Discussion Paper Series – CRC TR 224

Discussion Paper No. 717
Project C 02

Dominant Currency Pricing and Currency Risk Premia

Husnu C. Dalgic[1]
Galip Kemal Ozhan[2]

December 2025

[1] Department of Economics, University of Mannheim. URL: https://sites.google.com/view/husnucdalgic/.
Email: dalgic@uni-mannheim.de
[2] 700 19th St NW 20431 Washington, D.C. U.S.A. URL: http://galipkemalozhan.com.
Email: gozhan@gmail.com

Support by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) through CRC TR 224 is gratefully acknowledged.

Collaborative Research Center Transregio 224 - www.crctr224.de
Rheinische Friedrich-Wilhelms-Universität Bonn - Universität Mannheim

Dominant Currency Pricing and Currency Risk Premia[*]

Husnu C. Dalgic[†] Galip Kemal Ozhan[‡]

Mannheim IMF and NBER

November 13, 2025

Abstract

This paper argues that currency risk premia are an endogenous outcome of a country's fundamental trade and financial structures. Empirically, we isolate global risk factors from currency returns and show that a country's exposure to these factors is jointly determined by its share of dollar invoicing and its net foreign debt position. We then develop a small open-economy model with dominant-currency pricing (DCP) and dollar-denominated liabilities to explain the underlying mechanism. The model demonstrates that empirically plausible risk premia require the interaction of both frictions. High dollar invoicing mutes the expenditure-switching channel, while high dollar debt creates a potent, contractionary financial channel. Together, these frictions make currency depreciations recessionary (countercyclical), rendering the currency a poor hedge and "risky" for investors. We show this has a first-order policy consequence: the resulting risk premium raises the economy's neutral interest rate, leading to structurally high inflation under a standard Taylor rule. Our results show how trade and financial frictions jointly create currency risk and pose a fundamental challenge for monetary policy

[*]Previously circulated under the title, "Global Shocks and Local Response: Currency Risk and Monetary Policy." We benefited from discussions with Kenza Benhima, Emine Boz, Lawrence Christiano, Pierre-Olivier Gourinchas, Max Gödl, Şebnem Kalemli-Ozcan, Ralph Luetticke, Dmitry Mukhin (discussant), Hélène Rey, and Dimitri Vayanos. We are also grateful to audiences at the CEPR International Macro and Finance Annual Meeting at the University of Lausanne, CEPR-RISE Workshop at Waseda University, 25th Central Bank Macroeconomic Modeling Workshop, International Macroeconomics and Finance Conference at Peking University, Berlin Schumpeter Lecture in 2025. The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management. Dalgic gratefully acknowledges funding by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) through CRC TR 224 (Project C02).

[†]Department of Economics, University of Mannheim.
Email: dalgic@uni-mannheim.de URL: https://sites.google.com/view/husnucdalgic/.

[‡]700 19th St NW 20431 Washington, D.C. U.S.A.
Email: gozhan@gmail.com URL: http://galipkemalozhan.com.

JEL Classification: E44, F32, F41, G15, G21.
Keywords: Currency returns; dominant currency pricing; uncovered interest parity; inflation; dollar debt.

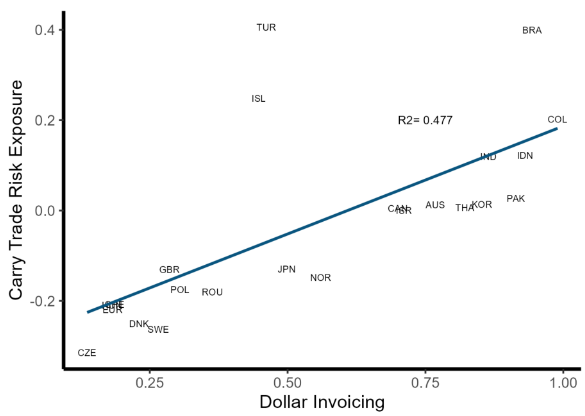
1 Introduction

A central fact in international finance is that currencies exhibit significant differences in their risk-free returns, and this is persistent across countries. The differences are large, comparable to the equity premium puzzle, and persist for decades rather than for years. Standard explanations based on predictable depreciations, default risk, or inflation differentials do not suffice. The evidence instead points to exchange-rate risk characteristics as primary determinant (Hassan and Zhang (2021)).

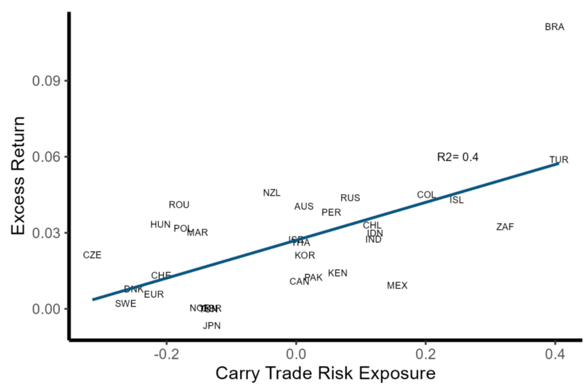
To identify the structural drivers of the risk premia required by international investors, we ask whether dominant-currency pricing and liability dollarization determine currencies' exposure to global risk—and hence the cross-section of currency risk premia—and how these features affect inflation and the transmission of monetary policy in small open economies.

To answer these questions, we combine new empirical evidence with a model tailored to flesh out the mechanisms that may be suggested by the data. On the empirical side, we assemble monthly excess currency returns for 25 countries from 2003:02 to 2018:11 (FX4Casts, IMF IFS, and invoicing measures from Gopinath et al. (2020); see Section 2.1). Following Lustig et al. (2011), we extract principal components that capture common pricing factors and interpret the first two as a "Dollar Risk" factor (co-moving with global growth) and a "Carry Trade Risk" factor (co-moving with global volatility). We then relate each currency's factor loadings to macro structure, focusing on the shares of USD export invoicing and USD-denominated liabilities in the banking sector. On the theory side, we develop a small open-economy framework with dominant-currency pricing for both exports and imports, a leveraged intermediary that borrows in foreign currency in the spirit of Ozhan (2020), and segmented asset markets that generate deviations from uncovered interest parity.

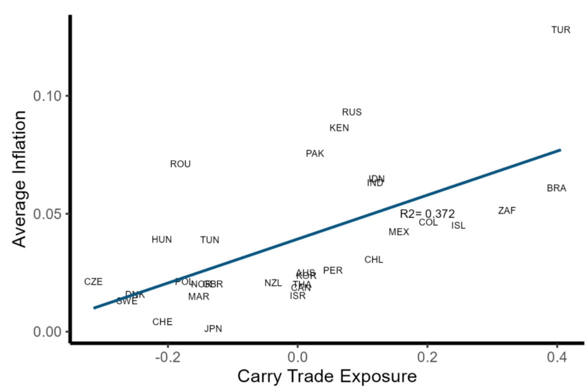
The core of our empirical contribution is to demonstrate that a country's exposure to these global factors is determined by its local frictions. The relationship is complex: we find that dollar invoicing and dollar debt jointly determine exposures to both global factors, revealing that these trade and financial frictions are deeply intertwined. Figure 1a provides a visual summary of this empirical narrative. Panel (a) shows that the share of exports invoiced in U.S. dollars is a powerful predictor of a country's exposure to "Carry Trade Risk." Panels (b) and (c) show the consequences: countries with higher "Carry Trade Risk" exposure not only offer significantly higher average excess returns (the risk premium) but are also systematically associated with higher long-run average inflation.



(a) Carry Trade Exposure and Dollar Invoicing



(b) Carry Trade Exposure and Excess Returns



(c) Carry Trade Exposure and Inflation

Figure 1: Carry Trade risk, currency returns, and inflation. Notes: Carry Trade exposure is the second principal component of currency excess returns following Lustig et al. (2011). Currency returns cover 25 countries, 2003:02–2018:11 (see Section 2.1). Data: FX4Casts, IMF IFS, and Gopinath et al. (2020).

Building on these empirical findings, we develop a small open economy model to analyze the underlying transmission mechanisms. The model's key features are designed to capture our empirical determinants. A leveraged financial intermediary that borrows in foreign currency captures the dollar debt friction. Dominant currency pricing, where both exports and imports are invoiced in dollars captures the dollar invoicing friction. We also introduce segmented markets to highlight how endogenous deviation from the uncovered interest rate parity (UIP) interacts with these features.

In the model, an increase in the foreign interest rate triggers a depreciation. This depreciation creates two contractionary forces. First, the real burden of foreign debt increases, crushing the net worth of firms and causing a severe contraction in investment. Second, because export prices are invoiced in dollars, firms' net USD demand increases to hedge against future fluctuations in the exchange rate. Together, these frictions make the exchange rate more volatile and pro-cyclical (recessionary), creating the currency risk we document empirically.

The risk premia required by international investors has profound consequences for monetary policy and inflation. This endogenously-generated currency risk premium elevates the economy's underlying "neutral" rate of interest. If the central bank follows a standard Taylor rule that does not account for this higher neutral rate, its policy stance will be systematically 'too low,' leading to high structural average inflation in the long run. We show that a 'robust' Taylor rule, in the spirit of Orphanides and Williams (2006), can achieve the inflation target, but at the cost of much higher local interest rates.

Our work builds on a rich literature documenting large and persistent excess currency returns, often attributed to systematic risk[1] or financial frictions[2]. We provide a bridge between studies emphasizing global drivers (Miranda-Agrippino and Rey (2020) and Lustig et al. (2011)) and those highlighting local conditions (Kalemli-Özcan and Varela (2021)). Our primary contribution is to link the literature on the Dominant Currency Paradigm (DCP) (Gopinath et al. (2020), McLeay and Tenreyro (2025)) to the determination of the currency risk premium.[3] Our setup shows how these trade and financial frictions jointly determine a currency's systematic risk profile, which in turn explains not only the required risk premium but also the economy's long-run structural inflation rate.

[1]For example, see, Hassan (2013), Richmond (2019); Lustig et al. (2014); Christiano et al. (2021a); Farhi and Gabaix (2016).

[2]Bacchetta and van Wincoop (2021), Gourinchas et al. (2022), Itskhoki and Mukhin (2021), Dao et al. (2025).

[3]In a recent paper, McLeay and Tenreyro (2025) show that DCP need not attenuate expenditure switching, our paper examines the risk channel. We contribute by documenting how DCP affects currency risk premia and how those premia condition the transmission of monetary policy.

The rest of the paper is organized as follows. The next section describes the data and the measurement of currency excess returns. We then detail factor extraction and document the two global risk factors. Next, we link factor exposures to USD invoicing and dollar debt. We present the small open-economy model with dominant-currency pricing and financial frictions, calibrate it, and quantify implications for risk premia, inflation, and monetary policy. A subsequent section provides robustness and alternative explanations, and the final section concludes.

2 Empirical Analysis

Our empirical analysis proceeds in four steps. First, we identify the key sources of risk in the currency market. Second, we establish the macroeconomic channel that creates this risk. Third, we link this channel to observable structural frictions. Finally, we show that these findings are consistent with ex-ante expectations.

1. Identifying Risk Factors We begin by applying principal component analysis to a panel of 25 currency returns (Section 2.1). We find that two factors explain a significant portion of currency variation (Table 2). We identify these as the **Dollar Risk Factor** and the **Carry Trade Risk Factor** (Table 3). The Dollar Risk Factor is strongly correlated with global growth (S&P 500 returns), while the Carry Trade Risk Factor is strongly correlated with global risk aversion (changes in the VIX). Both factors represent priced risks: currencies with higher exposures command higher average excess returns (Table 1).

2. The Macroeconomic Risk Channel We then investigate the macroeconomic source of this risk (Section 2.4). We show that the key mechanism is the co-movement between GDP and the exchange rate (ER). A negative GDP-ER correlation implies the currency depreciates during recessions, making it a poor hedge and thus "risky." We confirm this empirically: Figure 2 shows a strong negative relationship between the GDP-ER correlation and average excess returns.

3. Frictions as the Source of Risk The central question is what structural features determine this risky co-movement and, by extension, a country's exposure to the global risk factors. We find that the answer lies in two key dollar frictions (Sections 2.3 and 2.5).

- First, we show that high dollar invoicing and a net debtor position (low Net Foreign Assets/GDP) are both significant predictors of a more negative, "risky" GDP-ER co-movement (Table 5).
- Second, we show that these same frictions determine exposure to the abstract risk factors (Table 4). The relationship is complex: exposure to the Dollar Risk Factor is driven positively by banking-sector debt (FL/FA) but negatively by dollar invoicing. Exposure to the Carry Trade Risk Factor is driven positively by dollar invoicing but also by a country's net debtor status (negatively by NFA/GDP).

4. Expectations Finally, we show this is not just an ex-post result. Using professional forecasts (Section 2.6), we find that investors expect higher returns on currencies with high exposure to the Carry Trade factor (Table 6).

The empirical finding that dollar invoicing and dollar debt jointly determine a currency's risk profile by shaping its cyclical co-movement and its sensitivity to global factors motivates our theoretical model.

2.1 Currency Returns

Our primary dataset consists of monthly data for 25 countries from 02/2003 to 11/2018, sourced from FX4casts.[4] We define the **realized excess currency return** (RX_{t+1}) for a USD based investor as:

$$RX_{t+1} \equiv R_t^L \frac{S_t}{S_{t+1}} - R_t^{US} \tag{1}$$

where S_t is the spot exchange rate (LCU per USD), and R_t^L and R_t^{US} are the respective local and US **gross** short-term interest rates from t to $t+1$. This formula represents the ex-post profit from borrowing in USD, investing in the local currency, and converting the proceeds back to USD one period later.

[4] Australia, Canada, Switzerland, Czech Rep., Denmark, Euro Area, United Kingdom, Hungary, Indonesia, India, Japan, Korea, Mexico, Norway, New Zealand, Poland, Sweden, Thailand, Turkey, South Africa, Russia, Brazil, Colombia, Chile

From a macroeconomic perspective, our primary object of interest is the unconditional average of these returns, which forms the currency risk premium:

$$\mathbb{E}[RX] \equiv \mathbb{E}\left[R_t^L \frac{S_t}{S_{t+1}} - R_t^{US}\right]$$

We aim to understand the cross-sectional determinants of this premium. To expand our sample for the cross-sectional analysis, we augment this dataset with data for an additional 7 countries using forward returns.[5] The derivation of currency returns using forward contracts is detailed in Appendix Section C.

2.2 Global Risk Factors

Following Lustig et al. (2011), we use principal component analysis to extract the common factors from our panel of currency returns. We identify two key components, which we label the "Dollar Risk Factor" (Component 1) and the "Carry Trade Risk Factor" (Component 2), in line with the literature.

Table 1 presents the cross-sectional results, testing whether these risk exposures are priced. The results confirm they are. In the full specification (Column 3), both the Dollar Risk Exposure (0.011^{**}) and the Carry Trade Risk Exposure (0.007^{***}) show a positive and statistically significant relationship with average excess returns. This confirms that both factors represent priced risks in the currency market.

Table 2 demonstrates the time-series explanatory power of these factors for a selection of five countries. The high R^2 values for Turkey (0.599), Chile (0.460), Mexico (0.553), and the Euro Area (0.876) indicate that these two common factors drive a significant portion of currency return variation. The notable exception is Japan ($R^2 = 0.097$), whose currency is well-known to follow distinct safe-haven dynamics.

Finally, Table 3 provides a clear economic interpretation for these abstract factors. We regress the Dollar Risk Factor (Component 1) and the Carry Trade Risk Factor (Component 2) on standard macro-financial variables. The results show a sharp and theoretically consistent separation:

- The Dollar Risk Factor (Col 1) is strongly and positively correlated with S&P 500

[5] Romania, Iceland, Kenya, Israel, Tunisia, Morocco, and Pakistan

	Dependent variable:		
	Excess Returns		
	(1)	(2)	(3)
Dollar Risk Exposure	0.012*		0.011**
	(0.006)		(0.005)
Carry trade Risk Exposure		0.007***	0.007***
		(0.002)	(0.002)
Constant	0.0001	0.002***	0.0003
	(0.001)	(0.0003)	(0.001)
Observations	25	25	25
R^2	0.136	0.458	0.571
Adjusted R^2	0.098	0.435	0.532
Residual Std. Error	0.002 (df = 23)	0.002 (df = 23)	0.001 (df = 22)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 1: Average excess returns vs component loadings
Data source: FX4Casts. Left hand variable is the average monthly currency returns of 25 countries between 02/2003 - 11/2018. Right hand variables are the coefficients of each country for the two principal component of currency returns. Both components are scaled such that a positive coefficient means positive covariance with the returns.

returns (1.533^{***}) and is not significantly related to changes in the VIX. This identifies it as a global growth or equity risk factor.

- The Carry Trade Risk Factor (Col 2), in contrast, is not correlated with the S&P 500 but is significantly and negatively correlated with changes in the VIX (-0.085^{**}). This identifies it as a classic risk-off or volatility factor, as the carry trade unwinds (factor return is negative) when volatility spikes (VIX increases).

2.3 Determinants of Component Exposures

In this Section, we aim to understand what determines a currency's exposure to these global risk factors. We consider several variables established in the literature as key determinants of excess currency returns and regress our estimated risk exposures on them (Table 4).[6]

[6] External balance (Della Corte et al. (2016)), foreign assets in the banking system (Yeyati (2006); Christiano et al. (2021b)), Dollar invoicing (Gopinath and Stein (2020)), size(Hassan (2013)) and trade network centrality (Richmond (2019)). In Appendix Section A, we verify that these determinants also explain average currency returns directly.

	Dependent variable:				
	Turkey	Chile	Mexcio	Euro Area	Japan
	(1)	(2)	(3)	(4)	(5)
Dollar Risk Exposure	0.258***	0.167***	0.167***	0.191***	0.035
	(0.025)	(0.016)	(0.014)	(0.005)	(0.028)
Carry trade Risk Exposure	0.406***	0.118***	0.156***	−0.219***	−0.130**
	(0.093)	(0.028)	(0.041)	(0.029)	(0.051)
Constant	0.005**	0.003***	0.001	0.0005	−0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Observations	190	190	190	190	190
R^2	0.599	0.460	0.553	0.876	0.097
Adjusted R^2	0.595	0.454	0.548	0.874	0.087
Residual Std. Error (df = 187)	0.033	0.024	0.021	0.010	0.027
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 2: Excess returns vs Risk Factors
Data source: FX4Casts. Left hand variable is the returns of selected currencies between 02/2003 - 11/2018. Right hand variables are the two principal component of currency returns. Both components are scaled such that a positive coefficient means positive covariance with the returns.

The regression results highlight that both risk factors are determined by a complex interplay of financial and trade frictions.

First, a country's exposure to the **Dollar Risk Factor** is driven by both financial and trade structures (Columns 1 and 2).

- Financially, the FL/FA ratio in the banking system is a positive and significant predictor (0.043^{**}). This suggests economies reliant on foreign-currency funding are more vulnerable to the global financial cycle.
- Interestingly, Dollar Invoicing is also a key determinant, with a significant negative coefficient (-0.095^{**}). This implies that, controlling for financial vulnerabilities, high invoicing is associated with a *lower* exposure to this specific risk factor.

Second, exposure to the **Carry Trade Risk Factor** is also explained by a mix of trade and financial variables (Columns 3 and 4).

- The strongest predictor is the Dollar Invoicing share, which is positive and highly significant (0.457^{***}). This is a key finding: currencies of high-invoicing countries tend to be more exposed to global risk-off shocks, consistent with the carry trade.

	Dependent variable:	
	Component 1	Component 2
	(1)	(2)
$S\&P$ 500 Returns	1.533***	−0.080
	(0.341)	(0.110)
Δlog(VIX)	−0.070	−0.085***
	(0.053)	(0.032)
ΔGFC	−0.013	0.001
	(0.009)	(0.004)
Observations	190	190
R^2	0.306	0.045
Adjusted R^2	0.299	0.035
Residual Std. Error (df = 187)	0.105	0.058
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 3: Risk Factors

Data source: FX4Casts, Ken French dataset, CBOE. Right hand variables are the two principal components of currency returns of 25 countries between 02/2003 - 11/2018. Left hand variables are the returns of S&P500 and log change in VIX index.

- Financial structure also plays a clear role. Net Foreign Assets/GDP is a significant negative predictor (-0.190^{***}) in the full specification (Column 3). This indicates that net debtor countries (low NFA) have a significantly higher exposure to the Carry Trade factor, consistent with this factor capturing financial-fragility risk.

Overall, these regressions show that abstract risk factors are not cleanly separated. Instead, they are both determined by observable financial and trade frictions. This motivates the design of our theoretical model, where these frictions (e.g., dollar debt and dollar invoicing) jointly shape an economy's vulnerability to global shocks.

2.4 Comovement between GDP and Exchange Rate

We measure the cyclical co-movement between the economy and the exchange rate by calculating, for each country, the correlation between log real GDP growth and log real exchange rate changes. The real exchange rate (RER) is defined as the nominal dollar exchange rate divided by CPI (S_t/P_t). This correlation, ρ, is estimated via the following regression of standardized variables:

$$\frac{\Delta \log(GDP_t)}{\sigma_{\Delta \log(GDP)}} = \alpha + \rho \frac{\Delta \log(S_t/P_t)}{\sigma_{\Delta \log(S/P)}} + \epsilon_t$$

	Dependent variable:			
	Dollar Risk Exposure		Carry Risk Exposure	
	(1)	(2)	(3)	(4)
FL/FA	0.035*	0.043**	0.016	0.037
	(0.018)	(0.019)	(0.030)	(0.059)
Net Foreign Assets/GDP	−0.029	−0.049	−0.190***	−0.090
	(0.029)	(0.032)	(0.071)	(0.060)
Reserves/GDP	−0.079	−0.161	−0.157	−0.384
	(0.219)	(0.138)	(0.330)	(0.360)
Dollar Invoicing	−0.098**	−0.095**	0.490***	0.457***
	(0.043)	(0.040)	(0.086)	(0.075)
GDP(Nominal USD)	0.006		0.018	
	(0.018)		(0.026)	
Average Centrality		−6.345		−7.729
		(10.384)		(14.102)
Constant	0.213***	0.228***	−0.285***	−0.280**
	(0.053)	(0.076)	(0.088)	(0.119)
Observations	20	14	20	14
R^2	0.496	0.743	0.615	0.533
Adjusted R^2	0.316	0.582	0.477	0.242
Residual Std. Error	0.063 (df = 14)	0.047 (df = 8)	0.154 (df = 14)	0.167 (df = 8)
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 4: Determinants of Exposures
Data source: IFS, Datastream, FX4Casts, Gopinath et al. (2020), Richmond (2019), Ken French dataset. Risk factors are the two principal components of currency returns of 25 countries between 02/2003 - 11/2018. FL/FA denotes the ratio of foreign liabilities to foreign assets in the banking system.

The estimate $\hat{\rho}$ corresponds to the correlation coefficient. This approach is well-suited for our dataset, as countries have widely different volatilities in GDP growth and exchange rates, and the correlation coefficient suitably scales the variables by their respective standard deviations. Another benefit is that the correlation is direction-invariant, meaning which variable is used as the left-hand-side variable does not change the estimate. We do not claim any causality here; the correlation coefficient is simply our appropriate measure for co-movement.

A negative correlation ($\rho < 0$) is the core of our risk mechanism. It indicates that the currency depreciates (loses value) precisely when the economy is in recession (when income is low). This makes the local currency a poor hedge and thus "risky" from the perspective of local residents. In these economies, dollar assets provide better insurance against business cycle fluctuations, lowering the relative demand for local currency assets. Consequently, local residents demand a risk premium—in the form of higher expected returns—to hold local currency assets (Christiano et al. (2021a); Dalgic (2024)).

Figure 2 tests this hypothesis directly. The plot of average excess returns against the GDP-ER correlation reveals a strong, negative relationship (R^2 = 0.172). This visually confirms our mechanism: countries with a more negative correlation (e.g., Brazil, Turkey, Chile, Peru) are precisely those with riskier currencies, and investors are, on average, compensated with significantly higher excess returns. Conversely, countries with a positive correlation (e.g., Japan, Switzerland, Denmark), where the currency acts as a hedge, have near-zero or negative excess returns.

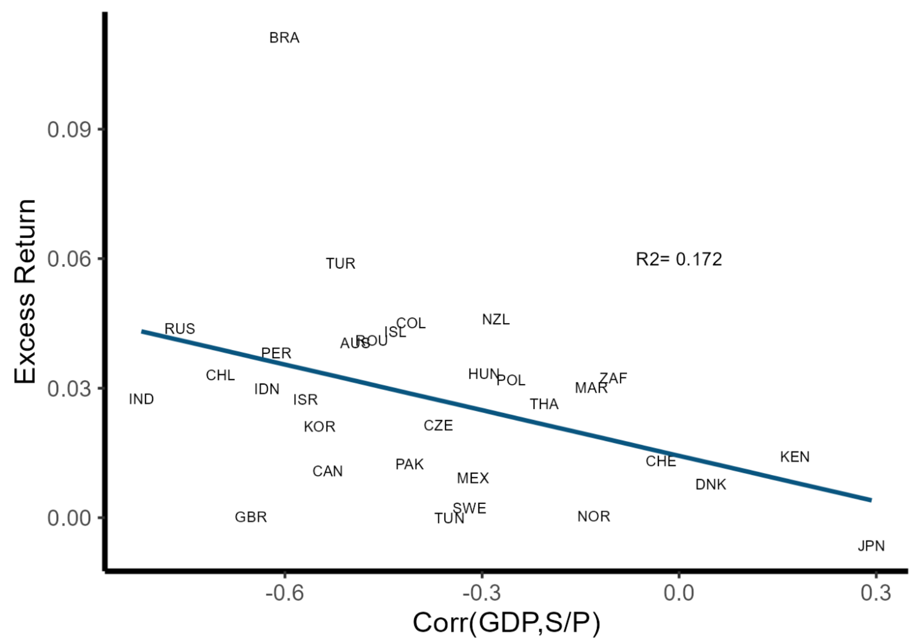


Figure 2: GDP-ER Comovement and excess returns

Data source: FX4Casts, IMF IFS. Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variable is comovement between GDP and Exchange Rate

2.5 Macroeconomic Transmission Channel

This section explores the mechanism through which dollar frictions shape a country's risk profile. A key determinant of currency risk is the cyclical co-movement between GDP and the exchange rate (Dalgic (2024)). When this co-movement is negative—meaning the currency depreciates during domestic recessions—the currency loses value when income is lowest, making it a poor hedge and "risky" for an investor.

We test the drivers of this co-movement in Table 5. The regression results show that our proposed dollar frictions are significant determinants of this relationship, confirming our hypothesis.

- Dollar Invoicing has a negative and highly significant coefficient (-0.396^{***}), confirming that a higher share of dollar invoicing is strongly associated with a more countercyclical exchange rate (a more negative correlation).
- Net Foreign Assets/GDP has a significant positive coefficient (0.203^{**}). This indicates that being a net creditor (high NFA) is associated with a less negative (or more positive) correlation. Conversely, this implies that being a net debtor (having a low or negative NFA/GDP) is associated with a significantly more negative GDP-ER correlation.

	Dependent variable:
	GDP-ER Correlation
Dollar Invoicing	-0.396^{***}
	(0.138)
FL/FA	-0.033
	(0.030)
Net Foreign Assets/GDP	0.203^{**}
	(0.093)
Constant	-0.023
	(0.149)
Observations	19
R^2	0.430
Adjusted R^2	0.316
Residual Std. Error	0.194 (df = 15)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 5: The Role of Dollar Frictions in GDP-Exchange Rate Co-movement
Data source: IFS, Datastream, FX4Casts, Gopinath et al. (2020)

Thus, the evidence shows that both high dollar invoicing and a net debtor position make the exchange rate fundamentally riskier.

Figure 3a provides a clear visual illustration of this two-part mechanism.

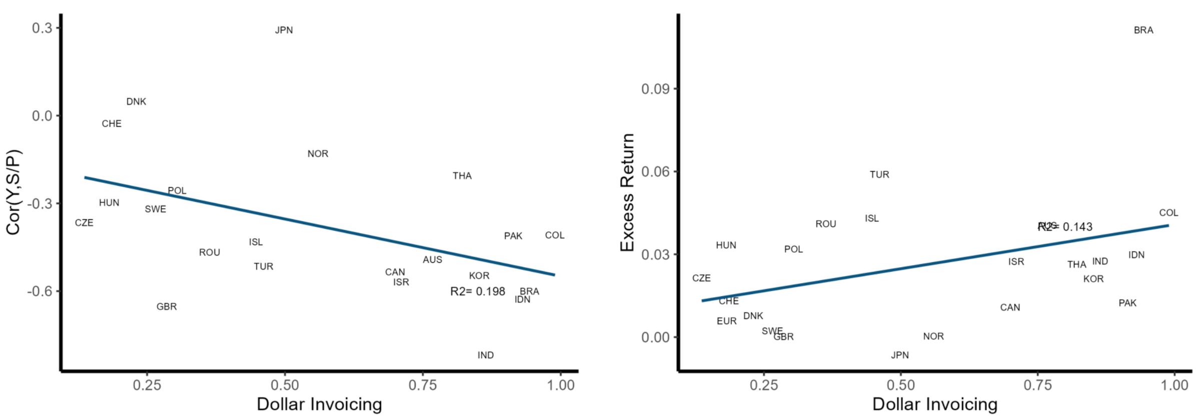
- Panel (a) plots the strong, negative relationship between Dollar Invoicing and the GDP-ER correlation ($R^2 = 0.198$). This visually confirms our first finding: as invoicing increases, the exchange rate becomes more countercyclical.

- Panel (b) completes the story by showing that this risk is priced. It plots average Excess Returns against Export Invoicing, revealing a positive relationship (R^2 = 0.143).

Taken together, the evidence suggests a clear transmission mechanism:

1. High dollar invoicing (Table 5 and Figure 3a) and being a net debtor (Table 5) cause the exchange rate to become countercyclical (risky).

2. Investors demand a risk premium, in the form of higher average excess returns, to hold these risky currencies (Figure 3a).



(a) Correlation of the exchange rate with GDP

(b) Average excess returns

Figure 3: Currency Cyclicality and Returns, and Dollar Invoicing

Data source: IMF, FX4Casts, Gopinath et al. (2020). Y-axis variables the comovement between GDP-ER and the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variable is the average dollar invoicing share of exports.

McLeay and Tenreyro (2025) provide an important framework for local shocks, arguing that for high elasticity goods such flexible-price commodity exporters, the expenditure-switching channel remains effective . Our paper complements this by focusing on two contexts where dollar invoicing is linked to vulnerability. First, we analyze global shocks, where these same commodity exporters are highly vulnerable to pro-cyclical external demand, as documented by Fernández et al. (2018). Second, in countries with high dollar invoicing, large share of trade in differentiated goods are invoiced in USD (as in Amiti et al. (2022)).

2.6 Currency Return Expectations

In this section, we construct a measure of expected returns using quarterly exchange rate expectations from FX4Casts. Our sample spans the period 2003Q1-2018Q4. This dataset has been used by Ince and Molodtsova (2017) to evaluate forecast accuracy and by Kalemli-Özcan and Varela (2021) to construct UIP premium series.

We define the expected excess currency return ($\mathbb{E}_t UIP_t$) as:

$$\mathbb{E}_t UIP_t = R_t^L \frac{S_t}{\mathbb{E}_t \left(S_{t+1}\right)} - R_t^{US} \tag{2}$$

where $\mathbb{E}_t S_{t+1}$ is the one-quarter-ahead professional forecast for the spot rate.

Similar to our analysis of realized returns, we apply principal component analysis (PCA) to the panel of expected currency returns to extract common factors. We then test if these factors price the cross-section of expected returns.

Table 6 presents the results from regressing average expected excess returns on the loadings for the first two factors. Column (3) shows that while the "Dollar Risk Factor" loading is not statistically significant, the "Carry Trade Risk Factor" loading is. The coefficient is positive and highly significant ($+0.031^{***}$). This finding indicates that, according to these professional forecasts, currencies with a higher exposure to the carry trade risk factor are associated with higher average expected returns, consistent with investors demanding a premium for bearing this risk.

3 Model

In countries where most exports are denominated in dollars, the expenditure switching channel is weaker, as depreciations cannot effectively stimulate exports. With a muted export response, economic performance tends to be weaker following an exchange rate depreciation.

The previous section established several stylized facts linking dollar invoicing to macroeconomic outcomes. We found that countries with higher dollar invoicing exhibit riskier currencies that are more exposed to global risks. Furthermore, in these economies, the exchange rate tends to be countercyclical, a factor against which investors demand a risk premium. We also observe persistently high inflation in these economies.

Table 6: Average Expected excess returns vs component loadings

	Dependent variable:		
	Excess Returns		
	(1)	(2)	(3)
Dollar Risk Factor	0.008		−0.007
	(0.011)		(0.008)
Carry Trade Risk Factor		0.028***	0.031***
		(0.005)	(0.005)
Constant	0.009***	0.005***	0.004**
	(0.002)	(0.001)	(0.002)
Observations	26	26	26
R^2	0.028	0.467	0.484
Adjusted R^2	−0.012	0.445	0.439
Residual Std. Error	0.007 (df = 24)	0.006 (df = 24)	0.006 (df = 23)
Note:			*p<0.1; **p<0.05; ***p<0.01

Data source: FX4Casts, Ken French dataset, CBOE. Left hand variables are the two principal components of currency returns of 25 countries between 02/2003 - 11/2018. Right hand variable is the average expected excess returns.

To rationalize these findings, this section builds a small open economy (SOE) New Keynesian model. The core mechanism is that exports are priced in dollars, and the degree of export price stickiness determines the strength of the expenditure switching channel. This, in turn, influences domestic inflation and interest rate spreads. The model builds on Camara et al. (2024) and incorporates financial frictions in the spirit of Ozhan (2020).

3.1 Households

Households in the model supply labor to firms and save in local currency and dollars. Households have access to one period local currency and dollar risk-free bonds with interest rates R_t and R_t^* respectively. They maximize

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(u\left(C_t\right) - \xi \frac{l_t^{1+\varphi}}{1+\varphi} - \frac{1}{2}\gamma \left(\Theta_t - \Upsilon_t\right)^2 \right)$$

Θ_t denotes dollarization; share of USD assets in the portfolio. The last term is non-pecuniary costs associated with deviating from the target portfolio(Υ_t). These costs can be thought of coming from a preferred habitat model (Gourinchas et al. (2022)). Household budget,

$$D_t + S_t D_t^* + P_t^c C_t = D_{t-1} R_{t-1} + S_t R_{t-1}^* D_{t-1}^* + W_t l_t + T_t$$

where D_t and D_t^* are peso and dollar deposits. S_t, and P_t^c are the nominal exchange rate and consumer price index.

3.2 Goods Production

Domestic homogenous good is combined with imported inputs to produce consumption, investment and export goods.

3.2.1 Domestic Homogeneous Goods

Domestic homogenous good Y_t is produced from intermediate domestic goods and is used as a input for consumption, investment and export goods.

$$Y_t = \left[\int_0^1 Y_{i,t}^{\frac{\varepsilon-1}{\varepsilon}} di \right]^{\frac{\varepsilon}{\varepsilon-1}}, \varepsilon > 1$$

Market clearing in homogeneous goods is

$$Y_t = I_t^d + C_t^d + X_t^d$$

where $\left(I_t^d, C_t^d, X_t^d\right)$ are domestic goods to produce final investment, consumption and export goods respectively.

3.2.2 Intermediate Goods

Intermediate goods are produced by monopolists using capital and labor, Production function of intermediate good firms:

$$Y_{i,t} = K_{i,t-1}^{\alpha} \left(A_t l_{i,t}\right)^{1-\alpha}$$

where A_t is exogenous technology. Intermediate good producing firms are subject to the Calvo Price-Setting Friction, only a share of $(1-\theta)$ of them are allowed to change their prices, the rest keep their old price.

3.2.3 Final Consumption Goods

Consumption good is produced by a representative, competitive firm using domestic homogenous good and imported foreign inputs, they are consumed by domestic households.

$$C_t = \left[(1-\omega_c)^{\frac{1}{\eta_c}} \left(C_t^d\right)^{\frac{\eta_c - 1}{\eta_c}} + \omega_c^{\frac{1}{\eta_c}} \left(C_t^m\right)^{\frac{\eta_c - 1}{\eta_c}} \right]^{\frac{\eta_c}{\eta_c - 1}}$$

Consumer price index is defined as

$$P_t^c = \left[(1-\omega_c) P_t^{1-\eta_C} + \omega_c \left(P_t^m\right)^{1-\eta_c} \right]^{\frac{1}{1-\eta_c}} \quad (3)$$

where $P_t^m = S_t P_t^f$ is the import price in local currency, where P_t^f is the exogenous dollar price of imported goods and S_t is the exchange rate. Since import prices directly enter consumer price index, there is a strong and immediate exchange rate passthrough especially for low η_c, in which case substitution between imported and domestically produced goods is hard. A large depreciation will reduce real incomes in consumption units if the wages do not increase as much as the consumption price index. For low values of η_c, a depreciation leads to a large increase in consumer prices and leads to a decline in consumption via real income channel of exchange rate depreciations (Auclert et al. (2021)).

3.2.4 Capital Goods and Investment

Capital is produced from domestic homogenous ($I_{d,t}$) and foreign ($I_{m,t}$) inputs.

$$I_t = \left[\gamma_I^{\frac{1}{\nu_I}} I_{d,t}^{\frac{\nu_I - 1}{\nu_I}} + (1-\gamma_I)^{\frac{1}{\nu_I}} I_{m,t}^{\frac{\nu_I - 1}{\nu_I}} \right]^{\frac{\nu_I}{\nu_I - 1}}$$

Similar to equation 3, price of capital depends on the exchange rate. Evolution of capital is subject to capital adjustment costs.

$$K_t = (1-\delta) K_{t-1} + \left[1 - S\left(\frac{I_t}{I_{t-1}} \right) \right] I_t.$$

3.2.5 Exports

Similar to consumption and Investment, exports are produced from intermediate export goods and imported inputs

$$X_t = \left[\gamma_x^{\frac{1}{\eta_x}} \left(X_t^d\right)^{\frac{\eta_x - 1}{\eta_x}} + \left(1-\gamma_x\right)^{\frac{1}{\eta_x}} \left(X_t^m\right)^{\frac{\eta_x - 1}{\eta_x}}\right]^{\frac{\eta_x}{\eta_x - 1}},$$

where X_t^d is a domestically produced input to exports with dollar price, $P_t^{d,x}$ and X_t^m is an imported good with dollar price, P_t^f. Export good is produced using both goods and sold at dollar price P_t^x

Foreigner demand local export goods is given by

$$X_t = \left(\frac{P_t^x}{P_t^f}\right)^{-\eta_f} Y_t^* \tag{4}$$

where $Y_t^*$is foreign demand. The domestic input is produced by a competitive firm using the following production function:

$$X_t^d = \left[\int_0^1 X_{i,t}^{\frac{\varepsilon_x - 1}{\varepsilon_x}} di\right]^{\frac{\varepsilon_x}{\varepsilon_x - 1}} \tag{5}$$

where $X_{i,t}$ is produced using domestic homogenous good by monopolists for price $P_{i,t}^x$. These monopolists face Calvo sticky prices, they can only change their price with with probability $(1-\theta_x)$. In the absence of export price stickiness ($\theta_x = 0$), monopolists will set $P_t^{d,x} = P_t$. In that case, export prices will depend only on P_t^m, which is the local currency price of foreign goods. Appendix Section D.4 describes the export sector in detail.

3.3 Financial System

The financial system is composed of banks that intermediate between households, foreigners, and firms. Both households and foreigners deposit funds in local currency and dollars. Figure 4 shows the financial system.

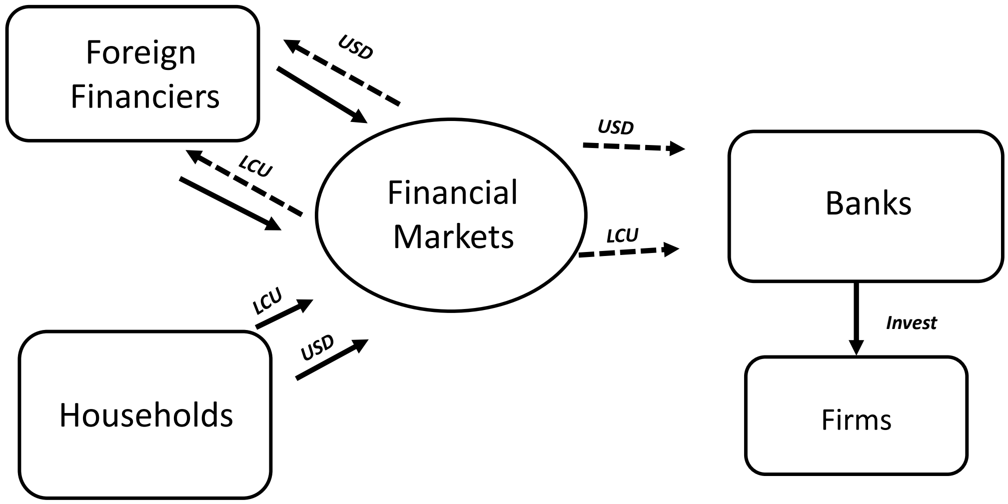


Figure 4: Financial Markets

3.3.1 Banks

Banks borrow funds from households and foreigners to finance firm investments, but their borrowing is constrained by financial frictions in the spirit of Gertler and Karadi (2011), which limit the amount they can borrow based on an incentive constraint. Banks with higher equity have greater borrowing capacity. They can choose to borrow in either local currency (LC) or USD, with a preference for the cheaper option. However, they also aim to maintain a balanced portfolio that aligns with their target. Bankers intermediate between households and non-financial firms. Households are standard except it's the bankers who buy and operate the capital. Bankers issue issue deposits and buy claims on non-financial firms and earn returns from capital. We derive banker equations in Appendix Section D.5.

3.3.2 Foreign Financiers

Foreign financiers borrow in USD and lend in local currency (LCU), operating under an incentive constraint as described by Gabaix and Maggiori (2015). While they have a preferred habitat, they may deviate from their target portfolio if excess returns are available. However, this incentive constraint becomes tighter when exchange rate volatility increases, as noted by Gabaix and Maggiori (2015).

$$(B_t^* - B^*) = \frac{\mathbb{E}_t^j\left(\frac{R_t S_t}{S_{t+1}}\right) - R_t^*}{\lambda(\mathbb{V}s_{t+1})} \tag{6}$$

where B_t^* is the dollar amount of investment in local assets, $B_t^F = B_t^* S_t$ is defined as the local currency amount of these investments.

3.3.3 Financial Markets Clearing

Local currency financial market clearing condition,

$$B_t^F + D_t = B_t^{LC}$$

where D_t is the amount of local currency deposits by households, B_t^F is local currency investments by foreigners and B_t^{LC} is the amount of total bank borrowing in local currency. The only constraint is $B_t^{LC} \geq 0$, foreigners or local can also have negative position. Dollar market clearing condition,

$$B_t^{F,*} + D_t^* = B_t^{FC}$$

similarly, $B_t^{F,*}$, D_t^* are foreign and local dollar deposits and B_t^{FC} is bank dollar borrowing (in terms of local currency). For foreigners, dollar lending/borrowing is riskless and at the exogenous risk free dollar interest rate R_t^* so that their position ($B_t^{F,*}$) is the difference between household and bank positions.

3.4 Balance of Payments

Net Financial Asset position of the economy is $-\left(B_t^F + B_t^{F,*}\right)$. Net exports $(X_t - M_t)$ equal to change in net foreign asset position (which includes interest income earned by foreigners)

$$X_t - M_t = -\left(B_t^{F,*} - B_{t-1}^{F,*} R_{t-1}^* \frac{S_t}{S_{t-1}}\right) - \left(B_t^F - B_t^F R_{t-1}\right)$$

3.5 Monetary Policy

Central bank in the model follows a Taylor rule,

$$\log\left(R_t/\bar{R}\right) = \rho_R \log\left(R_{t-1}/\bar{R}\right) + r_\pi \log\left(\pi_t/\bar{\pi}\right) + r_y \log\left(y_t/\bar{y}\right) + \epsilon_{R,t} \tag{7}$$

where r_π and r_y are inflation and output coefficients. According to De Leo et al. (2022), Taylor rule is a good approximation for both EME and AE central bank policies. Following Camara et al. (2024), we use domestic good inflation (as opposed to consumer price inflation) as the target. In the model simulations, we use the same Taylor coefficients and targets so that any systemic change in the response of monetary policy reflects endogenous response to economic fundamentals.

3.6 Shocks

The model features two exogenous foreign shocks: a foreign interest rate shock and an export demand shock. The primary shock, which drives the model's main dynamics, is the foreign interest rate (R_t^*). The literature documents that foreign interest rate shocks are an important driver of business cycles in small open economies (Neumeyer and Perri, 2005). Similarly, it is widely documented that US monetary policy shocks influence global financial conditions due to the international role of the USD Miranda-Agrippino and Rey (2020), Bruno and Shin (2015).We assume the foreign interest rate follows an AR(1) process:

$$R_t^* = \left(1-\rho^*\right)\bar{R}^* + \rho^* R_{t-1}^* + \sigma_{R^*}\epsilon_{R^*,t}$$

Global financial conditions also affect external economic activity. Camara et al. (2024) show that US monetary policy shocks affect US import demand, which translates into a trade shock for the rest of the world. We therefore model export demand (Y_t^*) as a process that also co-moves with the foreign interest rate:

$$Y_t^* = \left(1-\rho_Y^*\right)\bar{Y}^* + \rho_Y^* Y_{t-1}^* + \gamma_R\left(R_t^* - \bar{R}^*\right) + \sigma_{Y^*}\epsilon_{Y^*,t}$$

where γ_R controls the sensitivity of export demand to foreign interest rate movements.

In addition, the model features local monetary policy demand shocks (see above section) and AR(1) technology shocks.

3.7 Interest Rate Spread

In the model, households have access to both LC and USD bonds. Ignoring preferred habitat constraints, two Euler equations,

$$
\begin{aligned}
1 &= R_t \mathbb{E}_t \left(\lambda_{t+1}\right) \\
1 &= R_t^* \mathbb{E}_t \left(\lambda_{t+1} \frac{S_{t+1}}{S_t}\right)
\end{aligned}
$$

where $\lambda_{t+1} = \beta \frac{u'(c_{t+1})}{u'(c_t)\pi_{t+1}}$ is the real stochastic discount factor (SDF). We can write the Euler equation with respect to USD bonds as,

$$
1 = \mathbb{E}_t \left(R_t^* \frac{S_{t+1}}{S_t}\right) \mathbb{E}_t \left(\lambda_{t+1}\right) + cov\left(R_t^* \frac{S_{t+1}}{S_t}, \lambda_{t+1}\right)
$$

combining two Euler equations,

$$
R_t - \mathbb{E}_t \left(R_t^* \frac{S_{t+1}}{S_t}\right) = \frac{cov\left(R_t^* \frac{S_{t+1}}{S_t}, \lambda_{t+1}\right)}{\mathbb{E}_t \left(\lambda_{t+1}\right)}
$$

The interest rate spread is proportional to covariance of the exchange rate and SDF. In the model, a rise in dollar debt or dollar invoicing makes the economy more vulnerable to external shocks, which makes this covariance more positive: exchange rate depreciations coincide to periods of high marginal utility (see Dalgic (2024)). In Section 2.4, we test this equation using GDP as proxy for marginal utility. We find that in countries where exchange rate depreciations coincide to low GDP, we observe high interest rate spread.

3.8 Parameters

Table 7 presents parameter values. We use standard parameters in the literature, close to estimates by Camara et al. (2024), who estimate them for a set of EME. Elasticity of substitution between imported and domestic goods in consumption is less than 1, which means exchange rate depreciations lead to consumption drop because foreign inputs are not easily replaced, creating real income channel of exchange rate discussed by Auclert et al. (2021). We use relatively low home biases indicating that the economy is relatively open.

4 Results

In the classical Mundell-Fleming (M-F) framework, exchange rate depreciations act as a shock absorber by mitigating the impact of global shocks. Following a foreign interest rate shock (R_t^*), the exchange rate depreciates, boosting exports and countering recessionary effects.

Our model departs from the classical view by introducing two features—export dollar invoicing and dollar-denominated debt—that weaken the exchange rate's shock-absorbing role. First, when export prices are sticky in dollars, depreciations fail to stimulate exports, limiting the exchange rate's counter-cyclical effectiveness. Second, when the economy carries high levels of dollar debt, depreciation inflicts financial losses that constrain the financial system's risk-taking capacity, reduce lending, and ultimately trigger a sharp decline in investment.

Together, these factors make the economy more vulnerable. In response to a foreign interest rate hike, the exchange rate depreciates significantly, shrinking the economy and generating losses for local asset holders. This dynamic creates a demand for an ex-ante risk premium. Furthermore, the resulting high macroeconomic volatility—particularly in inflation and exchange rates—pushes firms to increase markups as a precautionary measure, leading to structurally high inflation.[7]

[7] We solve the model using a third-order perturbation to capture nonlinear effects, following Fernandez-Villaverde et al. (2011) and, more recently, Ghironi and Ozhan (2025).

Variable	Description	Value
β	Discount Factor	0.995
α	Capital Share	0.340
δ	Depreciation	0.020
φ	Inverse Frisch	1.000
r_π	Taylor Inflation Coefficient	1.500
r_y	Taylor Output Coefficient	0.100
r_S	Taylor Exchange Rate Coefficient	0.020
ϵ	Elasticity of Substitution, intermediate goods	6.000
θ	Calvo Parameter, intermediate goods	0.750
ϵ^x	Elasticity of Substitution, export goods	6.000
γ	Target Portfolio Cost (UIP Friction)	2.560
θ^x	Export Calvo Stickiness	0.800
κ	Investment Adjustment Cost	5.850
η_c	C, Elasticity of Substitution	0.410
$1-\omega_c$	Home Bias, C	0.830
ω_i	Home Bias, I	0.290
γ_x	Home Bias, X	0.500
η^f	Elasticity of Demand, Exports	1.530
η_i	I, Elasticity of Substitution	0.910
η_x	X, Elasticity of Substitution	0.700
ρ_R	MP Persistence	0.900
ϕ	Target Credit Dollarization	0.250
Υ	Target Deposit Dollarization	0.200
$\frac{d^*}{Y}$	Dollar Deposit/GDP	0.500
γ_R	Export Demand Shifter	-20.000
θ	Banker survival	0.972
W_b	Banker startup	0.030
λ	Banker constraint	0.300
λ^f	Financier Constraint	1.000

Table 7: Parameter Values

4.1 Response to Foreign Interest Rate Shock

Figure 5 illustrates the model's response to a foreign interest rate shock, comparing economies with low/high export price stickiness ($\theta^x = [0.01, 0.8]$) and low/high dollar debt ($\bar{\phi} = [0.1, 0.35]$). The results highlight a severe vulnerability when both frictions are present. We can trace the mechanisms by contrasting the two extreme scenarios. It is crucial to note that monetary policy follows the same Taylor rule (Section 3.5) in all scenarios. The different paths for the policy rate are not due to different rules, but are the endogenous response to the different response of the economy to the shock.

The Vulnerable Economy (High Stickiness High Debt) The solid blue line shows the economy with high dollar invoicing and high dollar debt. Following the foreign rate hike, the exchange rate (top-right) depreciates sharply and persistently. Because export prices are sticky in dollars, this depreciation fails to stimulate exports (bottom-middle), effectively breaking the expenditure-switching channel.

Simultaneously, the depreciation inflates the value of the high dollar debt, triggering a financial contraction. This is visible in two ways:

1. A large, positive UIP spread emerges (middle) as investors demand a risk premium, consistent with Kalemli-Ozcan (2019).
2. Investment (bottom-left) collapses due to these financial frictions.

The combination of a failed export channel and a deep investment recession drives a severe contraction in GDP (top-middle).

This places the central bank in a bind. Despite a sharp spike in inflation (π^c, bottom-right) from the passthrough, it is constrained from raising the policy rate (middle-left) because doing so would deepen the already severe recession. This policy constraint validates the sharp depreciation, which imposes large losses on local asset holders.

The Resilient Economy (Low Stickiness Low Debt) In sharp contrast, the economy with flexible prices and low debt (black dashed line) behaves classically. The exchange rate is relatively stable. The central bank (R) aggressively raises the policy rate to counter the foreign shock, which it can do because the economy is not facing a financial crisis or a recession. The expenditure-switching channel is functional (exports rise slightly) and the financial channel is benign (UIP spread is flat), resulting in almost no impact on GDP or consumption.

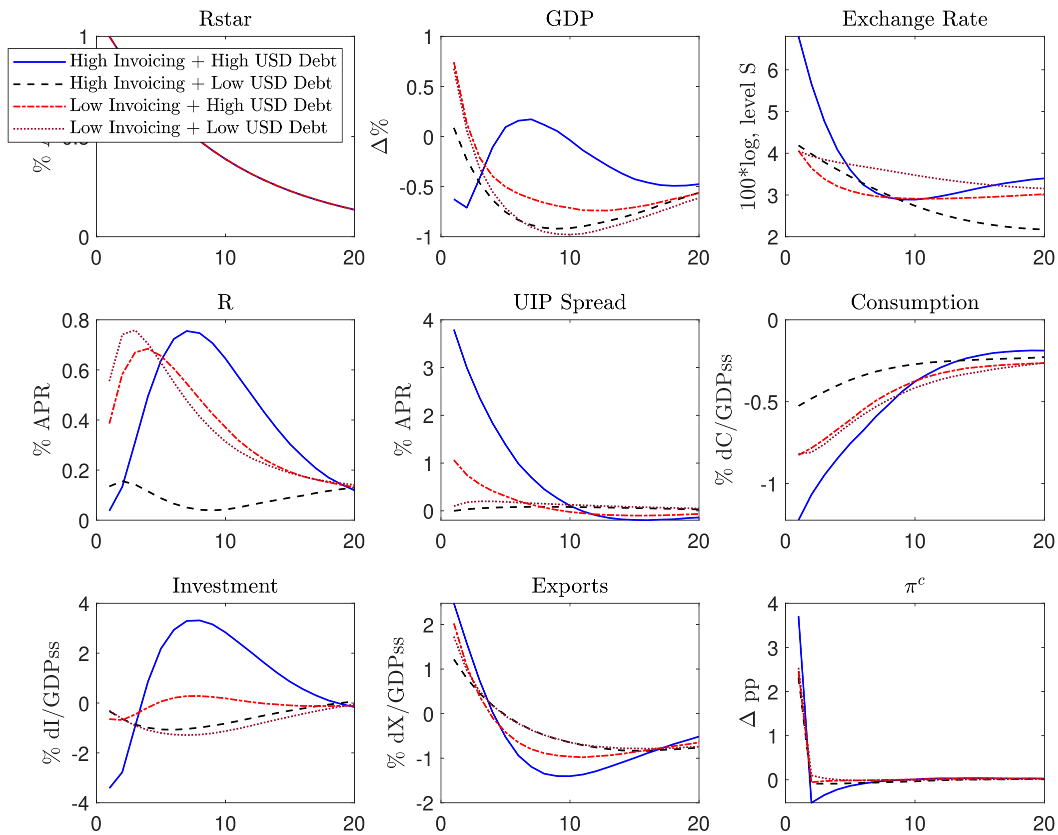


Figure 5: Response of the economy following a foreign interest rate shock

Mechanism

Figure 6 plots the UIP spread and export prices (in USD) following a foreign interest rate shock. The figure isolates the two key channels: the financial channel (liability composition) and the trade channel (price stickiness).

The Debt Channel The UIP Spread (left panel) rises significantly only in economies with high dollar debt (the solid blue and dashed-dotted red lines). As shown in the previous section (Figure 5), the foreign shock triggers a currency depreciation. This depreciation inflates the local-currency value of dollar-denominated liabilities, causing losses in the financial sector. To compensate for this heightened risk and attract necessary capital inflows, investors demand a risk premium, which manifests as a positive UIP spread.

The Price Channel The export prices (in USD, right panel) reveal the strength of the expenditure-switching channel. When export prices are flexible (low invoicing, the red dash-dotted and pink dotted lines), firms can lower their USD prices in response to the depreciation. This makes their goods more competitive, stimulating export demand and providing a cushion against the economic contraction. In contrast, when export prices are sticky (high invoicing, the solid blue and dashed black lines), they remain relatively unchanged, breaking the export channel.

The Interaction The "worst-case" scenario (solid blue line) arises from the interaction of two frictions. With sticky export prices, the primary trade-adjustment channel is blocked. To achieve any external adjustment (e.g., via import compression), the economy must undergo a much larger currency depreciation. This massive depreciation then collides with the high dollar debt, triggering severe financial sector distress. This extreme financial vulnerability, in turn, drives the sharp spike in the UIP spread, as investors demand a large premium to hold the currency.

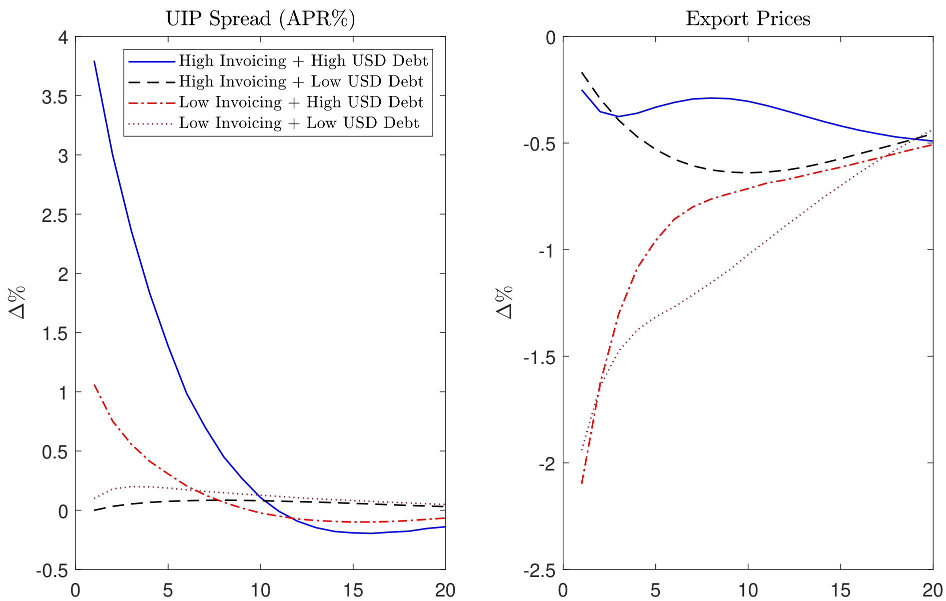


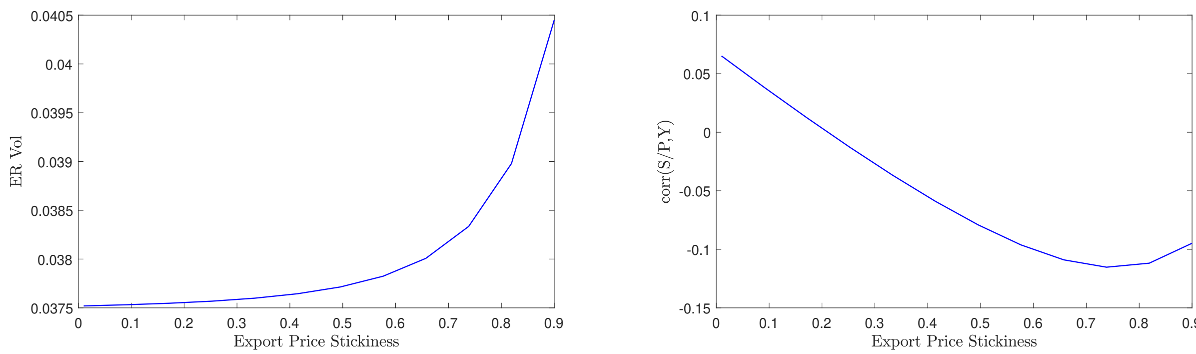
Figure 6: UIP Spread and Export Prices

4.2 Steady State Results

In this section, we examine the steady state of the economy as a function of export price stickiness (θ_x). We solve the model using a third-order approximation around the non-stochastic steady state, which allows the simulation averages to deviate from it. In the stochastic steady state, stickier export prices result in a more volatile exchange rate and more negative correlation between output and the exchange rate (Figure 7). Risk-averse investors demand a risk premium to hold local assets for: (i) foreign investors are averse to exchange rate volatility, and (ii) local investors prefer dollar assets, which appreciate during recessions. As a result, steady state UIP premium (Figure **??**) and inflation (Figure 9) rise.

Volatility and Cyclicality of Exchange Rate

Under high dollar invoicing, the exchange rate becomes highly sensitive to external shocks. When exports are priced in dollars, sticky prices prevent an increase in export volumes following a depreciation. As a result, the exchange rate must depreciate significantly to restore current account balance. As we discussed in Section 4.1, one precondition of this effect is dollarized financial system. In a financial system with substantial dollar debt, exchange rate losses increase the need for capital inflows, further exacerbating depreciation. Exchange rate volatility rises, and currency depreciations coincide with economic downturns, strengthening the negative comovement between GDP and the exchange rate.



(a) Exchange rate volatility (θ_x)

(b) Output and exchange rate comovement (θ_x)

Figure 7: Steady State and Export Price Stickiness

Risk Premium

When GDP and the exchange rate exhibit strong negative comovement, local assets provide poor insurance compared to dollar assets (Christiano et al. (2021b)), which tend to appreciate in value during downturns. As a result, households prefer to invest in dollar assets, which offer better protection against external shocks, leading to a higher risk premium on local assets. Similarly, heightened exchange rate volatility discourages foreign investors from holding local assets (Equation 6). Together, these forces imply that as the comovement between GDP and the exchange rate becomes more negative, the UIP premium in the steady state increases (Dalgic (2024)).

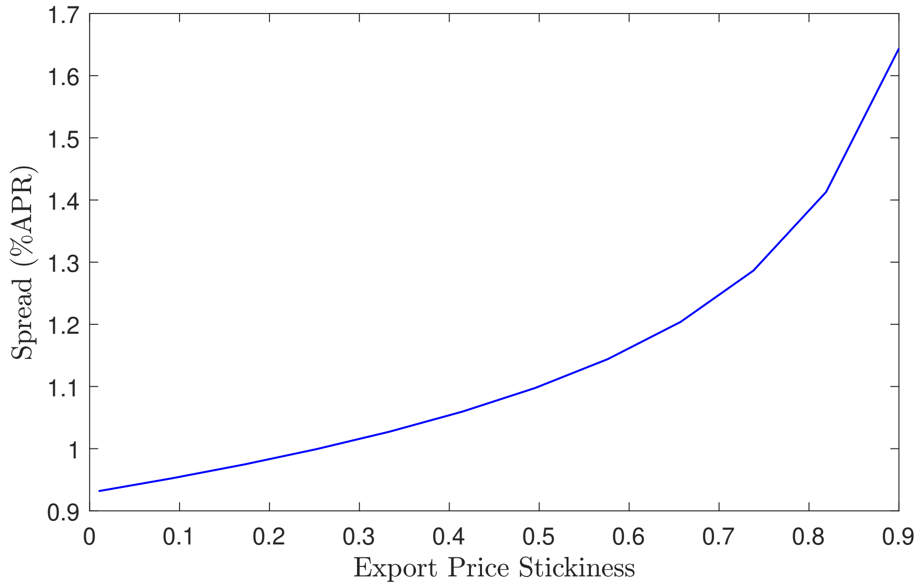


Figure 8: UIP Premium and export dollar price stickiness (θ^x)

Under dollar invoicing, exchange rate volatility amplifies macroeconomic fluctuations, increasing uncertainty for both resident and foreign investors. In response, investors expect large returns from local currency investments (see previous Section 4.2). However, supply of local currency and the interest rates are pinned down by the monetary policy. If the monetary policy follows a standard Taylor rule (such as in equation 7) that ignores the risk premium, interest rate at the target inflation can be 'too low' for investors. In equilibrium, inflation rises above target inflation to push the central bank to raise real interest rates ($r^\pi > 1$). Figure 9 shows that higher dollar invoicing is associated with higher steady state inflation. This mechanism provides a structural explanation for the strong positive correlation between Carry Trade Risk exposure and average inflation we documented in Figure 1c.

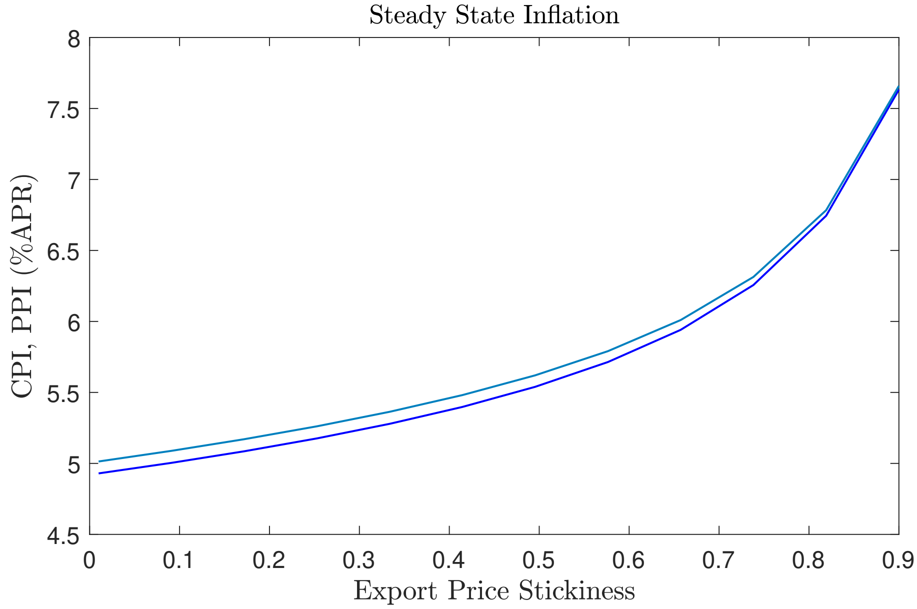
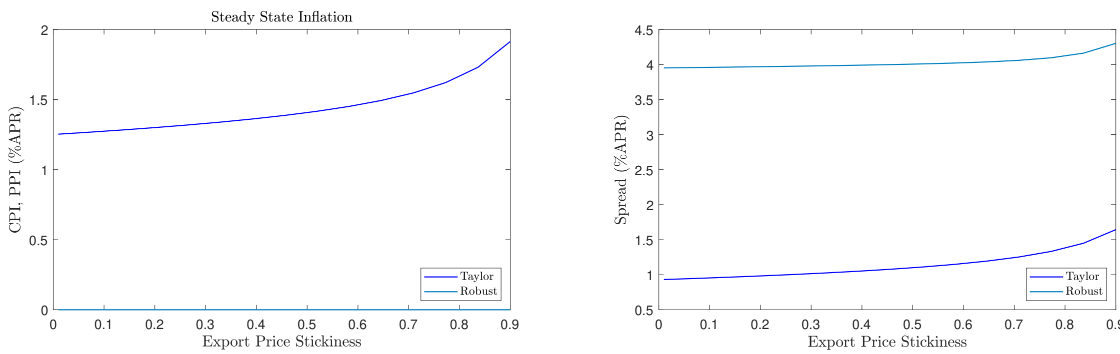


Figure 9: Steady state inflation and export price stickiness

Risk Premium and Inflation

Investors require risk premium to invest in currencies that lose value following global shocks. Previous section shows that if the central bank does not address the risk premium, steady state inflation rises above target. The rise in risk premium is similar to rise in neutral interest rate that is consistent with the target inflation. Following Orphanides and Williams (2006), we modify Taylor rule to be robust to changes in neutral interest rates,

$$R_t - R_{t-1} = r^{\pi} \log\left(\frac{\pi_t}{\bar{\pi}}\right) \tag{8}$$



(a) Steady State Inflation

(b) Steady State Interest Rate Spread

Figure 10: Inflation and Risk Premium under different monetary policy rules

Our results show that by adopting a robust Taylor rule, the central bank can achieve its target inflation (Figure 10a), but this comes at the cost of significantly higher real interest rates (Figure 10b). This finding highlights a fundamental dilemma for central banks in small open economies vulnerable to global shocks, reminding the inflationary bias concerns of Barro and Gordon (1983).

The currency risk premium creates a wedge between the interest rate needed to satisfy investors and the rate consistent with the inflation target. Policymakers must therefore choose between entrenching high inflation under a standard rule or imposing punitive real interest rates to achieve their targets, likely at the cost of lower output. Our framework demonstrates this is not a policy failure, but a difficult trade-off dictated by the economy's underlying structure.

5 Conclusion

This paper demonstrates how an economy's fundamental trade and financial structures endogenously determine the riskiness of its currency. We argue that two frictions are critical: a high share of exports invoiced in dollars and significant dollar-denominated debt in the financial system. The dollar invoicing friction mutes the traditional expenditure-switching channel. When this is combined with high dollar debt, which creates a powerful financial accelerator, the exchange rate's shock-absorbing capacity is broken. Currency depreciations, rather than being expansionary, become recessionary. This forces a countercyclical co-movement between GDP and the exchange rate, making the currency fundamentally risky.

Using a small open economy model, we formalize this mechanism. We show that when high dollar invoicing and dollar debt are present, global shocks that trigger a depreciation simultaneously cause a deep economic contraction. Because local currency assets lose value precisely when income is lowest, they are a poor hedge for investors. This "risky" co-movement, generated by the economy's structural frictions, forces investors to demand a significant risk premium to hold the currency, leading to large and persistent deviations from UIP.

An important macroeconomic consequence is the tendency toward high and persistent structural inflation. The currency risk premium directly elevates the economy's underlying "neutral" rate of interest. A central bank following a conventional policy framework, such as a standard Taylor rule, that is not calibrated to this higher neutral rate will find its policy stance to be systematically "too loose." This persistently accommodative policy, even if unintentional, creates a higher structural long-run inflation above target.

Our findings have several policy implications. First, monetary authorities in economies with these frictions must account for the fact that exchange rate movements may be contractionary. Policies that incentivize a shift away from dollar invoicing could help restore the exchange rate's shock-absorbing function. Second, macroprudential policies that mitigate excessive foreign currency debt in the financial system are crucial for reducing the financial vulnerabilities that amplify shocks. Finally, our analysis reveals that inflation-targeting regimes in such economies face a stark policy trade-off. Adhering to a standard policy rule risks entrenching high structural inflation, while adopting a "robust" rule that can anchor inflation expectations does so at the cost of higher real interest rates.

Overall, this paper provides a unified framework where trade and financial frictions jointly determine a currency's risk profile, which in turn has first-order consequences for inflation. Future research could explore how firms and financial institutions endogenously adjust their invoicing and debt structures in response to this risk, further enriching our understanding of currency risk in an interconnected global economy.

References

Amiti, Mary, Oleg Itskhoki, and Jozef Konings, "Dominant Currencies: How Firms Choose Currency Invoicing and Why It Matters," *The Quarterly Journal of Economics*, July 2022, *137* (3), 1435–1493.

Auclert, Adrien, Matthew Rognlie, Martin Souchier, and Ludwig Straub, "Exchange Rates and Monetary Policy with Heterogeneous Agents: Sizing up the Real Income Channel," *NBER Working Papers*, May 2021, (28872).

Bacchetta, Philippe and Eric van Wincoop, "Puzzling Exchange Rate Dynamics and Delayed Portfolio Adjustment," *Journal of International Economics*, July 2021, *131*, 103460.

Barro, Robert J. and David B. Gordon, "Rules, Discretion and Reputation in a Model of Monetary Policy," *Journal of Monetary Economics*, January 1983, *12* (1), 101–121.

Bocola, Luigi and Guido Lorenzoni, "Financial Crises, Dollarization, and Lending of Last Resort in Open Economies," *American Economic Review*, August 2020, *110* (8), 2524–57.

Bruno, Valentina and Hyun Song Shin, "Capital Flows and the Risk-Taking Channel of Monetary Policy," *Journal of Monetary Economics*, 2015, *71*, 119–132.

Camara, Santiago, Lawrence Christiano, and Hüsnü Dalgic, "The International Monetary Transmission Mechanism," in "NBER Macroeconomics Annual 2024, Volume 39," University of Chicago Press, July 2024.

Christiano, Lawrence, Hüsnü Dalgic, and Armen Nurbekyan, "Financial Dollarization: Efficient Intranational Risk Sharing or Prescription for Disaster?," Technical Report w29034, National Bureau of Economic Research, Cambridge, MA July 2021.

__ , Husnu Dalgic, and Armen Nurbekyan, "Financial Dollarization in Emerging Markets: Efficient Risk Sharing or Prescription for Disaster?," *CRC TR 224 Discussion Paper Series*, August 2021, (crctr224_2021_306).

Corte, Pasquale Della, Steven J. Riddiough, and Lucio Sarno, "Currency Premia and Global Imbalances," *Review of Financial Studies*, 2016, *29* (8), 2161–2193.

Dalgic, Husnu C., "Financial Dollarization in Emerging Markets: An Insurance Arrangement," *International Economic Review*, 2024, *65* (3), 1189–1219.

Dao, Mai, Pierre-Olivier Gourinchas, and Oleg Itskhoki, "Breaking Parity: Equilibrium Exchange Rates and Currency Premia," *IMF Working Papers*, August 2025, *2025* (153), 1.

Farhi, Emmanuel and Xavier Gabaix, "Rare Disasters and Exchange Rates," *The Quarterly Journal of Economics*, February 2016, *131* (1), 1–52.

Fernández, Andrés, Andrés González, and Diego Rodríguez, "Sharing a Ride on the Commodities Roller Coaster: Common Factors in Business Cycles of Emerging Economies," *Journal of International Economics*, March 2018, *111*, 99–121.

Fernandez-Villaverde, Jesus, Pablo Guerron-Quintana, Juan F Rubio-Ramirez, and Martin Uribe, "Risk Matters: The Real Effects of Volatility Shocks," *American Economic Review*, October 2011, *101* (6), 2530–2561.

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

Gertler, Mark and Peter Karadi, "A Model of Unconventional Monetary Policy," *Journal of Monetary Economics*, 2011, *58* (1), 17–34.

Ghironi, Fabio and Galip Kemal Ozhan, "Interest Rate Uncertainty as a Policy Tool?," *Journal of International Economics*, December 2025, *158*, 104180.

Gopinath, Gita and Jeremy C Stein, "Banking, Trade, and the Making of a Dominant Currency*," *The Quarterly Journal of Economics*, October 2020.

_, Emine Boz, Camila Casas, Federico J. Díez, Pierre-Olivier Gourinchas, and Mikkel Plagborg-Møller, "Dominant Currency Paradigm," *American Economic Review*, March 2020, *110* (3), 677–719.

Gourinchas, Pierre-Olivier, Walker D. Ray, and Dimitri Vayanos, "A Preferred-Habitat Model of Term Premia, Exchange Rates, and Monetary Policy Spillovers," NBER Working Papers 29875, National Bureau of Economic Research, Inc March 2022.

Hassan, Tarek A., "Country Size, Currency Unions, and International Asset Returns," *Journal of Finance*, 2013, *68* (6), 2269–2308.

— **and Tony Zhang**, "The Economics of Currency Risk," *Annual Review of Economics*, August 2021, *13* (1), 281–307.

Ince, Onur and Tanya Molodtsova, "Rationality and Forecasting Accuracy of Exchange Rate Expectations: Evidence from Survey-Based Forecasts," *Journal of International Financial Markets, Institutions and Money*, March 2017, *47*, 131–151.

Itskhoki, Oleg and Dmitry Mukhin, "Exchange Rate Disconnect in General Equilibrium," *Journal of Political Economy*, August 2021, *129* (8), 2183–2232.

Kalemli-Ozcan, Sebnem, "U.S. Monetary Policy and International Risk Spillovers," NBER Working Papers 26297, National Bureau of Economic Research, Inc September 2019.

Kalemli-Özcan, Ṣebnem and Liliana Varela, "Five Facts about the UIP Premium," Technical Report w28923, National Bureau of Economic Research, Cambridge, MA June 2021.

Leo, Pierre De, Gita Gopinath, and Ṣebnem Kalemli-Özcan, "Monetary Policy and the Short-Rate Disconnect in Emerging Economies," September 2022.

Lustig, Hanno, Nikolai Roussanov, and Adrien Verdelhan, "Common Risk Factors in Currency Markets," *Review of Financial Studies*, 2011, *24* (11), 3731–3777.

— **,** — **, and** — , "Countercyclical Currency Risk Premia," *Journal of Financial Economics*, 2014, *111* (3), 527–553.

Maggiori, Matteo, "Financial Intermediation, International Risk Sharing, and Reserve Currencies," *American Economic Review*, October 2017, *107* (10), 3038–3071.

McLeay, Michael and Silvana Tenreyro, "Dollar Dominance and the Transmission of Monetary Policy," *The Quarterly Journal of Economics*, September 2025, p. qjaf043.

Miranda-Agrippino, Silvia and Hélène Rey, "U.S. Monetary Policy and the Global Financial Cycle," *The Review of Economic Studies*, 2020, *87* (6), 2754–2776.

Neumeyer, Pablo A. and Fabrizio Perri, "Business Cycles in Emerging Economies: The Role of Interest Rates," *Journal of Monetary Economics*, 2005, *52* (2), 345–380.

Orphanides, Athanasios and John C. Williams, "Monetary Policy with Imperfect Knowledge," *Journal of the European Economic Association*, May 2006, *4* (2-3), 366–375.

Ozhan, Galip Kemal, "Financial Intermediation, Resource Allocation, and Macroeconomic Interdependence," *Journal of Monetary Economics*, November 2020, *115*, 265–278.

Richmond, Robert J., "Trade Network Centrality and Currency Risk Premia," *Journal of Finance*, 2019, *74* (3), 1315–1361.

Verdelhan, Adrien, "The Share of Systematic Variation in Bilateral Exchange Rates," *Journal of Finance*, 2018, *73* (1), 375–418.

Yeyati, Eduardo Levy, "Financial Dollarization: Evaluating the Consequences," *Economic Policy*, 2006, *21* (45), 61–118.

A Determinants of Currency Returns

In this section, we look at determinants of excess currency returns discussed in the literature. We consider external balance (Della Corte et al. (2016)), foreign assets in the banking system (Yeyati (2006); Christiano et al. (2021b)), Dollar invoicing (Gopinath and Stein (2020), size(Hassan (2013)) and trade network centrality (Richmond (2019)). Across currencies, foreign liabilities (external debt, NFA) and export dollar invoicing emerge as the robustly significant determinants of currency returns. Below, we look at each of these variables in isolation. Table 8 runs a regression of average returns on the variables discussed. Similar to Hassan and Zhang (2021), including GDP to the regression makes trade centrality insignificant, this is in line with Richmond (2019) which argues that either size or connectedness makes an economy central to international trade. Data on dollar invoicing, especially for EMEs, do not exist for many countries so in order to increase the number of countries, we added 13 more countries using Forward returns.

	Dependent variable:			
	Average Return			
	(1)	(2)	(3)	(4)
FL/FA	0.010***		0.009**	0.008**
	(0.004)		(0.004)	(0.004)
Net Foreign Assets/GDP	−0.031***		−0.027***	−0.028***
	(0.009)		(0.003)	(0.005)
GDP(Share of US)	0.006			0.003
	(0.005)			(0.007)
Reserves/GDP	0.060	0.003	0.015	0.033
	(0.048)	(0.026)	(0.025)	(0.042)
Export USD Invoicing	0.036*	0.018**	0.017***	0.019**
	(0.019)	(0.008)	(0.006)	(0.009)
Trade Centrality		−4.304**	−0.983	−2.774
		(2.011)	(1.088)	(4.387)
Constant	−0.004	0.029*	−0.003	0.013
	(0.011)	(0.016)	(0.011)	(0.035)
Observations	20	17	14	14
R^2	0.560	0.335	0.805	0.810
Adjusted R^2	0.402	0.182	0.683	0.648
Residual Std. Error	0.020 (df = 14)	0.016 (df = 13)	0.010 (df = 8)	0.011 (df = 7)
Note:			*p<0.1; **p<0.05; ***p<0.01	

Table 8: Determinants of Returns

Data source: IFS, Datastream, FX4Casts, Gopinath et al. (2020), Richmond (2019)

A.1 Foreign Assets and Liabilities of the Banking System

First variable we consider is the ratio of foreign liabilities over foreign assets in the banking system (FL/FA). FL/FA is found to be a good predictor of banking crises (Yeyati (2006); Christiano et al. (2021a)). High foreign liabilities can make the banking system susceptible to panics and roll-over problems, which will be accompanied by currency depreciation and low returns for investors ; against which the investors will ask for higher returns(Bocola and Lorenzoni (2020)). In 11, we plot average excess returns against average FL/FA. In economies where the banking system carries high foreign debt, we see higher expected currency returns.

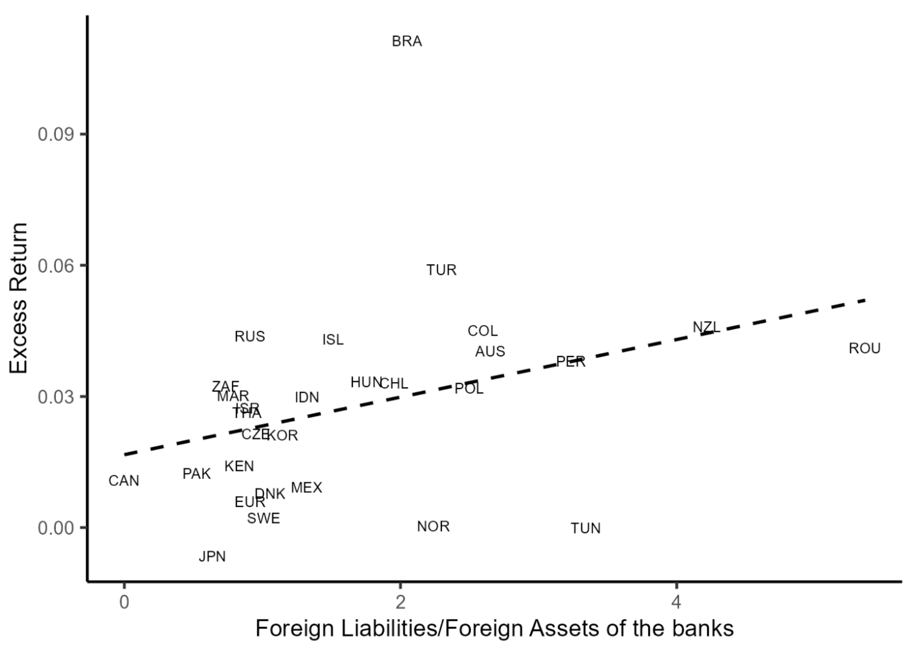


Figure 11: FL/FA and excess returns

Data source: FX4Casts, IMF IFS. Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variable is the ratio of foreign liabilities to foreign assets in the banking system

A.2 Reserves

Against foreign borrowing, central banks can hold reserves, which should reduce the risk of rollover crises. However, we do not see a significant relationship between reserves and average excess returns. In figure 12, we plot average excess returns against reserves as a share of GDP

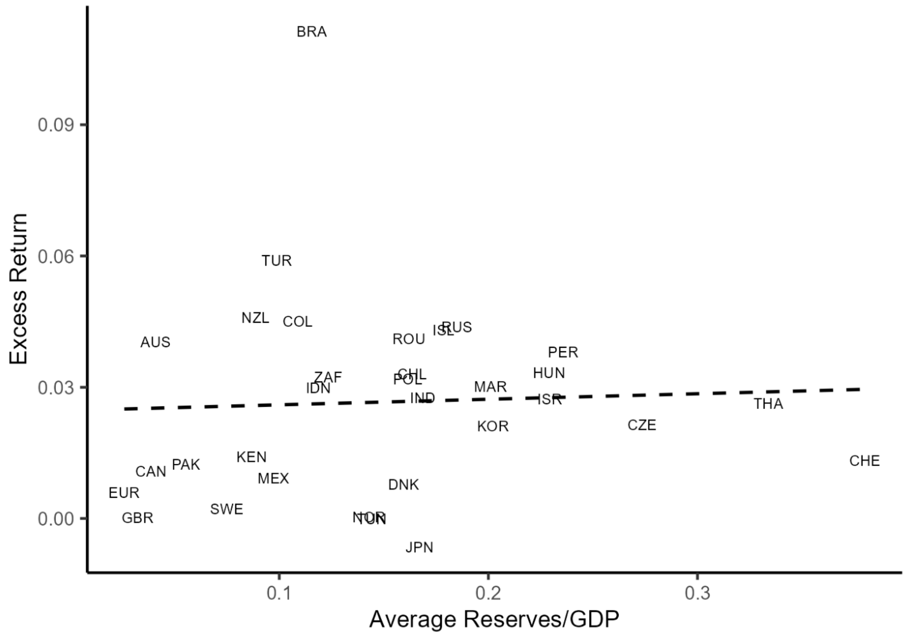


Figure 12: Reserves and excess returns

Data source: FX4Casts, IMF IFS. Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variable is the reserves as a share of GDP

A.3 External Balance

The third variable we consider is external balance as a share of GDP, which is a proxy for net investment position of a country which is found to be an important determinant of currency returns(Della Corte et al. (2016)) . There is a clear negative relationship between

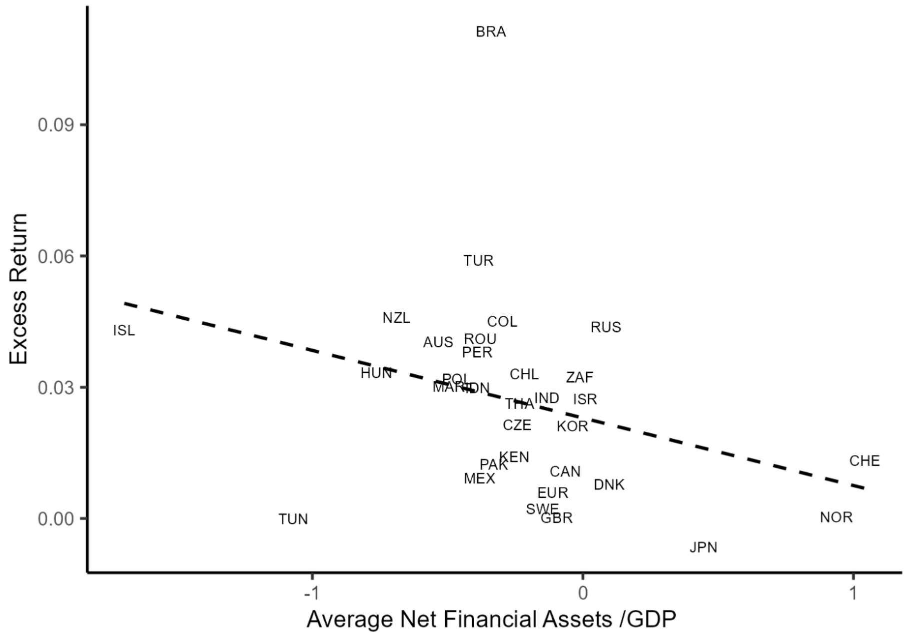


Figure 13: NFA and excess returns

Data source: FX4Casts, IMF IFS. Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variable is the average net external balance as a share of GDP,

A.4 Size and Trade Centrality

Country size (Hassan (2013)) and trade network centrality (Richmond (2019)) is found to be significant determinants of excess currency returns. Shocks to larger and/or to more central economies affect smaller economies but shocks to smaller economies do not spill over to larger economies. Then, assets of larger or more central economies provide insurance not only against country specific shocks, but also against global shocks. Thus, local currency assets of larger and/or more central economies should provide lower returns since there is high demand for them. Figure 14

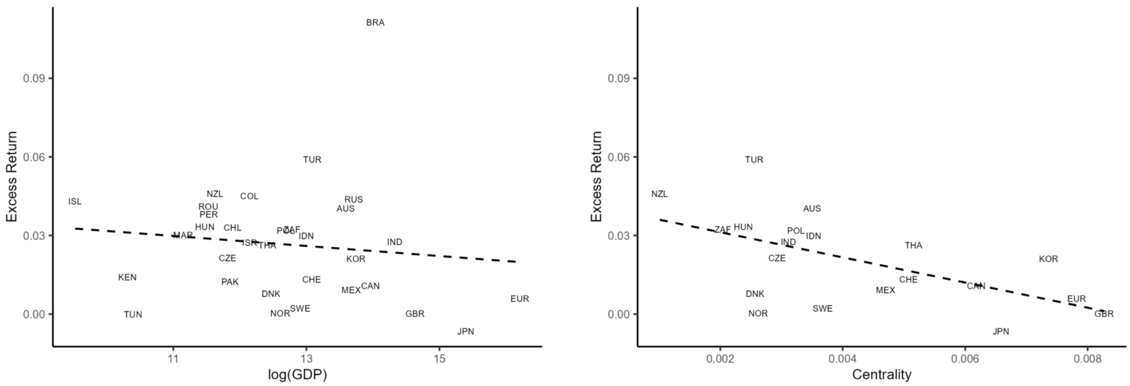


Figure 14: Size, centrality and excess returns

Data source: FX4Casts, IMF IFS, Richmond (2019). Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variables is the average log nominal GDP and average trade network centrality

A.5 Financial Depth and Currency Returns

Figure 15 plots total foreign assets and liabilities as a share of GDP, a proxy for financial depth, against excess returns. Maggiori (2017) argues that countries whose financial system is deep can intermediate large amounts of flows and carry a safety premium. Net external balance and financial depth are highly correlate, one is that the financial depth is driven mostly by assets rather than liabilities which are accumulated by giving large external surpluses

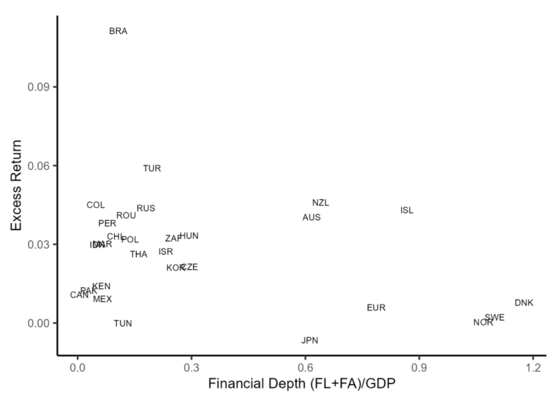


Figure 15: Excess returns vs Financial Depth

Data source: FX4Casts. Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variables is the sum of foreign assets and liabilities of the banking system as a share of GDP, proxy for financial depth.

B Inflation and GDP-ER Co-movement

In countries where the exports are mostly invoiced in USD, expenditure switching channel is muted. In these economies, the monetary policy faces a dilemma following external shocks. Economies with flexible export prices can respond to external shocks that cause exchange rate depreciations (capital flight, foreign interest rate shock etc.) by increasing exports which stimulates the economy. On the other hand, in countries with sticky export prices, external shocks are more contractionary because of weak response of exports.

Figure 16 plots average inflation against GDP-ER correlation. In countries with high inflation we tend to see countercyclical exchange rate

Figure 17 plots average inflation against average excess returns. In countries with high average inflation, demand for local currency assets is low, which drives up local currency interest rates.

Figure 18 plots export dollar invocing against average inflation. In line with our theory, in countries with high dollar invoicing, monetary policy cannot react sharply against external shocks because exchange rate shcoks are recessionary. In these economies, we see high average inflation.

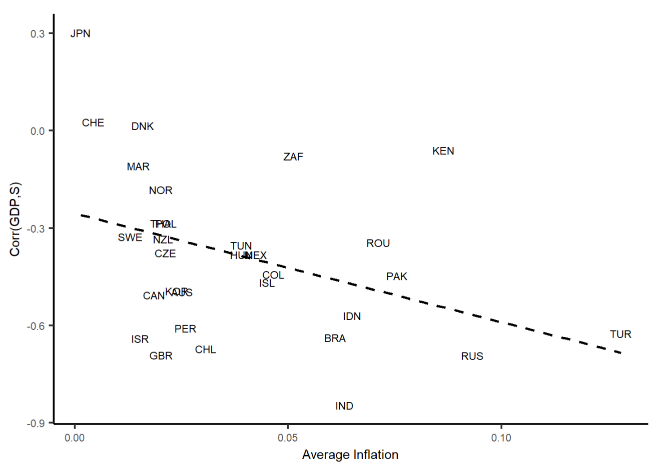


Figure 16: Average Inflation vs GDP-ER Correlation

Data source: FX4Casts, IMF IFS. Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variables are Δ logGDP and $\Delta \log \frac{S}{P}$. S is the Dollar exchange rate and P is the CPI.

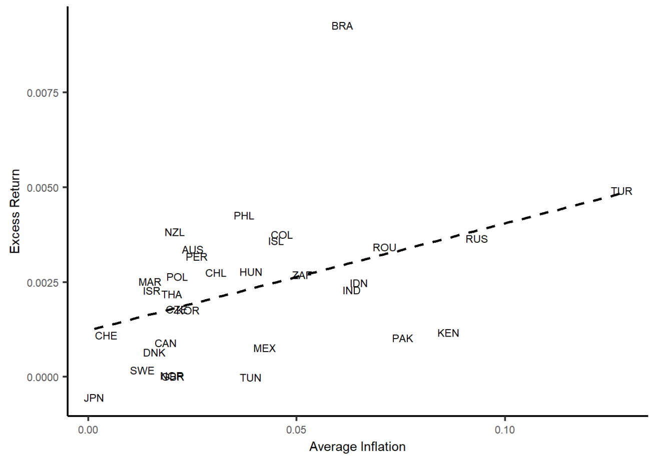


Figure 17: Average Inflation vs Average Excess Returns

Data source: FX4Casts, IMF IFS. Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variables are $\Delta\,\text{logGDP}$ and $\Delta \log \frac{S}{P}$. S is the Dollar exchange rate and P is the CPI.

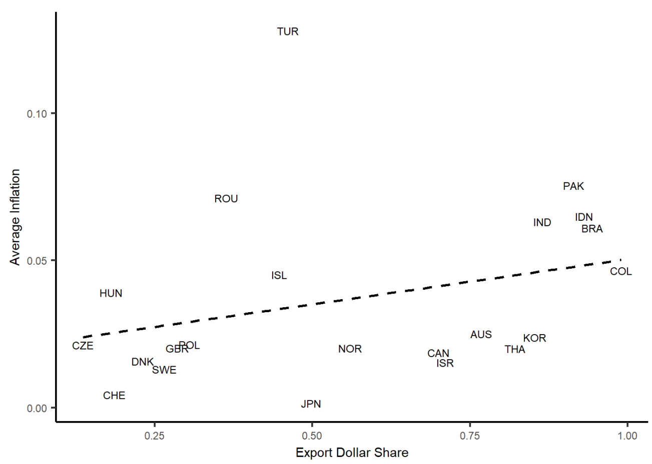


Figure 18: Average Inflation vs Dollar invoicing in exports

Data source: IMF, IFS, Gopinath et al. (2020). Y-axis variables are $\Delta\,\text{logGDP}$ and $\Delta \log \frac{S}{P}$. S is the Dollar exchange rate and P is the CPI. X-axis variable is the average dollar invoicing share of imports.

In addition to average inflation, we also look at price level volatility[8]. The results are virtually the same.

[8]we estimate price level volatility as the standard deviation of $\log(P_t)$, where P_t is the CPI index

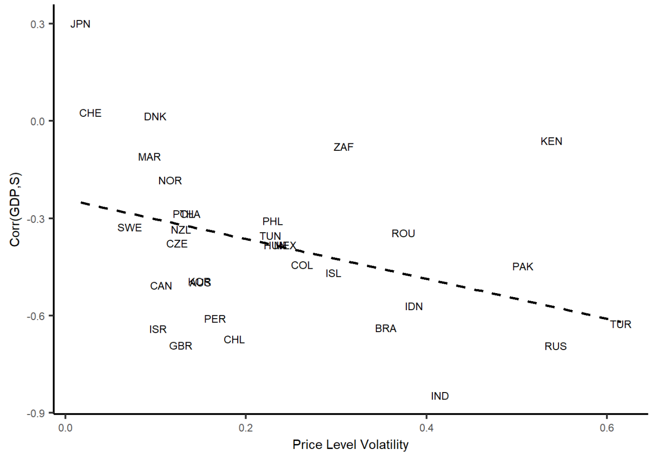


Figure 19: Price Level Volatility vs GDP-ER Correlation

Data source: FX4Casts, IMF IFS. Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variables are $\Delta\,\log\text{GDP}$ and $\Delta\log\frac{S}{P}$. S is the Dollar exchange rate and P is the CPI.

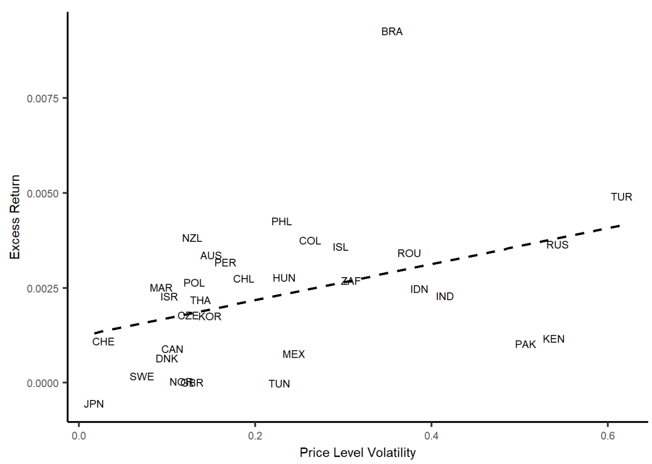


Figure 20: Price Level Volatility vs Average Excess Returns

Data source: FX4Casts, IMF IFS. Y-axis variable is the average currency return of 25 countries between 02/2003 - 11/2018. X-axis variables are $\Delta\,\log\text{GDP}$ and $\Delta\log\frac{S}{P}$. S is the Dollar exchange rate and P is the CPI.

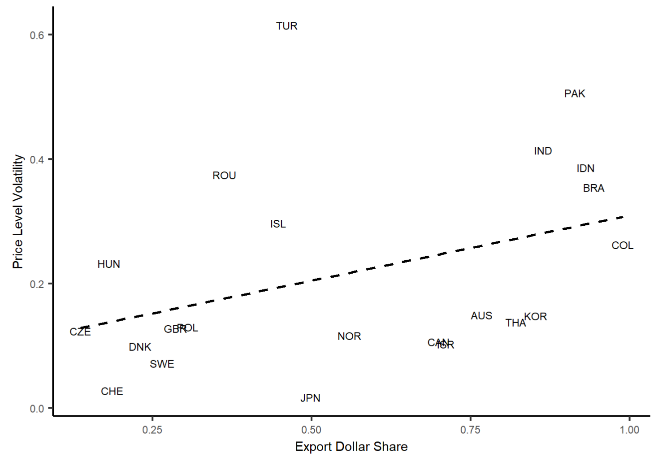


Figure 21: Price Level Volatility vs Dollar invoicing in exports

Data source: IMF, IFS, Gopinath et al. (2020). Y-axis variables are Δ logGDP and $\Delta \log \frac{S}{P}$. S is the Dollar exchange rate and P is the CPI. X-axis variable is the average dollar invoicing share of imports.

C Forward Returns

Covered interest rate parity gives us an alternative measure for currency returns. Denote F_t as the price of a forward contract. No arbitrage condition requires that the return to a hedged currency position financed by USD should be equal to the return to USD returns.

$$\frac{S_t}{F_t} R_t^L = R_t^{US} \tag{9}$$

We can replace R_t^L inside the equation 1 using the equation 9,

$$R_t^{US} \left(\frac{F_t}{S_{t+1}} - 1 \right) \tag{10}$$

Equation 10 allows us to overcome the problem of finding compatible interest rates across countries as well as accounting for trading costs using different ask/bid prices. One big potential issue with the forward returns is there are documented large CIP deviations. Verdelhan (2018) notes that in CIP holds most of the time in the monthly data. Still, buying forward contracts is the most straightforward strategy to invest in other currencies. Forward returns are by themselves valid returns, irrespective of whether they are a good proxy for actually borrowing in USD and investing in local currency interest rates.

D Model Equation

In this Section, we write down equations of the model in detail.

D.1 Household Problem

Scaled household budget constraint

$$d_t + d_t^* + p_t^c C_t = d_{t-1}R_{t-1} + s_t R_{t-1}^* d_{t-1}^* + w_t l_t + T_t$$

Here are the first order conditions with respect to household total savings (d_t, d_t^*) and dollar share (Θ_t). In order to pin total savings of the household in the open economy model, we introduce small adjustment costs γ_S with the steady state household total saving target being $\bar{d}$.

$$U_{c,t}\left(1 + \gamma_S(d_t + d_t^* - \overline{d})\right) = \beta U_{c,t+1}\frac{s_{+1}R_t^*\Theta_t + (1-\Theta_t)R_t}{\Pi_{c,t+1}}$$

$$\gamma(\Theta_t - \Upsilon_t) = \beta(d_t + d_t^*)\mathbb{E}_t\left(R_t - s_{t+1}R_t^*\right)\frac{U_{c,t+1}}{\Pi_{c,t+1}}$$

where d_t, d_t^* are local currency value of local currency and dollar savings. s_t is the exchange rate depreciation $\frac{S_t}{S_{t-1}}$, w_t is the wage rate.

Household labor supply decision,

$$w_t = (1/U_{c,t})\tau l_t^{\varphi};$$

D.2 Final Domestic Good Producers

Final good production function

$$Y_t = \left[\int_0^1 Y_{i,t}^{\frac{\varepsilon-1}{\varepsilon}} di\right]^{\frac{\varepsilon}{\varepsilon-1}}$$

Demand curve

$$Y_{i,t} = Y_t \left(\frac{P_t}{P_{i,t}} \right)^{\varepsilon}$$

Aggregate price index

$$P_t = \left(\int_0^1 P_{i,t}^{(1-\varepsilon)} di \right)^{\frac{1}{1-\varepsilon}}$$

D.3 Intermediate Good Producers

Production function of the intermediate good firms

$$Y_{i,t} = K_{i,t-1}^{\alpha} \left(A_t l_{i,t} \right)^{1-\alpha}$$

where A_t is exogenous productivity shock. Firms are subject to the Calvo Price-Setting Friction, only a certain fraction of firms $(1-\theta)$ can change their prices,

$$P_{i,t} = \begin{cases} \tilde{P}_t & \text{with probability } 1-\theta \\ P_{i,t-1} & \text{with probability } \theta \end{cases} .$$

Marginal cost of the firms with a cost subsidy to cancel out monopoly power ν

$$s_t = (1-\nu) \left(\frac{r_t}{\alpha} \right)^{\alpha} \left(\frac{w_t}{(1-\alpha) A_t} \right)^{1-\alpha}$$

The objective of an intermediate good producer firm,

$$\mathbb{E}_t^i \sum_{j=0}^{\infty} \beta^j \upsilon_{t+j} \left[P_{i,t+j} Y_{i,t+j} - P_{t+j} s_{t+j} Y_{i,t+j} \right],$$

where marginal utility of the household,

$$\upsilon_{t+j} = \frac{u' \left(C_{t+j} \right)}{P_{t+j}^c}, \tag{11}$$

Objective of the firms that can change their prices,

$$E_t \sum_{j=0}^{\infty} (\beta\theta)^j \, v_{t+j} \left[\tilde{P}_t Y_{i,t+j} - P_{t+j} s_{t+j} Y_{i,t+j} \right] + \chi_t$$

where $\tilde{P}_t$ is the new price chosen by the firm and χ_t term does not include terms with $\tilde{P}_t$.

First order condition with respect to $\tilde{P}_t$,

$$\mathbb{E}_t \sum_{j=0}^{\infty} (\beta\theta)^j \frac{u'(C_{t+j})}{p^c_{t+j}} P^{\varepsilon}_{t+j} Y_{t+j} \left[\frac{\tilde{P}_t}{P_{t+j}} - \frac{\varepsilon}{\varepsilon - 1} s_{t+j} \right] = 0,$$

Optimal price set by the firm,

$$\tilde{p}_t = \frac{\mathcal{K}_t}{\mathcal{F}_t}. \tag{12}$$

$$\mathcal{K}_t = \frac{U_{c,t}}{p^c_t} y_t \frac{\varepsilon}{\varepsilon - 1} s_t + \beta\theta E_t \pi^{\varepsilon}_{t+1} \mathcal{K}_{t+1}$$
$$\mathcal{F}_t = \frac{U_{c,t}}{p^c_t} y_t + \beta\theta E_t \pi^{\varepsilon-1}_{t+1} \mathcal{F}_{t+1}$$

where $\mathcal{K}_t$ denotes the discounted sum of expected marginal cost and $\mathcal{F}_t$ is the discounted sum of demand.

D.4 Export Sector

This section introduces sticky export prices in dollars, modeled via a Calvo friction (θ^x) at the level of differentiated intermediate good producers. These monopolistic firms produce domestic inputs ($X_{i,t}$) for the final export sector. While their marginal cost is the price of the domestic homogeneous good (P_t), they set their sales price in USD. The parameter θ^x governs the frequency of these USD price adjustments and, consequently, determines the model's resulting invoicing paradigm. A high θ^x implies infrequent price changes, replicating Dominant Currency Pricing (DCP). In the flexible-price limit ($\theta^x \to 0$), firms reset their price each period to a markup over their domestic-currency marginal cost, aligning the export price with the producer's currency and generating Producer Currency Pricing (PCP).

D.4.1 Final Exporter

A competitive firm produces the final export good X_t by combining a domestic input X_t^d and a foreign input X_t^m via a CES production function:

$$X_t = \left[\gamma_x^{\frac{1}{\eta_x}} \left(X_t^d\right)^{\frac{\eta_x - 1}{\eta_x}} + (1-\gamma_x)^{\frac{1}{\eta_x}} \left(X_t^m\right)^{\frac{\eta_x - 1}{\eta_x}}\right]^{\frac{\eta_x}{\eta_x - 1}}$$

The resulting dollar price index for the final export good is:

$$P_t^x = \left[\gamma_x \left(P_t^{d,x}\right)^{1-\eta_x} + (1-\gamma_x)\left(P_t^f\right)^{1-\eta_x}\right]^{\frac{1}{1-\eta_x}}$$

D.4.2 Domestic Input Aggregator

The domestic input X_t^d is produced by a competitive aggregator using a continuum of differentiated intermediate goods $X_{i,t}$:

$$X_t^d = \left[\int_0^1 X_{i,t}^{\frac{\varepsilon_x - 1}{\varepsilon_x}} di\right]^{\frac{\varepsilon_x}{\varepsilon_x - 1}}, \quad \varepsilon_x > 1$$

This implies a demand function for each intermediate good i:

$$X_{i,t} = X_t^d \left(\frac{P_{i,t}^{d,x}}{P_t^{d,x}}\right)^{-\varepsilon_x}$$

The aggregate dollar price index for the domestic input is:

$$P_t^{d,x} = \left(\int_0^1 \left(P_{i,t}^{d,x}\right)^{(1-\varepsilon_x)} di\right)^{\frac{1}{1-\varepsilon_x}}$$

D.4.3 Intermediate Good Producer

The monopolist producer of $X_{i,t}$ faces Calvo price frictions. In any period, the firm can reset its price $\tilde{P}_t^{d,x}$ (in dollars) with probability $1-\theta_x$. The aggregate price index $P_t^{d,x}$

thus evolves as:

$$P_t^{d,x} = \left[(1-\theta_x)\left(\tilde{P}_t^{d,x}\right)^{(1-\varepsilon_x)} + \theta_x\left(P_{t-1}^{d,x}\right)^{(1-\varepsilon_x)}\right]^{\frac{1}{1-\varepsilon_x}}$$

The firm's objective is to choose $\tilde{P}_t^{d,x}$ to maximize the expected discounted stream of future profits, weighted by the household's marginal utility of wealth υ_t:

$$\max_{\tilde{P}_t^{d,x}} E_t \sum_{j=0}^{\infty} (\beta\theta_x)^j \, \upsilon_{t+j}\left[S_{t+j}\tilde{P}_t^{d,x} X_{i,t+j} - P_{t+j}X_{i,t+j}\right]$$

The first-order condition, after substituting the demand for $X_{i,t+j}$, is:

$$E_t \sum_{j=0}^{\infty} (\beta\theta_x)^j \, \frac{u'\left(C_{t+j}\right)}{p_{t+j}^c / p_{t+j}^{d,x}} X_{t+j}^d \left(P_{t+j}^{d,x}\right)^{\varepsilon_x} \left[\frac{\tilde{P}_t^{d,x}}{P_{t+j}^{d,x}} - \frac{\varepsilon_x}{\varepsilon_x - 1} s_{t+j}^x\right] = 0$$

where $s_t^x \equiv P_t/(S_t P_t^{d,x}) = 1/p_t^{d,x}$ is the scaled marginal cost. The optimal relative price $\tilde{p}_t^{d,x} = \tilde{P}_t^{d,x}/P_t^{d,x}$ is:

$$\tilde{p}_t^{d,x} = \frac{\mathcal{K}_t^x}{\mathcal{F}_t^x}$$

Where $\mathcal{K}_t^x$ (discounted marginal costs) and $\mathcal{F}_t^x$ (discounted demand) are defined recursively (including tax τ_t and subsidy ν_x):

$$\mathcal{K}_t^x = (1-\tau_t)\,\frac{x_t^d}{p_t^c c_t}\frac{(1-\nu_x)\,\varepsilon_x}{\varepsilon_x - 1} + \beta\theta_x E_t \left(\pi_{t+1}^{d,x}\right)^{\varepsilon_x} \mathcal{K}_{t+1}^x$$

$$\mathcal{F}_t^x = (1-\tau_t)\,\frac{p_t^{d,x} x_t^d}{p_t^c c_t} + E_t \beta\theta_x \left(\pi_{t+1}^{d,x}\right)^{(\varepsilon_x - 1)} \mathcal{F}_{t+1}^x$$

Combining the optimal price $\tilde{p}_t^{d,x}$ with the aggregate price index evolution gives the equilibrium condition:

$$\frac{\mathcal{K}_t^x}{\mathcal{F}_t^x} = \left[\frac{1-\theta_x\left(\pi_t^{d,x}\right)^{\varepsilon_x - 1}}{1-\theta_x}\right]^{\frac{1}{1-\varepsilon_x}}$$

Finally, price dispersion $p_t^{*,x}$ evolves according to:

$$p_t^{*,x} = \left[(1-\theta_x) \left[\frac{1-\theta_x \left(\pi_t^{d,x}\right)^{\varepsilon_x - 1}}{1-\theta_x} \right]^{\frac{\varepsilon_x}{\varepsilon_x - 1}} + \theta_x \frac{\left(\pi_t^{d,x}\right)^{\varepsilon_x}}{p_{t-1}^{*,x}} \right]^{-1}$$

D.5 Banker Problem

Bankers are part of the household, with probability θ, they stay bankers and with probability $(1-\theta)$ they retire and become workers. Each period some workers become bankers and get W_b startup funds from the household. Bankers maximize,

$$V_{j,t} = \max \mathbb{E}_t \sum_{i=0}^{\infty} (1-\theta)\theta^i \beta^{i+1} \Lambda_{t,t+i+1} N_{j,t+i+1}$$

We can write $V_{j,t}$ recursively

$$V_{j,t} = \mathbb{E}_t \left[\beta(1-\theta) N_{j,t+1} + \beta\theta\Lambda_{t,t+1} V_{j,t+1} \right]$$

Evolution of net worth,

$$N_{j,t+1} = R_{t+1}^k Q_t S_{jt} - R_t B_{j,t}^{LC} - R_t^F \frac{S_{t+1}}{S_t} B_{j,t}^{FC}$$

We want to scale the above expression by $N_{j,t}$

$$\frac{N_{j,t+1}}{N_{j,t}} = R_{t+1}^k \frac{Q_t S_{jt}}{N_{j,t}} - R_t \frac{B_{j,t}^{LC}}{N_{j,t}} - R_t^F \frac{S_{t+1}}{S_t} \frac{B_{j,t}^{FC}}{N_{j,t}}$$

Define $\phi_t \in [0,1]$ as the share of net worth allocated to borrowing in dollars, which leaves $(1-\phi)$ share to be allocated to local currency borrowing. Define leverage ratios, $\left(L_t^{LC}, L_t^{FC}\right)$ as the ratio of assets that are funded by local currency and dollars respectively

$$B_{j,t}^{FC} = \left(L_{j,t}^{FC} - 1\right)\phi_{j,t} N_{j,t}$$
$$B_{j,t}^{LC} = \left(L_{j,t}^{LC} - 1\right)\left(1 - \phi_{j,t}\right) N_{j,t}$$

Evolution of net worth becomes

$$\frac{N_{j,t+1}}{N_{j,t}} = \left[\left(R_{t+1}^{k} - R_{t}\right) L_{j,t}^{LC}\left(1 - \phi_{j,t}\right) + \left(R_{t+1}^{k} - R_{t}^{F}\frac{S_{t+1}}{S_{t}}\right) L_{j,t}^{USD}\phi_{j,t} + R_{t}(1 - \phi_{t}) + R_{t}^{F}\frac{S_{t+1}}{S_{t}}\phi_{j,t}\right]$$

Bankers can divert λ fraction of the assets. In that case, they run away with the money. Understanding this, bankers lend to banks only if the value of being a banker exceeds the diverted assets. We assume that bankers get two separate loans in local currency and in dollars. The implication is that bankers can independently run away with local currency or dollar loans so that the incentive constraint need to bind for both types of borrowing,

$$V_{j,t}^{LC} \geq \lambda L_{j,t}^{LC} N_{j,t}^{LC}$$
$$V_{j,t}^{FC} \geq \lambda L_{j,t}^{FC} N_{j,t}^{FC}$$

where$N_{j,t}^{LC}$ and $N_{j,t}^{FC}$ are net worh allocated to local currency and dollar borrowing respectively $N_{j,t}^{LC} + N_{j,t}^{FC} = N_{j,t}$ and,

$$V_{j,t}^{LC} = \mathbb{E}_{t}\left[\beta(1-\theta)\left[L_{j,t}^{FC} N_{j,t}^{LC}\left(R_{t+1}^{k} - R_{t}\right) + R_{t}(1-\phi_{j,t})N_{j,t}^{LC}\right] + \beta\theta\Lambda_{t,t+1}V_{j,t+1}^{LC}\right]$$
$$V_{j,t}^{FC} = \mathbb{E}_{t}\left[\beta(1-\theta)\left[L_{j,t}^{FC} N_{j,t}^{FC}\left(R_{t+1}^{k} - R_{t}^{F}\frac{S_{t+1}}{S_{t}}\right) + R_{t}^{F}\frac{S_{t+1}}{S_{t}}N_{j,t}^{FC}\right] + \beta\theta\Lambda_{t,t+1}V_{j,t+1}^{FC}\right]$$

so that $V_{j,t}^{LC} + V_{j,t}^{FC} = V_{j,t}$

Scale recursive net worth for dollar borrowing,

$$\frac{V^{FC}_{j,t}}{N^{FC}_{j,t}} = \mathbb{E}_t \left[\beta(1-\theta) \left[L^{FC}_{j,t} \left(R^k_{t+1} - R^*_t \frac{S_{t+1}}{S_t} \right) + R^*_t \frac{S_{t+1}}{S_t} \right] + \beta\theta\Lambda_{t,t+1} \frac{V^{FC}_{j,t+1}}{N^{FC}_{j,t+1}} \frac{N^{FC}_{j,t+1}}{N^{FC}_{j,t}} \right]$$

where $\frac{N^{FC}_{j,t+1}}{N^{FC}_{j,t}} = \left[L^{FC}_{j,t} \left(R^k_{t+1} - R^*_t \frac{S_{t+1}}{S_t} \right) + R^*_t \frac{S_{t+1}}{S_t} \right]$ is the amount of equity a dollar borrowing bank expect to have at the end of the period. Simplifying,

$$\psi^{FC}_t = \mathbb{E}_t \left[\left[\beta(1-\theta) + \beta\theta\Lambda_{t,t+1}\psi^{FC}_{t+1} \right] \left[L^{FC}_{j,t} \left(R^k_{t+1} - R^*_t \frac{S_{t+1}}{S_t} \right) + R^*_t \frac{S_{t+1}}{S_t} \right] \right]$$

similarly for local currency borrowing

$$\psi^{LC}_t = \mathbb{E}_t \left[\left[\beta(1-\theta) + \beta\theta\Lambda_{t,t+1}\psi^{LC}_{t+1} \right] \left[L^{LC}_{j,t} \left(R^k_{t+1} - R_t \right) + R_t \right] \right]$$

Since the last equations are independent of j, all bankers make the same choice so we can remove j subscript.

D.5.1 Banker Optimization

A banker who borrows in dollars solve,

$$\psi^{FC}_t = \max_{L^{FC}_t} \mathbb{E}_t \left[\beta \left[(1-\theta) + \Lambda_{t,t+1}\theta\psi^{FC}_{t+1} \right] \left[L^{FC}_t \left(R^k_{t+1} - R^*_t \frac{S_{t+1}}{S_t} \right) + R^*_t \frac{S_{t+1}}{S_t} \right] \right]$$

subject to the incentive constraint

$$\psi^{FC}_t \geq \lambda L^{FC}_t$$

Solution satisfies

$$L^{FC}_t = \frac{\nu^{FC}_t}{\lambda - \eta^{FC}_t}$$

$$\eta^{FC}_t = \mathbb{E}_t \left[\beta\Lambda_{t,t+1}\Omega^{FC}_{t+1} \left(R^k_{t+1} - R^*_t \frac{S_{t+1}}{S_t} \right) \right]$$

$$
\begin{aligned}
\nu_t^{FC} &= \mathbb{E}_t \left[\beta \Lambda_{t,t+1} \Omega_{t+1}^{FC} R_t^* \frac{S_{t+1}}{S_t} \right] \\
\Omega_{t+1}^{FC} &= (1-\theta) + \theta \psi_{t+1}^{FC} \\
\psi_t^{FC} &= \lambda L_t^{FC}
\end{aligned}
$$

similarly local currency borrowing satisfies,

$$
L_t^{LC} = \frac{\nu_t^{LC}}{\lambda - \eta_t^{LC}}
$$

$$
\begin{aligned}
\eta_t^{LC} &= \mathbb{E}_t \left[\beta \Lambda_{t,t+1} \Omega_{t+1}^{LC} \left(R_{t+1}^k - R_t \right) \right] \\
\nu_t^{LC} &= \mathbb{E}_t \left[\beta \Lambda_{t,t+1} \Omega_{t+1}^{LC} R_t \right] \\
\Omega_{t+1}^{LC} &= (1-\theta) + \theta \psi_{t+1}^{LC} \\
\psi_t^{LC} &= \lambda L_t^{LC}
\end{aligned}
$$

D.5.2 Currency Choice

Bankers allocate net worth according to

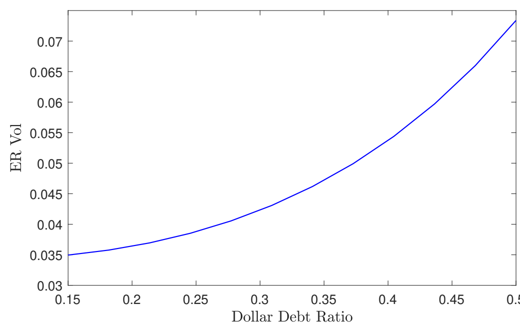
$$
\max_{\phi_t} \phi_t \psi_t^{LC} + (1-\phi_t)\psi_t^{USD} - \frac{\epsilon}{2}(\phi_t - \bar{\phi})^2
$$

where the last term denotes preferred habitat (or regulation) so that banks do not move their portfolios too much away from the target credit dollarization.

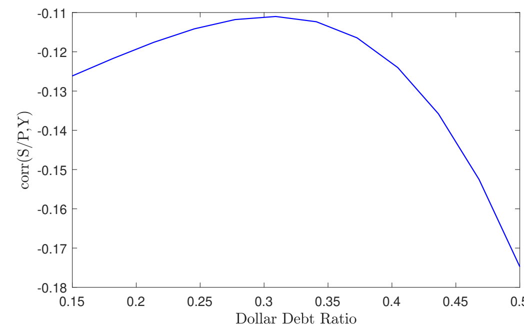
$$
\begin{aligned}
\psi_t^{LC} - \epsilon(\phi_t - \bar{\phi}) &= \psi_t^{USD} \\
L_t^{LC} - \frac{\epsilon}{\lambda}(\phi_t - \bar{\phi}) &= L_t^{USD} \\
\phi_t &= \frac{\lambda}{\epsilon} \left(L_t^{LC} - L_t^{USD} \right) + \bar{\phi}
\end{aligned}
$$

D.6 Varying Dollar Debt in the Steady State

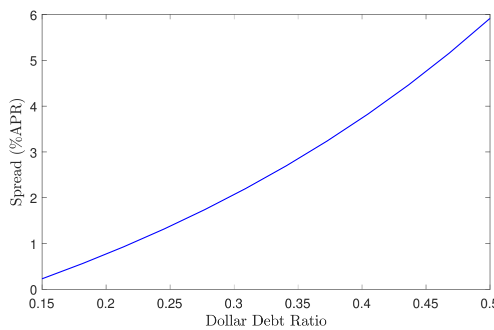
In this Section, we replicate results in Section 4.2 by varying dollar debt in the steady state by changing target portfolio of bankers $\bar{\phi}$. Figure 22 plots the increase in ER volatility, and rising UIP premium and inflation following increasing target dollar ratio.



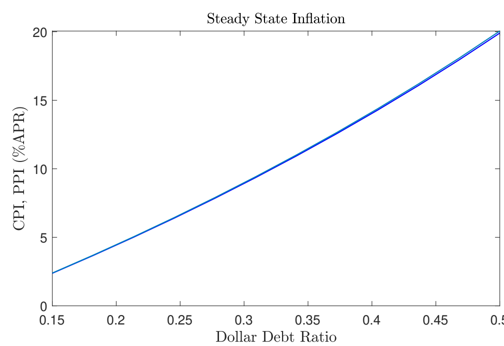
(a) Exchange rate volatility (ϕ)



(b) Output and exchange rate comovement (ϕ)



(c) UIP premium (ϕ)

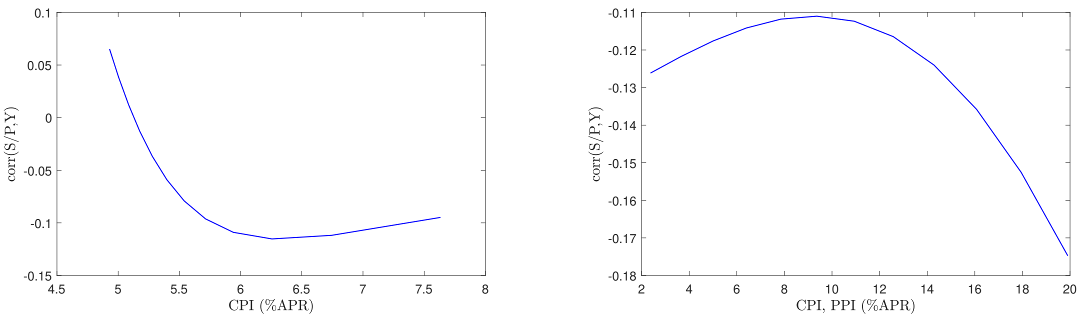


(d) Steady state inflation

Figure 22: Steady State with respect to Dollar Debt (ϕ)

D.7 Inflation and GDP-ER Co-movement

In this section, we use above simulations to generate the realtionship between GDP-ER comovement and inflation. Figure 23 is able to capture the negative relationship between average inflation and the comovement between output and the exchange rate along both dollar debt and dollar invoicing. In countries with negative comovement between GDP and ER, exchange rate is not able to insulate the economy against external shocks; which makes inflation and output more volatile. As a response, both local and foreign investors demand risk premium and if the central bank does not address this premium, inflation increases.



(a) Along export prices stickiness (θ^x)

(b) Along Dollar Debt ($\bar{\phi}$)

Figure 23: Inflation and GDP-ER Co-movement

D.7.1 Equity Premium

In this section, we look at what happens to equity premium as the macro risk increases with higher dollar invoicing. Equity premium,

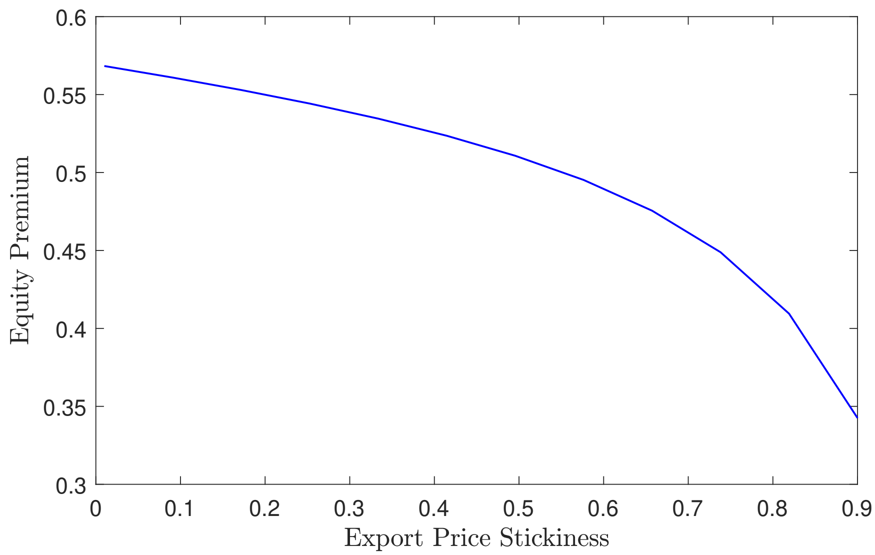
$$\mathbb{E}_t(R^k_{t+1}) - R_t$$

where return to capital is defined as marginal product of capital (r^k_t) and undepreciated capital priced at current price of capital ($(1-\delta)P^k_t$) divided by price of capital previous period (P^k_{t-1})

$$R^k = \frac{r^k_t + (1-\delta)P^k_t}{P^k_{t-1}}$$

We define equity premium as the difference between return to capital and local interest rates. This is slightly misleading because actual cost of capital is defined as the weighted average of funding sources, which also include dollar financing.

Figure 24a plots what happens to equity premium as dollar invoicing and dollar debt increase. Equity premium falls. This is because both R^k_t and R_t increase but R_t increases more. Capital gains part of return to capital provides cushion against global shocks because, as real assets, their value increases with pass through inflation generated by exchange rate depreciations. On the other hand, local interest rates become unattractive investment because they lose value following adverse global shocks, which makes investors require premium to invest.



(a) Equity Premium and export dollar price stickiness (θ^x)

Figure 24: Steady State Equity Premium