Managing Emerging Market Currency Risk*

Nanyu Chen†
Columbia Business School

Haonan Zhou‡
HKU Business School

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Abstract

Using a novel dataset covering U.S. mutual funds' emerging market currency forward usage from 2010 to 2023, we show that the currency risk exposure of foreign investors dedicated to emerging markets is much larger and wider than what their bond positions indicate. An average bond fund amplifies rather than hedges its currency risk through net long positions in short-term currency forwards, effectively speculating on currency appreciation. Forward usage patterns across currencies are weakly related to currency fundamentals, but are strongly correlated with the degree of capital control of currency issuers. We also uncover substantial heterogeneity in the directions and the determinants of forward usage across funds. Bond portfolio weights strongly predict forward sales for funds that primarily hedge, but less so for funds that speculate on currency upside, consistent with an inelastic hedging demand tied to bond investment. Guided by these findings, we develop an equilibrium model of forward exchange rate determination where speculators, hedgers and intermediaries interact. The model sheds light on the importance of accounting for speculative forces through derivative positions and market segmentation in understanding the dynamics of currency wedges and hedging cost in emerging markets.

Keywords: Hedging, currency risk, speculation, emerging markets.

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†nc2741@gsb.columbia.edu. Columbia Business School

‡haonanz@hku.hk. HKU Business School

1 Introduction

Local currency emerging market (EM) bonds have taken an increasingly important place in global investors' fixed income portfolio. As of 2021, more than half of foreign investors' EM government debt portfolio is denominated in local currency (Onen, Shin, & von Peter, 2023). Accompanying this trend is the shift of currency risk exposure from the borrowers to the lenders (Bertaut, Bruno, & Shin, 2025), and the sizable growth in offshore derivatives trading of major EM currencies–a turnover of $1.6 trillion in 2019 (Patel & Xia, 2019). Standard analyses based on advanced economy (AE) currencies conclude that fixed income investors should hedge a substantial portion of their portfolio exposed to currency risk (Campbell, Medeiros, & Viceira, 2010; Glen & Jorion, 1993, for instance). While the literature has shown that international investors deviate from the theoretical benchmark in their currency hedging patterns (Bräuer & Hau, 2024; Sialm & Zhu, 2024), there is to date little work documenting global investors' EM currency risk management practice and their ultimate currency risk exposure.

Understanding how global investors use FX derivatives specifically for emerging market currencies is nevertheless important. Extant studies focus on measuring global investors' exposure to EMs through cash positions. A precise characterization of the exposure and the implication for EM exchange rate dynamics, however, relies on understanding the derivative positions as well. This is especially relevant for EMs, where the market segmentation due to the non-deliverability of EM currency forward contracts and strong capital account restrictions may elevate the significance of FX derivatives in foreign investors' EM portfolio. Moreover, the interactions between different investment objectives and styles reflected in the derivative usage could play a meaningful role on the dynamics of forward exchange rates.

This paper takes a first step towards addressing these gaps. Using a novel dataset on U.S. investment funds' EM currency forward usage at the contract level from 2010 to 2023, we find pervasive evidence that the true currency risk exposure of major global fixed-income investors in emerging markets could be much larger and wider than what their direct holdings of bonds indicate. An average mutual fund with a mandate to in-

vest in EM fixed income assets actively employs currency forward agreements to build risk exposure on top of their underlying bond position instead of hedging the currency risk away. One dollar of EM local currency bond investment is associated with an average long forward position of 14 cents in the same currency. In addition, global mutual funds use forwards to seek direct exposure to currencies. For every five currencies in an average mutual fund's EM investments, there are two currencies associated with zero or tiny bond investment positions. Aggregated to the currency level, long forward exposure accounts for 25% of the overall exposure for U.S. EM-focused bond funds to major EM currencies. Direct holdings of debt securities, consequently, largely understates the degree of currency risk that global investors actually face in EMs.

Our dataset contains rich information on the characteristics of currency forward contracts, including the notional amount, maturity and the counterparty. We use the data to explore currency-level correlates that could explain the direction and degree of currency risk amplification through derivatives. First, we find that bond return differential, yield curve slopes, expected currency depreciation, and deviations from Covered Interest Parity (CIP) have limited explanatory power on net forward sales, while currency fixed effects explain a substantial portion of time-series variations, suggesting an important role for a persistent country-specific component. Second, net forward purchases of local currencies are systematically increasing in the degree of capital account restrictions imposed by the currency issuers. To the extent that mutual funds in our data predominantly source forwards from offshore global banks, the difficulty of capital movement across borders and the incentive to circumvent restrictions to gain synthetic exposure is thus another important determinant of fund managers' EM currency forward usage.

The average pattern of currency forward usage masks substantial heterogeneity. To understand the structure of the market for EM forward contracts in more detail, we separate funds in our sample into currency "hedgers" and "speculators" based on the sign of their average forward positions aggregated to the fund level. The dichotomy between hedger funds and speculator funds reveals fundamental differences in global investors' investment strategies in emerging markets. Speculator funds act as currency traders more than bond investors in two ways. First, speculator funds are exposed to a larger number of currencies on average, take larger gross forward positions than hedger

funds do, and generate returns that are more sensitive to currency fluctuations than hedger funds do. Second, we run predictive regressions and show that while currency volatility and hedging cost predict speculator funds' net forward usage, the strongest predictor of hedger funds' net forward sales in a currency is their corresponding bond portfolio weight. This finding lends support to the existence of an inelastic component of hedger funds' demand for forward.

The strong market segmentation and the heterogeneity that we document using our data could have important implications on forward exchange rates. To delineate the economic mechanism, we write down a partial equilibrium model featuring currency hedgers, speculators, and a global intermediary. In the model, risk averse hedgers are endowed with predetermined local currency bond exposure that gives rise to a hedging motive. Speculators, on the other hand, can choose to allocate their wealth on EM currency bonds and forwards, potentially accommodating the hedging pressure. A global intermediary can step in to absorb the remaining imbalances in the currency forward market and offload the risk to outside entities such as domestic investors in EMs, earning a portion of the expected returns as fees.

Capital flow restriction enters the model in meaningful ways. First, akin to conventional capital inflow restrictions, speculators pay a cost to purchase local currency bonds (the "onshore cost" channel). Second, the global intermediary has limited capacity due to a non-zero probability of not able to fully shed risk and thus having to resort to its costly balance sheet space. This probability is conceptually related to the imperfect integration between onshore and offshore derivative markets due to policy (the "intermediation cost" channel).

We characterize the currency forward market equilibrium and demonstrate the model's ability to rationalize several salient empirical patterns. In the model, speculators' willingness to absorb hedging demand is increasing in their expected profit from hedging service provision—measured by the relative difference between deviations from Uncovered Interest Parity (UIP) and Covered Interest Parity (CIP). We show in the data that this currency wedge is on average positive and is larger for currencies comprising a higher share in hedger funds' bond portfolio. We also construct portfolios of major EM

currencies, sorted by the degree of speculative pressure each currency faces, and show that by buying the high speculative pressure portfolio and selling the low speculative pressure portfolio, one obtains an excess realized return of 2.43% per annum. We also study the dynamics of currency hedging cost during periods of global financial tightening when speculative positions unwind. We find that the net long forward position on EM currencies sharply contracted over two quarters during the onset of the COVID-19 crisis, almost completely driven by a reduction in speculative positions. In the cross section, the stronger the speculative positions before the shock, the larger is the increase in currency hedging cost.

Under mild conditions, we show that the relationship between equilibrium hedging cost and capital flow restriction measures depends heavily on the types of restriction being considered. When the hedgers are sufficiently more risk averse than the speculators and EM currencies command a positive UIP premium, a higher "onshoring cost" associated with the local currency bond market reduces hedging cost, but the opposite is true when the "intermediation cost" increases and the global intermediary finds it more difficult to shed risk. We show that both predictions are consistent with the data. In particular, we find that when the central bank of Malaysia restricted onshore entities from trading in the Malaysian Ringgit (MYR) offshore forward market in late 2016, hedging cost spiked, validating the intermediation cost channel.

Overall, our analysis provide new insights in understanding exchange rate fluctuation and its connection to capital flow reversals in a number of ways. First, exchange rate movements could have stronger impact on capital inflow into emerging markets and the borrowing cost of EM issuers than previously thought, as the currency risk exposure of international investors is much larger and wider once we take into account the derivatives channel. Second, our results on speculative position unwinding during global downturns add to the literature on carry trades and currency crashes (Brunnermeier, Nagel, & Pedersen, 2008) and the recent empirical literature documents a pervasive impact of currency index affecting capital flows and portfolio allocation beyond the impact of bilateral exchange rates (Jansen, Shin, & von Peter, 2023, for example). From a policy-making perspective, we provide a framework to study the role of capital flow restrictions on forward exchange rates and currency hedging cost in EMs. Our data also provides a

rare look into the market of offshore currency forwards, whose activities could move exchange rates substantially but have received little attention to date due to strong market segmentation and data limitation.

Our paper contributes to three strands of literature. A growing literature documents the use of derivatives for institutional investors allocating capital worldwide.[1] An important predecessor is Sialm and Zhu (2024), who show that international fixed income funds' scale of currency hedging is in general smaller than what is theorized by standard models. They also find evidence of funds using currency forwards to increase, rather than hedge, their currency exposure. Opie and Riddiough (2024) arrive at a similar finding in the case of international equity funds. Cheema-Fox and Greenwood (2024) use custodial records to show that currency hedgers maintain a target hedge ratio and rebalance accordingly. All three papers, however, focus on more advanced (G10) currencies and study funds' derivative use and performances. The only two exceptions are Du and Huber (2024) and Hacioğlu-Hoke et al. (2024), who collect data on currency hedging and speculating practices for a wide spectrum of financial and non-financial firms and currencies. Our paper uses granular data on fund-contract level forward usage, to understand the role of several distinct feature of EM currencies, such as capital controls, in driving mutual fund managers' currency derivative usage.

We also contribute to the nascent literature studying the hedging and speculative channel of exchange rate determination. Kubitza, Sigaux, and Vandeweyer (2024) study the relationship between forward usage and deviations from EUR/USD CIP for Euro Area investors under maturity mismatch. Kremens (2024) demonstrates that hedge fund positioning in the currency futures market is informative of currency-equity correlation. Bräuer and Hau (2022) and Ben Zeev and Nathan (2024) establish a causal link between shifts in hedging demand from international bond and equity investors and exchange rates. Our paper is closely related to Liao and Zhang (2024), who study how hedging demand arising from dollar asset-liability gap and imperfect financial intermediation could jointly shape the dynamics of exchange rates for G10 currencies, and to De Leo, Keller,

[1] Beyond currency derivatives, the literature has also discussed mutual funds' usage of credit default swaps (Adam & Guettler, 2015; Jiang, Ou, & Zhu, 2021), interest rate derivatives (Choi, Kim, & Randall, 2024) and equity derivatives (Kaniel & Wang, 2022) using the same set of regulatory filings.

and Zou (2024), who use position data for Peruvian Sol to examine the exchange rate implication of the interaction between foreign speculative demand and constrained local intermediaries, who take the opposite position. Our paper differs in several major aspects. Our model focuses on the heterogeneous risk-return tradeoff facing the ultimate buyers and sellers of hedging services on both ends of the offshore forward intermediation chain. We take a direct approach to test the model mechanism, utilizing our granular data to relate observed hedging demand and speculative pressure to currency returns and deviations from interest parities. Unique to our model, it establishes the role of various forms of capital flow restrictions in driving currency hedging cost.[2]

The paper is also related to the literature on currency risk and optimal hedging (Black, 1990; Campbell et al., 2010; Opie & Riddiough, 2020; Solnik, 1974; Verdelhan, 2018, among others). We provide granular data on emerging market currency forward usage and show that the large currency risk premia for EM currencies could be closely related to currency speculative forces.

The remaining part of the paper is structured as follows: Section 2 offers an overview of the EM currency market and introduces the data. Section 3 provides a set of stylized facts associated with EM-focused mutual funds' currency forward usage. Section 4 focuses on the distinct role played by currency hedgers and speculators and delineates their differences. Section 5 introduces the partial equilibrium model of the offshore currency forward market and discusses its empirical validation. Section 6 concludes.

[2]From a broad perspective, our paper adds to the large literature on understanding deviations from interest rate parity (Borio, Iqbal, McCauley, McGuire, & Sushko, 2018; Cerutti & Zhou, 2024; Du & Schreger, 2016; Du, Tepper, & Verdelhan, 2018; Kalemli-Özcan & Varela, 2022; Kim & Kim, 2025, among others) by highlighting the equilibrium interactions between hedgers and speculators as the key force driving forward premia and CIP deviations in EM currencies.

2 Emerging market currency hedging: Data and context

2.1 Overview

The EM currency derivatives market is characterized by a number of unique features. For a large subset of EM currencies, the lack of full convertibility and capital control give rise to an active offshore non-deliverable forward (NDF) market and strong offshore-onshore segmentation. Forward pricing reflects such frictions. Cerutti and Zhou (2024) compute deviations from Covered Interest Parity (CIP) constructed using EM currency forward exchange rates and show that in most cases, CIP deviations are large and volatile compared to their G10 counterparts.[3] Consequently, international investors looking to hedge their currency risk arising from local currency bond or equity holding could face substantial hedging cost and rollover risk.

Currency derivatives can also be employed to gain direct exposure to currency risk without the need to hold any cash position. The dual role of currency forward for EM currencies could be even stronger than G10 currencies, thanks to pervasive capital control, persistently positive interest rate spread over the U.S., and high currency volatility.[4] The availability of instruments to play this dual role, such as non-deliverable forwards, also suggests that data on local currency bond or equity position paints an incomplete picture at best for our understanding on global investors' true currency exposure to emerging markets.

[3] Jung and Jung (2022) document strong law of one price deviations for onshore and offshore currency forwards during global crisis episodes and relate the gap to intermediary frictions and position limits.

[4] An instance in which offshore market could feature strong speculative force is Indonesia. While the Indonesian authority restricts onshore trading of currency derivatives without underlying investment, the Indonesian Rupiah has the largest offshore NDF market among Southeast Asian economies (Schmittmann & Chua, 2020).

2.2 Data

We focus on U.S.-domiciled fixed income mutual funds and ETFs with a mandate to direct most of their capital into in emerging market debt securities. We obtain the sample of funds from Morningstar (within the "Emerging Markets Fixed Income" category) and cross check the sample with CRSP Survivor-Bias-Free Mutual Fund database. The data covers a total of 150 funds from 2010Q1 to 2023Q3 with total net assets of 64 billion USD by the end of 2021.[5]

Mutual fund FX forward usage Fund-level FX forward positions are collected from the SEC's EDGAR system. Mutual funds are required to disclose their complete portfolio holdings, including all derivatives, to SEC every quarter (and later every month). Before 2019Q3, mutual funds report their complete holdings via Form N-CSR/CSRS and Form N-Q. Starting from 2019Q3, the SEC has standardized the filing format through the new Form N-PORT. We obtain data related to forward usage via scraping Form N-PORT and manually recording information in Form N-Q and N-CSR/CSRS with help from OCR softwares. We also manually cross-check our final data with the filings to ensure the accuracy of our processed data.

A fund filing contains detailed contract-level information on FX forwards, including currency to purchase, currency to sell, notional amount, market value of a contract, settlement date, counterparty, and unrealized valuation gains and losses. This provides us with a rich amount of information to study how mutual funds manage their currency risk unavailable in other data sources.[6] A total of 60 non-G10 currencies have forward contracts traded by mutual funds in our sample. We calculate summary statistics including all currencies. In subsequent analyses, we will also restrict attention to a subset of 20 major currencies for which we have high-quality data on hedging cost.[7]

[5]Due to fund entry and exit, the total number of funds each year vary from 34 to 100, and tend to stabilize after 2013.

[6]Figure A1 in the Appendix provides a screenshot of the FX forward-related information from an SEC filing by JPMorgan Emerging Markets Debt Fund using Form N-Q.

[7]This set of currencies include BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD and ZAR.

Portfolio holding and fund characteristics Security-level holding data comes from CRSP, available at quarterly frequency. We also collect fund characteristics including fund size (total net assets), return, expense and turnover ratio. We develop a crosswalk based on CRSP's SEC-CRSP fund matching file to merge information on FX forward usage with the CRSP data. We manually check fund-quarters missing in CRSP and fill in the missing data using records from Morningstar and SEC filings.

Security-level information such as currency denomination and issuer country comes from Refinitiv and Bloomberg based on matching with bond ISIN. Missing security identifiers in the CRSP portfolio holding data are prevalent, especially in the early part of our sample. We manually collect currency denomination from Bloomberg (using the OpenFIGI API) and Refinitiv based on CRSP-provided information on coupon, maturity date, and security name. For an average fund-quarter pair, we are able to assign currency denomination to 93% of the securities as a share of total net assets (excluding cash).

Currency wedges Two measures of currency wedges (deviations from interest parity) will be helpful for our analysis. We obtain average 3-month-ahead and 1-year-ahead median forecast on spot exchange rates from Bloomberg to compute an ex-ante measure of deviations from Uncovered Interest Parity (UIP, Kalemli-Özcan and Varela (2022)). In addition, we follow Cerutti and Zhou (2024) to construct forward premia and deviations from Covered Interest Parity (CIP) for emerging market currencies. In the convention of Du, Tepper, and Verdelhan (2018), the CIP deviations of tenor n against the USD are given by

$$x_{t,t+n} = i^{\$}_{t,t+n} - [i_{t,t+n} - (f_{t,t+n} - s_t)] \tag{1}$$

where $f_{t,t+n}, s_t$ are log forward and spot exchange rate, in units of local currency per USD. $i^{\$}_{t,t+n}$ and $i_{t,t+n}$ are money market interest rate in USD and local currency. We focus on short tenors such as 1-month and 3-month CIP deviations, as we will show later that these are the main tenors of the contracts in our granular data. (1) is a direct measure of the hedging cost facing a foreign investor in EM. A negative $x_{t,t+n}$ corresponds to a lower hedging cost, as the currency-hedged local currency return exceeds the return of dollar assets with a similar risk and maturity profile.

Overall, compared with the literature, our data has the advantage that it combines multiple reporting forms to achieve a much longer sample period, while preserving the granularity of the data.[8] Our focus on mutual funds and ETFs with EM investment mandates should capture a major share of activities in both the EM currency forward market and the local currency debt market, as other types of institutions are unlikely to maintain a substantial position on local currency assets, and if anything, these other types do not hedge their currency exposure.[9]

2.3 Currency risk management of investment funds: Measurement

Following standard practice in the literature (Opie & Riddiough, 2024; Sialm & Zhu, 2024), we define a number of terms that measure various dimensions of how investment funds manage currency risk via FX forwards.

Starting from the fund-currency level, the *net forward sale* is the present value of the total notional amount of forward currency sold, net of forward currency purchased. The notional amount is converted to USD value. More formally, let

$$\text{NFS}_{ict} = \frac{\widetilde{\text{FS}}_{ict} - \widetilde{\text{FP}}_{ict}}{\text{TNA}_{it}}. \tag{2}$$

Both $\widetilde{\text{FS}}_{ict}$ (forward sales) and $\widetilde{\text{FP}}_{ict}$ (forward purchases) are aggregated across contracts of all tenors.[10] A positive NFS_{ict} indicates that fund i is on net selling currency c forward. To the extent that fund i has a long position in currency-c bonds, the exchange rate risk

[8] Sialm and Zhu (2024) and Opie and Riddiough (2024) use N-Q and N-CSR/CSRS, while Kaniel and Wang (2022) focus on NPORT-P data. Liao and Zhang (2024) and Du and Huber (2024) use data on insurance companies' currency hedged investment aggregated at the company level.

[9] Zhou (2024) shows that Germany-based banks, insurance companies and pension funds hold tiny position on local currency EM sovereign bonds. Jansen et al. (2023) show that Dutch pension funds employ little hedge for investments that are not USD, GBP or JPY denominated. Bertaut et al. (2025) provide evidence that US investment funds are the dominant holders of EM local currency government bonds among all types of U.S. institutions.

[10] Following Sialm and Zhu (2024), we work with present values in our subsequent analysis. We use one-month U.S. treasury yield to discount the contract value. For instance, $\widetilde{\text{FS}}_{ict} = \sum_j \text{FS}^j_{ict}/(1+r_t)^{M_j/365}$, where r_t is the risk free rate and j groups all forward sale contracts with the same residual maturity M_j. The case of $\widetilde{\text{FP}}_{ict}$ is analogously defined.

is partially or fully hedged if $\text{NFS}_{ict} > 0$.

Another measure characterizing currency forward usage at fund-currency level is the *hedge ratio*, defined as

$$\text{HR}_{ict} = \frac{\text{NFS}_{ict}}{\omega_{ict} \times \mathbb{1}\{\omega_{ict} > \underline{\omega}\}}, \tag{3}$$

where ω_{ict} is fund i's portfolio weight in currency c. A positive hedge ratio (i.e., $\text{HR}_{ict} > 0$) means that a fund reduces its exposure in currency c via FX forwards, and vice versa. An HR_{ict} equal to one indicates that fund i is fully hedged in currency c while a bigger number indicates overhedging.

In the data, mutual funds could report small positions in bonds denominated in a currency while holding a large notional position in forward contracts involving the same currency. To make sure the hedge ratio reflects economically meaningful currency hedges, the measure (3) is only defined for currencies whose portfolio weight exceeds a threshold $\underline{\omega}$. Our baseline measure sets $\underline{\omega}$ to 0, and we check for robustness of our findings varying the size of $\underline{\omega}$.

Subtracting net forward sales from portfolio weights, the *net currency exposure* of fund i in currency c is given by

$$\text{NCE}_{ict} = \omega_{ict} - \text{NFS}_{ict}, \tag{4}$$

where a positive NCE_{ict} indicates residual currency risk arising from partial hedges.

To aggregate our measures (2), (3), and (4) to the fund level, we take the sum over all currencies for each fund:

$$\text{NFS}_{it} = \frac{\sum_{c \neq USD} (\widetilde{\text{FS}}_{ict} - \widetilde{\text{FP}}_{ict})}{\text{TNA}_{it}} \tag{5}$$

$$\text{HR}_{it} = \frac{\sum_{c \neq USD} \text{NFS}_{ict}}{\sum_{c \neq USD} \omega_{ict} \times \mathbb{1}\{\omega_{ict} > \underline{\omega}\}} \tag{6}$$

$$\text{NCE}_{it} = \sum_{c \neq USD} (\omega_{ict} - \text{NFS}_{ict}). \tag{7}$$

3 Understanding the currency exposure of EM investors

3.1 Currency risk amplification

Table 1 reports a number of basic summary statistics on the forward-contract-level data. On average, EM-focused funds in our sample employ short-term currency forwards to manage currency risk. The average residual maturity of the contracts is 50 days. This finding suggests that there is a substantial maturity mismatch between the underlying bond investment and the currency derivatives. To the extent that the hedging cost is generally high for EM currencies (Cerutti & Zhou, 2024), these factors could deter investors from substantially hedging their currency exposure.

	Obs	Mean	STD	P25	P50	P75
Purchase EM currency against USD	253202	0.47	0.50	0.00	0.00	1.00
Sell EM currency against USD	253202	0.38	0.49	0.00	0.00	1.00
Purchase G9 currency against USD	253202	0.05	0.21	0.00	0.00	0.00
Sell G9 currency against USD	253202	0.07	0.26	0.00	0.00	0.00
Contracts with two Non-USD currencies	253202	0.04	0.18	0.00	0.00	0.00
Notional Amount ($ Million)	253202	6.28	31.58	0.23	0.90	3.55
Remaining Days to Maturity	253195	50.16	63.13	16.00	39.00	66.00
Observations	253202					

Table 1: Summary statistics: Forward-contract-level

Notes: Table 1 presents summary statistics of the forward-contract level data. Sample currencies include 60 non-G10 and G9 (excluding USD) currencies. The sample runs from 2010Q1 to 2023Q3.

Table 2, Panel (a) verifies this logic, by providing a list of relevant summary statistics at the fund level.[11] The average hedge ratio is -14% – for one dollar invested in an EM currency, investors on average *adds* 14 cents to the currency risk exposure. Average net forward sales is on average -9% of total net assets. In addition, an average fund has a long or short position in 9 currencies but sources the contracts from 6 counterparties, indicating a generally concentrated market for EM currency forwards. The counterparty banks are predominantly global banks. Local EM intermediaries barely serve as the immediate

[11] Table A2 provides additional fund-level summary statistics beyond FX forward usage.

forward supplier.[12] Panel (b) reports average hedge ratio when we exclude tiny bond positions from the calculation – we get even more negative values converging towards -16%. The distribution of net forward positions and hedge ratios are highly spread out (Figure 1(a), 1(b)), but ultimately an average fund has a stronger net currency exposure compared to their bond-level portfolio weight, according to Figure 1(c). Furthermore, using forwards to increase currency exposure is a pervasive phenomenon among our sample funds investing in EM currencies, and it is not driven by a few extreme outliers. We show this precisely in Figure A3 in the Appendix, by documenting a significant share of fund-currency-quarters that involve tiny to zero bond position but net long forward position. In comparison, Sialm and Zhu (2024, Figure 3) show that for a larger sample of mutual funds investing in both G10 and non-G10 currencies, while some funds use forwards to increase their currency exposure, a substantial portion of fund-level net foreign currency exposure is below its portfolio weight, indicating a stronger propensity to hedge against funds' G10 currency exposure.[13]

We aggregate net forward sales of each fund to the currency level and report the aggregate currency exposure of U.S. bond funds to EM currencies in Figure 2 separated by exposure due to bond holdings and due to forward usage. We find that across most major EM currencies, net long forward positions add substantially to the overall currency exposure. For currencies such as Indian Rupee (INR), Chinese Renminbi (CNY), and Polish Zloty (PLN), a large fraction of forward exposure comes from mutual funds with no corresponding bond holdings denominated in the same currency. Overall, for major EM currencies averaged across 2010Q1 to 2023Q3, currency forwards add 25% to the bond funds' long exposure, of which more than 55% is attributed to forward-only exposure without holding bonds denominated in the same currencies.

[12]The entire forward intermediation chain could nevertheless involve both global banks and onshore intermediaries, as global banks channel forward demand from ultimate offshore entities (De Leo et al., 2024). Appendix Table A1 lists all counterparty banks appearing in the sample.

[13]Our results are also robust after excluding ETFs, index funds, and liquidated or merged share classes from the calculation (see Appendix Table A3).

	Obs	Mean	STD	P25	P50	P75
Fraction of Fund-Quarter with FX Forward	4387	0.76	0.43	1.00	1.00	1.00
Total Net Assets ($ Million)	4387	761.21	1500.43	39.80	169.50	699.09
Portfolio Weight of EM Currencies	4387	0.37	0.36	0.03	0.27	0.71
Hedge Ratio: EM	4097	-0.14	0.99	-0.24	0.00	0.00
Net Forward Sales scaled by TNA: EM	4387	-0.09	0.20	-0.11	0.00	0.00
Net Currency Exposure	4387	0.46	0.42	0.04	0.37	0.91
Forward Purchases scaled by TNA: EM	4387	0.24	0.34	0.00	0.07	0.34
Forward Sales scaled by TNA: EM	4387	0.15	0.23	0.00	0.05	0.21
Gross Forward scaled by TNA: EM	4387	0.39	0.54	0.00	0.13	0.58
Number of Unique FX Counterparties	4387	4.73	4.79	1.00	3.00	8.00
Number of Unique Purchase Currencies	4387	8.97	8.56	1.00	6.00	16.00
Number of Unique Sale Currencies	4387	8.06	7.92	1.00	6.00	14.00
Number of Currencies with No Bond Investment	4387	4.07	4.84	0.00	2.00	7.00
Number of Currencies with Bond Investment	4387	9.52	7.12	3.00	9.00	16.00
Number of Contracts	4387	50.66	78.84	1.00	16.00	68.00
Observations	4387					

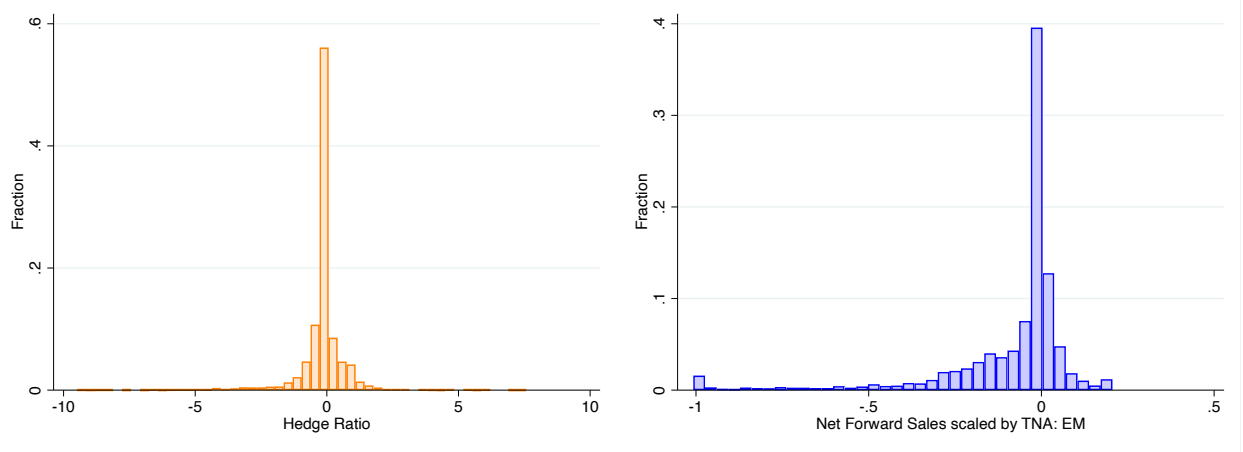
(a) Summary statistics: Fund-level

	P0.1	P0.5	P1.0
Hedge Ratio	-0.15	-0.16	-0.16
Observations	4,017	3,883	3,723

(b) Hedge ratio, with varying portfolio weight thresholds

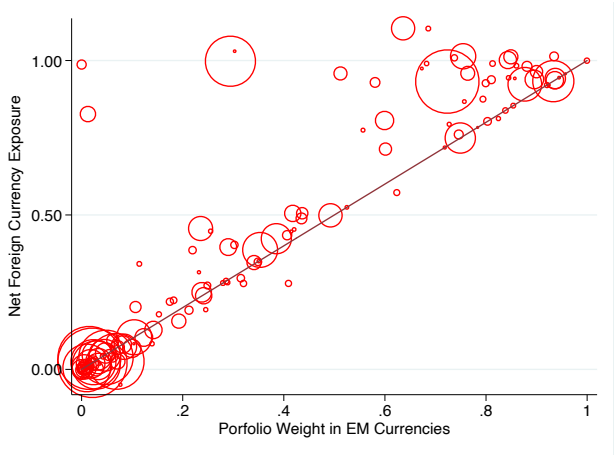
Table 2: U.S. fixed-income EM mutual funds: Fund-by-quarter level summary

Notes: Table 2 presents summary statistics of the fund-quarter level data. In the calculation of hedge ratio, net forward sales, forward purchases, and forward sales, we restrict to 60 non-G10 EM currencies. For hedge ratio, we remove extreme observations of which the absolute value of hedge ratio exceeds 10. We winsorize net forward sales, forward purchases, and forward sales at 1%. In Panel (a), the hedge ratio is based on fund-quarters with non-zero portfolio weights. Panel (b) presents our measure of hedge ratio at fund-level with different portfolio weight cutoffs (P, in percentage points), below which the underlying position would be regarded as too small to warrant a hedge ratio calculation. The first column reports the hedge ratio conditional on $\omega_{it} > 0.1\%$; the second column is conditional on $\omega_{it} > 0.5\%$; the third column is conditional on $\omega_{it} > 1\%$. The sample runs from 2010Q1 to 2023Q3.



(a) Histogram of hedge ratio

(b) Histogram of net forward sales



(c) Net currency exposure and portfolio weight

Figure 1: U.S. fixed income mutual funds' FX forward position and portfolio weight to EM

Notes: Figure 1 presents histograms of two key measures that capture FX forward usage at fund-quarter level, and illustrates the extent to which each fund's underlying portfolio weight in EM currencies differs from its true currency exposure. Upper left panel is hedge ratio defined in Equation (6), and upper right panel is net forward sales scaled by total net assets defined in Equation (5). The figure in the bottom panel plots fund-level time-series average of underlying portfolio weight in EM currencies (x-axis) against time-series average of net foreign currency exposure defined in Equation (7) (y-axis). Circles above the 45-degree line are funds that hold net long forward positions (i.e., increase currency exposure), and those below are funds that hold net short forward position (i.e., decrease currency exposure). Each circle is weighted by the size of a fund's total net assets.

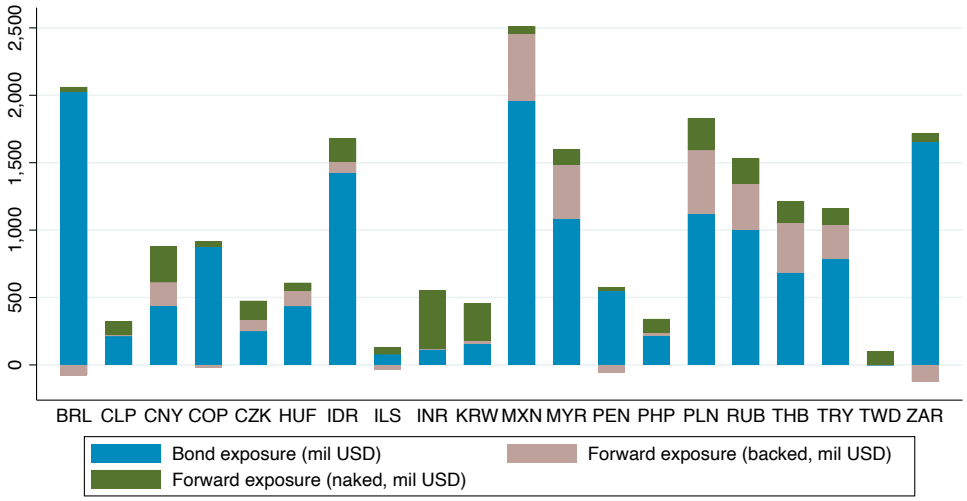


Figure 2: Bond versus forward exposure: Major EM currencies

Notes: Figure 2 reports the aggregate currency exposure of U.S. mutual funds across major EM currencies through both bond positions (blue) and forward positions (pink and green), averaged across our sample period starting from 2010Q1 to 2023Q3. The unit of exposure is USD millions. Naked exposure refer to forward positions of funds with zero or tiny underlying bond positions ($<$ 0.1% TNA bond positions denominated in the same currency). Backed positions refer to forward positions of funds with more than 0.1% TNA corresponding bond positions.

3.2 Explaining the net long positions in currency forwards

Currency fundamentals and net forward positions We start by examining currency-level correlates of net forward positions. Table 3 reports panel regressions relating aggregate net forward sales at the currency level to a series of currency fundamental indicators. The indicators include measures of attractiveness of local currency bond investment (return differential relative to benchmark U.S. Treasury yields, as well as the slope of the yield curve proxied by 5-year minus 3-month local currency bond yield). On the currency side, we include exchange rate forecast, implied volatility and deviations from CIP as the indicator for hedging cost. In our cross-sectional regressions using time fixed effect, we also examine the role of the hedging property of EM currencies, by including currency-specific β against the EM bond market (proxied by the JPMorgan GBI-EM total index return) and the US stock market (proxied by the SP500 return).

Table 3 shows that a stronger depreciation expectation is consistently associated with stronger net forward sales in the time series and the cross-section dimension. Using time-series variations (columns (1) and (3)), we find that holding all else unchanged, aggregate net forward sales rise with higher CIP deviations, suggesting a role for a rising hedging demand to materially affect hedging cost. A steeper yield curve slope is associated with lower net forward sales. A likely explanation is global investors' rebalancing acts to exploit the positive time-series comovement between term premia and currency returns in emerging markets (De Leo, Keller, Simoncelli, Villamizar-Villegas, & Williams, 2025).

The attractiveness of long-term bond also plays a role in explaining the cross-sectional variation of net forward sales (columns (2) and (4)). Currencies with a higher return differential relative to the U.S., as well as currencies with a steeper yield curve, is associated with stronger net forward sales. The signs of the coefficients are opposite to those obtained from the regressions with currency fixed effect. A possible explanation for this difference is that the ability of currency forward to create synthetic long exposure depends on the attractiveness of local currency bonds, as forward contracts tend to have a lower duration. At the cross section, a higher average long-term bond yield reduces the attractiveness of currency forward as a synthetic instrument, thereby leading to the observed positive correlation between yields and net forward sales.

We also report R^2 from the regression with currency fixed effects. Ranging from 20% (cross-section) to nearly 50% (time-series), the fit is mostly driven by the fixed effects: dropping currency fixed effect significantly reduces the R^2 to less than 5%. This finding implies that other currency-specific, persistent factors that are not reflected in returns, hedging cost and volatility could better explain the direction and degree of global investors' forward exposure.

In Appendix C, we delve deeper into our finding on the role of currency risk and returns in driving currency-level net forward sales and show that a uni-currency, mean-variance framework of optimal portfolio choice among unhedged and hedged local currency investments (see Du and Huber (2024)) delivers a mixed performance in predicting hedge ratios. While the framework calibrated using data on EM bond returns and currency returns is able to match the sign of the observed hedge ratios for a large number

VARIABLES	(1) NFS (% TNA)	(2) NFS (% TNA)	(3) NFS (% TNA)	(4) NFS (% TNA)
5-Year LC-USD Govt Yield Spread (%)	-0.045	0.065**	-0.038	0.054**
	(0.034)	(0.025)	(0.042)	(0.026)
5-Year-3M LC Govt Yield Spread (%)	-0.105**	0.172***	-0.098**	0.191***
	(0.048)	(0.041)	(0.048)	(0.043)
3-Month CIP Deviations (%)	0.054**	-0.010	0.052*	-0.028*
	(0.023)	(0.013)	(0.026)	(0.014)
3-Month Depreciation Forecast (%)	0.010	0.040**		
	(0.013)	(0.015)		
3-Month ATM Implied Volatility	0.015	0.010		
	(0.016)	(0.014)		
1-Year Depreciation Forecast (%)			0.019*	0.051***
			(0.010)	(0.012)
1-Year ATM Implied Volatility			0.006	0.015
			(0.025)	(0.020)
$\beta(FX, GBI)$		0.201		0.355*
		(0.177)		(0.207)
$\beta(FX, SP500)$		-0.151		-0.387
		(0.639)		(0.577)
Observations	1,075	1,075	1,075	1,075
R-squared	0.483	0.206	0.486	0.221
Number of groups	20	20	20	20
Currency FE	✓	-	✓	-
Time FE	-	✓	-	✓
R-squared (without FE)	0.034	0.035	0.044	0.047

Table 3: Currency-level correlates with net forward sales across major EM currencies

Notes: Table 3 reports regressions relating U.S. mutual funds' net forward sales aggregated to the currency level and a series of currency fundamental indicators associated with 20 major EM currencies. Column (1) and (3) use within-currency time-series variation, while column (2) and (4) utilize cross-currency variation. Driskoll-Kraay standard errors are reported in parentheses. The sample runs from 2010Q1 to 2023Q3.

of major EM currencies, a very low absolute risk aversion coefficient to the order of 0.1 is needed to generate a negative hedge ratio. This result further illustrates the deviations from observed mutual funds' EM currency risk management practice and theoretical predictions.

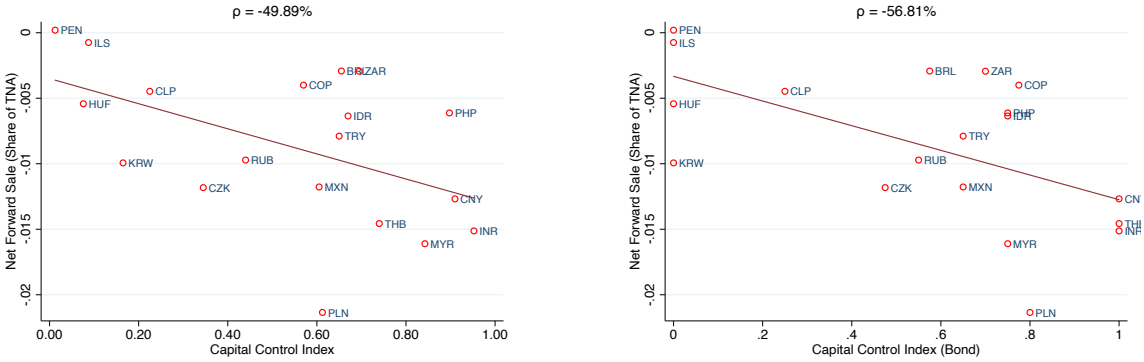
The role of capital account restrictions According to Table 3, persistent differences in the characteristics of EM borrowers could explain variations in the currency forward

usage of U.S. bond funds. Among the characteristics, capital account restrictions could play an important role. Offshore-traded derivatives (such as non-deliverable forwards) offer fund managers the option to gain direct, long exposure and flexibly adjust positions while overcoming barriers to capital movement across borders.[14] We thus expect to see a stronger propensity of EM funds to long a currency forward when the country issuing the currency imposes stronger capital account restrictions.

To operationalize the comparison, we use data on capital account restrictions from Fernández, Klein, Rebucci, Schindler, and Uribe (2015) from 2010 to 2019, which constructs standardized indices (ranging from 0 to 1) of various types of capital account restrictions based on the IMF Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) filed by country authorities. Figure 3 shows that there is a strong negative relationship between a country's capital account restrictiveness and net forward sale position of the currency of that country. We also look at subindices of the Fernández et al. (2015) dataset and show in Figure 3(b) that consistent with our intuition, there is an even stronger negative correlation between net forward sales and capital control related to the bond market, indicating that currency forwards are particularly useful instruments for fixed-income fund managers to gain exposure while alleviating explicit constraints for capital movements. In Appendix A.2, we provide a complementary case study on Brazil's repeal of its foreign financial transaction taxes in June 2013 and show evidence along the same line.[15]

[14] We read through fund prospectus and find that most funds, when stating the purpose of derivatives usage, explictly mention creating synthetic exposure. Also see Table A5 in the Appendix.

[15] In unreported regressions, we find that the relationship between capital control and net forward position of EM-focused mutual funds cannot be explained away by other regressors included in Table 3 in a cross-currency regression with time fixed effect. The estimated coefficient remains strongly statistically significant.



(a) Overall capital account restrictions **(b)** Capital account restrictions for bonds

Figure 3: FX forward usage and capital control

Notes: Figure 3 presents the cross-sectional correlation between FX forward usage and capital control. The left panel focuses on the capital control index that captures all asset categories. The right panel focuses on the capital control index that captures restrictions on bond transactions. The capital control index ranges from 0 to 1. A higher capital control index indicates more stringent capital control. Data for capital control index is from Fernández, Klein, Rebucci, Schindler, and Uribe (2015), which is updated to 2019. Therefore, both FX forward usage and capital control are computed based on a sample from 2010Q1 to 2019Q4.

4 Speculators and hedgers in the EM currency market

To get a deeper understanding of the market structure and important players, in this section we delve into the heterogeneity in currency risk management styles among investment funds, by focusing on the split between "hedger" funds – who on average reduce currency exposure via currency forwards – and "speculator" funds, who on average amplify their currency exposure through a long forward position.[16]

We first provide a precise definition of these two fund types, based on their observed forward usage patterns. A fund is classified as a speculator fund if the time-series average of its net forward position across all currencies is strictly negative (i.e., $\overline{\text{NFS}_i} < 0$), and a hedger if the mean of its net forward position is positive (i.e., $\overline{\text{NFS}_i} \geq 0$). We further require that a fund needs to use FX forward frequently for classification such that the

[16]Figure A2 in the Appendix plots the time-series of FX forward usage and shows that there is a large cross-sectional dispersion.

fund needs to maintain a non-zero gross forward position (that is, the sum of forward purchase and forward sale) for at least 10 percent of the period that the fund appears in the data. This restriction filters out funds that only sporadically use currency forwards.[17]

We use a "revealed preference" approach as opposed to directly sourcing information from stated objectives for derivatives usage in fund prospectus, as we do not find much information content from such ex-ante measures. We read the prospectus of all funds in our sample, and show in Table A5 that more than 90 percent of funds state that they use derivatives for the dual purpose of hedging and creating synthetic exposure. As a result, there is no significant difference in the fraction of funds mentioning using derivatives for hedging, creating synthetic exposure, or return enhancement purposes across the hedger and speculator groups that we identify. While the hedger and speculator designation is based on the funds' overall forward usage, Figure A6 provide further validation, that for most currencies, speculator funds' aggregate forward sales are net negative while the opposite is true for hedger funds.

Our samples funds are persistent in their currency management styles over time, as the sign of their net forward positions do not shift very often from quarter to quarter. For both speculators and hedgers, the probability of switching signs quarter-to-quarter is 0.11. The transition probability reduces further when we exclude funds with near-zero net forward sales. Figure 4 shows that the time-series average of net forward sale position of hedgers and speculators mostly stay in the positive and negative territories, respectively. Net forward sale positions of speculator funds are more volatile.

Table 4 reports basic characteristics of speculator and hedger funds. Several dimensions are worth highlighting. Speculators hold a substantially larger gross forward positions (57%) than hedger funds do (17%), and are simultaneously exposed to more currencies (14) than hedger funds are (7). Speculator funds' return is also more sensitive to the movement of local currency exchange rates compared to the return on the underly-

[17] Our definition of hedgers and speculators at the fund level reflects the currency risk borne by a fund across all derivative positions. A fund may hold a long forward position in one currency while being classified as a hedger fund. Figure A5 in the Appendix presents two examples of speculator and hedger funds and plots the time-series of their net forward sales position. Table A4 in the Appendix reports the total number of fund in our sample with breakdown into hedger or speculator funds. In later analysis at the currency level, we define speculative and hedging position separately.

ing bonds.[18] These findings, taken together, supports the notion that speculator mutual funds take on a role more similar to currency traders than bond investors. The average hedge ratio of hedger funds is 29%, while the corresponding number for speculators is a negative 47%. We also find that an average speculator's liabilities are less stable during downturns, as the comovement between fund flows and fund returns are much stronger than that associated with an average hedger fund. There's no significant difference in portfolio turnover and fund return sensitivity to GBI-EM return—an important local currency bond benchmark. This finding, along with the evidence in Appendix Table A5 with respect to funds' stated objective of currency forward usage, indicates that these funds are also not systematically different in their activeness or forward usage strategy.

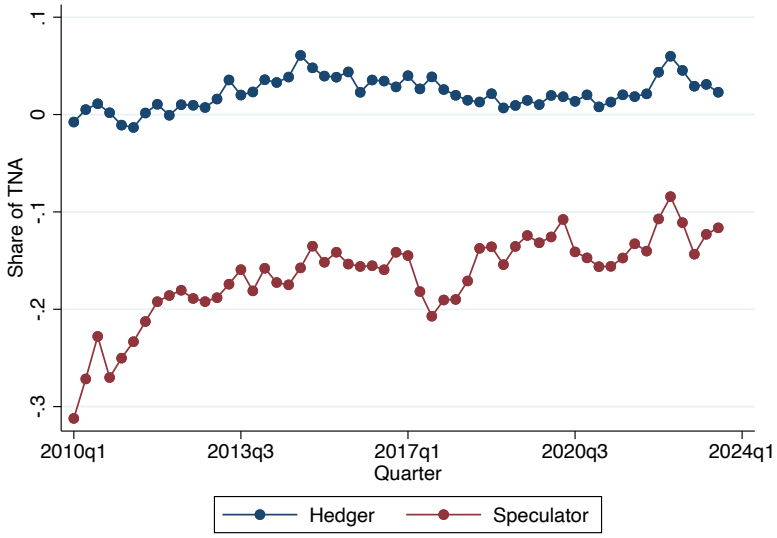


Figure 4: Time-series of net FX forward sales: Hedger and speculator funds

Notes: Figure 4 presents the time-series average of fund-level net forward sales position (scaled by total net assets) for hedger funds and speculator funds. A fund is classified as a speculator if the time-series average of its net forward sale position across all currencies is strictly negative, and a hedger if the mean of its net forward sale position is positive and the mean of its portfolio weight is non-zero. The sample runs from 2010Q1 to 2023Q3.

[18] Appendix Figure A7 visualizes the distribution of hedger and speculator funds' return beta to bond and currency returns.

	Hedger		Speculator		Mean Diff.
	mean	sd	mean	sd	t
Total Net Assets ($ Million)	846.75	(1497.50)	694.18	(1514.14)	2.97
Hedge Ratio	0.29	(0.92)	-0.47	(1.13)	20.05
Net Forward Sales scaled by TNA	0.02	(0.06)	-0.16	(0.22)	29.44
Forward Purchases scaled by TNA	0.07	(0.17)	0.37	(0.36)	-28.48
Forward Sales scaled by TNA	0.10	(0.21)	0.20	(0.22)	-14.22
Gross Forward scaled by TNA	0.17	(0.37)	0.57	(0.55)	-23.72
Portfolio Weight of USD	0.76	(0.25)	0.42	(0.34)	31.47
Portfolio Weight of Cash	0.03	(0.08)	0.06	(0.13)	-8.42
Number of Portfolio Currencies	7.34	(4.67)	14.24	(5.33)	-39.75
Number of Currencies in Speculative Position	1.64	(2.29)	7.91	(5.25)	-41.64
Number of Currencies in Hedging Position	3.38	(3.49)	4.11	(3.21)	-6.51
Number of Currencies with No Bond Investment	2.86	(3.52)	4.46	(4.46)	-11.34
Number of Currencies with Bond Investment	4.32	(3.53)	9.62	(5.56)	-31.64
Portfolio Turnover Ratio	1.01	(1.14)	0.96	(0.76)	1.53
Fund Return	3.25	(1.78)	1.20	(1.74)	33.97
Return Volatility	9.91	(2.06)	10.76	(1.94)	-12.42
Flow Volatility	22.89	(16.65)	27.24	(16.65)	-7.58
Flow-Performance Sensitivity	0.30	(5.03)	2.27	(9.31)	-7.15
Return-Bond Sensitivity	0.58	(0.18)	0.59	(0.19)	-0.08
Return-Currency Sensitivity	0.09	(0.23)	0.45	(0.33)	-35.97
Observations	1348		2404		3752

Table 4: Fund characteristics: Speculators and hedgers

Note: Table 4 presents fund-quarter level characteristics for speculators and hedgers. A fund is classified as a speculator if the time-series average of its net forward sale position across all currencies is strictly negative, and a hedger if the mean of its net forward sale position is positive. Fund return is computed as the annualized quarterly return in percentage terms. Return volatility is the annualized standard deviation of quarterly return in percentage terms. Flow volatility is the standard deviation of quarterly flow in percentage terms. Flow-performance sensitivity is the flow beta to fund alpha, which is computed based on a one-factor (JPM GBI-EM index return) model and flow is winsorized at 1%. Return-bond sensitivity and return-currency sensitivity are fund (raw) return beta to JPM GBI-EM index return and a simple average of FX spot return across 20 major EM currencies, including BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR. The sample runs from 2010Q1 to 2023Q3.

4.1 Correlates of forward usage vary across hedgers and speculators

We assess how speculators and hedgers manage their currency forward positions across currencies by running the following predictive regressions:

$$\text{NFS}_{ict} = \gamma' \boldsymbol{X}_{c,t-1} + \delta'(\boldsymbol{X}_{c,t-1} \times \omega_{c,t-1}) + \chi \omega_{c,t-1} + \alpha_{it} + \epsilon_{ict}, \tag{8}$$

where NFS_{ict} refers to net forward sales (short) position of fund i in currency c, and $\boldsymbol{X}_{c,t-1}$ includes a set of variables that capture currency-specific characteristics, such as momentum, CIP deviation, and volatility. $\omega_{c,t-1}$ is the bond portfolio weight of currency c during the previous quarter. α_{it} denotes fund-quarter fixed effect. We include the interaction between currency characteristics and bond portfolio weights to capture how the exposure to local currency bond changes the responsiveness of forward usage. The base coefficient γ for speculator funds, for instance, can be interpreted as the sensitivity to changes in currency characteristics for funds with no underlying bond position corresponding to the same currency.

We report the results in Table 5. We find that hedger funds are not responsive to past currency returns, currency hedging cost, or volatility. The strongest predictor of hedger funds' net forward sales in a currency is their pre-existing portfolio weight of bond denominated in that currency (column (3)), with the estimated coefficients close to hedger funds' average hedge ratio (30%). This finding is consistent with a generally inelastic demand for currency hedges, possibly due to mandates or maintaining a targeted hedge ratio. For speculator funds, bond weights enter significantly (column (1)), but lose significance after interacted with currency fundamentals. For these funds, currency volatility and hedging cost are among the significant predictors. In addition, the sensitivity of speculator funds' net forward position to currency volatility fluctuations declines with bond portfolio weight, highlighting the increasing importance of hedging motive when the underlying bond position becomes more significant.[19]

[19]Table A6 in the Appendix shows that our findings remain robust when we replace 3-month CIP deviations by 1-month CIP deviations, with the predictive power of hedging cost on hedger funds' forward usage reduced even further. Appendix Table A7 shows that our finding stands when we exclude a small number of fund-quarters with no bond investment denominated in EM currencies.

	Speculator fund		Hedger fund	
	(1)	(2)	(3)	(4)
Lag-1 Portfolio Weight	0.147***	0.055	0.406***	0.334***
	(0.025)	(0.039)	(0.060)	(0.069)
Lag-1 Momentum	-0.000	-0.011	0.005	-0.003
	(0.012)	(0.015)	(0.006)	(0.005)
Lag-1 3-Month CIP Deviation	0.050***	0.055***	0.005	0.016*
	(0.013)	(0.019)	(0.009)	(0.009)
Lag-1 Currency Volatility	-0.066**	-0.154***	0.000	-0.034
	(0.027)	(0.043)	(0.027)	(0.027)
Lag-1 Momentum × Weight		0.004		0.005**
		(0.002)		(0.002)
Lag-1 CIP × Weight		0.002		-0.010
		(0.005)		(0.009)
Lag-1 Volatility × Weight		0.031***		0.023
		(0.007)		(0.016)
Fund-by-Quarter FE	✓	✓	✓	✓
R-squared	0.337	0.340	0.351	0.353
N	31719	31719	8104	8104

Table 5: Predicting net forward sale using currency characteristics: By fund type

Notes: Table 5 reports regression results based on Equation (8) in understanding the currency-level determinants of currency forward positions by different types of U.S. EM-focused mutual funds. A fund is classified as a speculator fund if the time-series average of its net forward sale position across all currencies is strictly negative, and a hedger if the mean of its net forward sale position is positive and the mean of its portfolio weight is non-zero. The dependent variable is the net forward sale position of fund i in currency c at time t. The independent variables include momentum (computed by spot exchange rate return), 3-month CIP deviation, currency volatility (computed by past 12 months' exchange rate volatility). All independent variables are lagged by one quarter. Both dependent and independent variables are converted to percentage terms. Standard errors in parentheses are two-way clustered by fund and time. The estimation is based on the sample period from 2010Q1 to 2023Q3. Our sample currencies include major EM currencies with sufficiently active foreign exchange markets and for which we have substantial data coverage on hedging cost: BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR.

5 Connection to exchange rate dynamics

Informed by Section 3 and 4, we build on Tsiang (1959) and introduce a partial equilibrium model of the offshore forward market with investor heterogeneity and various forms of market access restriction or intermediation friction. Focusing on the currency market equilibrium, we characterize the dependence of currency hedging cost on the cost of accessing the bond market or intermediating offshore forward trades.

5.1 Model setup

Hedger A fixed income investor in EM local currency debt enters period 0 with wealth $W_0^{\$}$ in US dollar. She can invest in the local currency bond ("peso"), which yields a risk-free, exogenous return $(1+r)$ in period 1. The rest of the hedger's wealth is invested in risk-free USD cash. The peso-dollar exchange rate in period 1 is the only source of uncertainty in the market. To focus on the forward exchange rate, we assume that spot exchange rate process $\{S_0, S_1\}$ in units of peso per USD is exogenously determined. Emerging market currencies command a positive UIP premium, $\mathbb{E}\left[\frac{S_0(1+r)}{S_1} - 1\right] > 0$ (Kalemli-Özcan & Varela, 2022). In what follows, we assume that the first moment of S_1 is such that the UIP premium will be positive.

Similar to Liao and Zhang (2024) and Du and Huber (2024), we assume that the hedger holds a pre-determined amount of peso bonds equal to ωW_0, where W_0 is the wealth of the hedger converted to pesos. She can enter into a forward agreement that sells (or buys) peso in period 1 at the forward exchange rate F (also in units of peso per USD). Similar to the market structure in a large number of emerging market currencies, the forward contract is non-deliverable, involving no currency exchange at inception. In period 1, counterparties settle the profit and loss in USD. A contract worth one peso of notional value sold at time 0 is expected to generate a profit of $F^{-1} - \mathbb{E}[S_1^{-1}]$ in USD terms, where S_1 is the peso-dollar exchange rate in period 1. The larger the peso is expected to depreciate (a higher $\mathbb{E}[S_1]$), the higher is the expected profit from selling peso forward and locking in the exchange rate at F.

The hedger has mean-variance preference over wealth at period 1. Given a predetermined local currency bond weight ω, she chooses the notional amount of forward contracts to sell, h, takes period 0 forward exchange rate F and period 1 spot exchange rate expectation given, and solves the following problem:

$$\max_h \mathbb{E}\Big[\frac{\omega W_0(1+r)}{S_1} + \frac{h}{F} - \frac{h}{S_1}\Big] - \frac{\gamma_h}{2} Var\Big(\frac{\omega W_0(1+r)}{S_1} + \frac{h}{F} - \frac{h}{S_1}\Big)$$

where γ_h is the risk aversion coefficient of the hedger. As will be seen later, the fundamental hedging demand of the hedger is increasing in γ_h.

The optimal amount of forward selling as a share of total wealth (the counterpart to NFS in our empirical analysis) is implied from the first-order condition:

$$\tilde{h} \equiv \frac{h}{W_0} = \omega(1+r) + \frac{\mathbb{E}[F^{-1} - S_1^{-1}]}{\gamma_h Var(S_1^{-1}) W_0} \tag{9}$$

Using the definition of dollar wealth $W_0^{\$} S_0 = W_0$ and normalizing the period 0 dollar wealth $W_0^{\$}$ to 1, the optimal demand for hedging services can be more intuitively expressed as

$$\tilde{h} = \omega(1+r) + \frac{\frac{S_0}{F} - \mathbb{E}\Big[\frac{S_0}{S_1}\Big]}{\gamma_h Var\Big(\frac{S_0}{S_1}\Big)} \tag{10}$$

(10) implies that the optimal hedging decision of the investor depends on the return of the investment, since she needs to hedge a larger cash flow when the return goes up; the (inverse of) hedging cost S_0/F relative to expected appreciation of the peso; and the variance of appreciation, scaled by the hedger's risk aversion. The first component in (10) captures the inelastic hedging demand that is insensitive to exchange rate expectation or hedging cost, due to the predetermined bond holding. The second component corresponds to an elastic component that reacts to changes in the hedging cost and exchange rate expectations. The optimal hedging demand will be increasing when the local currency is expected to depreciate by more, when the local currency depreciation

becomes more volatile, or when the hedging cost decreases.

Speculator The speculator also has initial wealth $W_0^{\$} = 1$. Unlike the hedger, she can choose to tap both the onshore local currency bond market and the offshore forward market for direct and synthetic exposure to pesos. The rest of her wealth is also allocated to US at risk-free rate r_f normalized to be zero. Due to capital controls, however, buying one dollar worth of local-currency bonds would incur an additional quadratic cost that scales with parameter κ_b. We label this parameter "onshore cost" to reflect the idea that it best captures direct restrictions on capital inflows.

The speculator solves the following problem:

$$\begin{aligned}\max_{\omega_s, h_s} \quad & \mathbb{E}\Big[\frac{\omega_s W_0(1+r)}{S_1}\Big] + (1-\omega_s)\frac{W_0}{S_0} - \frac{\kappa_b}{2}\Big(\frac{\omega_s W_0}{S_0}\Big)^2 + h_s \mathbb{E}[S_1^{-1} - F^{-1}] \\ & - \frac{\gamma_s}{2} Var\Big(\frac{\omega_s W_0(1+r)}{S_1} + h_s(S_1^{-1} - F^{-1})\Big)\end{aligned}$$

The first-order conditions are given by

$$\omega_s = \kappa_b^{-1} \cdot \underbrace{\Big[\frac{S_0}{F}(1+r) - 1\Big]}_{\text{CIP deviation}} \tag{11}$$

$$\tilde{h}_s \equiv \frac{h_s}{W_0} = \frac{\mathbb{E}\left[\frac{S_0}{S_1}\right] - \frac{S_0}{F}}{\gamma_s Var(S_0/S_1)} - (1+r)\omega_s \tag{12}$$

The optimality conditions of speculators imply that in the presence of onshoring costs, speculators use offshore forward contracts to obtain currency risk exposure, while the optimal bond holding would depend on the effective "risk-free" excess return in dollar terms, captured via CIP deviations. The onshoring cost parameter scales the optimal bond holding. When hedging cost (forward discount) changes, the speculator substitutes between onshore bond holding and offshore forward contracts. We will provide mild conditions in Proposition 2 that ensures speculator takes a long position in both bonds and forwards in equilibrium.

Global intermediary A global intermediary can serve as the residual absorber of demand imbalances in the offshore forward market. It has limited risk-bearing capacity: holding the forward contract on its balance sheet incurs a quadratic cost per dollar of exposure that scales with parameter c. The intermediary is nevertheless able to trade with a group of outside investors, such as investors in the onshore currency market, to offload the currency risk. With probability $\lambda(\kappa_f)$, the intermediary finds a local counterparty to offload the position. With probability $1-\lambda(\kappa_f)$, it holds the risk into period 1 and pays the balance sheet cost. We assume that $\lambda(\kappa_f)$ satisfies $\lambda'(\kappa_f) < 0$, $\lambda(0) = 1$, and $\lim_{\kappa_f \to \infty} \lambda(\kappa_f) = 0$, so that the parameter κ_f can capture the degree of segmentation between onshore and offshore derivative markets, or the intermediation friction: the weaker is the onshore-offshore linkage, the more difficult the intermediary could offload currency risk. Modeling global intermediaries in this way is consistent with the practice of major global banks, who are not the natural holder of currency risk but can nevertheless access EM local markets, transfering the risk from their own balance sheets to local banks and end investors (also see Jung and Jung (2022) and De Leo et al. (2024)).

Finally, for analytical tractability, we make the simplifying assumption that upon meeting outside investors, the global intermediary keeps θ fraction of expected returns from the non-deliverable contract as fees for facilitating the risk sharing.[20]

The global intermediary solves the following problem:[21]

$$\max_{h_I} \lambda(\kappa_f)\theta \cdot \mathbb{E}[S_1^{-1} - F^{-1}] \cdot h_I + (1-\lambda(\kappa_f)) \Big[\mathbb{E}[S_1^{-1} - F^{-1}] h_I - c \Big(\frac{h_I}{S_0} \Big)^2 \Big]. \tag{13}$$

The intermediary's optimal supply of hedging services, normalized by the wealth of hedger or speculator, is given by

$$\tilde{h}_I \equiv \frac{h_I}{W_0} = \alpha(\kappa_f) \cdot \Big(\mathbb{E}\Big[\frac{S_0}{S_1}\Big] - \frac{S_0}{F} \Big), \tag{14}$$

[20] This can be motivated by considering a generalized Nash bargaining problem between buyers and sellers in an OTC setup, where θ represents the bargaining power of the global intermediary.

[21] We write (13) without carrying an absolute value sign for the expected difference between S_1 and F. As will be clear in Proposition 2, under mild condition, one can ensure that the intermediary always longs forward in equilibrium.

where $\alpha(\kappa_f) \equiv \frac{1-(1-\theta)\lambda(\kappa_f)}{2(1-\lambda(\kappa_f))c}$. The price elasticity of supply decreases when the derivative market becomes more segmented.

Market clearing We focus on the offshore forward market equilibrium and impose market clearing: $\tilde{h}_s + \tilde{h}_I = \tilde{h}$. The equilibrium forward premium is given by

$$\frac{S_0}{F} = \frac{\frac{1+r}{\kappa_b} + \mathbb{E}[\frac{S_0}{S_1}]C(\kappa_f) - \omega(1+r)}{C(\kappa_f) + \frac{(1+r)^2}{\kappa_b}}, \tag{15}$$

where $C(\kappa_f) \equiv \alpha(\kappa_f) + \frac{1}{\gamma_s Var(S_0/S_1)} + \frac{1}{\gamma_h Var(S_0/S_1)}$. A higher expected appreciation of the peso enlarges the profit of hedging service provision and thus strengthens the incentives of the speculator and intermediary to supply hedging services, leading to a lower equilibrium hedging cost. Meanwhile, a larger inelastic hedging demand of the hedger, $\omega(1+r)$ would push up the equilibrium hedging cost, as the speculator and the intermediary would require a higher risk premium to compensate for bearing a higher quantity of currency risk. To sharpen the intuition, Proposition 1 focuses on the limiting case in which the global intermediary plays no role, and the speculator specializes in providing hedging services:

Proposition 1. *When $\kappa_b \to \infty$, $\kappa_f \to \infty$, and $c \to \infty$, the intermediary-less equilibrium features*

$$\frac{S_0}{F} = -\omega(1+r)\Big(\frac{1}{\gamma_h} + \frac{1}{\gamma_s}\Big)^{-1} Var\Big(\frac{S_0}{S_1}\Big) + \mathbb{E}\Big[\frac{S_0}{S_1}\Big] \tag{16}$$

Proof. Plug in the parameter restriction into (15) and rearrange. □

When κ_f, κ_b and $c \to \infty$, we obtain simple equation that characterizes an endogenous positive gap between the expected appreciation of the peso and forward premium, S_0/F. This gap corresponds to the speculator's expected profit from hedging service provision. (16) also uncovers a close inverse relationship between equilibrium hedging cost and expected peso appreciation: when the peso is expected to appreciate more, speculators settle for a lower hedging cost, trading off the direct benefit of absorbing hedgers' inelastic forward demand against the expected gain from bearing currency risk.[22]

[22]The model in De Leo et al. (2024) also generates an inverse relationship between CIP and UIP devia-

In the general case with finite κ_b, κ_f, c, we can put mild restriction on the risk aversion parameter of the hedger and the speculator and characterize the comparative statics connecting currency hedging cost with onshore cost and intermediation friction:

Proposition 2. *Suppose the risk aversion of speculator is sufficiently small and the risk aversion of hedger is sufficiently large, and the deviation from uncovered interest parity (UIP),* $\mathbb{E}[\frac{S_0}{S_1}](1+r)-1$*, is positive. Then, there exists an equilibrium where the hedger partially hedges her currency risk and the following results hold:*

- $\frac{S_0}{F} - \mathbb{E}\left[\frac{S_0}{S_1}\right] < 0$*: the gap between forward premium and expected appreciation of the peso is negative.*
- $\frac{S_0}{F}(1+r)-1 > 0$*: the CIP deviation is positive.*
- $\frac{\partial S_0/F}{\partial \kappa_f} < 0$*: the equilibrium hedging cost is increasing in the degree of segmentation in the forward market.*
- $\frac{\partial S_0/F}{\partial \kappa_b} > 0$*: the equilibrium hedging cost is decreasing in the onshoring cost of purchasing local currency bonds.*

Proof. See Appendix B.1. □

Proposition 2 shows that it is possible to construct an equilibrium where the speculator and intermediary earn positive profit from hedging service provision, while ensuring that the hedger's hedge ratio remains positive. When the speculator's risk aversion is low enough, the market for hedging service would be sufficiently deep to accommodate the hedger's hedging demand, ensuring that an equilibrium with positive forward exchange rate exists. Any γ_s below the threshold given by

$$\frac{1}{\omega(1+r)^2} \cdot \frac{UIP}{Var(S_0/S_1)} \tag{17}$$

tions, through an intermediary-based mechanism different from ours. In their model, local intermediaries cannot take currency risk. They require profits to overcome portfolio frictions and to accommodate a higher speculative forward demand driven by UIP violations.

would also imply that the speculator holds a long position on bonds, which requires CIP deviations—the effective risk-free excess return on the local bond in dollar term—to be positive. This threshold tightens with the degree of inelastic hedging demand and the volatility of spot exchange rate, but loosens when the excess return from currency risk exposure enlarges.

Meanwhile, the proof shows that if CIP deviations are positive (i.e., γ_s is below the threshold given by (17)), a necessary and sufficient condition of the hedger's forward sales being positive is given by

$$\gamma_h \omega > \frac{1}{\alpha(\kappa_f)\ Var(S_0/S_1) + \gamma_s^{-1}} \cdot \omega_s, \tag{18}$$

where the left hand side captures hedger's desire to hedge, driven by her risk aversion and the quantity of currency risk, and the right hand side reflects the intermediary and speculator's capacity to absorb the hedging demand. With a positive UIP premium, a higher γ_h pushes up profit from hedging service provision, so that ω_s would decrease as the speculator shifts from holding bonds to buying forwards, relaxing the inequality. Hence, partial hedge is guaranteed when γ_h is sufficiently large.

Proposition 2 highlights that different types of capital flow restrictions could have starkly different implications on the equilibrium hedging cost. Higher onshoring costs in the local bond market prompts the speculator to shift towards building long positions in forward contracts to get exposure to EM currency risk, resulting in higher supply of hedging services and lower hedging cost. On the other hand, measures that decrease the degree of market integration between onshore and offshore forward markets—connected via the global intermediary—would increase the hedging cost, as the intermediary faces a higher possibility that its limited balance sheet space would be occupied. Subsequent sections take these predictions to the data.

5.2 Model verification: currency wedges, portfolio returns, and global financial tightening

Our model prediction is largely verified in the data by a number of empirical regularities. First, we focus on the relative deviations from interest parity ("currency wedges") across currencies and show that the data supports the tight relationship between the wedges, hedging demand, and volatility posited in Equation (16).[23] We then show that by sorting currencies into portfolios based on the degree of mutual fund speculative pressure, one is also able to detect an excess return reflecting the compensation to speculators providing hedging services as implied in the model. Finally, we study COVID-19 to illustrate how risk-off events drive the unwinding of speculative positions that affect hedging cost.

Relative currency wedges Guided by (16), for each major EM currency, we compute and report the time-series average distance between log expected appreciation and log forward premium (both at 3-month horizon) in Figure 5. This distance is a measure of the relative deviations from interest parities, and represents the empirical counterpart to speculators' profit from hedging service provision. Consistent with (16), we find that this wedge is in general positive, except in the case of CZK, TWD and ILS. For Czech Koruna, the negative wedge is driven by the period of exchange rate floor against the Euro from late 2013 to early April 2017, while Figure 2 suggest that mutual funds in our sample take on very little net exposure to TWD and ILS through either bonds or derivatives.

Figure 6 further explores the cross-currency heterogeneity in the currency wedges and relate them to the primitives in our model. (16) implies that the wedge is widening in the volatility of currency depreciation ($Var(S_0/S_1)$ and the inelastic hedging demand of hedger funds (ω, the portfolio weight associated with local currency bonds). Panel (a) demonstrates a strong positive relationship between the wedges and currency volatility, while Panel (b) show that currencies with large currency wedges are also those that the hedger funds in our sample put more weight on their bond portfolio.

[23] Such relationships also hold in the general case. See Equation (20) in Appendix B.1.

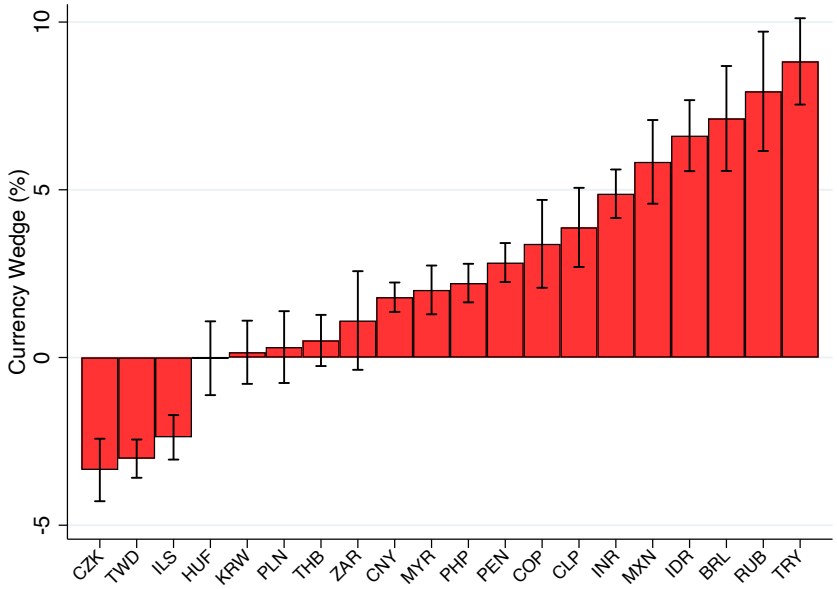


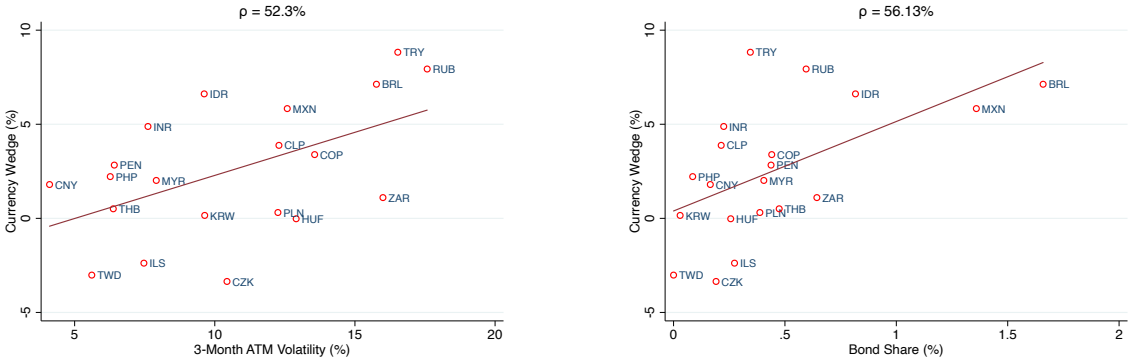
Figure 5: Relative currency wedge at 3-month horizon

Notes: Figure 5 reports the relative currency wedge ($\ln \mathbb{E}\left[\frac{S_0}{S_1}\right] - \ln \frac{S_0}{F}$) at the 3-month horizon. The vertical black line of each bar represents the 75% confidence interval of each currency's wedge. The estimation is based on the sample period from 2010Q1 to 2023Q4. Our sample currencies include major EM currencies with sufficiently active foreign exchange markets: BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR.

Portfolio sorting One important cross-sectional implication of the model is that holding all else constant, speculators are more willing to hold a long forward position if the local currency is expected to appreciate by a larger extent. We test this hypothesis following the usual approach of constructing sorted portfolios. For each month, we group the 20 major EM currencies in our sample into three equal-weighted portfolios, sorted by the speculative pressure faced by the currencies, defined as

$$\text{Speculative Share}_{ct} = \frac{|\sum_i NFS_{ict} \times \mathbb{1}\{NFS_{ict} < 0\}|}{|\sum_i NFS_{ict} \times \mathbb{1}\{NFS_{ict} > 0\}| + |\sum_i NFS_{ict} \times \mathbb{1}\{NFS_{ict} < 0\}|}. \tag{19}$$

The denominator, $|\sum_i NFS_{ict} \times \mathbb{1}\{NFS_{ict} < 0\}|$, is sum of the absolute net long for-



(a) Currency volatility **(b)** Currency weight in bond portfolio

Figure 6: Relative currency wedges, volatility, and currency share in hedger funds' bond portfolio

Notes: Figure 6 reports the cross-sectional correlations between various currency-level characteristics and portfolio patterns. The left panel plots the relative currency wedge $\ln \mathbb{E}\left[\frac{S_0}{S_1}\right] - \ln \frac{S_0}{F}$ (3-month tenor) against 3-month ATM implied volatility. The right panel plots the relative currency wedge against underlying bond share of hedger funds, which is computed by dividing the sum of hedger funds' local currency bond investment by the sum of their total net assets. The estimation is based on the sample period from 2010Q1 to 2023Q3. Our sample currencies include 20 major EM currencies with sufficiently active foreign exchange markets: BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR.

ward position across all funds trading currency-c forward contracts. (19) is a monotonic transformation of the ratio between hedging and speculating mutual fund forward positions in our data, intuitively separating currency risk-taking from currency risk-hedging due to underlying bond investment.

We calculate the log currency return ($f_t - s_{t+1}$) and the long-short strategy of longing Portfolio 3 (the one with the highest speculative pressure) and shorting Portfolio 1 (the one facing the lowest speculative pressure), and report the results in Table 6. The long-short strategy generate an excess return of 2.43% per annum, statistically significant at 10% level. This finding is consistent with our model prediction, that the speculators are expected to earn a risk premium from taking a long forward position to engage in hedging service provision.

In Table 6, we also report other statistics associated with each portfolio. In particular,

we find that portfolios with stronger speculative pressure faces strong capital control from the currency issuer, echoing Figure 3(a). In addition, consistent with (16), these portfolios also feature currencies that are expected to depreciate by less in the future.

	Mean	STD	SE	Fwd Disc	Exp Dep	Int Diff	CCI	Sharpe Ratio
Low Speculative Share	-2.08	8.43	2.11	3.71	0.76	3.64	0.46	-0.25
Medium Speculative Share	-0.09	8.06	1.93	3.88	1.23	3.74	0.50	-0.01
High Speculative Share	0.35	7.42	1.77	2.61	0.02	2.99	0.63	0.05
High Minus Low	2.43	5.43	1.44	-1.10	-0.74	-0.65	0.17	0.45

Table 6: Summary statistics: Currency portfolios sorted on speculative pressure

Notes: Table 6 presents the summary statistics of the currency portfolios formed based on currency-level speculative position defined in Equation (19). Portfolios are rebalanced every quarter. STD refers to standard deviation. Newey-West standard errors (SE) with 4 lags are reported. All variables are annualized and in percentage points. "Fwd disc" refers to forward discount. "Exp dep" refers to expected 3-month depreciation of the local currency sourced from Bloomberg. "Int diff" refers to raw interest rate differential, and "CCI" refers to the average capital control index for the issuing countries in each portfolio, with the data coming from Fernández, Klein, Rebucci, Schindler, and Uribe (2015). The estimation is based on a monthly sample from 2010M1 to 2023M12. Our sample currencies include 20 major EM currencies with sufficiently active foreign exchange markets: BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR.

Global downturn: COVID-19 crisis Figure 7 documents a sharp increase in aggregate net forward sales (short position) by EM-focused mutual funds during the initial phase of the COVID-19 pandemic, from 2019Q4 to 2020Q2, driven mostly by speculators' unwinding of long forward position in EM currencies. Figure 8 confirms a substantial correlation between the scale of speculative position unwound and the rise in hedging cost in the cross-section of currencies, measured by the difference in the forward premium for each currency between 2019Q4 and 2020Q2.

5.3 Hedging cost and capital flow restrictions

We now turn to the data to verify the comparative statics of hedging cost with respect to various types of capital flow restrictions in Proposition 2. We show that the relationship crucially depends on whether policy measures target foreign participation in the bond market or the segmentation between onshore and offshore derivative markets.

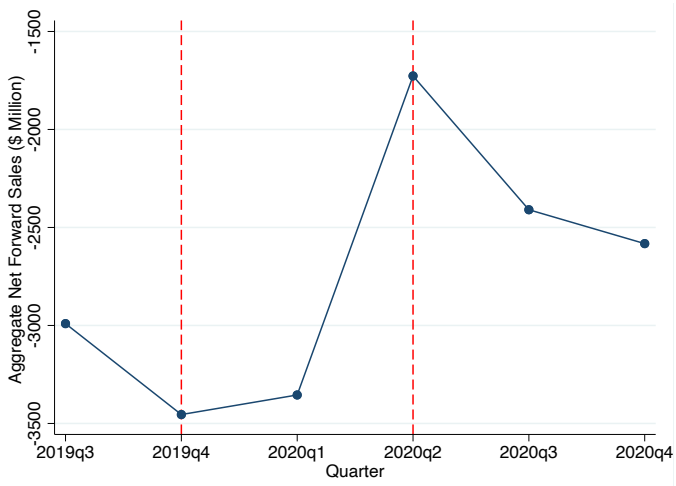


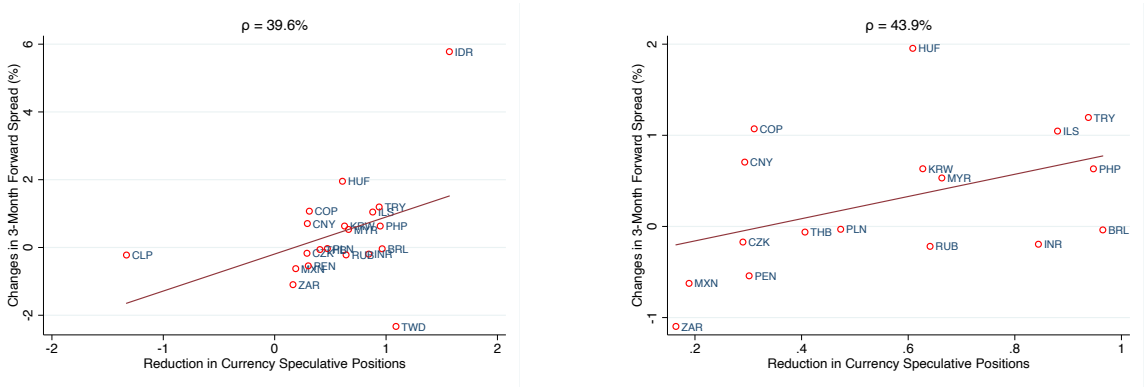
Figure 7: Aggregate net forward sales by EM-dedicated U.S. funds during the COVID-19 crisis

Notes: Figure 7 presents the time-series of aggregate net forward sale position across major EM currencies in our sample before and during the initial phase of the COVID-19 crisis (early 2020). Our sample currencies include: BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR.

Onshoring cost We first focus on the capital control measures used in Figure 3 and Table 6. The Fernández et al. (2015) index mostly captures the openness of a country's capital account through the relaxation of "onshoring" restriction. Consistent with our theory, Figure 3 shows that a stronger level of onshoring cost corresponds to a higher overall degree of net forward purchase by our sample funds. Table 6 shows that the currency portfolio with the highest degree of speculative pressure is also the one facing the strongest average degree of capital control and lowest forward discount.

Onshore-offshore segmentation The Malaysian Ringgit boasted a large NDF market before 2017. The central bank, Bank Negara Malaysia, does not allow domestic entities trading in the offshore NDF market, but did not seriously enforce the ban until November 13, 2016, when they announced an explicit prohibition of domestic Malaysian banks from engaging in offshore NDF transactions.[24]

[24]More concretely, banks are required to attest that they do not trade in the NDF market, and 75% of export proceeds are mandated to convert back to MYR. Schmittmann and Teng (2020) discuss the policy



(a) All major currencies

(b) Dropping CLP, TWD, IDR

Figure 8: Changes in hedging cost and speculative net forward positions during COVID-19 across currencies

Notes: Figure 8 illustrates the correlation between the scale of reduction in currency speculative position and rise in hedging cost during the onset of the COVID-19 crisis. The y-axis in both panels refers to change in 3-month forward spread ($f_t - s_t$) between 2019Q4 and 2020Q2, which is expressed in percentage point. The x-axis in both panels indicates change (reduction) in currency speculative position between 2019Q4 and 2020Q2. The right panel removes three currencies (TWD, IDR, CLP) to make the plot more graphically interpretable. The definition of currency speculative position is defined in the same spirit of Equation (19). The change in currency speculative position is defined as:

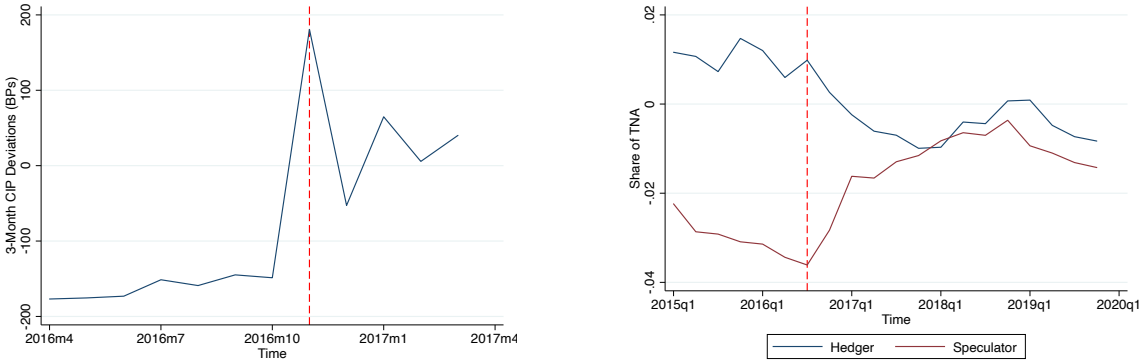
$$\Delta\text{Speculative Position}_{c,2020Q2} = \frac{\sum_i NFS_{ic,2020Q2} \times \mathbb{1}\{NFS_{ic,2020Q2} < 0\} - \sum_i NFS_{ic,2019Q4} \times \mathbb{1}\{NFS_{ic,2019Q4} < 0\}}{|\sum_i NFS_{ic,2019Q4} \times \mathbb{1}\{NFS_{ic,2019Q4} > 0\} + \sum_i NFS_{ic,2019Q4} \times \mathbb{1}\{NFS_{ic,2019Q4} < 0\}|}$$

.

Interpreted through the lens of our model, such ban would increase the hedging cost through the intermediation cost channel, by increasing the difficulty for the global intermediary to offload currency risk. Consistent with the model's prediction, we find that following the ban, 3-month CIP deviations spike by more than 200 basis points (Figure 9).[25] This is accompanied, in particular, by a substantial reduction of hedger funds' MYR hedging position. This event study suggests that the tighter FX regulation to discourage forward trading may have inadvertently pushed fund managers to use forward contracts to directly gain long exposure to MYR, as it becomes prohibitively expensive to hedge in the offshore market.

in detail.

[25]Speculator and hedger funds are defined based on the sign of average MYR net forward sale position for each fund from 2015Q1 to 2016Q3. As a result, a hedger's position can go negative after the shock.



(a) 3-Month CIP deviation

(b) Net forward sales

Figure 9: FX Hedging Cost and Speculative Positions around 2016Q4 for MYR

Notes: Figure 9 presents time-series of MYR's 3-month CIP deviation and FX net forward sale position of hedgers and speculators around the regulatory event in November 2016 that banned residents from trading in FX NDF markets. The definition of fund type is based on fund-level FX net forward sale position in MYR from 2015Q1 to 2016Q3. In particular, a fund is classified as a speculator in MYR if its average net forward sale position in MYR is strictly negative, and a hedger if its average net forward sale position in MYR is positive and the mean of its portfolio weight in MYR is non-zero.

6 Conclusion

Using novel data, we analyze currency hedging and speculating by international mutual funds focused on EM fixed income assets, and relate the empirical pattern to equilibrium exchange rate dynamics. Our findings show that the currency risk exposure of an average EM-focused investors are much bigger and wider than previously understood. We demonstrate that capital account restrictions could explain the degree of currency forward positions observed in data. We then unpack the average pattern of currency forward usage by separating funds into currency hedgers and speculators, and explore the key drivers of their currency risk management decisions and show how they differ in important dimensions. Based on these findings, we propose a partial equilibrium model of the offshore forward market that features heterogeneous market participants and market segmentation due to various forms of capital flow restrictions. The model sheds light on the dynamics of EM currency wedges and the relationship between hedging cost and policies that manage capital flow and derivative market integration.

This paper offers a unique perspective to rationalize the strong relationship between currency indices and global capital allocation and CIP deviations (Avdjiev, Du, Koch, & Shin, 2019; Jansen et al., 2023) and the currency crashes during global downturns (Brunnermeier et al., 2008). It provides a rare look into the market of offshore currency forwards, whose activities could move exchange rates substantially but have received little attention due to strong market segmentation and data limitation. The paper also opens up new avenues for future work to understand international shock spillovers through the FX derivative channel.

References

Adam, T., & Guettler, A. (2015). Pitfalls and perils of financial innovation: The use of cds by corporate bond funds. *Journal of Banking and Finance*, *55*, 204–214. Global Governance and Financial Stability. doi:https://doi.org/10.1016/j.jbankfin.2015.02.019

Avdjiev, S., Du, W., Koch, C., & Shin, H. S. (2019). The dollar, bank leverage, and deviations from covered interest parity. *American Economic Review: Insights*, *1*(2), 193–208. doi:10.1257/aeri.20180322

Ben Zeev, N., & Nathan, D. (2024). Shorting the dollar when global stock markets roar: The equity hedging channel of exchange rate determination. *The Review of Asset Pricing Studies*, *14*(4), 640–666. doi:10.1093/rapstu/raae012. eprint: https://academic.oup.com/raps/article-pdf/14/4/640/60678499/raae012.pdf

Bertaut, C. C., Bruno, V., & Shin, H. S. (2025). Original sin redux: Role of duration risk. *Available at SSRN*, *3820755*.

Black, F. (1990). Equilibrium exchange rate hedging. *The Journal of Finance*, *45*(3), 899–907.

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

Bräuer, L., & Hau, H. (2022, October). *Can Time-Varying Currency Risk Hedging Explain Exchange Rates?* (Swiss Finance Institute Research Paper Series No. 22-77). Swiss Finance Institute. Retrieved from https://ideas.repec.org/p/chf/rpseri/rp2277.html

Bräuer, L., & Hau, H. (2024, November). *Fund-Level FX Hedging Redux* (Swiss Finance Institute Research Paper Series No. 24-103). Swiss Finance Institute. Retrieved from https://ideas.repec.org/p/chf/rpseri/rp24103.html

Brunnermeier, M. K., Nagel, S., & Pedersen, L. H. (2008). Carry trades and currency crashes. *NBER Macroeconomics Annual*, *23*(1), 313–348.

Campbell, J. Y., Medeiros, K. S.-D., & Viceira, L. M. (2010). Global Currency Hedging. *Journal of Finance*, *65*(1), 87–121. doi:10.1111/j.1540-6261.2009.

Cerutti, E., & Zhou, H. (2024). Uncovering CIP deviations in emerging markets: Distinctions, determinants, and disconnect. *IMF Economic Review*, *72*(1), 196–252.

Cheema-Fox, A., & Greenwood, R. (2024). *How do global portfolio investors hedge currency risk?* Working Paper.

Choi, J., Kim, M., & Randall, O. (2024, June). Hidden Duration: Interest Rate Derivatives in Fixed Income Funds. SSRN Scholarly Paper. doi:10.2139/ssrn.4662054. Social Science Research Network: 4662054

De Leo, P., Keller, L., Simoncelli, G., Villamizar-Villegas, M., & Williams, T. (2025, February). Global Investors in Local-Currency Bond Markets: Implications for Bond Yields and Exchange Rates. SSRN Scholarly Paper. doi:10.2139/ssrn.5133549

De Leo, P., Keller, L., & Zou, D. (2024). *Speculation, forward exchange demand and CIP deviations in emerging economies*. Working Paper.

Du, W., & Huber, A. W. (2024). *Dollar asset holdings and hedging around the globe*. National Bureau of Economic Research.

Du, W., Im, J., & Schreger, J. (2018). The US treasury premium. *Journal of International Economics*, *112*, 167–181.

Du, W., & Schreger, J. (2016). Local currency sovereign risk. *The Journal of Finance*, *71*(3), 1027–1070.

Du, W., Tepper, A., & Verdelhan, A. (2018). Deviations from covered interest rate parity. *The Journal of Finance*, *73*(3), 915–957.

Fernández, A., Klein, M. W., Rebucci, A., Schindler, M., & Uribe, M. (2015). *Capital control measures: A new dataset*. National Bureau of Economic Research.

Glen, J., & Jorion, P. (1993). Currency Hedging for International Portfolios. *Journal of Finance*, *48*(5), 1865–1886. Retrieved from https://ideas.repec.org/a/bla/jfinan/v48y1993i5p1865-86.html

Hacioğlu-Hoke, S., Ostry, D., Rey, H., Planat, A. R., Stavrakeva, V., & Tang, J. (2024). *Topography of the fx derivatives market: A view from london*. Bank of England Staff Working Paper No. 1103.

Jansen, K. A., Shin, H. S., & von Peter, G. (2023). Which exchange rate matters to global investors? *SSRN Electronic Journal*. doi:10.2139/ssrn.4644609

Jiang, W., Ou, J., & Zhu, Z. (2021). Mutual fund holdings of credit default swaps: Liquidity, yield, and risk. *The Journal of Finance*, *76*(2), 537–586. doi:https://doi.org/10.1111/jofi.12996. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/jofi.12996

Jung, H., & Jung, J. ((2022). *Deviations from the law of one price across economies*. Working Paper.

Kalemli-Özcan, S., & Varela, L. (2022, May). *Five Facts about the UIP Premium* (CEPR Discussion Papers No. 16244). C.E.P.R. Discussion Papers. Retrieved from https://ideas.repec.org/p/cpr/ceprdp/16244.html

Kaniel, R., & Wang, P. (2022). Unmasking mutual fund derivative use. *Available at SSRN 3692838*.

Kim, J., & Kim, M. (2025). *Deciphering cip deviation: Who moves it and why it matters?* Working Paper.

Kremens, L. (2024). *Positioning risk*. Working Paper.

Kubitza, C., Sigaux, J.-D., & Vandeweyer, Q. (2024). Cross-currency basis risk and international capital flows. *Fama-Miller Working Paper, Chicago Booth Research Paper*, 24–18.

Liao, G., & Zhang, T. (2024). The hedging channel of exchange rate determination. *Forthcoming in Review of Financial Studies*.

Onen, M., Shin, H. S., & von Peter, G. (2023). *Overcoming original sin: Insights from a new dataset*. BIS Working Paper 1075.

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

Opie, W., & Riddiough, S. J. (2020). Global currency hedging with common risk factors. *Journal of Financial Economics*, *136*(3), 780–805.

Patel, N., & Xia, D. (2019). Offshore markets drive trading of emerging market currencies. *BIS Quarterly Review*. Retrieved from https://ideas.repec.org/a/bis/bisqtr/1912h.html

Schmittmann, J., & Teng, C. H. (2020). Offshore currency markets: Non-deliverable forwards (ndfs) in asia. *IMF Working Paper*.

Schmittmann, J. M., & Chua, H. T. (2020, September). *Offshore Currency Markets: Non-Deliverable Forwards (NDFs) in Asia* (IMF Working Papers No. 2020/179). International Monetary Fund. Retrieved from https://ideas.repec.org/p/imf/imfwpa/2020-179.html

Sialm, C., & Zhu, Q. (2024). Currency management by international fixed-income mutual funds. *The Journal of Finance*, *79*(6), 4037–4081. doi:https://doi.org/10.1111/jofi.13381. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/jofi.13381

Solnik, B. H. (1974). An equilibrium model of the international capital market. *Journal of Economic Theory*, *8*(4), 500–524. doi:https://doi.org/10.1016/0022-0531(74)90024-6

Tsiang, S. C. (1959). The Theory of Forward Exchange and Effects of Government Intervention on the Forward Exchange Market. *IMF Staff Papers*, *7*(1), 75–106. Retrieved from https://ideas.repec.org/a/pal/imfstp/v7y1959i1p75-106.html

Verdelhan, A. (2018). The share of systematic variation in bilateral exchange rates. *The Journal of Finance*, *73*(1), 375–418.

Zhou, H. (2024). The fickle and the stable: Global financial cycle transmission via heterogeneous investors. *Available at SSRN 4616182*.

Online Appendix

A Additional Figures and Tables

A.1 Data and basic statistics

JPMorgan Emerging Markets Debt Fund

SCHEDULE OF PORTFOLIO INVESTMENTS
AS OF NOVEMBER 30, 2018 (Unaudited) (continued)

Forward foreign currency exchange contracts outstanding as of November 30, 2018 (amounts in thousands):

Currency Purchased		Currency Sold		Counterparty	Settlement Date	Unrealized Appreciation (Depreciation) ($)
ARS	94,723	USD	2,287	BNP Paribas**	12/4/2018	223
USD	829	ARS	30,673	Barclays Bank plc**	12/4/2018	16
USD	1,738	ARS	64,050	BNP Paribas**	12/4/2018	41
CLP	286,571	USD	424	Goldman Sachs International**	12/19/2018	3
KRW	4,178,659	USD	3,701	Goldman Sachs International**	12/19/2018	32
KRW	518,713	USD	462	Merrill Lynch International**	12/19/2018	1
ARS	84,295	USD	2,120	BNP Paribas**	12/28/2018	39
CLP	6,131,806	USD	9,115	Merrill Lynch International**	12/28/2018	15
EUR	13,547	USD	15,349	HSBC Bank, NA	12/28/2018	26
TRY	58,160	USD	8,782	Merrill Lynch International	12/28/2018	2,215

Figure A1: An example of N-Q filing: JPMorgan Emerging Markets Debt Fund

FX Counterparty	Percent	FX Counterparty	Percent
ABN AMRO	0.00	ING Financial Markets Llc	0.08
ANZ	0.21	Industrial and Commercial Bank of China	0.10
AXA	0.00	JP Morgan	14.37
BBVA	0.00	Macquarie	0.01
BNP Paribas	5.95	Mimlic	0.00
BT Brokerage	0.01	Morgan Stanley	11.03
Banco Santander	0.39	National Australia Bank	0.03
Bank of Georgia	0.00	Natixis	0.00
Bank of America	5.15	Natwest	0.67
Bank of Montreal	1.27	Nomura	0.16
Bank of New York Mellon	0.00	Northern Trust Co	0.01
Bank of Nova Scotia	0.00	Payden	0.00
Barclays	8.54	Raiffeisen	0.00
Baring	0.00	Royal Bank of Canada	0.77
Brown Brothers Harriman	0.15	Scotiabank	0.00
Canadian Imperial Bank of Commerce	0.06	Siam Commercial Bank	0.02
Cantor Fitz & Co.	0.00	Societe Generale	0.01
Citigroup	14.21	Standard Bank	0.65
Commonwealth Bank of Australia	0.03	Standard Chartered	0.06
Credit Agricole	0.32	Standard and Poor's Securities	0.02
Credit Suisse	2.23	State Street	1.93
Danske Bank	6.13	Stifel, Nicolaus & Company	0.00
Den Norske Bank	0.00	Toronto Dominion	5.40
Deutsche Bank	5.40	Truist Securities, Inc.	0.00
Deutsche Boerse	0.00	UBS	4.54
Dresdner	0.00	VTB Capital Plc	0.02
Goldman Sachs	9.42	Wells Fargo	0.36
HC Istanbul	0.00	Westpac	0.21
HH Clearing Services	0.00		
HSBC	0.02		
Hencorp	0.00		
Highland Information Services	0.00		

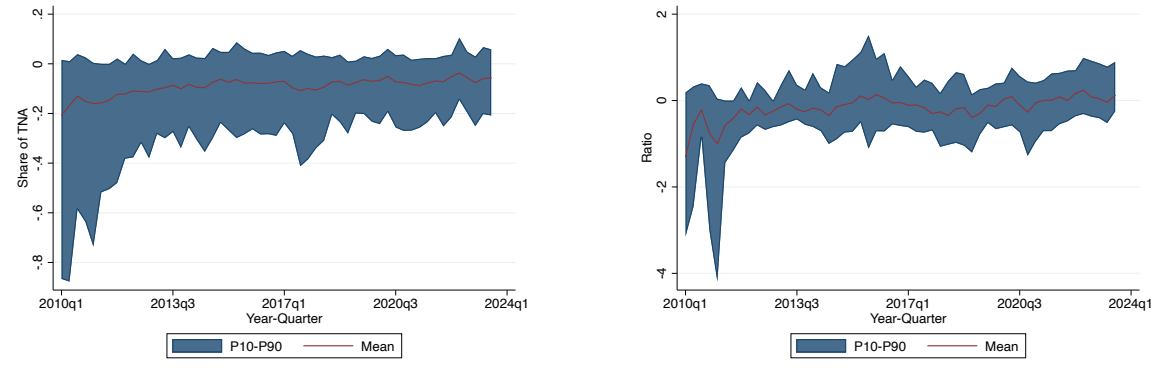
Table A1: List of FX counterparties

Notes: Table A1 tabulates the list of all FX counterparties (at parent level) in our sample. The second and fourth columns indicate the percentage of observations associated with each counterparty.

	Obs	Mean	STD	P25	P50	P75
Portfolio Weight of G9 (non-USD) Currencies	4387	0.02	0.05	0.00	0.00	0.02
Portfolio Currency Concentration	4387	0.61	20.07	0.09	0.14	0.37
Portfolio Weight of Sovereign Securities	4264	0.62	0.25	0.52	0.67	0.80
Portfolio Weight of Cash	4264	0.05	0.14	0.01	0.03	0.07
Maturity (Years)	4231	8.88	3.45	7.05	8.72	11.04
Management Fee	4028	0.33	0.79	0.22	0.55	0.71
Expense Ratio	4012	0.01	0.00	0.01	0.01	0.01
Turnover Ratio	3984	0.93	0.91	0.43	0.71	1.10
Institutional Share	4296	0.77	0.34	0.65	0.96	1.00
Observations	4387					

Table A2: Additional summary statistics: Fund-level

Notes: Table A2 presents additional summary statistics of the fund-quarter level data. The sample runs from 2010Q1 to 2023Q3.



(a) Net forward sale

(b) Hedge ratio

Figure A2: Time-series of fund-level FX forward usage

Notes: Figure A2 presents the time-series average of fund-level net forward sale position (scaled by total net assets) and hedge ratio from 2010Q1 to 2023Q3. The shaded area indicates the 10th and 90th percentiles of the corresponding variable.

	Benchmark	Ex. index/ETF	Ex. merger/liquidation
Hedge Ratio	-0.14	-0.16	-0.14
Net Forward Sales scaled by TNA	-0.09	-0.08	-0.09

Table A3: Robustness check: excluding ETF/index fund, and liquidated/merged share classes

Notes: Table A3 reports robustness check for hedge ratio and net forward sales under alternative sample selection criteria. Column (1) refers to our baseline sample. Column (2) is based on a sub-sample that excludes ETF and index funds. Column (3) is based on a sub-sample that excludes liquidated and merged share classes.

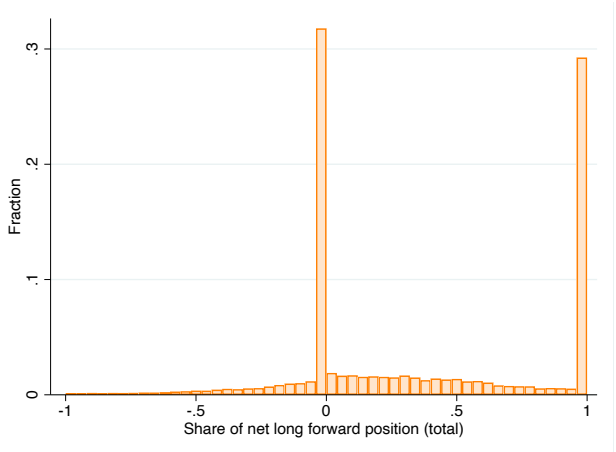


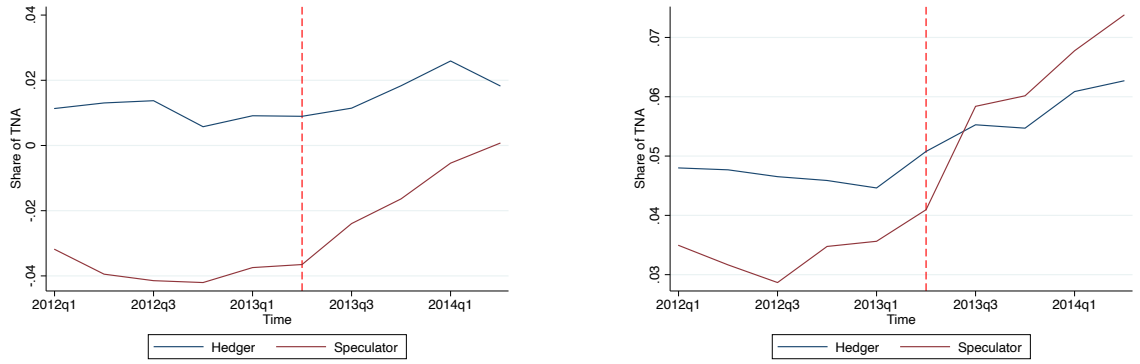
Figure A3: Histogram: share of net long forward position

Notes: Figure A3 presents histograms of share of net long forward position at fund-currency-quarter level, and illustrates the extent to which a fund's currency exposure is gained via net long forward or bond position. Our sample includes 20 major EM currencies, including BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR. The sample runs from 2010Q1 to 2023Q3.

A.2 Forward usage and capital controls: Additional evidence from Brazil

Brazil in June 2013 eliminated its tax on financial transactions in place since October 2009 as part of its macroprudential / capital flow management measures. According to Du and Schreger (2016), the tax (Imposto sobre Operações Financieras, IOF) ranges from 2% and 6% on foreign portfolio debt inflows. In the same period, a tax on notional amount of currency derivatives was also in place. Our analysis suggests that looser capital controls should incentivize fund managers to use local currency bond directly to get exposure to Brazilian Real, through a reduction in onshoring cost. For funds with ex-ante position in forward contracts, this shows up in a reduction of net forward sales position. For funds with existing currency hedges, this shows up in increases in the bond position, and also in net forward sales, if the fund aims to maintain a stable hedge ratio.

Applying our criterion of hedger funds and speculator funds to BRL, we indeed find speculator funds unwind their net forward sales position and allocate more of their assets to local currency bonds, while there is also a slight uptick in hedger funds' LC bond purchase and net BRL forward sales (Figure A4).



(a) Net forward sales **(b)** Bond position in BRL

Figure A4: FX net forward sale and bond position around 2013Q2 for BRL

Notes: Figure A4 presents time-series of BRL's FX net forward sale and bond position of hedgers and speculators around the regulatory event in June 2013 that removed the IOF on foreign investment. The definition of fund type is based on fund-level FX net forward sale position in BRL from 2010Q1 to 2013Q1. In particular, a fund is classified as a speculator in BRL if its average net forward sale position in BRL is strictly negative, and a hedger if its average net forward sale position in BRL is positive and the mean of its portfolio weight in BRL is non-zero.

A.3 Speculator and hedger funds: Additional results

Year	Speculator	Hedger	Non-FX User	Total
2010	19	15	5	39
2011	39	17	11	67
2012	43	22	13	78
2013	53	29	17	99
2014	56	30	16	102
2015	57	31	16	104
2016	56	32	16	104
2017	54	34	14	102
2018	54	33	13	100
2019	48	30	13	91
2020	43	26	9	78
2021	43	25	10	78
2022	45	25	8	78
2023	41	23	10	74

Table A4: Fund type over time

Table A4 tabulates the number of speculator and hedger funds over time. A fund is classified as a speculator fund if the time-series average of its net forward sale position across all currencies is strictly negative, and a hedger if the mean of its net forward sale position is positive and the mean of its portfolio weight is non-zero. The sample runs from 2010Q1 to 2023Q3.

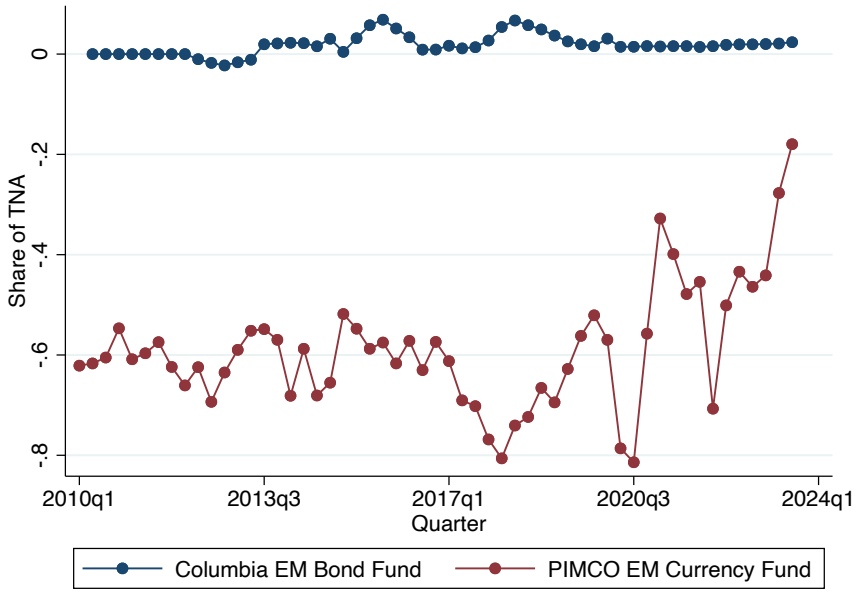


Figure A5: Example: Speculator and hedger funds

Notes: Figure A5 presents the time-series average of net forward sale position of two funds in our sample – PIMCO EM Currency and Short-term Investment Fund (speculator) and Columbia EM Bond Fund (hedger). A fund is classified as a speculator fund if the time-series average of its net forward sale position across all currencies is strictly negative, and a hedger if the mean of its net forward sale position is positive.

	Hedger		Speculator		Mean Diff.
	mean	sd	mean	sd	t
Hedge	0.81	(0.39)	0.92	(0.27)	-1.65
Synthetic Exposure	0.81	(0.39)	0.90	(0.30)	-1.35
Return Enhancement	0.42	(0.50)	0.35	(0.48)	0.69
Index Benchmark	0.98	(0.15)	0.92	(0.27)	1.22
Observations	43		68		111

Table A5: Hedger and speculator funds: Information from prospectus

Table A5 summarizes the derivative strategies for speculator and hedger funds based on the verbal description in their prospectuses (SEC filing N-1 or 497K). "Hedge", "Synthetic Exposure", and "Return Enhancement" indicates the proportion of funds that state to be using FX derivatives to hedge, gain synthetic exposure, and enhance return, respectively. "Index Benchmark" indicates the proportion of funds that state at least one benchmark index (for performance comparison) in their prospectuses. A fund is classified as a speculator if the time-series average of its net forward sale position across all currencies is strictly negative, and a hedger if the mean of its net forward sale position is positive. The sample runs from 2010Q1 to 2023Q3.

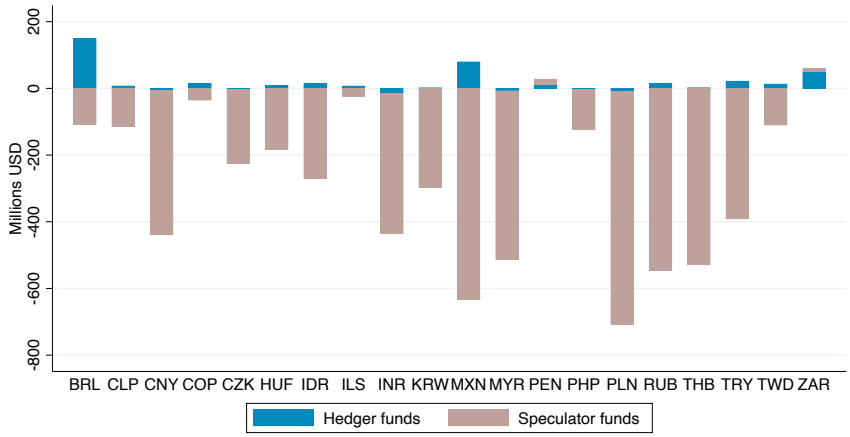


Figure A6: Speculator and hedger fund share of net forward sales in each currency

Notes: Figure A6 plots the net forward sales position of speculator and hedger funds identified in Section 4, aggregated to the currency level. The sample runs from 2010Q1 to 2023Q3.

	Speculator fund		Hedger fund	
	(1)	(2)	(3)	(4)
Lag-1 Portfolio Weight	0.147***	0.057	0.406***	0.336***
	(0.025)	(0.038)	(0.060)	(0.070)
Lag-1 Momentum	-0.001	-0.012	0.005	-0.003
	(0.012)	(0.015)	(0.006)	(0.005)
Lag-1 1-Month CIP Deviation	0.028***	0.031**	-0.000	0.008*
	(0.009)	(0.013)	(0.004)	(0.005)
Lag-1 Currency Volatility	-0.061**	-0.146***	0.002	-0.031
	(0.027)	(0.043)	(0.026)	(0.026)
Lag-1 Momentum × Weight		0.004		0.005**
		(0.002)		(0.002)
Lag-1 CIP × Weight		0.001		-0.008*
		(0.003)		(0.004)
Lag-1 Volatility × Weight		0.031***		0.022
		(0.007)		(0.016)
Fund-by-Quarter FE	✓	✓	✓	✓
R-squared	0.336	0.339	0.351	0.353
N	31719	31719	8104	8104

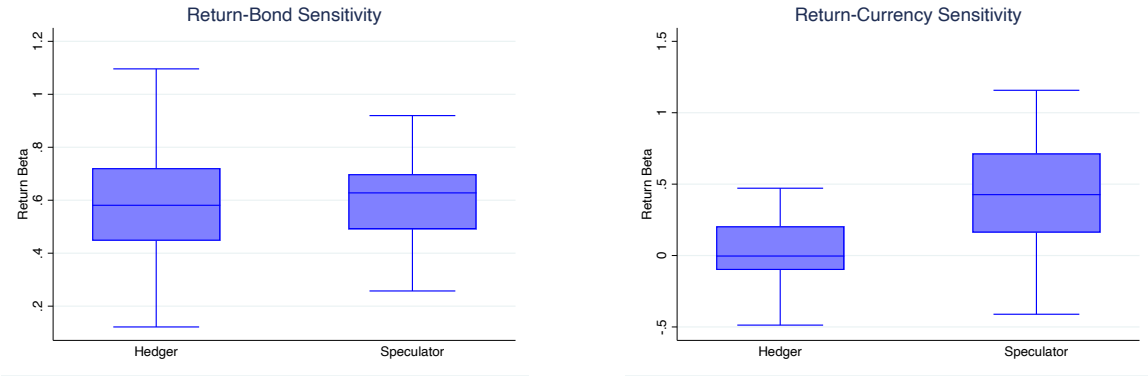
Table A6: Predicting net forward sales using currency characteristics: By fund type (1-month horizon)

Notes: Table A6 reports regression results based on Equation (8) in understanding the currency-level determinants of currency forward positions by different types of U.S. EM-focused mutual funds. A fund is classified as a speculator fund if the time-series average of its net forward sale position across all currencies is strictly negative, and a hedger if the mean of its net forward sale position is positive and the mean of its portfolio weight is non-zero. The dependent variable is the net forward sale position of fund i in currency c at time t. The independent variables include momentum (computed by spot exchange rate return), 1-month CIP deviation, currency volatility (computed by past 12 months' exchange rate volatility). All independent variables are lagged by one quarter. Both dependent and independent variables are converted to percentage terms. Standard errors in parentheses are double-clustered by fund and time. The estimation is based on the sample period from 2010Q1 to 2023Q3. Our sample currencies include major EM currencies with sufficiently active foreign exchange markets and for which we have substantial data coverage on hedging cost: BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR.

	Speculator fund				Hedger fund			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lag-1 Portfolio Weight	0.147***	0.055	0.146***	0.057	0.406***	0.333***	0.406***	0.335***
	(0.025)	(0.039)	(0.025)	(0.039)	(0.059)	(0.069)	(0.060)	(0.070)
Lag-1 Momentum	0.001	-0.011	-0.000	-0.012	0.005	-0.003	0.006	-0.003
	(0.012)	(0.016)	(0.012)	(0.016)	(0.006)	(0.005)	(0.006)	(0.005)
Lag-1 3-Month CIP Deviation	0.053***	0.060***			0.004	0.016*		
	(0.013)	(0.019)			(0.009)	(0.009)		
Lag-1 1-Month CIP Deviation			0.030***	0.034**			-0.001	0.008
			(0.009)	(0.013)			(0.004)	(0.005)
Lag-1 Currency Volatility	-0.063**	-0.157***	-0.058**	-0.146***	0.000	-0.037	0.002	-0.033
	(0.027)	(0.045)	(0.027)	(0.045)	(0.028)	(0.028)	(0.027)	(0.027)
Lag-1 Momentum × Weight		0.004		0.004		0.005***		0.005**
		(0.002)		(0.002)		(0.002)		(0.002)
Lag-1 CIP3M × Weight		0.001				-0.010		
		(0.005)				(0.009)		
Lag-1 CIP1M × Weight				0.001				-0.008*
				(0.003)				(0.004)
Lag-1 Volatility × Weight		0.032***		0.030***		0.023		0.023
		(0.008)		(0.008)		(0.016)		(0.016)
Fund-by-Quarter FE	✓	✓	✓	✓	✓	✓	✓	✓
R-squared	0.233	0.237	0.233	0.236	0.351	0.353	0.350	0.353
N	30301	30301	30301	30301	7882	7882	7882	7882

Table A7: Predicting net forward sales using currency characteristics: By fund type (excluding fund-quarters with zero EM local currency holding)

Notes: Table A7 reports regression results based on Equation (8) in understanding the currency-level determinants of currency forward positions by different types of U.S. EM-focused mutual funds. For robustness check, fund-quarters with zero holding in EM currencies are excluded. A fund is classified as a speculator fund if the time-series average of its net forward sale position across all currencies is strictly negative, and a hedger if the mean of its net forward sale position is positive and the mean of its portfolio weight is non-zero. The dependent variable is the net forward sale position of fund i in currency c at time t. The independent variables include momentum (computed by spot exchange rate return), 1-month CIP deviation, currency volatility (computed by past 12 months' exchange rate volatility). All independent variables are lagged by one quarter. Both dependent and independent variables are converted to percentage terms. Standard errors in parentheses are double-clustered by fund and time. The estimation is based on the sample period from 2010Q1 to 2023Q3. Our sample currencies include major EM currencies with sufficiently active foreign exchange markets and for which we have substantial data coverage on hedging cost: BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR.



(a) Return-bond sensitivity **(b)** Return-currency sensitivity

Figure A7: Return beta to bond and currency returns: Speculator vs. hedger funds

Notes: Figure A7 presents the box plots of fund-return beta to bond and currency returns for speculator and hedger funds. The center line of each box represents the median of a variable. The bottom and top of each box represents 25th and 75th percentile of a variable, respectively. Bond return is measured by JPMorgan GBI-EM index return, and currency return is measured by a simple average of FX spot return across 20 major EM currencies, including BRL, CLP, CNY, COP, CZK, HUF, IDR, ILS, INR, KRW, MXN, MYR, PEN, PHP, PLN, RUB, THB, TRY, TWD, ZAR. The sample runs from 2010Q1 to 2023Q3.

B Proofs

B.1 Proof of Proposition 2

We start with the equation for the equilibrium relative currency wedge after applying the market clearing condition. Note that Equation (15) can be rearranged as:

$$\frac{S_0}{F} - \mathbb{E}\Big[\frac{S_0}{S_1}\Big] = -(1+r)\Big(\frac{1-(1-\theta)\lambda(\kappa_f)}{2(1-\lambda(\kappa_f))c} + \frac{1}{\gamma_s Var(S_0/S_1)} + \frac{1}{\gamma_h Var(S_0/S_1)}\Big)^{-1}\Big[\omega + \kappa_b^{-1}\cdot\Big(\frac{S_0}{F}(1+r)-1\Big)\Big] \tag{20}$$

Therefore, a sufficient condition to ensure a negative gap between forward premium and expected appreciation of the peso is $\frac{S_0}{F}(1+r)-1 > 0$. This condition also ensures the positivity of global intermediary's supply of hedging services, as well as the speculator's optimal weight in onshore bond allocation.

Applying (15), we can express the CIP deviation as:

$$\frac{S_0}{F}(1+r)-1 = \frac{UIP\cdot C(\kappa_f) - \omega(1+r)^2}{C(\kappa_f) + \frac{(1+r)^2}{\kappa_b}}.$$

A positive CIP deviation corresponds to

$$C(\kappa_f) = \alpha(\kappa_f) + \frac{1}{\gamma_s Var(S_0/S_1)} + \frac{1}{\gamma_h Var(S_0/S_1)} > \frac{\omega(1+r)^2}{UIP} \tag{21}$$

and as a result, a sufficient condition for (21) is such that

$$\frac{1}{\gamma_s Var(S_0/S_1)} > \frac{\omega(1+r)^2}{UIP}$$

and we obtain (17).

Comparative statics 1: $\frac{\partial S_0/F}{\partial \kappa_f} < 0$ Taking the partial derivative of (15) with respect to κ_f, we have:

$$\frac{\partial S_0/F}{\partial \kappa_f} = \frac{\alpha'(\kappa_f)\left[\mathbb{E}[\frac{S_0}{S_1}]\frac{(1+r)^2}{\kappa_b} - \frac{1+r}{\kappa_b} + \omega(1+r)\right]}{[C(\kappa_f) + \frac{(1+r)^2}{\kappa_b}]^2} \tag{22}$$

Given the definition of $\alpha(\kappa_f) = \frac{1-(1-\theta)\lambda(\kappa_f)}{2(1-\lambda(\kappa_f))c}$, it is straightforward to show that $\alpha'(\kappa_f) = \frac{\theta\lambda'(\kappa_f)}{2c(1-\lambda(\kappa_f))^2} < 0$. Thus, a sufficient condition to ensure $\frac{\partial S_0/F}{\partial \kappa_f} < 0$ is:

$$\mathbb{E}[\frac{S_0}{S_1}]\frac{(1+r)^2}{\kappa_b} - \frac{1+r}{\kappa_b} + \omega(1+r) > 0 \tag{23}$$

Rearranging the inequality, we have:

$$\kappa_b > -\omega^{-1}\Big(\mathbb{E}[\frac{S_0}{S_1}](1+r) - 1\Big) \tag{24}$$

As $\kappa_b > 0$, (24) is satisfied as long as $\mathbb{E}[\frac{S_0}{S_1}](1+r) - 1 > 0$.

Comparative static 2: $\frac{\partial S_0/F}{\partial \kappa_b} > 0$ Taking the partial derivative of (15) with respect to κ_b, we have:

$$\frac{\frac{1+r}{\kappa_b^2}\Big(C(\kappa_f)(\mathbb{E}[\frac{S_0}{S_1}](1+r) - 1) - \omega(1+r)^2\Big)}{[C(\kappa_f) + \frac{(1+r)^2}{\kappa_b}]^2} \tag{25}$$

Given the definition of $C(\kappa_f)$, $\frac{\partial S_0/F}{\partial \kappa_b} > 0$ is equivalent to

$$\alpha(\kappa_f) > \omega(1+r)^2\Big(\mathbb{E}[\frac{S_0}{S_1}](1+r) - 1\Big)^{-1} - \frac{1}{\gamma_s Var(S_0/S_1)} - \frac{1}{\gamma_h Var(S_0/S_1)} \tag{26}$$

Note that this is the same condition as in (21), which leads to (17) as a sufficient

condition.

Partial hedge Finally, we have to find sufficient conditions to ensure that the hedger's optimal hedging demand is positive, i.e. $\tilde{h} > 0$. We prove that the sufficient conditions are (17) and (18), and we further show that under these conditions, the hedger only partially hedges.

By market clearing, we have:

$$\tilde{h} = \tilde{h}_s + \tilde{h}_I = \left(\alpha + \frac{1}{\gamma_s \sigma^2}\right) \cdot \frac{(1+r)(\omega + \omega_s(\cdot))}{C(\cdot)} - (1+r)\omega_s(\cdot). \tag{27}$$

To ensure $\tilde{h} > 0$, the right hand side must be larger than zero. We use $C(\cdot)$ and $\omega_s(\cdot)$ to track C's dependence on γ_h. To ease notation, we express $\alpha(\kappa_f)$ as α, and $Var(S_0/S_1)$ as σ^2.

Rearranging the implied inequality: Given (17), we have $\omega_s(\cdot) > 0$, so that the condition is equivalent to

$$\frac{\omega + \omega_s(\cdot)}{\omega_s(\cdot)} > \frac{C(\cdot)}{\alpha + \frac{1}{\gamma_s \sigma^2}}. \tag{28}$$

Observe that using the definition of $C(\cdot)$, we can rewrite this inequality to

$$\frac{\omega}{\omega_s(\cdot)} > \frac{\gamma_s}{\alpha \gamma_s \sigma^2 + 1} \cdot \gamma_h^{-1} \tag{29}$$

or

$$\frac{\gamma_h}{\omega_s(\cdot)} > \frac{\gamma_s}{\omega} \cdot \frac{1}{\alpha \gamma_s \sigma^2 + 1}. \tag{30}$$

Then (18) follows. It is straightforward to show that $\partial \omega_s(\cdot)/\partial \gamma_h < 0$ if $UIP > 0$.

First, by substituting the equilibrium forward premium in (15) into (11), we have:

$$\omega_s = \frac{C(\kappa_f)\left(\mathbb{E}\left[\frac{S_0}{S_1}\right](1+r)-1\right) - \omega(1+r)^2}{\kappa_b C(\kappa_f) + (1+r)^2} \tag{31}$$

Taking partial derivative with respect to γ_h gives us:

$$\frac{\partial \omega_s}{\gamma_h} = \frac{-\frac{(1+r)^2}{\sigma^2\gamma_h^2}(UIP + \omega\kappa_b)}{(\kappa_b C(\kappa_f) + (1+r)^2)^2} < 0. \tag{32}$$

The intuition is that a less risk-averse hedger would reduce hedging demand through forward, lowering the gain from hedging service provision and leads the speculator to substitute to bond investment. As a result, when γ_h is sufficiently large, the inequality would be satisfied.

Simple algebra allows us to express the optimal hedging demand as

$$\tilde{h} = \omega(1+r) - \frac{(1+r)[C(\kappa_f)]^{-1}(\omega+\omega_s)}{\gamma_h Var(S_0/S_1)} \tag{33}$$

$$= \frac{\omega(1+r)\left[\gamma_h Var(S_0/S_1)\left(\alpha(\kappa_f) + \gamma_s^{-1}Var(S_0/S_1)^{-1}\right)\right] - \omega_s(1+r)}{1+\gamma_h Var(S_0/S_1)\left(\alpha(\kappa_f) + \gamma_s^{-1}Var(S_0/S_1)^{-1}\right)} \tag{34}$$

$$= \omega(1+r)\xi - \omega_s(1+r), \tag{35}$$

where $\xi = \frac{\gamma_h Var(S_0/S_1)\left(\alpha(\kappa_f)+\gamma_s^{-1}Var(S_0/S_1)^{-1}\right)}{1+\gamma_h Var(S_0/S_1)\left(\alpha(\kappa_f)+\gamma_s^{-1}Var(S_0/S_1)^{-1}\right)} \in (0,1)$.

Since $\omega_s > 0$ in equilibrium, it is straightforward to show that $\tilde{h} \in (0, \omega(1+r))$.

C A mean-variance model of optimal hedging

We sketch a simple mean-variance framework following Du and Huber (2024) to take the empirical hedge ratio to the data. Consider a representative US investor with mean-variance preference. The investor chooses to invest in the US or a foreign country j, which are denominated in USD and foreign currency, respectively. Within her investment in country j, she can choose to hedge the currency risk in country j or not.

Denote log excess return on USD and foreign currency assets in country j as:

$$rx^{\$}_{t+1} = r^{\$}_{t+1} - rf^{\$}_{t} \tag{B1}$$

$$rx^{j}_{t+1} = r^{j}_{t+1} - rf^{j}_{t} \tag{B2}$$

Define the log spot exchange rate of foreign currency per USD as s_t. Then, log excess return on non-hedged foreign currency asset is:

$$rx^{j,NH}_{t+1} = r^{j}_{t+1} - \Delta s_{t+1} - rf^{\$}_{t} \tag{B3}$$

$$= (r^{j}_{t+1} - rf^{j}_{t}) + \underbrace{(rf^{j}_{t} - rf^{\$}_{t} - \Delta s_{t+1})}_{:=rx^{FX}_{t+1}} \tag{B4}$$

$$= rx^{j}_{t+1} + rx^{FX}_{t+1} \tag{B5}$$

If the investor chooses to hedge the foreign currency assets, the log excess return is:

$$rx^{j,H}_{t+1} \approx r^{j}_{t+1} - (f_t - s_t) - rf^{\$}_{t} \tag{B6}$$

$$= (r^{j}_{t+1} - rf^{j}_{t}) + \underbrace{(rf^{j}_{t} - rf^{\$}_{t} - (f_t - s_t))}_{:=x_t} \tag{B7}$$

$$= rx^{j}_{t+1} + x_t \tag{B8}$$

Effectively, there are three types of assets for the investor to choose: USD asset, hedged foreign currency asset, non-hedged foreign currency asset. Define w_j as the

portfolio weight on the foreign currency asset, and $w_{j,NH}$ as the weight on non-hedged foreign currency asset in country j. By complementarity, the weight on hedged foreign currency asset is $w_j - w_{j,NH}$.

The investor chooses portfolio weights to maximizes her mean-variance utility:

$$\max_{w_j, w_{j,NH}} \mathbb{E}[rx_{t+1}^P] - \frac{\gamma}{2}\mathbb{V}[rx_{t+1}^P], \tag{B9}$$

where

$$\begin{aligned} rx_{t+1}^P &= (1-w_j)rx_{t+1}^{\$} + w_{j,NH}(rx_{t+1}^j + rx_{t+1}^{FX}) + (w_j - w_{j,NH})(rx_{t+1}^j + x_t) && \text{(B10)} \\ &= (1-w_j)rx_{t+1}^{\$} + w_j rx_{t+1}^j + w_{j,NH} rx_{t+1}^{FX} + (w_j - w_{j,NH})x_t && \text{(B11)} \end{aligned}$$

Now, the expected return and variance on the entire portfolio can be computed as:

$$\mathbb{E}[rx_{t+1}^P] = (1-w_j)\overline{rx}^{\$} + w_j\overline{rx}^j + w_{j,NH}\overline{rx}^{FX} + (w_j - w_{j,NH})x \tag{B12}$$

$$\begin{aligned} \mathbb{V}[rx_{t+1}^P] = (1-w_j)^2\sigma_{\$}^2 + w_j^2\sigma_j^2 + w_{j,NH}^2\sigma_{FX}^2 \\ + 2w_j(1-w_j)\sigma_{\$,j} + 2w_{j,NH}(1-w_j)\sigma_{\$,FX} + 2w_j w_{j,NH}\sigma_{j,FX} \end{aligned} \tag{B13}$$

The optimal portfolio weights are:

$$w_j = \frac{(\sigma_{j,FX} - \sigma_{\$,FX})(\overline{rx}^{FX} - x - \gamma\sigma_{\$,FX}) - \sigma_{FX}^2(\overline{rx}^j - \overline{rx}^{\$} + x - \gamma\sigma_{\$,j} + \gamma\sigma_{\$}^2)}{\gamma[(\sigma_{\$,FX} - \sigma_{j,FX})^2 - \sigma_{FX}^2\sigma_{j-\$}^2]}, \tag{B14}$$

$$w_{j,NH} = \frac{\gamma\sigma_{\$,FX}(\sigma_j^2 - \sigma_{\$,j}) + \gamma\sigma_{j,FX}(\sigma_{\$}^2 - \sigma_{\$,j}) + (\sigma_{j,FX} - \sigma_{\$,FX})(\overline{rx}^j - \overline{rx}^{\$} + x) + \sigma_{j-\$}^2(x - \overline{rx}^{FX})}{\gamma[(\sigma_{\$,FX} - \sigma_{j,FX})^2 - \sigma_{FX}^2\sigma_{j-\$}^2]}, \tag{B15}$$

where $\sigma_{j-\$}^2 = (\sigma_j - \sigma_{\$})^2$.

The implied hedge ratio is then:

$$\text{HR}_j = \frac{w_j - w_{j,NH}}{w_j} \tag{B16}$$

C.1 Mapping Model Prediction to Data

We use monthly data on bond and currency pricing from 2000m1 to 2021m2 as model input, and then predict hedge ratio for each currency according to equation B16. Then, we compare predicted hedge ratio with observed hedge ratio from 2021Q2 to 2023Q2 in our sample.[26] We focus on one- and three-month horizons.

For bond returns, we compute holding period return based on 10-year government bond pricing data from Du and Schreger (2016) and Du, Im, and Schreger (2018). For currency return and hedging cost, we compute currency excess return and CIP deviation based on data from Cerutti and Zhou (2024). Risk aversion γ in the benchmark calibration is set to 0.1.

In particular, for bonds, (annualized) one-month holding period return can be computed as:

$$rx^j_{t+1} = y_{10Y,t} - 119\Delta y_{10Y,t+1} - rf^j_t, \tag{B17}$$

where $y_{10Y,t}$ is the continuously compounded yield of 10-year government bond in country j, and rf^j_t is one-month IBOR of country j.

Next, we compute one-month currency return with one-month IBOR and spot exchange rate:

$$rx^{FX}_{t+1} = rf^j_t - rf^\$_t - 12\Delta s_{t+1} \tag{B18}$$

One-month hedging cost (i.e., one-month CIP deviations) is computed as in equation

[26] Our results are robust to different input and prediction time ranges.

1 of Section 2.

With overlapping monthly frequency, three-month holding period return of bonds can be computed by:

$$rx^j_{t+1} = y_{10Y,t-2} - 39(y_{10Y,t+1} - y_{10Y,t-2}) - rf^j_{t-2}, \tag{B19}$$

where $y_{10Y,t}$ is the continuously compounded yield of 10-year government bond in country j, and rf^j_t is three-month IBOR of country j.

Similarly, three-month currency return can be computed by:

$$rx^{FX}_{t+1} = rf^j_{t-2} - rf^{\$}_{t-2} - 4(s_{t+1} - s_{t-2}) \tag{B20}$$

Based on this portfolio choice framework, we calculate the variance-covariance matrix associated with EM currency and bond returns. We focus on the 1- and 3-month horizons, since these are the main tenors of the contracts in our granular data.[27] Table B1 compares the optimal hedge ratio predicted from the model (column 1) to the hedge ratio we calculate from the mutual fund data. For most currencies, we are able to match the sign of the ratios, indicating that the pattern of a negative hedge ratio on average, instead of implying a general missed opportunity for EM-focused funds to reduce their currency risk exposure, may be consistent with the risk-return tradeoffs and the cost of hedging these investors are actually facing. Moreover, given the risk-return characteristics in the data, a very low degree of risk aversion is necessary to generate a negative hedge ratio.[28]

[27] Our benchmark estimation focuses on 1-month horizon, and in unreported tables, we test the robustness of our benchmark results under 3-month horizon.

[28] In our benchmark calibration, we set risk aversion γ to 0.1. In Appendix C.2, we provide additional results on comparative statistics, by plotting optimal hedge ratios against the risk aversion parameter.

Currency	Predicted Hedge Ratio	Observed Hedge Ratio
BRL	-	-
CNY	-	-
COP	+	-
HUF	+	-
IDR*	-	-
ILS	+	+
INR	-	-
KRW	+	-
MXN	+	-
MYR	+	-
PEN	+	+
PHP	-	-
PLN	+	-
RUB*	-	-
THB	-	-
TRY*	-	-
ZAR	+	+

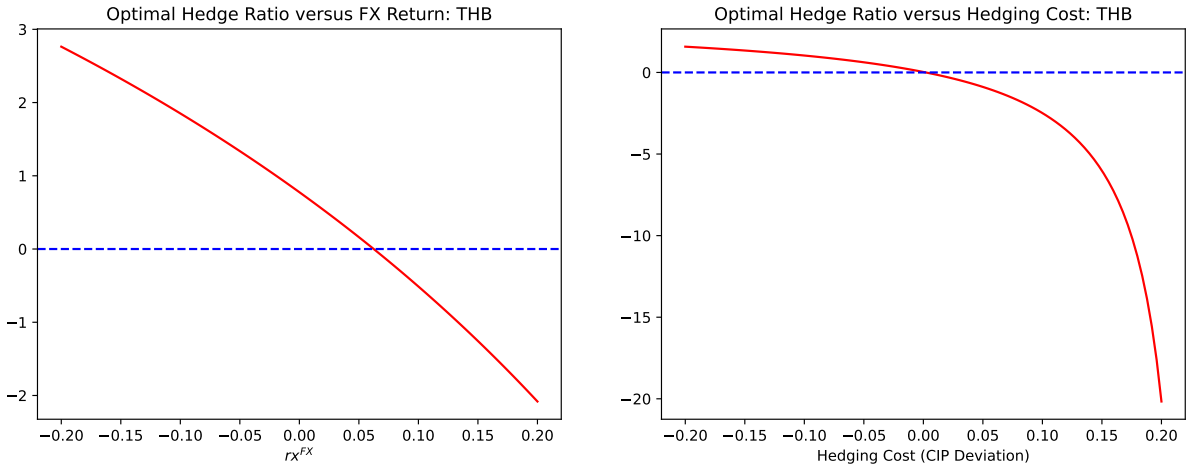
Table B1: Signs of model-predicted versus observed hedge ratio

Notes: Table B1 compares the predicted hedge ratio from the optimal portfolio choice model versus observed hedge ratios in our sample. We use data on monthly bond and currency returns from 2000M1 to 2021M2 as model input, and then predict hedge ratio for each currency. Then, we compare predicted hedge ratio with average observed hedge ratio from 2021Q2 to 2023Q3 in our sample. For bond returns, we compute one-month holding period return based on 10-year government bond pricing data from Du and Schreger, 2016 and Du, Im, and Schreger, 2018. For currency return and hedging cost, we compute one-month currency return and 1-month CIP deviation based on data from Cerutti and Zhou, 2024. We also test robustness of our results using 3-month holding period return and 3-month CIP deviation as an alternative measure for hedging cost. Risk aversion γ in this benchmark calibration is set to 0.1. For currencies denoted with $*$, we compare their predicted and observed net forward sale position scaled by total net assets, because we impose non-negative constraint on the underlying risky assets and these currencies have binding constraints (i.e., negative predicted weights). Model details can be found in Appendix C.

C.2 Comparative Statics: A numerical example

Here, we present a numerical example of Thailand baht (THB). In particular, we plot optimal hedge ratio by varying the level of currency return, hedging cost, and risk aversion, holding all else equal. In this exercise, we focus on one-month holding period.

Figure B1 shows that higher FX return and higher hedging cost could lead a mean-variance investor to amplify her currency risk exposure by taking negative hedge ratio. Figure B2 highlights the role of risk aversion in optimal hedging decision. In particular, given the risk-return characteristics of THB bond and currency returns, as well as hedging cost, a low level of risk aversion is essential to generate a negative hedge ratio.



(a) FX return **(b)** Hedging cost

Figure B1: Optimal hedge ratio, FX return, and hedging cost: The case of THB

Notes: Figure B1 shows the relationship between the model-implied optimal hedge ratio and FX return and hedging cost, given returns of Thailand and US government local currency bonds, as well as variance-covariance matrix of bond and FX returns. Left panel plots optimal hedge ratio against FX return and right panel plots optimal hedge ratio against hedging cost. The following parameters are estimated based on a monthly sample from 2000m1 to 2021m2: $\sigma_j^2 = 7.47$, $\sigma_\$^2 = 6.4$, $\sigma_{FX}^2 = 2.84$, $\sigma_{\$,j} = 3.13$, $\sigma_{j,FX} = 0.89$, $\sigma_{\$,FX} = 0.30$, $\overline{rx}^j = 0.28$, $\overline{rx}^\$ = 0.30$, $\overline{rx}^{FX} = 0.16$, $x = -0.07$, $\gamma = 0.1$. Each plot is generated by varying the variable of interest and holding all others fixed.

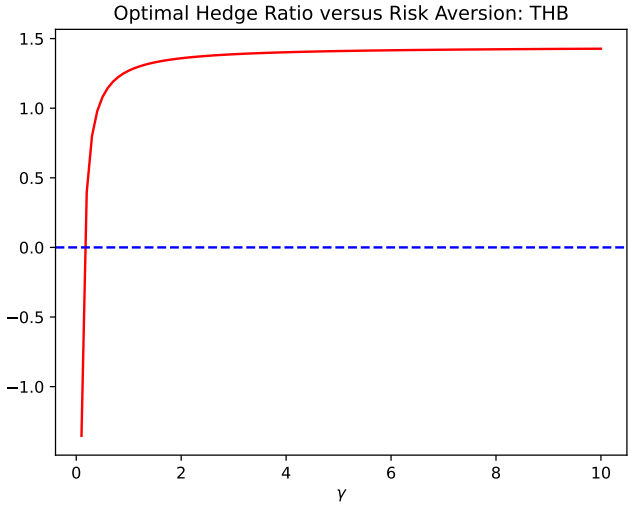


Figure B2: Optimal hedge ratio and risk aversion: The case of THB

Notes: Figure B2 presents how optimal hedge ratio of THB responds to risk appetite, given returns of Thailand and US government local currency bonds, as well as variance-covariance matrix of bond and FX returns. The following parameters are estimated based on a monthly sample from 2000m1 to 2021m2: $\sigma_j^2 = 7.47$, $\sigma_{\$}^2 = 6.4$, $\sigma_{FX}^2 = 2.84$, $\sigma_{\$,j} = 3.13$, $\sigma_{j,FX} = 0.89$, $\sigma_{\$,FX} = 0.30$, $\overline{rx}^j = 0.28$, $\overline{rx}^{\$} = 0.30$, $\overline{rx}^{FX} = 0.16$, $x = -0.07$. The plot is generated by varying the variable of interest and holding all others fixed.