of default risk as a key driver.

7 Forward Demand: Speculation vs. Hedging Motives

The literature on CIP deviations often assumes that forward demand primarily reflects hedging motives. In contrast, our framework models a distinct motive—"currency speculation"—whereby global investors take forward positions to increase, rather than offset, currency risk exposure in pursuit of positive expected return. We argue that speculative motives are likely the dominant force behind forward demand in emerging markets, and next we provide several additional pieces of evidence to support this view.

First, if global investors were hedging, we would expect them to have long dollars forward positions to offset their exposure to Peruvian assets that are denominated in soles (since global investors can only hold long positions in soles-denominated assets). However, as shown in Figure 2, global investors' total long forward positions were mostly *negative* before February 2011, except during the Global Financial Crisis (2008-2009), when they turned positive. Rather than hedging, global investors' positions appear consistent with them speculating on sol appreciation by selling dollars forward. The shift in February 2011 likely stems from a regulatory change targeting carry trades involving forward contracts.[26] Since then,

[25] Panel regressions that control for global risk factors and explicitly include sovereign CDS spreads show little evidence that default risk drives short-term CIP deviations (Cerutti and Zhou, 2024).

[26] At the end of January 2011, the Peruvian bank regulator (SBS) introduced a regulation imposing limits on local banks' net forward positions. The regulation explained that this was necessary because *"low interest rates abroad and expectations of an appreciation of the sol are attracting carry trade operations via foreign exchange derivatives, generating excessive volatility in the exchange rate market"* (Superintendencia de Banca y Seguros, 2011). News reports speculated that additional restrictions, such as taxes, could follow

global investors have held long dollar forward positions, though it remains unclear whether this reflects speculation on sol depreciation or hedging Peruvian bonds and stocks holdings. For example, after 2013, the increase in global investors' short-soles forward positions coincided with the so-called Taper Tantrum, which led to outflows from emerging economies, and higher likelihood of future sol depreciation.

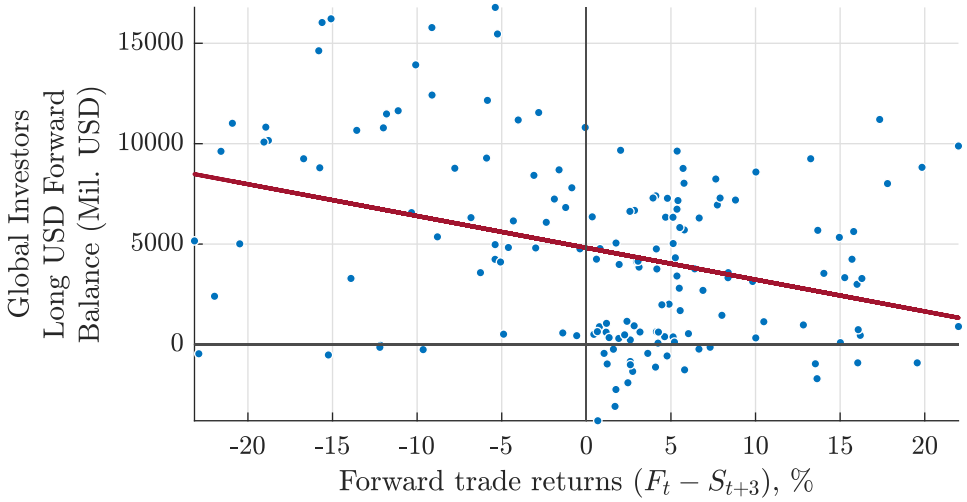
Second, if forward positions primarily reflected hedging, global investors would be expected to buy dollars forward when increasing their holdings of sol-denominated assets. In that case, changes in their forward dollar balances should be positively correlated with changes in their sol asset positions. While we do not observe all sol-denominated holdings, we do have data on their positions in Peruvian sovereign debt and forward contracts. As shown in Appendix Figure C.5, the correlation between changes in global investors' forward positions and their Peru sovereign bond holdings is weak (-0.03) and statistically insignificant. Furthermore, this correlation is highly unstable across subperiods, with rolling estimates at times turning significantly negative.

Third, we show that global investors' forward market positions are correlated with returns from the forward trade, even after controlling for the VIX, our preferred measure of global risk aversion. This aligns with a natural prediction of our model of speculative forward demand: for a given level of risk aversion, global investors hold larger long dollar forward positions when the agreed forward price is below the expected spot price at maturity. Figure 7 confirms this prediction. Specifically, the correlation between net long dollar forward positions and the difference between the forward price and the 3-month-ahead spot price (both residualized with respect to the VIX) is approximately -0.35. Moreover, 60% of months in our sample generate positive profits for global investors. Similar results hold when using survey-based expectations of the 3-month future spot rate (Appendix Figure C.5) or when not residualizing for the VIX.

Fourth, a growing literature studies the use of FX derivatives by U.S. fixed-income and equity mutual funds investing outside of the U.S.. Across U.S. mutual funds, FX derivatives usage is often limited, related to expected currency returns, and even used to amplify, rather than dampen, market exposure, especially in emerging economies (Sialm and Zhu, 2024;

if the sol continued to appreciate (Bloomberg, 2011).

Figure 7: Global investors' forward balance and returns from forward trade



Note: Each point in the scatter plot represents the monthly average of the global investors' net long dollar forward balance plotted against the corresponding average of forward prices agreed minus the spot rate that realized 3 months ahead. Both series have been residualized with respect to the VIX. The correlation between the two series is −35%.

Chen and Zhou, 2025; Opie and Riddiough, 2024; Kaniel and Wang, 2025; De Leo et al., 2025).[27]

8 CIP Deviations in Emerging vs. Advanced Economies

CIP deviations in emerging and advanced economies display different unconditional and conditional properties. We emphasize two main differences:

#1 CIP deviations are significantly larger in emerging economies (100 basis points on average in absolute value) than in advanced ones (20 basis points).

#2 During periods of heightened global risk aversion, CIP deviations increase in emerging economies while they decline in advanced economies.[28]

What factors might be behind these differences? We discuss specific extensions of the baseline framework of Section 2 to answer this question.

Market segmentation Regarding Fact #1, we emphasize that the constraints that global investors face in adjusting their short-term bond positions in emerging economies (Assump-

[27] Hacioğlu-Hoke et al. (2024) document that the position of hedge funds active in the UK FX derivatives reflects trading activity consistent with carry trade, momentum, and macroeconomic news investment strategies.

[28] CIP deviations in advanced economies respond negatively to a VIX innovation (Figure C.7), in contrast to the positive and persistent response in emerging economies (Figure 5) (see also Table 1 and Figure C.9).

tion 1) are *essential* for sustaining non-zero CIP deviations. If global investors had unrestricted access to bond and spot markets, they could engage in the "UIP trade" not only through forward contracts, as in the baseline model (the "forward trade"), but also via bonds. In this scenario, arbitrage would equalize the returns on these two strategies, necessarily driving CIP deviations to zero. The following proposition formalizes this argument.

Proposition 4 *Relax Assumption 1, and consider the problem of an otherwise identical global investor that actively trades in home/foreign bond and spot/forward market. Under these conditions, CIP deviations are zero.*

Proof. See Appendix A.5 ■

Limited access to short-term borrowing and lending in home currency by global investors is prevalent in emerging economies, as argued in Section 1.1, but not in advanced economies, and can rationalize why CIP deviations in emerging economies are significantly larger than in advanced economies. In addition, it helps explain why CIP deviations on supranational bonds are significantly smaller (Dao and Gourinchas, 2025), as these bonds are not affected by the market segmentation emphasized in this paper.

Dollar hedging If local investors' demand for hedging their (foreign) dollar assets plays a key role in shaping forward market dynamics, and if this hedging demand rises during periods of heightened risk aversion, then global risk aversion could increase the overall demand for home-currency forwards, leading to a decline in CIP deviations (Fact #2).[29,30] The following proposition formalizes this mechanism.

Proposition 5 *Extend the baseline model of the forward market of Section 2.1 to include a set of local investors that hold predetermined long dollar position and are partially hedged. Assume that these local investors have mean-variance preferences with the same risk aversion of global investors. If the unhedged dollar position of local investors is sufficiently large, global financial disruptions ($\hat{\Gamma}_t \uparrow$) cause a decline in CIP deviations.*

Proof. See Appendix A.5 ■

[29] The authors thank Wenxin Du for suggesting this explanation.
[30] Time-varying convenience yields can explain why CIP deviations decline when the dollar appreciates, even absent market segmentation (Jiang et al., 2021).

In a setting with both local and global investors, total forward demand during periods of heightened global risk aversion reflects two opposing forces: global investors' desire to sell home-currency forwards and local investors' demand to buy them as a hedge against dollar exposure. The net effect of these forces determines the direction of forward pressure and the movement in CIP deviations.

In advanced economies, local investors are often significant players in the forward market (on the demand side), and their trading behavior may be driven by a need to hedge dollar exposure, particularly during episodes of global risk aversion. Abbassi and Bräuning (2020), Liao and Zhang (2021) and Du and Huber (2023) provide empirical evidence supporting this mechanism for advanced economies.[31] In line with this conjecture, hedging appears to be more prevalent among non-U.S. investors, as compared to U.S. mutual funds' evidence mentioned in Section 7. Du and Huber (2023) document that U.S. dollar hedging ratios among global investors in 2020 are around 44%, 35%, and 21%, for insurance companies, pension funds, and mutual funds, respectively. Kubitza et al. (2024) document that U.S. dollar hedge ratios are heterogeneous across Euro Area investors, with insurance companies hedging on average 38% of U.S. dollar bond positions, investment funds 35%, and pension funds 57%.[32]

In Section 4, we show that forward demand in Peru is predominantly driven by global investors, whose trading is largely motivated by currency speculation, including carry trades. In contrast, the local investor sector is relatively small and less inclined to hedge, possibly due to the desirable characteristics of the dollar exchange rate relative to emerging-market currencies and the widespread presence of dollar-denominated liabilities.

9 Conclusions

Currency derivatives markets are a well-recognized channel for currency speculation, serving as an alternative to the textbook approach of executing carry trades through bond markets

[31] Liao and Zhang (2021) document a negative relationship between NFAs and CIP deviations in advanced economies (see Figure C.9). Their interpretation is based on a hedging model of forward demand, in which countries with higher NFAs have greater dollar exposure and thus hold a shorter dollar position.

[32] Du and Huber (2023) document that a significant portion of unhedged U.S. dollar allocations is explained by UIP deviations, proxied by interest rate differentials, as well CIP deviations. Kubitza et al. (2024) show that CIP deviations are an important determinant of both FX derivative and U.S. dollar bond holdings among Euro Area investors (see also Bräuer and Hau, 2024).

(Burnside et al., 2008). In this paper, we argue that these markets provide a particularly advantageous—if not the only—avenue for global investors operating on emerging-market currencies, given restrictions in access to short-term bond markets. We show that this perspective helps explain key properties of CIP deviations in emerging economies, including their relationship with currency returns, their behavior during periods of heightened global risk aversion, and, notably, the forward market positions of different investors. These empirical patterns would be difficult to reconcile with theories that primarily attribute currency derivatives usage to hedging motives.

We emphasize how specific financial market regulations influence these relationships by shaping access and risk-bearing capacity differently for local and global market participants. Building on this baseline, we extend the analysis to formally account for key differences in CIP deviations between emerging and advanced economies, linking them to different structural and institutional characteristics of financial markets and investors composition.

We highlight how global investors' speculative forward exchange demand influences the pricing of instruments originally designed for currency risk hedging, with important implications for macroeconomic and financial policies. For example, we show that the dynamics of global demand for forwards increases CIP deviations during global recessions. As a result, the cost of synthetic domestic-currency borrowing—the dominant form of external financing for many emerging economies—increases during downturns, weakening the effectiveness of countercyclical monetary policy (De Leo et al., 2024) and potentially justifying policy interventions aimed at "basis control" (Gourinchas, 2021).

References

Abbassi, P. and F. Bräuning (2020): "Demand Effects in the FX Forward Market: Micro Evidence from Banks' Dollar Hedging," *The Review of Financial Studies*, 34, 4177–4215.

Aldunate, F., Z. Da, B. Larrain, and C. Sialm (2023): "Pension Fund Flows, Exchange Rates, and Covered Interest Rate Parity," *Working Paper*.

Alfaro, L., M. Calani, and L. Varela (2023): "Granular Corporate Hedging Under Dominant Currency," *CEPR Discussion Paper 16232*.

Alvarez, F., A. Atkeson, and P. J. Kehoe (2009): "Time-varying risk, interest rates, and exchange rates in general equilibrium," *The Review of Economic Studies*, 76, 851–878.

Autorregulador del Mercado de Valores (2023): "Guía de Regulación Cambiaria," https://www.amvcolombia.org.co/wp-content/uploads/2024/05/RECA-2024.pdf.

Avdjiev, S., W. Du, C. Koch, and H. S. Shin (2019): "The Dollar, Bank Leverage, and Deviations from Covered Interest Parity," *American Economic Review: Insights*, 1, 193–208.

Bacchetta, P., K. Benhima, and B. Berthold (2023): "Foreign exchange intervention with UIP and CIP deviations: The case of small safe haven economies," *Swiss Finance Institute Research Paper*.

Bacchetta, P., J. S. Davis, and E. Van Wincoop (2024): "Exchange Rate Determination under Limits to CIP Arbitrage," Tech. rep., National Bureau of Economic Research.

Bacchetta, P., J. S. Davis, and E. van Wincoop (2025): "Offshore Dollar Funding Shocks and the Dollar Exchange Rate," *University of Lausanne mannuscript*.

Baker McKenzie (2022): "Global Public MA Guide: Colombia," https://resourcehub.bakermckenzie.com/en/resources/global-public-ma-guide/latin-america/colombia/topics/general-legal-framework.

Banco Central de Reserva del Perú, . (2023a): "Data on: Interbancaria S/," Last updated Sep 12 2023.

——— (2023b): "Data on: Interbancaria US$," Last updated Sep 12 2023.

Bank of Indonesia (2005): "Cirlation Letter: Minimum Capital Adequacy Requirements for Commercial Banks Conducting Business Based on Sharia Principle," https://ojk.go.id/Files/201402/sebi075305_1392881724.pdf.

Barbiero, O., F. Bräuning, G. Joaquim, and H. Stein (2024): "Dealer Risk Limits and Currency Returns," *Available at SSRN*.

Ben Zeev, N. and D. Nathan (2024a): "Shorting the Dollar When Global Stock Markets Roar: The Equity Hedging Channel of Exchange Rate Determination," *The Review of Asset Pricing Studies*, 14, 640–666.

——— (2024b): "The widening of cross-currency basis: When increased FX swap demand meets limits of arbitrage," *Journal of International Economics*, 152, 103984.

BIS (2015): *Currency carry trades in Latin America*, no. 81 in BIS Papers, Bank for International Settlements.

——— (2022): "Foreign exchange markets in Asia-Pacific," .

Bloomberg, . (2011): "Peru Sol Has First Weekly Fall this Month on Currency Measures," .

Bloomberg (2023): "Data on: Currencies and Money Markets." .

Borio, C. E., M. Iqbal, R. N. McCauley, P. McGuire, and V. Sushko (2018): "The failure of covered interest parity: FX hedging demand and costly balance sheets," *BIS Working Papers*.

Bradesco (2023): "Bradesco Reference Form: Resolution CVM N80/22," https://www.latibex.com/docs/Documentos/esp/hechosrelev/2024/FR_Bradesco_EN_2023.pdf.

Bräuer, L. and H. Hau (2024): "Fund-Level FX Hedging Redux," .

Bruno, V. and H. S. Shin (2017): "Global Dollar Credit and Carry Trades: A Firm-Level Analysis," *The Review of Financial Studies*, 30, 703–749.

Burnside, C., S. Rebelo, and M. Eichenbaum (2008): "Carry Trade: The Gains of Diversification," *Journal of the European Economic Association*, 6, 581–588.

Bush, G. (2019): "Bank FX hedging needs and the impact on covered interest parity, an emerging market perspective," Tech. rep., Working paper, Bank of Mexico.

Business World (2021): "Foreign exchange rules liberalized further," https://www.bworldonline.com/banking-finance/2021/06/04/373154/foreign-exchange-rules-liberalized-further/.

Canta, M., P. Collazos, and M. Shiva (2007): "Límites a las posiciones de cambio como mecanismo de mitigación del riesgo cambiario ." *SBS, Revista de Temas Financieros*, 119–136.

Cenedese, G., P. Della Corte, and T. Wang (2021): "Currency mispricing and dealer balance sheets," *The Journal of Finance*, 76, 2763–2803.

Cerutti, E. and H. Zhou (2024): "Uncovering CIP deviations in emerging markets: Distinctions, determinants, and disconnect," *IMF Economic Review*, 72, 196–252.

Cerutti, E. M., M. Obstfeld, and H. Zhou (2021): "Covered interest parity deviations: Macrofinancial determinants," *Journal of International Economics*, 130, 103447, nBER International Seminar on Macroeconomics 2020.

Chen, N. and H. Zhou (2025): "Managing Emerging Market Currency Risk," Tech. rep.

Coeurdacier, N., H. Rey, and P. Winant (2011): "The Risky Steady State," *American Economic Review*, 101, 398–401.

Dao, M. and P.-O. Gourinchas (2025): "Covered Interest Parity in Emerging Markets: Measurement and Drivers," IMF Working Papers 2025/057, International Monetary Fund.

Dao, M. C., P.-O. Gourinchas, and O. Itskhoki (2025): "Breaking Parity: Equilibrium Exchange Rates and Currency Premia," Tech. rep., Working Paper forthcoming, IMF.

De Leo, P., G. Gopinath, and S. Kalemli-Ozcan (2024): "Monetary Policy and the Short-Rate Disconnect in Emerging Economies," *Working Paper*.

De Leo, P., L. Keller, G. Simoncelli, M. V. Villegas, and T. Williams (2025): "Global Investors in Local-Currency Bond Markets: Implications for Bond Yields and Exchange Rates," *Working Paper*.

Della Corte, P., S. J. Riddiough, and L. Sarno (2016): "Currency Premia and Global Imbalances," *The Review of Financial Studies*, 29, 2161–2193.

di Giovanni, J., Şebnem Kalemli-Özcan, M. F. Ulu, and Y. S. Baskaya (2022): "International Spillovers and Local Credit Cycles," *Review of Economic Studies*, 89, 733–773.

Dodd, R. and S. Griffith-Jones (2007): "Brazil's Derivatives Markets: Hedging, Central Bank Intervention and Regulation," *CEPAL*.

Driscoll, J. C. and A. C. Kraay (1998): "Consistent Covariance Matrix Estimation With Spatially Dependent Panel Data," *The Review of Economics and Statistics*, 80, 549–560.

Du, W. and A. Huber (2023): "Dollar Asset Holding and Hedging Around the Globe," *Working Paper*.

Du, W., J. Im, and J. Schreger (2018a): "The us treasury premium," *Journal of International Economics*, 112, 167–181.

Du, W. and J. Schreger (2016): "Local currency sovereign risk," *The Journal of Finance*, 71, 1027–1070.

——— (2022): "CIP deviations, the dollar, and frictions in international capital markets," in *Handbook of International Economics*, Elsevier, vol. 6, 147–197.

Du, W., A. Tepper, and A. Verdelhan (2018b): "Deviations from covered interest rate parity," *The Journal of Finance*, 73, 915–957.

Duo, L. (2025): "Uncovering the Rising Demand for NDF Trading: A Closer Look at Emerging Markets and Future Developments," https://www.alpfin.com/post/uncovering-the-rising-demand-for-ndf-trading-a-closer-look-at-emerging-market.

Euromoney (2020): "Can FX NDFs still deliver?" https://www.euromoney.com/article/27mm7etau498o7ijtqadc/foreign-exchange/can-fx-ndfs-still-deliver.

Fama, E. F. and K. R. French (1993): "Common risk factors in the returns on stocks and bonds," *Journal of financial economics*, 33, 3–56.

Fanelli, S. and L. Straub (2021): "A Theory of Foreign Exchange Interventions," *Review of Economic Studies*.

Gabaix, X. and M. Maggiori (2015): "International Liquidity and Exchange Rate Dynamics," *The Quarterly Journal of Economics*, 130, 1369–1420.

Gonzalez, R. B., D. Khametshin, J.-L. Peydró, and A. Polo (2022): "Hedger of last resort: Evidence from Brazilian FX interventions, local credit, and global financial cycles," *Working Paper*.

Gourinchas, P.-O. (2021): "International Macroeconomics: From the Global Financial Crisis to COVID-19, and Beyond," *Mundell-Fleming Lecture, XXII Jacques Polak Annual Research Conference, International Monetary Fund*, https://youtu.be/8Go8fUgdhgE?t=2.

Gutierrez, B., V. Ivashina, and J. Salomao (2023): "Why is dollar debt Cheaper? Evidence from Peru," *Journal of Financial Economics*, 148, 245–272.

Hacioğlu-Hoke, S., D. Ostry, H. Rey, A. R. Planat, V. Stavrakeva, and J. Tang (2024): "Topography of the FX derivatives market: a view from London," *Working Paper*.

He, Z., B. Kelly, and A. Manela (2017): "Intermediary asset pricing: New evidence from many asset classes," *Journal of Financial Economics*, 126, 1–35.

Heenan, G., S. Zhou, D. Benedek, and M. Chivali (2011): "Indonesia: Selected Issues," *International Monetary Fund*.

IMF (2011): "Republic of Korea: Staff Report for the 2011 Article IV Consultation," *International Monetary Fund*.

IMF (2022): "IMF Country Report N22/338: Mexico - Financial Sector Assessment Program," https://www.imf.org/-/media/Files/Publications/CR/2022/English/1MEXEA2022003.ashx#:~:text=43,element%20of%20Mexican%20banks%20liquidity.

Jiang, Z., A. Krishnamurthy, and H. Lustig (2021): "Foreign Safe Asset Demand and the Dollar Exchange Rate," *Journal of Finance*, 76, 1049–1089.

Kalemli-Ozcan, S. and L. Varela (2024): "Five Facts about the UIP Premium," *Working Paper*.

Kaniel, R. and P. Wang (2025): "Unmasking Mutual Fund Derivative Use," *The Review of Financial Studies*, hhaf001.

Kekre, R. and M. Lenel (2023): "The high frequency effects of dollar swap lines," Tech. rep., National Bureau of Economic Research.

Keller, L. (2024): "Arbitraging covered interest rate parity deviations and bank lending," *American Economic Review*, 114, 2633–2667.

Kubitza, C., J.-D. Sigaux, and Q. Vandeweyer (2024): "Cross-Currency Basis Risk and International Capital Flows," *Fama-Miller Working Paper, Chicago Booth Research Paper*, 24–18.

Lane, M. P. R. and M. G. M. Milesi-Ferretti (2017): *International financial integration in the aftermath of the global financial crisis*, International Monetary Fund.

Lexsite.com (2024): "Master Direction - Risk Management and Inter-Bank Dealings: Amendments," https://www.lexsite.co.in/eDocs/RBI-32.pdf.

Liao, G. and T. Zhang (2021): "The hedging channel of exchange rate determination," *Working Paper*.

Lustig, H., N. Roussanov, and A. Verdelhan (2011): "Common Risk Factors in Currency Markets," *The Review of Financial Studies*, 24, 3731–3777.

Ministerio de Economía y Finanzas, . (2023): "Reporte de Tenencias de Bonos Soberanos," .

Newey, W. K. and K. D. West (1986): "A simple, positive semi-definite, heteroskedasticity and autocorrelationconsistent covariance matrix," .

Opie, W. and S. Riddiough (2024): "On the use of currency forwards: Evidence from international equity mutual funds," *Available at SSRN 4432796*.

Patel, N. and F. D. Xia (2019): "Offshore markets drive trading of emerging market currencies," *BIS Quarterly Review, December*.

Patnaik, I., S. Malik, R. Pandey, and Prateek (2013): "Foreign investment in the Indian Government bond market," *Securities and Exchange Board of India (SEBI)*.

Reserve Bank of India (2010): https://www.rbi.org.in/commonman/english/scripts/Notification.aspx?Id=729#.

Reuters (2025): "India rupee NDF volume hits record high on arbitrage activity," https://www.reuters.com/markets/currencies/india-rupee-ndf-volume-hits-record-high-arbitrage-activity-2025-01-09/.

Rime, D., A. Schrimpf, and O. Syrstad (2022): "Covered interest parity arbitrage," *The Review of Financial Studies*, 35, 5185–5227.

Schmittmann, J. M. and C. H. Teng (2020): "Offshore Currency Markets: Non-Deliverable Forwards (NDF) in Asia," *IMF Working Paper*.

Sialm, C. and Q. Zhu (2024): "Currency Management by International Fixed-Income Mutual Funds," *The Journal of Finance*, 79, 4037–4081.

Siriwardane, E., A. Sunderam, and J. L. Wallen (2022): "Segmented arbitrage," Tech. rep., National Bureau of Economic Research.

Superintendencia de Banca y Seguros, . (2011): "Resolucion S.B.S, N 923-2011," .

Superintendencia de Banca y Seguros (SBS), . (2018): "Data on: Anexos y Reportes," SBS provided access to the confidential data in February 2018.

——— (2024): "Data on: Tipo de Cambio Contable," Appended data accessed December 4 2018 with an update downloaded February 2 2024.

The Trade (2024): "Despite the dominance of voice trading, electronification is the natural path for Peru," https://www.thetradenews.com/despite-the-dominance-of-voice-trading-electronification-is-the-natural-path-for-peru

Wallen, J. L. (2022): "Markups to Financial Intermediation in Foreign Exchange Markets," .

Watanabe, K., H. Akama, and J. Mifune (2002): "The Effectiveness of Capital Controls and Monitoring: The Case of Non-Internationalization of Emerging Market Currencies," *EMEAP Discussion Paper*.

Appendix

A Model Derivations and Proofs

This appendix uses the following approximation:

Approximation 1 *Let X_t being a variable sufficiently close to 1. Set $x_t \approx X_t - 1$, where lower-case letters are the logarithm of the respective upper-case variables. For example, $\frac{R_t^\star}{R_t}\frac{F_t}{S_t} - 1 \approx r_t^\star - r_t + f_t - s_t$.*

A.1 Derivations of global investors' forward demand

In this appendix we show how the market access restrictions to global investors result in the global investors' forward demand in eq. (1). We begin by formulating the general problem faced by global investors when they have access to both bonds and forwards. We then impose Assumption 1 to characterize their problem under the form of market segmentation analyzed in this paper.

Bond Position A global investor holds a position in the home-currency short-term bond $\frac{X_{t+1}}{R_t}$, and a corresponding opposite position in the short-term U.S. dollar bond $\frac{X_{t+1}^\star}{R_t^\star}$. Denote S_t as the spot exchange rate, defined as units of home currency per U.S. dollar, so that an increase in S_t is a depreciation of home currency or appreciation of U.S. dollar. A zero-capital portfolio $\frac{1}{S_t}\frac{X_{t+1}}{R_t} + \frac{X_{t+1}^\star}{R_t^\star} = 0$ delivers a return of $\frac{1}{S_{t+1}}X_{t+1} + X_{t+1}^\star$ U.S. dollars. Thus, the realized excess return from a $\frac{X_{t+1}^\star}{R_t^\star}$ U.S. dollar position is $X_{t+1}^\star\left(1 - \frac{S_t}{S_{t+1}}\frac{R_t}{R_t^\star}\right)$ U.S. dollars.

In Section 1.1, we show that various financial regulations impose significant costs on global investors seeking access to the local bond and spot markets or adjust their positions in many emerging economies. Underlying Assumption 1 is the milder assumption that global investors cannot re-evaluate their short-term bond positions:

Assumption A.1 *Global investors' position in home-currency bond $\frac{X_{t+1}}{R_t}$ is predetermined and constant, i.e. $X_{t+1} = X$.*

Forward Demand Global investors actively trade in the forward market by choosing a long home-currency/short U.S. dollar forward position (H_{t+1}), where the position is expressed in U.S. dollars. A 1 U.S. dollar short forward position (long home-currency forward position) returns $\frac{F_t}{S_{t+1}} - 1$ U.S. dollars (or $F_t - S_{t+1}$ home currency). Thus, the realized excess return from a H_{t+1} short forward U.S. dollar position is $H_{t+1}\left(\frac{F_t}{S_{t+1}} - 1\right)$ U.S. dollars, and the realized return on the global investor's overall portfolio is, in U.S. dollars:

$$W_{t+1} \equiv X^\star\left(1 - \frac{S_t}{S_{t+1}}\frac{R_t}{R_t^\star}\right) + H_{t+1}\left(\frac{F_t}{S_{t+1}} - 1\right).$$

Taking the bond position $X^\star$ as predetermined and constant, global investors choose their forward position H_{t+1} to maximize their mean-variance utility:

$$\max_{H_{t+1}} \quad E_t\left(W_{t+1}\right) - \frac{\gamma_t}{2}\operatorname{var}_t\left(W_{t+1}\right),$$

where γ_t governs the global investors' aversion to risk.

The first-order condition for home-currency forward (H_{t+1}) reads:

$$\frac{\left(E_t \frac{S_t}{S_{t+1}}\frac{R_t}{R_t^\star} - \frac{R_t}{R_t^\star}\frac{S_t}{F_t}\right)}{\gamma_t \operatorname{var}_t\left(\frac{R_t}{R_t^\star}\frac{S_t}{S_{t+1}}\right)} = -X^\star + H_{t+1}\frac{R_t^\star}{R_t}\frac{F_t}{S_t} \tag{A.1}$$

In Section 1.1, we note that global investors' *short-term* bond positions in emerging economies are relatively small compared to their forward market positions. Assumption 1 thus directly implies:

Assumption A.2 *Global investor's predetermined position in the short-term bond market is nil, i.e.* $X^\star = 0$.

This assumption allows us to abstract from hedging motives of forward demand in the baseline model, and thus rewrite global investors' forward demand, eq. (A.1), as:

$$\frac{\left(E_t \frac{F_t}{S_{t+1}} - 1\right)}{\gamma_t \operatorname{var}_t\left(\frac{F_t}{S_{t+1}}\right)} = H_{t+1}, \tag{A.2}$$

which represents eq. (1) in the main text.

A.2 Derivations of local intermediaries' forward supply

To obtain a deterministic return in U.S. dollars (Assumption 2), the local intermediary j's portfolio, described in Section 2.1.2, implies the following relationship between its spot and forward market positions:

$$K_{j,t+1} = G^\star_{j,t+1}\frac{R_t}{R_t^\star}\frac{S_t}{F_t}. \tag{A.3}$$

As a result, the overall return on the intermediary's portfolio, eq. (2), becomes:

$$K_{j,t+1}\left(\frac{R_t^\star}{R_t}\frac{F_t}{S_t} - 1\right). \tag{A.4}$$

Furthermore, intermediaries investment decisions are subject to the following set of restrictions (Assumption 3). First, each intermediary is subject to a net open position limit $K > 0$,

and, second, intermediaries face heterogeneous participation costs, as in Alvarez et al. (2009) and Fanelli and Straub (2021). In particular, each intermediary j active in the foreign bond market at time t is obliged to pay a participation cost of j U.S. dollars per unit of foreign currency position.

Putting these features together, intermediary j optimally takes a $K_{j,t+1}$ position in forwards (short U.S. dollar), solving

$$\max_{K^{\star}_{j,t+1}\in[-K,K]} K_{j,t+1}\left(\frac{R^{\star}_t}{R_t}\frac{F_t}{S_t}-1\right)-j\left|K_{j,t+1}\right|,$$

Intermediary j's cash flow conditional on investing is $K\left|\left(\frac{R^{\star}_t}{R_t}\frac{F_t}{S_t}-1\right)\right|$ while participation costs are jK. Thus, investing is optimal for all intermediaries $j\in[0,\bar{j}]$, with the marginal active intermediary $\bar{j}$ given by $\bar{j}=\left|\left(\frac{R^{\star}_t}{R_t}\frac{F_t}{S_t}-1\right)\right|$. The aggregate investment volume is then $K_{t+1}=\bar{j}K\,\text{sign}\left\{\frac{R^{\star}_t}{R_t}\frac{F_t}{S_t}-1\right\}$. Defining $\kappa\equiv K^{-1}$ and substituting out $\bar{j}$, we obtain the total supply of (short-dollar) forward:

$$K_{t+1}=\frac{1}{\kappa}\underbrace{\left(\frac{R^{\star}_t}{R_t}\frac{F_t}{S_t}-1\right)}_{\text{CIP Deviation}_t}. \tag{A.5}$$

Equation (A.5) represent local intermediaries' forward supply, *i.e.* equation (3). In addition, local intermediaries' demand for U.S. dollar spot, eq. (10), is obtained by combining equation (A.5) with the aggregate version of equation (A.3).

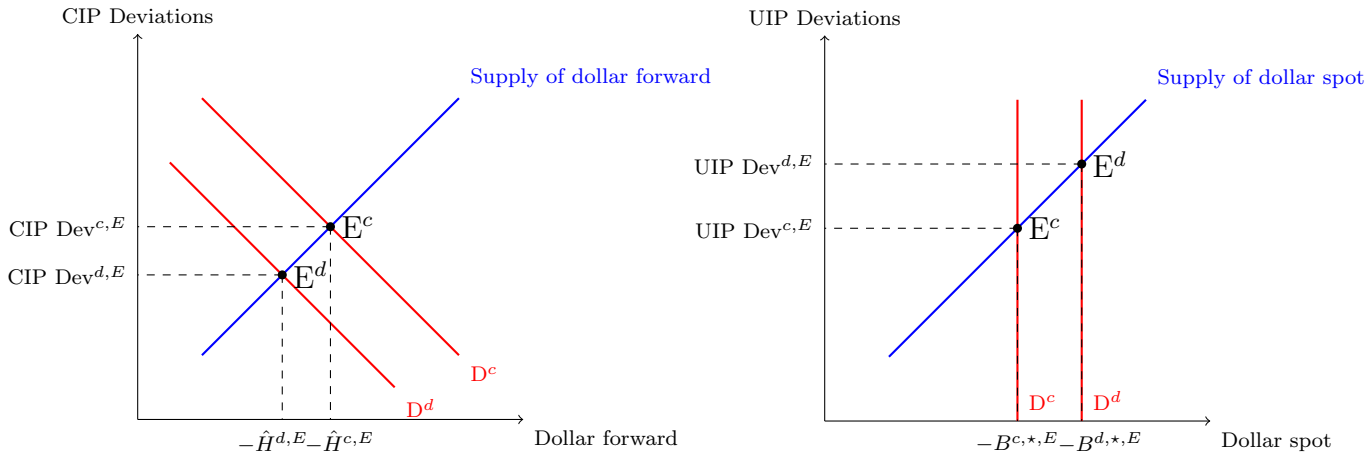
A.3 Derivations of equations underlying Figure 1

Figure 1 depicts the first-order approximation of the equilibrium equations in the forward and spot market around a risky steady state (Coeurdacier et al., 2011). We use hat variables to express the first-order change around the steady state, that is $\hat{X}_t\approx X_t-X$. The derivations below also use Approximation 1.

Equilibrium in forward market (Figure 1a) The supply of dollar forward is represented by the first-order approximation of eq. (3):

$$\underbrace{\left(\hat{r}^{\star}_t-\hat{r}_t+\hat{f}_t-\hat{s}_t\right)}_{\widehat{\text{CIP Deviation}_t}}=\kappa\hat{K}_{t+1}; \tag{A.6}$$

Graphical analysis of Proposition 2



(a) Equilibrium in the Forward Market **(b)** Equilibrium in the Spot Market

Figure A.1: Steady-state Equilibrium in Forward and Spot Markets

Note: The graphs depict the steady-state equilibrium in the forward market (Panel (a)) and in the spot market (Panel (b)). In the graph superscripts c and d represents two different countries.

The demand of U.S. dollar forward is the first-order approximation of eq. (1):

$$\underbrace{\left(\hat{r}_t^\star - \hat{r}_t + \hat{f}_t - \hat{s}_t\right)}_{\widehat{\text{CIP Deviation}}_t} = -\underbrace{\left(\hat{r}_t - \hat{r}_t^\star - E_t\hat{s}_{t+1} + \hat{s}_t\right)}_{\widehat{\text{UIP Deviation}}_t} + \Gamma(\hat{H}_{t+1}) + H(\hat{\Gamma}_t). \tag{A.7}$$

Equilibrium in spot market (Figure 1b) The supply of dollar spot represents the first-order approximation of eq. (7):

$$\underbrace{\left(\hat{r}_t - \hat{r}_t^\star - E_t\hat{s}_{t+1} + \hat{s}_t\right)}_{\widehat{\text{UIP Deviation}}_t} = -\Lambda(\hat{B}_{t+1}^\star).$$

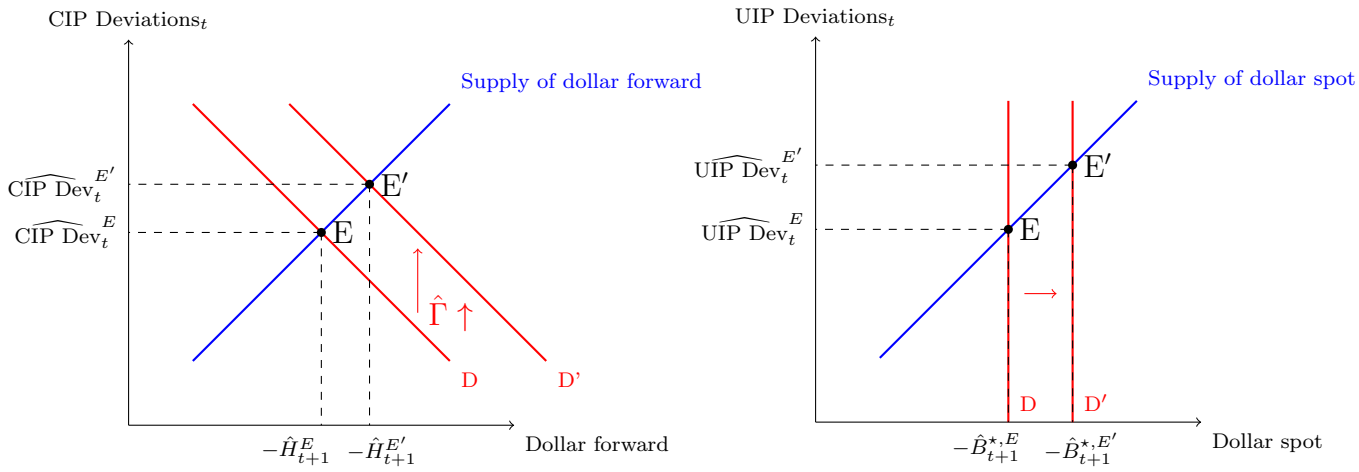
The demand of dollar spot is the first-order approximation of eq. (10):

$$\hat{G}_{t+1}^\star = \frac{1 + 2\text{CIP Dev.}}{\kappa} \underbrace{\left(\hat{r}_t^\star - \hat{r}_t + \hat{f}_t - \hat{s}_t\right)}_{\widehat{\text{CIP Deviation}}_t}.$$

A.4 Derivations of equilibrium UIP and CIP deviations

Throughout our derivations, we assume that the conditional variance of exchange rate changes *vis a vis* the U.S. dollar is constant, and it is the same across small open economies.

Graphical analysis of Proposition 3



(a) Equilibrium in the Forward Market **(b)** Equilibrium in the Spot Market

Figure A.2: Equilibrium in Forward and Spot Markets following Global Risk Aversion Shock (around a Steady State with Positive UIP Deviations (*i.e.* $\xi^c < 0$))

Note: The graphs depict the equilibrium in the forward market (Panel (a)) and in the spot market (Panel (b)). We take the first-order approximation of the relevant equilibrium conditions to depict these equilibrium relationships, as we describe in Appendix A.3.

That is $\text{var}_t(\Delta s^c_{t+1}) = \text{var}_t(\Delta s^d_{t+1}) = \sigma_s^2$ for each $c \neq d$. The structure of shocks ensures that this is the case.

Equilibrium in the forward market (eqs. (1), (3), and (5)) implies:

$$-\frac{1}{\kappa}\left(\frac{R_t^\star}{R_t}\frac{F_t}{S_t} - 1\right) = \frac{\left(E_t \frac{F_t}{S_{t+1}} - 1\right)}{\gamma_t \,\text{var}_t\left(\frac{F_t}{S_{t+1}}\right)} \tag{A.8}$$

Equilibrium in the spot market (eqs. (7), (10), and (9)) implies:

$$-\xi_t + \frac{1}{\kappa}\left(1 - \frac{R_t}{R_t^\star}\frac{S_t}{F_t}\right) = \frac{\left(E_t \frac{R_t}{R_t^\star}\frac{S_t}{S_{t+1}} - 1\right)}{\lambda \,\text{var}_t\left(\frac{F_t}{S_{t+1}}\right)}. \tag{A.9}$$

Use Approximation 1 to rewrite eqs. (A.8)-(A.9) as:

$$-\frac{1}{\kappa}\left(r_t^\star - r_t + f_t - s_t\right) = \frac{(r_t - r_t^\star - E_t s_{t+1} + s_t) + (r_t^\star - r_t + f_t - s_t)}{\gamma_t \sigma_s^2} \tag{A.10}$$

$$-\xi_t + \frac{1}{\kappa}\left(r_t^\star - r_t + f_t - s_t\right) = \frac{(r_t - r_t^\star - E_t s_{t+1} + s_t)}{\lambda \sigma_s^2}, \tag{A.11}$$

where we used $\text{var}_t\left(f_t - s_{t+1}\right) = \text{var}_t\left(\Delta s_{t+1}\right) = \sigma_s^2$.

Let us, then, define:

$$\Gamma_t = \gamma_t \sigma_s^2; \qquad \Lambda = \lambda \sigma_s^2$$

as the global investors and local spot traders risk-bearing capacity, respectively.

Using (A.10) and (A.11) we reach closed-form expressions for CIP and UIP deviations (eq. (11)):

$$\underbrace{\left(r_t^\star - r_t + f_t - s_t\right)}_{\text{CIP Deviation}_t} = \frac{\Lambda\kappa}{\Gamma_t + \kappa + \Lambda}(\xi_t);$$

$$\underbrace{\left(r_t - r_t^\star - E_t s_{t+1} + s_t\right)}_{\text{UIP Deviation}_t} = -\frac{\Lambda(\Gamma_t + \kappa)}{\Gamma_t + \kappa + \Lambda}(\xi_t^c).$$

A.5 Proofs

Proof of Proposition 1. Proposition 1(a) directly follows from the forward market clearing condition (5); Proposition 1(b) directly follows from the forward supply equation (3); Proposition 1(c) derives from equation (4). Note that we express the predictions in terms of dollar positions because this is the notional amount of forward contracts traded. ■

Proof of Proposition 2. Consider a continuum of small-open economies, indexed by $c \in [0, 1]$, with idiosyncratic levels of currency imbalances, ξ^c. The steady-state version of closed form expressions of CIP and UIP deviations (see eq. (11)) for country c read:

$$\underbrace{\left(r^\star - r^c + f^c - s^c\right)}_{\text{CIP Deviation}^c} = \frac{\Lambda\kappa}{\Gamma + \kappa + \Lambda}\xi^c; \qquad \underbrace{\left(r^c - r^\star - s^{c,\prime} + s^c\right)}_{\text{UIP Deviation}^c} = -\frac{\Lambda(\Gamma + \kappa)}{\Gamma + \kappa + \Lambda}\xi^c$$

Thus:

$$\text{cov}_c(\text{UIP Deviation}^c, \text{CIP Deviation}^c) = -\frac{\Lambda^2\kappa(\Gamma + \kappa)}{(\Gamma + \kappa + \Lambda)^2}\,\text{var}_c(\xi^c) < 0.$$

Note that the covariance between UIP and CIP deviations is negative as long as global investors are present. Absent global investors ($\Gamma = \infty$), the covariance is zero. ■

Proof of Proposition 3. Consider a continuum of small-open economies, indexed by $c \in [0, 1]$, with idiosyncratic levels of currency imbalances, ξ^c. The first-order approximation of the closed-form solutions of currency-c CIP and UIP deviations (see eq. (11)) are, respectively:

$$\underbrace{\left(\hat{r}_t^\star - \hat{r}_t^c + \hat{f}_t^c - \hat{s}_t^c\right)}_{\widehat{\text{CIP Deviation}}_t^c} = \frac{\Lambda\kappa}{\Gamma + \kappa + \Lambda}\hat{\xi}_t^c - (\xi^c)\frac{\kappa}{(\Gamma + \kappa + \Lambda)^2}\Lambda\hat{\Gamma}_t \tag{A.12}$$

$$\underbrace{\left(\hat{r}_t^c - \hat{r}_t^\star - E_t\Delta\hat{s}_{t+1}^c\right)}_{\widehat{\text{UIP Deviation}}_t^c} = -\frac{\Lambda(\Gamma+\kappa)}{\Gamma+\kappa+\Lambda}\hat{\xi}_t^c - (\xi^c)\frac{1}{(\Gamma+\kappa+\Lambda)^2}\Lambda^2\hat{\Gamma}_t \tag{A.13}$$

Using (A.12) and (A.13), one can derive the response of currency-c's CIP and UIP deviations to an increase in global risk aversion, $\hat{\Gamma}_t$:

$$\frac{\partial\widehat{\text{CIP Deviation}}_t^c}{\partial\hat{\Gamma}_t} = \frac{\kappa}{(\Gamma+\kappa+\Lambda)(\Gamma+\kappa)}\text{UIP Deviation}^c \tag{A.14}$$

$$\frac{\partial\widehat{\text{UIP Deviation}}_t^c}{\partial\hat{\Gamma}_t} = \frac{\Lambda}{(\Gamma+\kappa+\Lambda)(\Gamma+\kappa)}\text{UIP Deviation}^c \tag{A.15}$$

where $\text{UIP Deviation}^c \equiv -\frac{\Lambda(\Gamma+\kappa)}{\Gamma+\kappa+\Lambda}\xi^c$ is currency-c average UIP deviation.

Using the first-order approximation of eq. (3), $\hat{K}_{t+1}^c = \frac{1}{\kappa}\left(\hat{r}_t^\star - \hat{r}_t^c + \hat{f}_t^c - \hat{s}_t^c\right)$, as well as the the forward market clearing condition (5), one can also derive the responses of forward-market positions to an increase in global risk aversion, $\hat{\Gamma}_t$:

$$\frac{\partial\hat{K}_{t+1}^c}{\partial\hat{\Gamma}_t} = \frac{1}{(\Gamma+\kappa+\Lambda)(\Gamma+\kappa)}\text{UIP Deviation}^c \tag{A.16}$$

$$\frac{\partial\hat{H}_{t+1}^c}{\partial\hat{\Gamma}_t} = -\frac{1}{(\Gamma+\kappa+\Lambda)(\Gamma+\kappa)}\text{UIP Deviation}^c \tag{A.17}$$

Equations (A.14)-(A.17) prove the statements in Proposition 3 that pertain to the response of country-c variables.

Now, define the common component of CIP deviations across all currencies as:

$$\widehat{\text{CIP Deviation}}_t \equiv \int_0^1 \widehat{\text{CIP Deviation}}_t^c \, \mathrm{d}c = \frac{\Lambda\kappa}{\Gamma+\kappa+\Lambda}\hat{\xi}_t - (\xi)\frac{\kappa}{(\Gamma+\kappa+\Lambda)^2}\Lambda\hat{\Gamma}_t \tag{A.18}$$

Then, using (A.18):

$$\frac{\partial\widehat{\text{CIP Deviation}}_t}{\partial\hat{\Gamma}_t} = \frac{\kappa}{(\Gamma+\kappa+\Lambda)(\Gamma+\kappa)}\text{UIP Deviation} \tag{A.19}$$

where $\text{UIP Deviation} \equiv \int \text{UIP Deviation}^c \, \mathrm{d}c \equiv -\frac{\Lambda(\Gamma+\kappa)}{\Gamma+\kappa+\Lambda}\xi$ is the average UIP deviation across countries and time.

Equation (A.19) indicates that when the cross-country-time average UIP deviation is positive, a global financial disruption is associated with an increase in CIP deviations proving the second part of Proposition 3. ■

Proof of Proposition 4. Consider the problem of a global investor that actively trades

in *both* forward and bond markets of country c. We thus relax Assumption 1. Using the notation of Appendix A.1, the realized return on the global investor's overall portfolio is, in U.S. dollars:

$$W^c_{t+1} \equiv X^{c,\star}_{t+1}\left(1 - \frac{S^c_t}{S^c_{t+1}}\frac{R^c_t}{R^\star_t}\right) + H^c_{t+1}\left(\frac{F^c_t}{S^c_{t+1}} - 1\right),$$

while its expected value and variances are, respectively:

$$E_t W^c_{t+1} \equiv X^{c,\star}_{t+1}\left(1 - E_t\frac{S^c_t}{S^c_{t+1}}\frac{R^c_t}{R^\star_t}\right) + H^c_{t+1}\left(E_t\frac{F^c_t}{S^c_{t+1}} - 1\right)$$

$$\operatorname{var}_t W^c_{t+1} \equiv \left(-X^{c,\star}_{t+1}\frac{R^c_t}{R^\star_t} + H^c_{t+1}\frac{F^c_t}{S^c_t}\right)^2 \operatorname{var}_t\left(\frac{S^c_t}{S^c_{t+1}}\right)$$

Unlike in the baseline setting of Section 2, the global investors now choose both its bond position $X^{c,\star}_{t+1}$ and forward position H^c_{t+1} to maximize their mean-variance utility:

$$\max_{X^{c,\star}_{t+1},\, H^c_{t+1}} \quad E_t W^c_{t+1} - \frac{\gamma_t}{2}\operatorname{var}_t W^c_{t+1}, \tag{A.20}$$

where γ_t governs the global investors' aversion to risk.
The first-order condition for $X^{c,\star}_{t+1}$ and H^c_{t+1} read, respectively:

$$\frac{\left(E_t\frac{S^c_t}{S^c_{t+1}}\frac{R^c_t}{R^\star_t} - 1\right)}{\gamma_t \operatorname{var}_t\left(\frac{R^c_t}{R^\star_t}\frac{S^c_t}{S^c_{t+1}}\right)} = -X^{c,\star}_{t+1} + H^c_{t+1}\frac{R^\star_t}{R^c_t}\frac{F^c_t}{S^c_t} \tag{A.21}$$

$$\frac{\left(E_t\frac{S^c_t}{S^c_{t+1}}\frac{R^c_t}{R^\star_t} - \frac{R^c_t}{R^\star_t}\frac{S^c_t}{F^c_t}\right)}{\gamma_t \operatorname{var}_t\left(\frac{R^c_t}{R^\star_t}\frac{S^c_t}{S^c_{t+1}}\right)} = -X^{c,\star}_{t+1} + H^c_{t+1}\frac{R^\star_t}{R^c_t}\frac{F^c_t}{S^c_t} \tag{A.22}$$

Equations (A.21)-(A.22) together imply that, in equilibrium:

$$\frac{R^c_t}{R^\star_t}\frac{S^c_t}{F^c_t} - 1 = 0.$$

That is, if global investors can freely trade in both home/foreign bonds and forwards, their maximizing behavior drives CIP deviations to zero. Intuitively, if global investors can chase excess currency returns through both bonds and forwards their equilibrium returns should be equalized—which occurs if and only if CIP deviations are zero. ∎

Proof of Proposition 5. Introduce a set of *local* investors, such as a local pension funds in a setting that is otherwise identical to the baseline forward market of Section 2.1.

In the bond market, local investors hold a zero-capital portfolio $\frac{1}{S_t}\frac{D_{t+1}}{R_t}+\frac{D^\star_{t+1}}{R^\star_t}=0$, which delivers a return of $\frac{1}{S_{t+1}}D_{t+1}+D^\star_{t+1}$ U.S. dollars. The realized excess return from a $\frac{D^\star_{t+1}}{R^\star_t}$ U.S. dollar position is $D^\star_{t+1}\left(1-\frac{S_t}{S_{t+1}}\frac{R_t}{R^\star_t}\right)$ U.S. dollars. Assume that local investors' bond allocation is predetermined at time t. This assumption embodies the notion that local investors' bond allocation is sticky, and determined by slow-moving factors, such as the amount of deposits in local pension funds.

In the forward market, local investors choose a U.S. dollar short forward position (H^l_{t+1}), subject to a transaction cost ψ for each U.S. dollar short forward position.

The realized return on the global investor's overall portfolio is, in U.S. dollars:

$$W_{t+1}\equiv D^\star_{t+1}\left(1-\frac{S_t}{S_{t+1}}\frac{R_t}{R^\star_t}\right)+H^l_{t+1}\left(\frac{F_t}{S_{t+1}}-1-\psi\right).$$

Given the bond position $D^\star_{t+1}$, local investors choose H^l_{t+1} to solve:

$$\max_{H^l_{t+1}}\quad E_t\left(W_{t+1}\right)-\frac{\gamma_t}{2}\operatorname{var}_t\left(W_{t+1}\right),$$

where local investors' aversion to risk is the same as global investors, that is γ_t.

Local investors' demand for home-currency forward (H^l_{t+1}) reads:

$$\frac{\left(E_t\frac{F_t}{S_{t+1}}-1-\psi\right)}{\gamma_t\operatorname{var}_t\left(\frac{F_t}{S_{t+1}}\right)}=H^l_{t+1}-\frac{R_t}{R^\star_t}\frac{S_t}{F_t}D^\star_{t+1},\tag{A.23}$$

which resembles the optimal hedging demand equations of non-U.S. investors in Liao and Zhang (2021) and Du and Huber (2023).

Assume that $D^\star_{t+1}=\frac{F_t}{S_t}\frac{R^\star_t}{R_t}D^\star$, and use Approximation 1, to rewrite equation (A.23) as:

$$\frac{\left(f_t-E_ts_{t+1}-\psi\right)}{\gamma_t\operatorname{var}_t\left(\frac{F_t}{S_{t+1}}\right)}=H^l_{t+1}-D^\star.\tag{A.24}$$

Equilibrium in the forward market now consists in aggregate forward demand (by local investors (A.24) and global investors (1)), i.e.,

$$\frac{\left(f_t-E_ts_{t+1}-\frac{1}{2}\psi\right)}{\gamma_t\operatorname{var}_t\left(\frac{F_t}{S_{t+1}}\right)}=\frac{H_{t+1}+H^l_{t+1}-D^\star}{2},\tag{A.25}$$

as well as forward supply by local intermediaries (3), and forward market-clearing condition:

$$-K_{t+1} = H_{t+1} + H^l_{t+1}. \tag{A.26}$$

We consider a steady-state equilibrium in which returns on the forward trade are positive ($f_t - E_t s_{t+1} > 0$), and thus global investors are short dollars forward ($H > 0$) as in the baseline model. In addition, local investors hold dollar assets ($D^\star > 0$), sell dollars forward ($H^l > 0$), but are only partially hedged ($H^l - D^\star < 0$). By market clearing, local intermediaries are long dollar forward $K < 0$ and CIP deviations are negative ($r^\star - r + f_t - s < 0$), as in the baseline model. This steady state equilibrium can be achieved by appropriate choice of forward transaction costs, ψ, dollar bond position, $D^\star$, and UIP deviations $r - r^\star - s' + s$.

To a first-order approximation, aggregate forward demand (A.25), keeping UIP deviations constant in this partial equilibrium model of the forward market, is:

$$\underbrace{\left(\hat{r}^\star_t - \hat{r}_t + \hat{f}_t - \hat{s}_t\right)}_{\widehat{\text{CIP Deviation}}_t} = \frac{\Gamma}{2}(\hat{H}_{t+1} + \hat{H}^l_{t+1}) - \frac{(D^\star - H^l) - H}{2}(\hat{\Gamma}_t). \tag{A.27}$$

Combining equations (A.27), (A.6), and market clearing $-\hat{K}_{t+1} = \hat{H}_{t+1} + \hat{H}^l_{t+1}$, one obtains:

$$\frac{\partial \widehat{\text{CIP Deviation}}_t}{\partial \hat{\Gamma}_t} = -\frac{\kappa}{2\kappa + \Gamma}\left[(D^\star - H^l) - H\right] \tag{A.28}$$

If unhedged dollar exposure of local investors outweigh the short-dollar forward position of global investors ($D^\star - H^l > H$), an increase in global risk aversion lowers CIP deviations. Higher global risk aversion has opposing effects on forward demand of local and global investors. While global investors keep wanting to buy dollar forward (sell home-currency forward), local investors sell dollar forward. If the latter effect dominates, then the aggregate demand of forward dollars declines, rather than increases, and CIP deviations (further) decline, as a result, to compensate local intermediaries. ■

B Additional Analyses

B.1 Local banks' profits from arbitraging CIP deviations

Several important factors must be taken into account to compute local banks' profits from arbitraging CIP deviations. First, the direction of the trade is crucial, as the calculation of profits varies depending on whether banks are buying or selling dollars forward. To estimate banks' profits from trading forwards—presumably unwinding these positions at the reported spot rate at the time the forward contracts were executed—we analyze profits at the trade level and then aggregate them at the banking system level. Additionally, the funding and investment currency are influenced by the trade direction, which we also factor into our analysis.

Second, banks do not disclose the funding and investment rates associated with their covered interest parity (CIP) arbitrage activities, making it difficult to ascertain the exact rates they employ. To address this, we estimate banks' arbitrage profits in two ways.

The first method employs a straightforward assumption that the funding and investment rates correspond to 1-month term deposits. Since we have access to the daily rates at which each bank acquires new deposits, our profit computations are conducted at the bank level. We also adjust the corresponding costs to account for the reserve requirement rates applicable to each bank.

The second method involves identifying the most likely investment and funding rates used by each bank in the CIP arbitrage. As noted in Keller (2024), banks primarily fund their activities through term deposits. Thus, we use the 1-month dollar (soles) term deposit rate—adjusted for reserve requirements—as the funding rate for dollars (soles). Additionally, Keller (2024) highlights that most short-term dollar investments are held in deposits at the Central Bank, while short-term investments in soles typically consist of purchases of Central Bank certificates of deposit. Therefore, we adopt these rates as the investment rates. Notably, this calculation is conducted using each bank's specific investment and deposit rates on every trading day. More precisely, the computation at the trade-level works as follows. When banks buy dollars forward, they profit by buying at a lower forward price than the synthetic forward they could do in the spot market. That is, they profit when the cross-currency basis is negative by buying dollars forward and unwinding in the spot market. The negative of the basis becomes their profit margin. The opposite will occur when banks sell dollars forward. In this case, positive basis proxy the profit of banks. Therefore, the trade-level profit is given by:

$$\text{Profit}_{\text{Buy fwd}} = Not^{\text{Fwd}} \times (-CCB)$$

$$= Not^{\text{Fwd}}\left[(1+y^{inv}_{t,t+n})^n - \frac{F_{t,t+n}}{S_t}(1+y^{\$,borrow}_{t,t+n})^n - 1\right]$$

$$\text{Profit}_{\text{Sell fwd}} = Not^{\text{Fwd}} \times (CCB)$$

$$= Not^{\text{Fwd}}\left[\frac{F_{t,t+n}}{S_t}(1+y^{\$,inv}_{t,t+n})^n - 1 - (1+y^{borrow}_{t,t+n})^n\right]$$

Where $\text{Profit}_{\text{Buy fwd}}$ is the profits banks make by buying dollars forward (and selling them spot), while $\text{Profit}_{\text{Sell fwd}}$ is the profits banks make from selling dollars forward and buying them spot.

As previously described, the interest rates in soles and dollars used depend on the direction of the trade. When banks buy dollars forward and sell dollars in spot, they need dollar funding for the spot transaction. In exchange, they receive soles cash, which needs to be invested. Therefore, to compute $\text{Profit}_{\text{Buy fwd}}$, the dollar rate used is the dollar funding rate while the soles rate used is the soles investment rate. In contrast, to compute $\text{Profit}_{\text{Sell fwd}}$, we use the dollar investment rate and soles funding rate.

B.2 CIP deviations under default risk

Part of the literature suggests that CIP deviations in emerging markets could simply price sovereign default risk. For example, Du and Schreger (2016) show that *long-term* local-currency sovereign bonds trade at sizable premia over synthetic dollar funding rates and interpret this spread as compensation for the risk that governments default on obligations issued in their own currency. On the other hand, Cerutti and Zhou (2024) do not find that country-level CDS spreads help explain *short-term* CIP bases. In our paper we focus on a different object than Du and Schreger (2016)—*short-term* CIP bases—and in Section 6.3 we argue that the dynamics of these deviations do not line up with credit-risk explanations.

Ignoring the market segmentation frictions we document, namely that foreign investors cannot purchase short-term emerging market government (or central bank) debt, it is conceptually natural to attribute CIP deviations to sovereign default risk. To understand this, first consider the CIP trade in a frictionless world. The dollar cash leg is risk-free: the investor borrows in dollars at the known rate $r^\star_t$ and knows at time t that it will have to pay $(1+r^\star_t)$ back. The dollar synthetic rate is only risk-free in the defaultless case: the investor converts the dollar borrowed to local-currency at the spot rate S_t, invests at the local-currency rate r_t, and locks the reconversion with the forward F_t. Its local-currency investment payoff, expressed in dollars at $t+1$, $(1+r_t)\frac{S_t}{F_t}$, is known at time t only when the local short-term bond is default-free.

Default risk makes the synthetic leg stochastic. If the local-currency payoff has the possibility of default, the actual return on the local-currency bond is only known at $t+1$, thus

r_{t+1}. In this case, the Euler equation implies that the sign of CIP deviations are determined by the sign of the covariance between the dollar stochastic discount factor, $M^{\star}_{t+1}$, and the local-currency rate:

$$E_t\left[M^{\star}_{t+1}\underbrace{\left((1+r_{t+1})\frac{S_t}{F_t}-(1+r^{\star}_t)\right)}_{\text{- CIP deviations}}\right]=0.$$

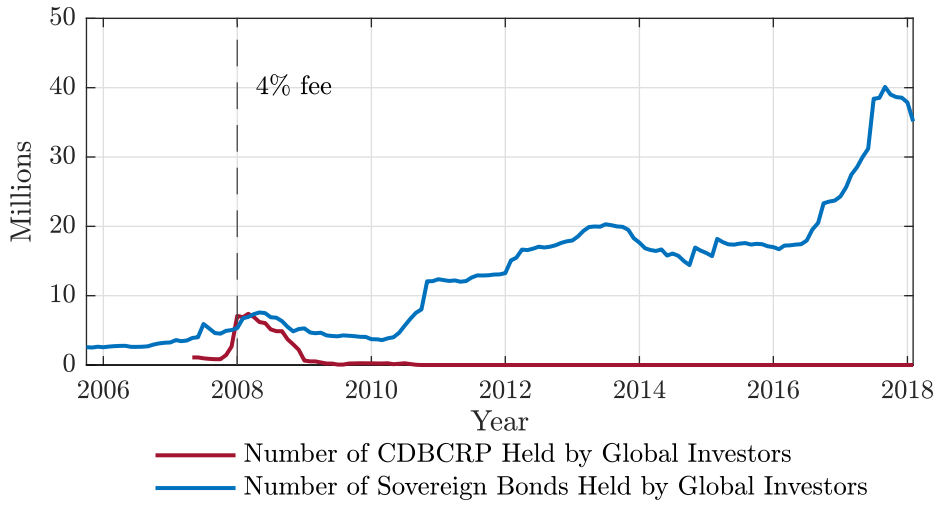
Solving for CIP deviations, which are defined as the dollar cash rate minus the dollar synthetic rate, we obtain:

$$E_t[\text{CIP deviations}_{t+1}]=\frac{S_t}{F_t}\frac{\text{cov}_t\left(M^{\star}_{t+1},r_{t+1}\right)}{E_t[M^{\star}_{t+1}]}=(1+r^{\star}_t)\frac{S_t}{F_t}\text{cov}_t\left(M^{\star}_{t+1},r_{t+1}\right)$$

The expression above clarifies why default risk might explain CIP deviations. In particular, during periods of heighten global risk aversion, default risk rises, lowering the expected local-currency return since r_{t+1} may not be fully repaid or could be subject to a haircut. At the same time, in downturns investors place higher value on each marginal dollar of consumption, so $M^{\star}_{t+1}$ increases. Consequently, if default risk was driving CIP deviations in emerging economies, we would expect these deviations to turn negative during episodes of heightened global risk aversion. As we argue in Section 6.3, in the data we CIP deviations move upward, and may even turn positive, during episodes of heightened global risk aversion.

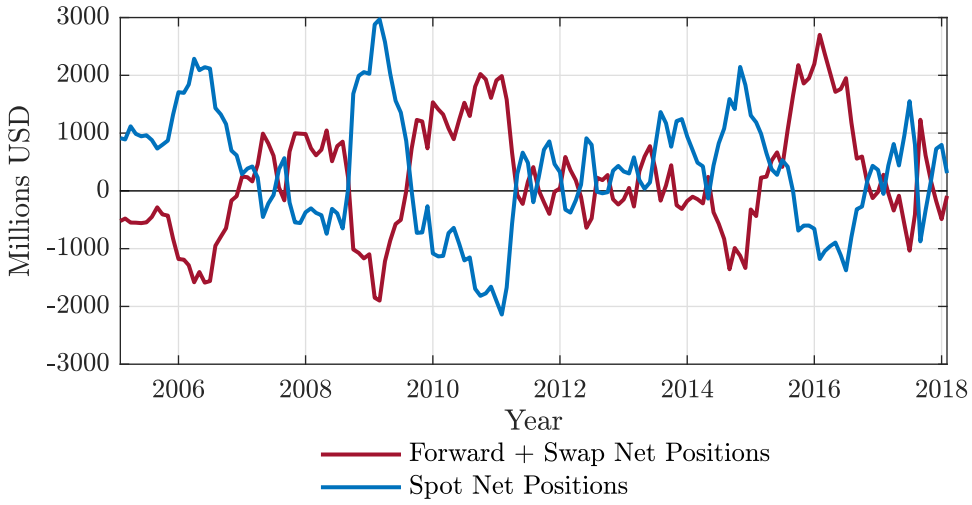
C Additional Tables and Figures

Figure C.1: Global investors' holdings of bonds and Central Bank's Certificates of Deposit



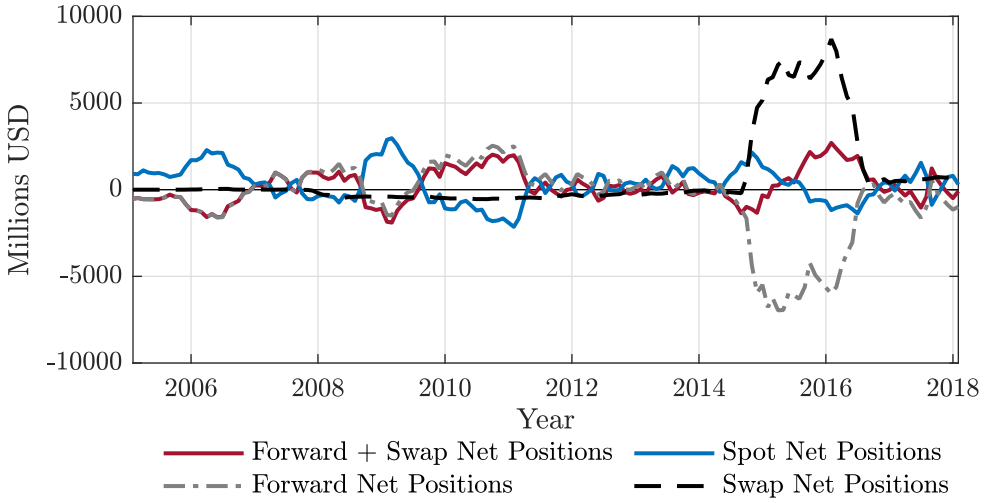
Note: The red line depicts the number of CDs of the Central Bank that global investors hold (in millions). The blue line depicts the number of sovereign bonds global investors hold (in millions). The dashed line in January 2008 indicates the time when the Central Bank imposed the 4% fee on purchases of soles CDs on global investors. In November 2010 and February 2012, global investors purchased newly issued 10-year sovereign bonds. These bonds were structured as Global Depository Notes (GDNs), allowing them to be traded, settled, and paid in dollars while maintaining the terms of the sol-denominated Peruvian sovereign debt.

Figure C.2: Local intermediaries' forward and spot positions



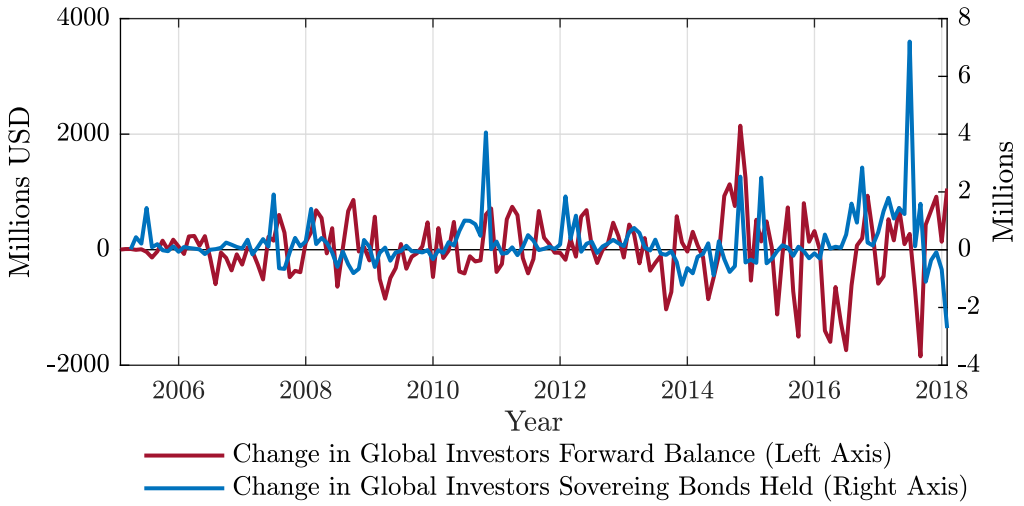
Note: The figure reports Peru's banking system's long dollar spot along with forward and swap FX positions.

Figure C.3: Local intermediaries' forward position, swap position and spot position



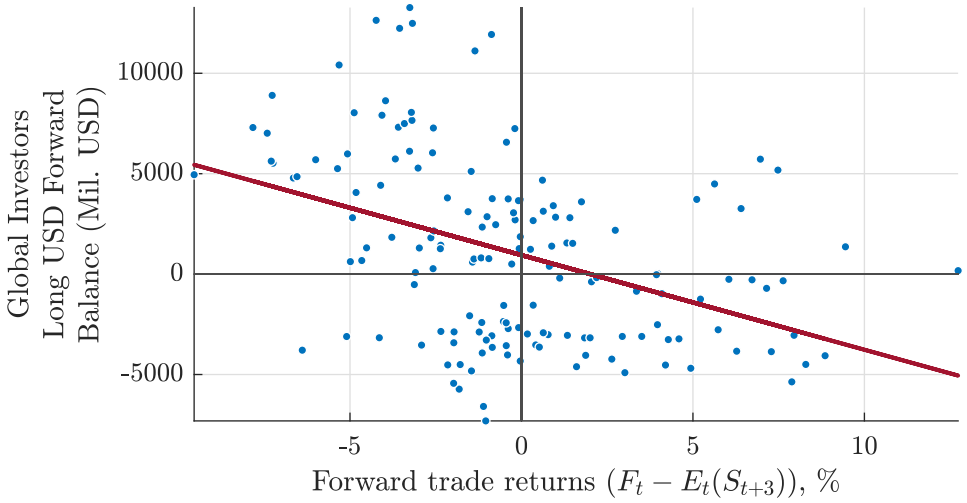
Note: This figure decomposes the "forward + swap" position shown in Figure C.2 into its forward and swap components. As illustrated, FX swaps were negligible before 2015. Between 2015 and part of 2016, banks' FX swap balances became a significant component of their overall FX derivatives positions. This increase reflects the Central Bank's decision at the time to intervene in the FX market via swaps, rather than through spot market interventions as had been done previously.

Figure C.4: Global investors' forward balance and bond holdings



Note: This figure shows the month-over-month change in global investors' forward long dollar balances and the month-over-month change in the units of their bonds holdings. Their correlation is −3%.

Figure C.5: Global investors' forward balance and returns from forward trade (using survey expectations to compute returns from forward trade)



Note: Each point in the scatter plot represents the monthly average of the global investors' net long dollar forward balance plotted against the corresponding average of forward prices agreed minus the 3-month ahead *survey-expected* spot rate. Both series have been residualized with respect to the VIX. The correlation between the two series is −41%.

Table C.1: Summary Statistics: CIP deviations and profitability

	2005-2018		2005-2013		2005-2018 no GFC		2005-2013 no GFC	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Panel A. $CIP > 0$								
Profits (Adj 1M Term Deposit rates)	108.37	183.64	21.11	43.40	107.35	185.89	10.81	17.94
Profits (Investment and Funding rates) (Million USD)	39.45	56.05	6.13	16.48	39.55	56.42	3.64	8.21
Peru CCB (%)	1.52	1.83	0.72	1.05	1.48	1.80	0.54	0.51
Panel B. $CIP \leq 0$								
Profits (Adj 1M Term Deposit rates)	17.27	34.36	16.68	31.51	8.77	30.69	5.90	24.27
Profits (Investment and Funding rates) (Million USD)	5.84	20.58	3.55	15.41	4.19	21.09	0.72	13.54
Peru CCB (%)	-1.12	1.62	-1.20	1.71	-0.66	0.59	-0.65	0.49

Table C.2: Data for 1-month and 3-month variables

Country/Region	**Currency**	**FX Forward rate**		**Domestic interbank rate**	
		1M	3M	1M	3M
Brazil	BRL	BCN1M	BCN3M	PREDI30	PREDI90
				BRDPR1M	*BRDPR3M*
Chile	CLP	CHN1M	CHN3M	CHSWPC	CHSWPC
				CLTAB1M	*CLTAB3M*
China	CNY	CCN1M	CCN3M	SHIF1M	SHIF3M
Colombia	COP	CLN1M	CLN3M	COOVIBR1	DTF RATE
Czech Rep.	CZK	CZK1M	CZK3M	PRIB01M	PRIB03M
Hungary	HUF	HUF1M	HUF3M	BUBOR01M	BUBOR03M
Indonesia	IDR	IHN1M	IHN3M	JIIN1M	JIIN3M
Israel	ILS	ILS1M	ILS3M	TELBOR01	TELBOR03
India	INR	IRN1M	IRN3M	MIFORIM1	IROS3M
		USINR1F	*USINR3F*		
South Korea	KRW	KWN1M	KWN3M	KRBO1M	KRBO3M
Mexico	MXN	MXN1M	MXN3M	MXIBTIIE	MXIB91DT
Malaysia	MYR	MRN1M	MRN3M	KLIB1M	KLIB3M
Peru	PEN	PSN1M	PSN3M	PRBOPRB1	PRBOPRB3
		USPEN1F	*USPEN3F*		
Philippines	PHP	PPN1M	PPN3M	PREF1MO	PREF3MO
Poland	PLN	PLN1M	PLN3M	WIBR1M	WIBR3M
Russia	RUB	RUB1M	RUB3M	MOSKP1	MOSKP3
Thailand	THB	THB1M	THB3M	BOFX1M	BOFX3M
Turkey	TRY	TRY1M	TRY3M	TRLIB1M	TRLIB3M
Taiwan	TWD	NTN1M	NTN3M	TAIBOR1M	TAIBOR3M
South Africa	ZAR	ZAR1M	ZAR3M	JIBA1M	JIBA3M

Note: Bloomberg FX Forward tickers are with suffix CURNCY, which are abbreviated here. Bloomberg interbank rate tickers have suffix INDEX except for Chile's CHSWPC (CURNCY). Datastream tickers are in italics. Bloomberg FX forward rates are in forward points, and Datastream rates are outright rates.

Table C.3: Summary statistics of CIP and excess currency returns in emerging economies

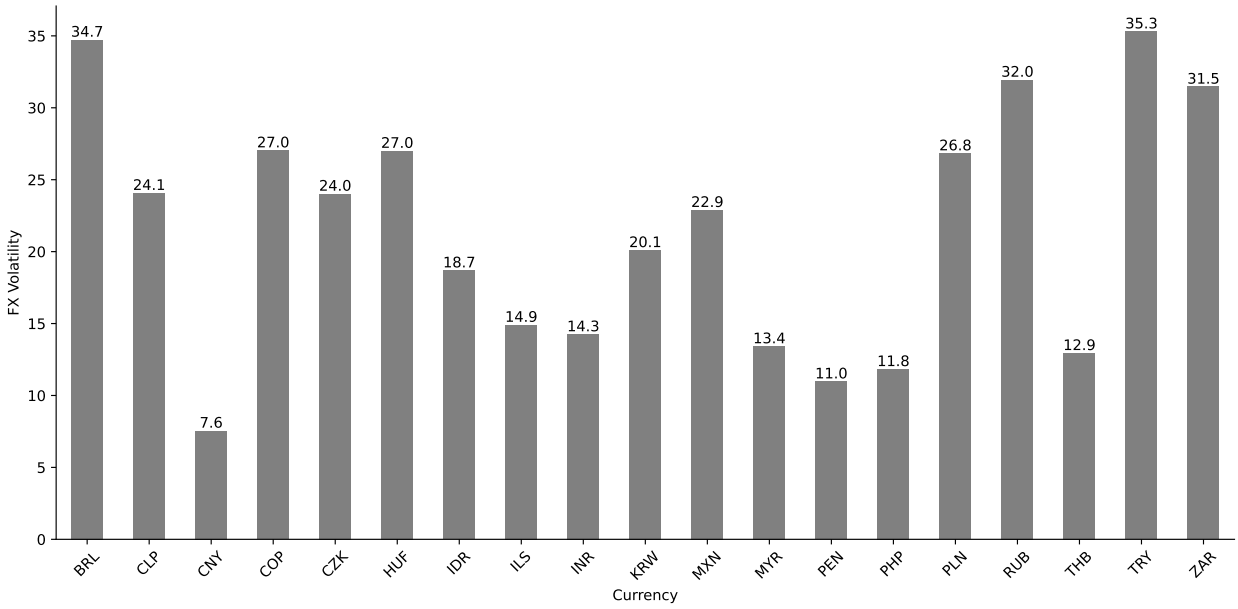
(a) 3-month cross-currency basis

	N	Mean	Std	25%	Median	75%
BRL	5036	-1.780	3.162	-1.929	-1.219	-0.732
CLP	3791	-0.292	0.972	-0.659	-0.166	0.238
CNY	3829	-1.263	3.240	-2.972	-0.321	0.615
COP	5126	-0.555	1.413	-1.122	-0.409	0.201
CZK	5151	-0.479	0.567	-0.641	-0.408	-0.035
HUF	5139	-0.527	0.638	-0.808	-0.313	-0.087
IDR	5028	0.375	4.527	-1.501	-0.430	0.835
ILS	4902	-0.393	0.483	-0.511	-0.280	-0.112
INR	5053	-0.136	2.153	-1.179	-0.196	0.742
KRW	4343	-0.763	1.491	-0.760	-0.474	-0.268
MXN	4092	-0.283	0.746	-0.751	-0.294	0.006
MYR	5032	-0.662	0.976	-1.161	-0.614	-0.271
PEN	4073	-0.905	1.900	-1.369	-0.621	-0.152
PHP	5047	0.310	1.876	-0.315	-0.002	0.415
PLN	5206	-0.286	0.552	-0.416	-0.207	-0.093
RUB	3993	-0.428	3.066	-1.166	-0.759	-0.472
THB	4892	0.459	1.754	-0.443	0.073	0.612
TRY	4796	-0.607	4.032	-1.722	-1.143	-0.722
ZAR	5200	0.266	0.405	0.011	0.159	0.436

(b) 3-month FX excess returns

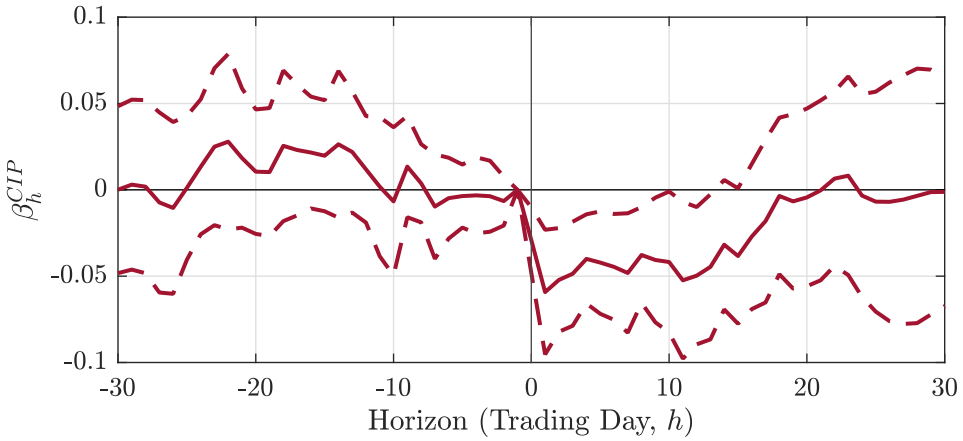
	N	Mean	Std	25%	Median	75%
BRL	4918	6.252	35.471	-11.923	11.410	28.101
CLP	3639	-0.362	24.643	-15.124	2.045	13.722
CNY	3587	3.012	8.813	0.028	3.851	8.349
COP	5008	1.063	26.975	-13.077	4.364	17.523
CZK	5203	2.536	23.933	-11.996	2.792	18.729
HUF	5158	2.383	27.746	-13.165	2.808	20.397
IDR	4827	4.274	19.367	-4.717	4.005	12.631
ILS	5119	2.077	15.081	-6.939	3.386	10.990
INR	4744	2.145	13.908	-4.609	3.911	10.365
KRW	4292	0.371	20.736	-9.700	1.295	12.274
MXN	4098	1.328	24.420	-10.016	4.990	16.334
MYR	4870	0.761	13.216	-4.953	1.804	8.750
PEN	4247	2.069	10.727	-3.235	2.701	7.880
PHP	4777	2.193	11.955	-5.297	2.790	9.648
PLN	5193	1.871	26.905	-11.639	3.157	19.260
RUB	3865	-0.204	34.778	-10.621	5.697	16.922
THB	4754	1.771	12.751	-6.357	3.295	10.165
TRY	4861	2.771	37.970	-17.272	6.886	24.710
ZAR	5196	3.637	32.176	-15.102	3.970	22.458

Figure C.6: Annualized FX volatility across emerging market currencies



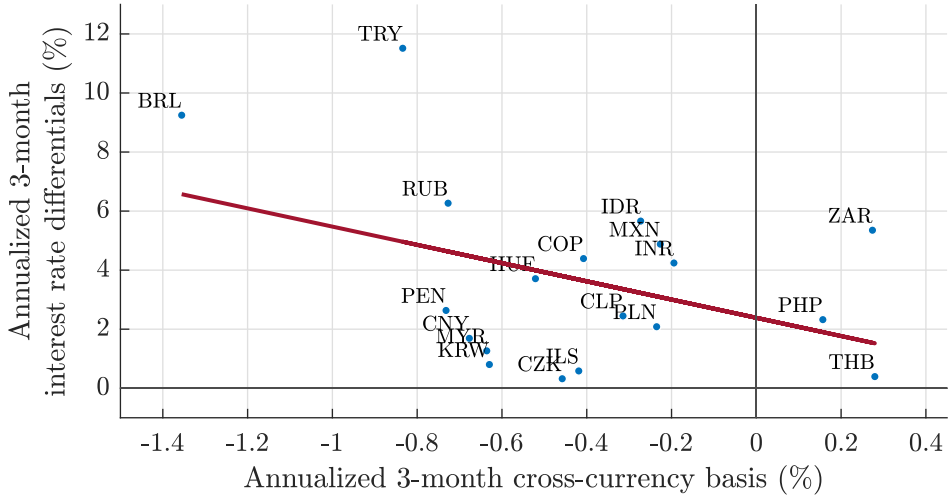
Note: The figure shows the annualized FX volatility across the emerging economies. The FX volatility is of similar magnitude across currencies, ranging from 7.6% for Chinese Yuan, to 35% for Turkish Lira. Though there exists heteroskedasticity among the currencies, there is little evidence of an outlier in terms of exchange rate volatility.

Figure C.7: Dynamic responses of CIP deviations in advanced economies to VIX changes

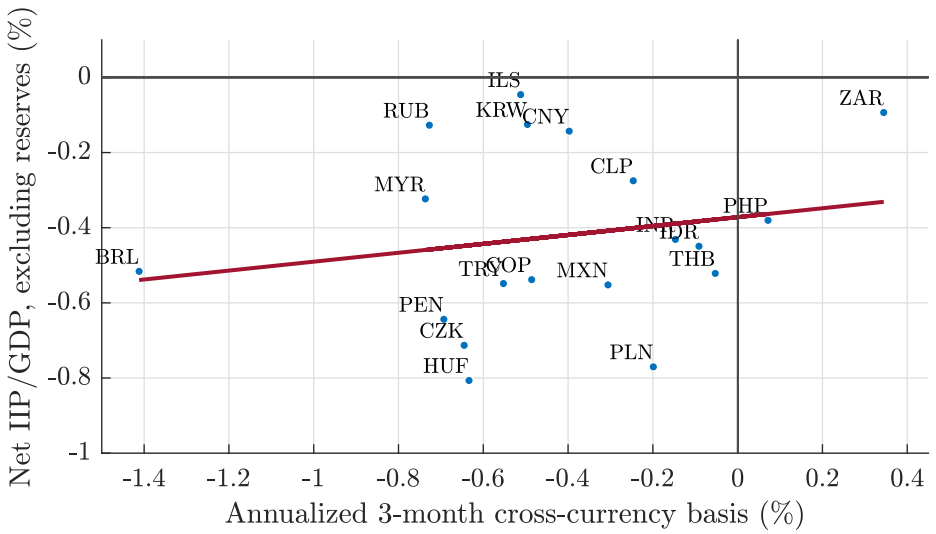


Note: For the sample of advanced economies, the figure reports the coefficients β_h^{CIP} and corresponding 95% confidence intervals from the regression: $CIP_{i,t+h} - CIP_{i,t-1} = \alpha + \gamma_i + \beta_h^{CIP} \Delta VIX_{t-1,t} + \epsilon_{i,t+h}$, where $CIP_{i,t+h}$ is the annualized 3-month cross-currency basis for economy i, and $\Delta VIX_{t-1,t}$ is the daily change in the log VIX. Currency fixed effects γ_i are included. The horizon h ranges from -30 to +30 trading days. Confidence intervals use Driscoll and Kraay (1998) standard errors.

Figure C.8: CIP deviations, interest differentials, and NFA positions across emerging economies



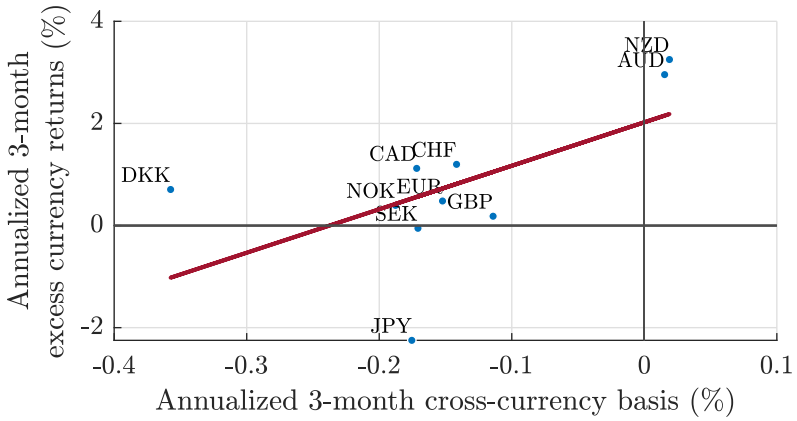
(a) CIP deviations and interest rate differentials



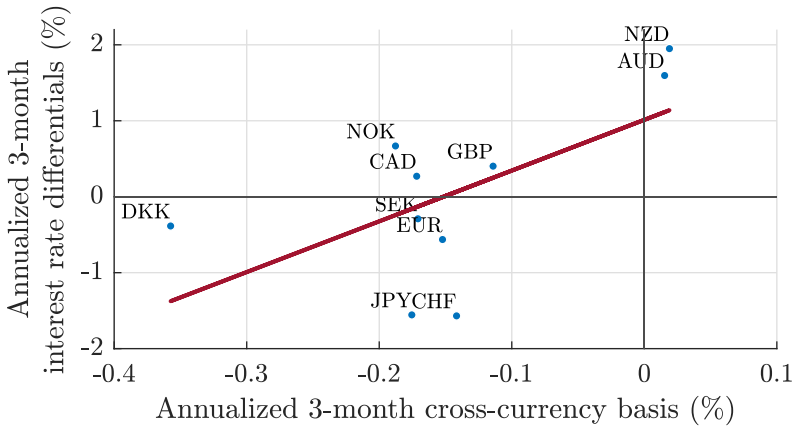
(b) CIP deviations and NFA positions

Note: The figure depicts scatter plots of mean cross-currency basis (i.e. CIP deviations) with interest rate differentials and net international investment (net IIP) positions across emerging economies. The cross-currency bases and interest rate differentials are based on 3-month interbank rates, annualized, and quoted in percentage points. The net IIPs are from the external wealth of nations database by Lane and Milesi-Ferretti (2017); the annual positions exclude FX reserves and are scaled by GDP. For illustration, variables are winsorized at the 5% level. The date range for interest rate differentials is 2002-2022, for net IIP 2010-2022.

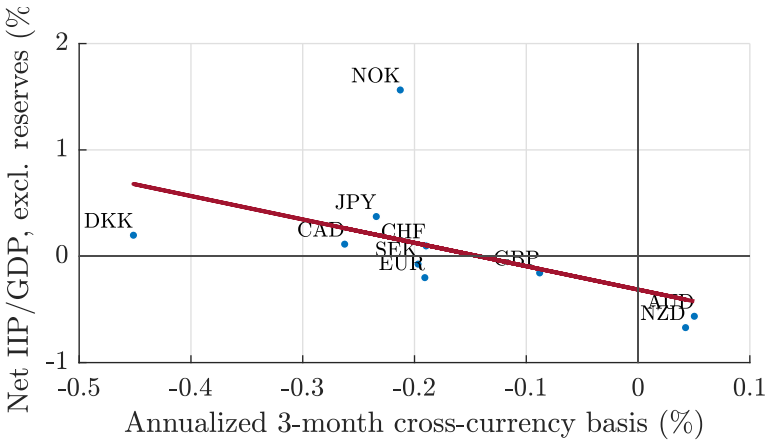
Figure C.9: CIP deviations across advanced economies



(a) CIP deviations and excess currency returns



(b) CIP deviations and interest rate differentials



(c) CIP deviations and NFA positions

Note: The figure depicts scatter plots of mean cross-currency basis with excess home-currency returns, interest rate differentials, and net international investment (net IIP) positions across advanced economies. The cross-currency bases, excess currency returns, and interest rate differentials are based on 3-month interbank rates, annualized, and quoted in percentage points. The net IIPs are from the the external wealth of nations database by Lane and Milesi-Ferretti (2017); the annual positions exclude FX reserves and are scaled by GDP. For illustration, variables are winsorized at the 5% level. The date range for excess currency returns and interest rate differentials is 2002-2022, for net IIP 2010-2022.