Local Safe Assets

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Abstract

We enrich the taxonomy of safe assets by formally introducing the concept of "local safe assets": an asset denominated in local currency that serves as a haven for investors against country-specific risk (as opposed to global risk) and might interact with global sources of safety. Empirically, we show that local-currency sovereign bonds in fourteen high-income emerging markets fall into this category. Their liquidity attributes increase against country-specific risks in both domestic currency and dollar terms, but drop against global risks due to a fall in their liquidity premium compared to dollar assets. An analysis of the Covid event suggests the latter is driven by the larger relative float of dollar assets, not by relative fundamentals.

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1 Introduction

The literature on safe assets has focused almost exclusively on what one might call global safe assets—U.S. Treasuries, and, at a regional level, Bunds and Japanese government bonds (JGB)—that serve as havens for investors worldwide. This paper enriches the taxonomy. We introduce the concept of a local safe asset: an asset denominated in local currency that serves as a haven against country-specific risk but loses this privileged status, relative to global alternatives, when the shock is global in nature.

We follow Brunnermeier, Merkel, and Sannikov (2024) in treating safety as state-contingent and coordination-based: safe assets are valued for being "there when you need them" and because investors coordinate on them in stress. This immediately allows safety to be conditional on the type of stress. A local safe asset, in our definition, is traded mostly in the domestic market and provides liquidity services against country-specific shocks—domestic policy uncertainty, local banking stress, idiosyncratic financial or trade conditions. Its convenience yield rises with local risk but falls, relative to global safe assets, when global risk rises. Local-currency denomination is a feature, not a limitation: country-specific shocks typically hit both asset values and the investor's liabilities, and a local-currency asset maintains its value precisely when the investor needs liquidity in that currency.

We formalize this concept within a framework that extends the spread decomposition of Krishnamurthy and Vissing-Jorgensen (2012) to allow for an endogenous, state-contingent safe-haven status. A representative investor interacts with convenience seekers in a secondary market subject to search frictions, and seekers coordinate on one of three assets: bonds of local firms, the local-currency sovereign bond, or a global reserve asset in much larger supply. Following He, Krishnamurthy, and Milbradt (2019), two channels determine which asset is selected: relative fundamentals—an asset with higher idiosyncratic credit or liquidity risk is a worse safe haven—and relative float—a deeper market is less prone to congestion when demand for convenience surges. The model delivers a sharp prediction: under a local shock, the smaller float of the local sovereign suffices and its liquidity premium rises relative to both local private assets and the global reserve; under a global shock, only the large float of the reserve asset can absorb the surge in demand, and the local sovereign loses its liquidity

advantage.

We test these predictions on local-currency sovereign bonds in fourteen high-income emerging market economies (EMEs).[1] EMEs are a natural laboratory: they face substantial country-specific uncertainty—policy risk, institutional fragility, financial and economic risks—yet are deeply integrated into global financial markets. Over the past two decades, EME governments have deepened their local-currency bond markets, which now represent the lion's share of outstanding sovereign debt in these economies (BIS, 2020)[2].

Our empirical analysis yields three sets of findings.

First, EME sovereign bonds command positive convenience yields. Following Krishnamurthy and Vissing-Jorgensen (2012), we decompose the spread between sovereign bonds and private alternatives of comparable credit risk (interest-rate swaps, term deposits)[3]. We complement this with a direct measure of the local-currency convenience yield in dollar terms, obtained by comparing local-currency sovereign bonds—hedged into dollars via forward contracts—against safe dollar assets such as U.S. agency bonds or highly rated corporates, after explicitly accounting for default risk, regulatory risk, segmentation, and currency-market frictions. The two measures play complementary roles: both measure the liquidity value of local-currency sovereign bonds but against different benchmarks, possibly reflecting the valuation of different investors[4]. Together, they deliver consistent evidence; separately they exploit different investment strategies. The dollar measure averages approximately 30 basis points and captures the liquidity value of local-currency sovereign bonds for investors who measure returns in dollars. Both measures behave as the convenience yield hypothesis[5] predicts and as established for advanced economies: they decline with the supply of govern-

[1]Brazil, Chile, Colombia, Hungary, Indonesia, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, South Africa, Thailand, and Turkey.

[2]In addition, foreign investors have increased their participation in EME local-currency sovereign bonds in recent years. See Onen, Shin, and von Peter (2023) and Du and Schreger (2022).

[3]We complement with country-specific evidence that government bonds are central to the functioning and liquidity of the local financial market.

[4]Notice that the residence of the investor could go either way. The domestic liquidity value could come from a domestic investor who measures her returns in the local currency or from a foreign investor with a portfolio of local assets. The dollar convenience yield could originate from a foreign investor with investment opportunities in EMEs or from a domestic investor with investment opportunities in the US. The possibility of market segmentation -which breaks this equivalence- will be discussed later in the paper.

[5]As defined later, under the hypothesis that liquidity and safety are priced attributes, the yield spread between these pairs of assets should reflect the equilibrium price of liquidity/safety.

ment debt and rise with the monetary policy rate, which proxies for the opportunity cost of holding money-like substitutes.

Second, the safe-haven status of EME sovereign bonds is conditional on the shock. Against local risk—proxied by country-specific economic policy uncertainty and the financial and economic components of the International Country Risk Guide—both the domestic and the dollar spread rise: local sovereigns serve as havens against country-specific uncertainty.[6] Against global risk—proxied by the VIX and the global factor of Miranda-Agrippino and Rey (2020)—the pattern is the opposite.[7] The domestic spread and the dollar liquidity premium fall: they no longer offer superior liquidity to local and global alternatives. This is the defining signature of a local safe asset, and it stands in contrast to G10 sovereigns, whose convenience yields strengthen regardless of the shock's origin.

Third, an event analysis allows us to disentangle the mechanisms. The Covid-19 shock of 2020, by contrast, triggered a flight to safety. The domestic spread fell through the fundamentals channel (heightened risk aversion), while the dollar spread fell through the relative float channel: the interaction between the Covid shock and the relative supply of U.S. Treasuries is strongly significant, indicating that as investors coordinated on the global safe asset, the relative convenience yield of local safe assets collapsed.

The paper proceeds as follows. After the literature review, Section 2 develops the theory and Section 3 presents the empirical evidence on the liquidity attributes of EME sovereign bonds. Section 4 tests their role as safe havens against global and local risk. Section 5 concludes by drawing out the implications of local safe assets for a multipolar financial order and for fiscal and unconventional monetary policy in developing economies.

Related Literature. Our paper contributes to four overlapping literatures. We locate the "local safe asset" concept at their intersection and, at each juncture, identify the specific object we study and the mechanism we invoke that distinguishes our analysis from prior work.

The paper belongs most directly to the safe-asset literature initiated by Krishnamurthy

[6]Kalemli-Özcan and Varela (2023) show that these variables capture a relevant factor in EME systematic risk.

[7]González-Rozada and Levy Yeyati (2008) show that global factors such as risk appetite and liquidity explain a significant share of the time variation in EME bond spreads.

and Vissing-Jorgensen (2012), KV henceforth, who show that U.S. Treasuries earn a safety and liquidity premium over comparably safe private debt. Du, Im, and Schreger (2018) document that the U.S. Treasury premium exists internationally; Diamond and Van Tassel (2023) extend the decomposition to a panel of advanced-economy sovereigns; Jiang, Krishnamurthy, and Lustig (2021, 2024) embed the dollar convenience yield in a two-country asset-pricing model and link it to the global financial cycle; Engel and Wu (2023) document its consequences for exchange rates. This literature treats only global safe assets, principally U.S. Treasuries and — in the advanced-economy extensions — Bunds, gilts, and JGBs. Our contribution is to introduce and measure a conditional, local safe asset: a local-currency EME sovereign bond that, after stripping default risk via CDS, offers a liquidity premium relative to local and global assets. The asset is "local" because it serves as a safe haven for country-specific risk, not global risk; it is "conditional" because its dollar and domestic liquidity premium collapses during global risk-off episodes as international investors rotate into U.S. Treasuries.

Second, the paper's measurement strategy extends the local-currency (LC)-yield–minus–swap construction of Du and Schreger (2016), who compute an LC sovereign credit spread and interpret the residual as a selective-default premium. Du, Pflueger, and Schreger (2020) trace the LC–FC composition of sovereign debt to the inflation–output covariance that determines whether LC debt is a good hedge for foreign investors. We flip the sign of the residual. Where Du and Schreger (2016) find that LC yields remain above the LC risk-free rate and attribute the gap to credit risk, we isolate — using CDS-stripped sovereign yields and a decomposition of the swap - sovereign components — a gap that inverts: sovereigns trade at lower yields than matched-maturity domestic private instruments, exactly as they do in advanced economies when priced as safe assets. Our sample of 14 high-income EMEs is crucial: in these economies, LC sovereign debt has matured into a deep, investable, largely onshore-held market (Arslanalp and Tsuda 2014; Du, Pflueger, and Schreger 2020), and it is precisely in this subset that the safe-asset interpretation applies.

Third, a large macro-finance small-open-economies (SOE) literature studies "country spreads" — the yield differential between EME sovereign debt and U.S. Treasuries. Three features separate our object from this literature. First, the spreads priced in this litera-

ture are all compensation for risk — default risk (Arellano, 2008; Morelli, Ottonello, and Perez, 2022), a reduced-form debt-elastic wedge (Schmitt-Grohé and Uribe, 2003; Aguiar and Gopinath, 2007; Jahan-Parvar et al., 2013; Croce et al., 2022), a collateral-constraint shadow value (Mendoza and Smith, 2006; Bianchi, 2011; Bianchi and Mendoza, 2018), or the reserve-insurance shadow value (Bianchi and Sosa-Padilla, 2024; Jeanne and Sandri, 2023). Our object is a non-pecuniary premium for monetary services — safety and/or liquidity — that is positive after default risk, currency risk, and capital-control risk have been removed. Second, the SOE literature uses a single external instrument, implicitly FC-denominated (see also Neumeyer and Perri, 2005; Uribe and Yue, 2006). We study LC sovereign debt and, in the dollar-spread construction, an LC sovereign bond synthetically swapped into USD via forwards. Third, no paper in the SOE tradition features the coexistence of a local and a global safe asset with state-contingent portfolio rotation between them. Our framework generates this coexistence endogenously: local idiosyncratic shocks make the LC sovereign the marginal liquidity provider, while aggregate global shocks exhaust local safe-asset capacity and push investors toward the U.S. Treasury.

The closest antecedents within the sovereign-debt-with-liquidity subset are Passadore and Xu (2022) and Chaumont (2024), who embed over-the-counter (OTC) search frictions à la Duffie, Gârleanu, and Pedersen (2005) into sovereign default models. Their liquidity component is, however, an illiquidity discount: spreads widen as secondary markets become less liquid. Our object has the opposite sign — the sovereign trades at a price premium because it is more liquid than domestic private alternatives. Both mechanisms can coexist; our focus is the safe-asset end of the spectrum, theirs the distressed end.

A separate literature studies how sovereign credit risk transmits to corporate credit risk (Durbin and Ng, 2005; Dittmar and Yuan, 2008; Ağca and Celasun, 2012; Borensztein, Cowan, and Valenzuela, 2013; Acharya, Drechsler, and Schnabl, 2014; Bedendo and Colla, 2015; Almeida et al., 2017; Bevilaqua, Hale, and Tallman, 2020). This literature is complementary to ours but measures a different object. Every paper in this group studies either (i) USD-denominated corporate-over-sovereign or corporate-over-Treasury spreads, (ii) sovereign–corporate CDS co-movement, or (iii) ratings-based transmission — all credit-risk objects, with spreads driven by default risk (or its proxy in ratings). We study an

LC spread between the sovereign and private benchmarks after stripping default risk via CDS; the residual is by construction a convenience yield, and its sign is inverted relative to the corporate-over-sovereign spread this literature prices. Conceptually, that literature asks whether the sovereign drags corporates down in stress; we ask whether the sovereign provides monetary services that corporates cannot. These questions are not nested, and our empirical answers are not predicted by prior sovereign-corporate findings.

Finally, the literature has established that U.S. monetary policy is a dominant driver of EME sovereign spreads (Bruno and Shin , 2015a,b; Gilchrist, Yue, and Zakrajšek, 2019; Kalemli-Özcan, 2019; Hoek, Kamin, and Yoldas, 2022; Bauer, Bernanke, and Milstein, 2023; Kalemli-Özcan and Unsal, 2023; Degasperi, Hong, and Ricco, 2024). Our contribution is to identify a specific safe-asset channel within this literature. During episodes of high global risk, the dollar convenience yield on EME LC sovereigns collapses as and international investors rotate into U.S. Treasuries (consistent with Jiang, Krishnamurthy, and Lustig, 2024). At the same time, the local-currency liquidity premium in these bonds also drops, consistent with the rise in the risk of these assets. These results are neither implied by nor identified in prior spillover work, and it provides a missing link between the dollar-safety / GFC literature and the EME-spillover literature.

2 A Theory of Local Safe Assets

In this Section, we extend the methodology in KV (2012) to estimate whether local-currency EME government bonds are valued for their safety and liquidity. KV (2012) examines the yield spread between a pair of assets that differ only in terms of their liquidity, as well as the yield spread between a pair of assets that are different only in terms of their safety. Under the hypothesis that liquidity and safety are priced attributes (the "convenience yield hypothesis"), the yield spread between these pairs of assets should reflect the equilibrium price of liquidity/safety.

We provide two measures of the spreads, which differ in the "alternative asset" used in the comparison. The first could be considered capturing an investor's valuation - call her d - who compares the returns of only domestic assets, both financed with the same currency.

The second could be considered capturing an investor's valuation -call her f- who measures returns in dollars and compares the local-currency sovereign bond with a non-Treasury safe dollar bond (an agency or a highly-rated corporate bond)[8].

For any of these investors $i \in \{d, f\}$, the framework modifies a standard representative agent model to include a term that captures agents deriving utility directly from holding a "convenience" asset. A representative investor maximizes

$$E \sum_{t=1}^{\infty} \beta^t u(c_t + \nu(\theta_t^i, \text{GDP}_t^i)) \tag{1}$$

where c_t is consumption from an endowment stream, and the second term represents the "convenience" benefits of holding bonds that provide safety or liquidity services, θ_t^i. The assets that enter into θ_t^i will be specified later for each investor. The agent's income is GDP_t^i, measured in real terms. Problem (1) shows that both investors differ in the assets held in their portfolio and might differ in the endowment stream they receive, GDP_t^i.

The function $\nu(\cdot)$ is a reduced-form way of capturing non-pecuniary benefits from the safety and liquidity of certain bonds. For example, there are benefits of holding a liquid asset that eases transactions (as collateral) or holding an asset that promises stable nominal repayments. These assets could be cash, sovereign bonds, or private assets that share, to some extent, these characteristics (like insured bank deposits, central bank reserves, or corporate bonds of highly rated companies).

Assume that the convenience function is homogeneous of degree one in GDP_t^i and θ_t^i. Thus define $v(\frac{\theta_t^i}{\text{GDP}_t^i})\text{GDP}_t^i \equiv \nu(\theta_t^i, \text{GDP}_t^i)$. Assume that the convenience function is increasing in $\theta_t^i/\text{GDP}_t^i$, but the marginal convenience benefit is decreasing in $\theta_t^i/\text{GDP}_t^i$, and $\lim_{\theta_t^i/\text{GDP}_t^i \to \infty} v'(\theta_t^i/\text{GDP}_t^i) = 0$.

The Euler equation for holdings of a convenience asset, θ_t^i, gives the following expression (to simplify, assume no default risk, which will be introduced later): $P_t = E_t[M_{t+1} P_{t+1} \Lambda_{t+1}^i]$, where $M_{t+1} = \beta \frac{u'(C_{t+1})}{u'(C_t)} \frac{Q_t}{Q_{t+1}}$ is the pricing kernel and Q_t is the price level. $\Lambda_t^i \equiv 1/(1 - v'(\theta_t^i/\text{GDP}_t^i))$ captures the marginal benefits investor i derives from these bonds. A positive marginal value of convenience by investor i, $v'(\cdot)$, raises Λ_t^i, and therefore raises the price

[8] Although it is natural to think of domestic vs. foreign investors, with no segmented markets this exercise does not tell the residence of the investor.

of the bond, P_t. Later, unlike KV (2012), we will make this term state-dependent and endogenous.

2.1 Domestic Spread

Consider investor d with the alternative of investing in a domestic sovereign bond (with some level of default risk) or a domestic private asset, which carries higher risk and thus offers lower convenience services, such as a term deposit at a local commercial bank.

The portfolio of convenience assets of this investor is given by $\theta_t^d = \theta_t^M + \kappa_t^{T,d}\theta_t^T + \kappa_t^{P,d}\theta_t^P$, where θ_t^M, θ_t^T, and θ_t^P correspond to holdings of money or cash (as the most liquid domestic asset), sovereign bonds, and alternative private substitutes, respectively. The latter two are of the same maturity. $\kappa_t^{T,d}$ and $\kappa^{P,d}$ represent the investor's d relative preference for the convenience service of assets other than money. Both are assumed to be less than one. Time variation in $\kappa_t^{T,d}$ and $\kappa_t^{P,d}$ could come from changes in their safe asset status: if, in certain states of the world, investors switch preferences to the safety and liquidity services of other assets, beyond what would be explained by variations in credit risk.

Proposition 1. *The spread between the yield of a local-currency domestic private asset, y_t^P, and the yield of a local-currency sovereign bond, y_t^T, of the same maturity, can be decomposed as follows:*

$$y_t^P - y_t^T \approx (\lambda_t^{T,d} - \lambda_t^{P,d}) + (l_t^P - l_t^T) + (\xi_t^{T,d} - \xi_t^{P,d}) \tag{2}$$

where $\lambda_t^{T,d}$ measures the marginal safety/liquidity services the investor d derives from the sovereign bond (the convenience yield), $\lambda_t^{T,d} \approx \kappa_t^{T,d} v'(\theta_t^d / GDP_t^d)$, and $\lambda_t^{P,d} \approx \kappa_t^{P,d} v'(\theta_t^d / GDP_t^d)$; l_t^P and l_t^T are, for each asset, the expected default plus a risk premium associated with the covariance between default and the stochastic discount factor; and $\xi_t^{T,d}$, $\xi_t^{P,d}$ are the covariances between credit risk and the convenience yield.

Proof: see the Appendix B.1.

The domestic measure of the convenience yield of local-currency sovereign bonds is given

by[9]:

$$CY_t^d = \lambda_t^{T,d} - \lambda_t^{P,d} = (\kappa_t^{T,d} - \kappa_t^{P,d})v'(\theta_t^d/\text{GDP}_t^d) \tag{3}$$

The decomposition contains default-risk and covariance terms alongside the convenience yield. We don't have direct measures of default risk for each instrument[10]. Thus, we do not attempt to isolate CY_t^d from the raw spread. Our strategy in Section 3 is instead to test whether the spread responds to supply and policy-rate variation in the way the convenience yield hypothesis (stated below) predicts—if it does, the convenience yield is a plausibly dominant driver.

What increases the convenience yield on sovereign bonds, CY_t^d? First, a lower supply of government debt, $\theta_t^T/\text{GDP}_t^d$. Second, if sovereign bonds provide the same liquidity services as money, then a lower supply of $\theta_t^M/\text{GDP}_t^d$ will also increase the convenience yield. Third, variations in the relative convenience service. For example, losing the safe asset status (switch in investors' preferences towards other safe assets) can reduce $\kappa_t^{T,d}$.

2.2 Dollar Convenience Yield

This measure will capture the liquidity value of the sovereign bond, denominated in local currency, but expressed in dollar terms. This measure does not capture the liquidity value of the EME sovereign bond denominated in foreign currency.

Consider an investor f that measures her returns in dollars and whose portfolio of safe and liquid assets is given by $\theta_t^f = \theta_t^{\$M} + \kappa_t^{T,f}\theta_t^T + \kappa_t^{US,f}\theta_t^{US}$, where $\theta_t^{\$M}$ correspond to dollar money and near-money assets such as U.S. Treasuries; θ_t^T correspond to synthetic dollar bonds: a local-currency sovereign EME bond with all the cash flows swapped into dollars via a forward contract[11]; θ_t^{US} correspond to holdings of non-Treasury safe dollar bond such as a highly rated U.S. corporate bond or a U.S. agency bond. The latter two are of the same maturity. $\kappa_t^{T,f}$ captures the relative convenience service investor f derives from local-

[9]Equation 3 shows that what we call the "domestic convenience yield" is really a *differential* convenience yield because we allow the domestic private asset to provide some (but lower) convenience benefits. Henceforth, whenever we mention the "domestic convenience yield", we will refer to this differential convenience yield.

[10]For example, CDS for private assets are thin or non-existent.

[11]As we discuss later in this Section, with the only exception of Turkey, the sovereign bond market in these countries is unlikely to feature market segmentation between currencies and foreign/local investors

currency sovereign bonds of EMEs. As in the previous subsection, time variation in $\kappa_t^{T,f}$ could come from changes in investors' preference for certain assets during, for example, a flight to quality episode.

This can capture an actual strategy by an investor with investment opportunities in EMEs. An investor with one US dollar in hand today can invest in a highly-rated corporate bond in the US and receive $e^{y_t^{US}}$ at maturity. The investor could instead exchange the US dollar for S_t units of the EME currency and invest in the local-currency sovereign bond to receive $e^{y_t^T}$ units of EME currency at the same maturity. A currency forward contract signed today would convert the EME currency earned into $e^{y_t^T} S_t/F_{t+1}$ dollars. In an ideal world where sovereign bonds are free of default or regulatory risks and the FX market is frictionless, the two investments would be equivalent, and the spread would be zero due to the absence of arbitrage.

Financial frictions, convenience yields, default risk, and the possibility of capital controls eliminate riskless arbitrage opportunities, giving rise to profitable trades. For example, if the spread is negative, an investor can earn profits by borrowing at the dollar rate, investing in the EME sovereign bond, and signing a forward contract to convert the EME currency back into dollars. Proposition 2 shows how credit and regulatory risks, along with convenience yields, explain the profitability of this trade (all assets are of the same maturity).

Proposition 2. *The spread between the yield on a non-Treasury safe dollar bond, y_t^{US}, and the yield on the synthetic dollar bond, $y_t^T - \rho_t$, (the yield of the local-currency bond of an EME, y_t^T, minus the forward premium between the local currency and the dollar, $\rho_t = log F_{t+1} - log S_t$, where F_{t+1} and S_t are the forward and spot exchange rates, respectively, both expressed as units of local currency per dollar) can be decomposed as follows:*

$$\underbrace{y_t^{US} - (y_t^T - \rho_t)}_{Spread} = \underbrace{\lambda_t^{T,f} - \lambda_t^{US,f}}_{Diff.\ Convenience\ yield} + \underbrace{(l_t^{US} - l_t^T)}_{Differential\ default\ risk} - \underbrace{k_t}_{Regulatory\ risk} + \underbrace{(q_t^T + p_t + (\xi_t^{T,f} - \xi_t^{US,f}) + \psi_t^{T,f})}_{Covariances} \tag{4}$$

where $\lambda_t^{US,f}$ measures the marginal safety/liquidity services the investor f derives from this US bond (the convenience yield); l_t^{US} is the expected default plus a default risk premium, and

$\xi_t^{US,f}$ is the covariance between default risk and the convenience yield. Similarly, $\lambda_t^{T,f}$ is the convenience yield the investor f derives from the sovereign bond of the EME; $l_t^T - q_t$ is the expected loss upon default, l_t^T, net of the covariance between default and currency risk, q_t^T; $k_t - p_t$ are the expected losses upon the imposition of regulations, k_t, net of the covariance between the risk of regulations and currency risk, p_t; and $\xi_t^{T,f}$ and $\psi_t^{T,f}$ the covariance of default risk and the convenience yield, and the covariance between the convenience yield and capital control risk, respectively.

Proof: see the Appendix B.2.

In this paper, we will use the non-Treasury liquid bond as the benchmark to make sure the convenience yield of US Treasuries does not drive our empirical results.

Unlike the domestic case (Proposition 1), each component on the right-hand side of the decomposition is observable or can be proxied: default risk via CDS, regulatory risk via the onshore–offshore gap, and currency-market frictions via deviations from covered interest parity. This makes it possible to isolate CY_t^f directly in the data, and we refer to this extracted object as the *dollar convenience yield*.

If the CIP condition holds for risk-free rates, then $y_{rf,t} - \rho_t = y_{rf,t}^{US}$ (later we consider the case where this does not hold). In this case, the convenience yield on local-currency sovereign bonds of EMEs in dollar terms, which is a *differential* convenience yield, corresponds to:

$$\begin{aligned} CY_t^f \equiv & \lambda_t^{T,f} - \lambda_t^{US,f} \\ = & (\kappa_t^{T,f} - \kappa_t^{US,f}) v'(\theta_t^f / \text{GDP}_t^f) \\ = & \left[y_{rf,t} - \left(y_t^T - l_t^T + q_t^T - k_t + p_t + \xi_t^{T,f} + \psi_t^{T,f} \right) \right] - \left[y_{rf,t}^{US} - \left(y_t^{US} - l_t^{US} + \xi_t^{US,f} \right) \right] \end{aligned} \tag{5}$$

The second line in Equation (5) gives the model's interpretation of the dollar convenience yield, and the third line gives its empirical counterpart.

In the second line, if EME sovereign bonds share the liquidity services provided by dollar money, a lower supply of dollar liquid assets such as dollar cash or U.S. Treasuries will increase the convenience yield in dollar terms on EME sovereign bonds through $v'(\theta_t^f / \text{GDP}_t^f)$.

In addition, a lower $\kappa_t^{T,f}$ would also reduce the convenience yield. A lower $\kappa_t^{T,f}$ can come from a loss of the safe asset status during a flight-to-quality episode.

In the third line, the empirical counterpart in Equation (5) shows that $\lambda_t^{T,f}$, in the first square bracket, corresponds to the spread between the local-currency risk-free rate and the sovereign bond of the same maturity. This adjusts the yield on the sovereign bond to account for all possible risks to replicate a riskless return. Any spread between the risk-free rate and this riskless sovereign return must come from the safety/liquidity non-pecuniary return, captured by $\lambda_t^{T,f}$. The second square bracket has a similar interpretation for the dollar bond.

Both the default risk and k_t are net of their covariance with currency risk, q_t^T and p_t, respectively. Intuitively, when dollar investors invest in local-currency EME sovereign bonds, default or capital controls cause an additional, indirect loss to them. They not only receive less local currency back, but those cash flows are now worth less if the currency depreciates upon these events. The yield on the synthetic bond does not capture the latter, as currency risk is being hedged. Therefore, the synthetic bond yield underestimates the loss risk upon these events[12].

2.3 The Convenience Yield Hypothesis

The spread decomposition in this Section can be summarized by the following empirical implication,

Prediction 1. ***(Convenience yield hypothesis)***. *From* $CY_t^i = (\kappa^T - \kappa^{alt})v\prime(\theta_t^i/GDP_t^i)$ *and* $v\prime\prime < 0$*:*

(i) $\partial CY_t^i/\partial(\theta_t^T/GDP_t^i) < 0$*: more supply* $\Rightarrow$ *lower CY (scarcity channel).*

(ii) Supply coefficient stays significant after controlling for default risk.

(iii) $\partial CY_t^i/\partial i_t^{MP} > 0$*: tighter money* $\Rightarrow$ *higher CY (money-like substitution, Nagel, 2016).*

[12]The new term $\psi_t^{T,f}$ captures the covariance between the convenience yield and the risk of capital controls. Since higher regulatory risk will lower the non-pecuniary benefits earned by investors, states of the world with higher capital control risk likely coincide with states with lower convenience yields.

which is a natural extension of the hypothesis in KV (2012). Under the hypothesis that liquidity is a priced attribute, the yield spread between these pairs of assets should reflect the equilibrium price of liquidity. Thus, changes in government debt supply or money-like assets should significantly affect these yield spreads. The results in Section 3 below fully support this Prediction: changes in the supply of government debt and money-like assets separately change the equilibrium prices of liquidity.

2.4 Endogenous Convenience Weights and Safe-Haven Status

The convenience weights $\kappa_t^{T,i}$ and $\kappa_t^{P,i}$ in Propositions 1–2 capture the relative quality of each asset's convenience service. We now endogenize these weights as equilibrium objects that respond to the state of the economy, thereby connecting the convenience yield decomposition to the safe-haven status of the local government bond.

Two channels determine convenience quality. First, a *fundamentals channel*: the suitability of a bond as collateral depends on its credit quality, which varies across states. When private credit risk rises, convenience seekers shift demand toward the government bond, deepening its secondary market and raising its convenience quality. Second, a *depth channel*: when aggregate demand for safe assets surges globally, the reserve asset's much larger float can absorb the demand without saturating, drawing convenience demand away from local bonds. Both channels are determinants of safe-asset status in He, Krishnamurthy, and Milbradt (2019). We formalize them jointly within the representative-agent framework.

2.4.1 Within-Period Secondary Market

Environment. Each period t, before the representative agent's portfolio problem is solved, a within-period secondary market opens.[13] A mass $D(\omega) > 0$ of agents — counterparties in collateral, settlement, and repo transactions — enters the secondary market seeking to acquire safe bonds. We call these *convenience seekers*. Each seeker demands one unit and chooses which asset market to enter: $a \in \{T, P, US\}$, which stand for the local government bond (T), the local private bond (P), and the dollar asset (US).

[13]This timing follows Holmström and Tirole (1998) and Coppola, Krishnamurthy, and Xu (2024), where liquidity needs arise within the period.

States of the world. Nature draws $\omega_t \in \{N, L, G\}$:

- N (normal): baseline demand $D(N) = D_0$. Probability $1 - \pi_L - \pi_G$.
- L (country-specific stress): demand $D(L) \geq D_0$, from domestic financial stress. Probability π_L.
- G (global stress): demand $D(G) \gg D_0$, from worldwide financial stress. Probability π_G.

We interpret G as generating a demand surge that is large relative to the local bond market but modest relative to the global reserve asset market. This is consistent with the interpretation from the viewpoint of a small open economy (which also fit EMEs): local shocks affect one country, and the small open economy is a negligible fraction of the world economy; global shocks affect seekers worldwide, generating aggregate demand orders of magnitude larger.

2.4.2 The Seeker's Problem

Payoff. A convenience seeker entering market a in state ω obtains expected payoff:

$$W_a(\tau_a, \omega) = \bar{\kappa}_a \cdot (1 - \pi_a(\omega)) \cdot p^B(\tau_a) - \mathbf{1}_{a=US} \cdot \chi \tag{6}$$

where:

- $\bar{\kappa}_a > 0$ is the *institutional convenience value*: a time-invariant parameter reflecting collateral eligibility at central banks and clearinghouses, membership in settlement systems, and dealer network depth.[14]
- $\pi_a(\omega) \in [0, 1)$ is the *default probability* of issuer a in state ω: an observable primitive available from CDS markets. A bond with higher default risk is less valuable as collateral because the counterparty bears the risk of loss upon default.[15]

[14] In most countries in our sample, government bonds enjoy central bank collateral eligibility, and access to clearing houses. See Supplemental Appendix I.D.

[15] Collateral haircuts at clearinghouses and central banks are increasing functions of the issuer's credit risk. Higher π_a can be interpreted as a wider haircut. Deafult is taken as exogenous within this framework.

- $p^B(\tau_a)$ is the buyer's matching probability, with market tightness $\tau_a \equiv D_a/\bar{S}_a$.
- $\chi > 0$ is a *cross-currency friction*: the cost of using a foreign-currency bond for domestic convenience purposes (currency conversion, regulatory haircuts on foreign-currency collateral at local clearinghouses).[16]

Remark 1 (Consistency with the yield decomposition)**.** *The yield decomposition* $y^P - y^T \approx (\lambda^T - \lambda^P) + (l^P - l^T) + (\xi^T - \xi^P)$ *in Proposition 1 is a mathematical identity derived from the Euler equation. It holds for* any *specification of the convenience weights* κ*. If* κ *depends on default risk through the equilibrium reallocation of seekers, the interaction is absorbed by the covariance term* $\xi_t^{T,i} \equiv cov_t(\lambda_{t+1}^{T,i}, \tilde{L}_{t+1}^T)/\mathbb{E}_t[M_{t+1}]$*, which already appears in the decomposition. No terms need to be added or modified. The empirical identification via bond supply remains valid because supply affects* $v'(\theta/GDP)$ *independently of default risk.*[17]

Remark 2 (Distinction from regulatory risk)**.** *The friction* χ *captures the structural cost of cross-currency collateral use, borne by local convenience seekers considering the dollar bond. This is distinct from the regulatory risk* k_t *in Proposition 2, which captures the risk of government-imposed capital controls borne by the dollar investor holding the local bond. They operate on different agents:* k *penalizes the local bond from the dollar investor's perspective (widening the spread), while* χ *penalizes the dollar bond from the local seeker's perspective (indirectly narrowing the spread). Both are economically meaningful and nonredundant.*

Assumptions.

Assumption 1 (Credit risk)**.**

(i) $\pi_T(\omega) < \pi_P(\omega)$ *for all* ω*: sovereign bonds carry lower credit risk than private bonds.*

(ii) $\pi_P(L) > \pi_P(N)$*: private credit risk strictly increases during country-specific stress.*

(iii) $\pi_T(G) > \pi_T(N)$*: sovereign credit risk strictly increases during global stress.*

(iv) π_{US} *is state-independent.*

[16] Central banks in EMEs typically accept only domestic-currency instruments as eligible collateral for lending facilities. ISDA Credit Support Annexes specify higher haircuts for foreign-currency collateral.

[17] This can be verified in Supplemental Appendix I.E.2, where bond supply does not affect CDS spreads.

All parts are empirically verifiable. Part (i): sovereign CDS spreads are lower than corporate spreads in every country in the sample.[18] Part (ii): corporate default risk rises during domestic stress (documented in the credit risk literature). Part (iii): EME sovereign CDS spreads widen during global crises[19]. Part (iv): U.S. Treasury credit risk is negligible and stable.

Assumption 2 (Institutional quality)**.** $\bar{\kappa}_T > \bar{\kappa}_P > 0$.

Assumption 3 (Domestic convenience advantage)**.** $\bar{\kappa}_T(1 - \pi_T(\omega)) > \bar{\kappa}_{US}(1 - \pi_{US}) - \chi$ *for all* ω.

Assumption 3 is a statement about domestic financial infrastructure, not about global bond quality. It does not claim that EME sovereign bonds are globally superior to US Treasuries; it states that, for *local* convenience purposes — collateral at domestic clearinghouses, eligibility at the central bank's lending facility, settlement in domestic payment systems — the local government bond is preferred to the dollar bond after accounting for cross-currency frictions. The friction χ ensures an interior equilibrium in which all three markets are active: without it, the global preeminence of US Treasuries ($\bar{\kappa}_{US}$ large) could draw all seekers to the dollar market, producing a corner solution with $\tau_T \to 0$ and $\kappa^T \to 0$. The level of χ affects baseline market tightness but does not affect the sign of the comparative statics in Proposition 3, which depend only on the interior equilibrium structure.

Matching technology. Matches in market a follow the urn-ball function (Butters, 1977; Burdett, Shi, and Wright, 2001):

$$m(D_a, \bar{S}_a) = \bar{S}_a \left(1 - e^{-D_a/\bar{S}_a}\right) \tag{7}$$

[18] Although Durbin and Ng (2005) document that some EME corporates "pierce" the sovereign ceiling in USD markets, Borensztein, Cowan, and Valenzuela (2013) show that ratings agencies apply a de facto ceiling.

[19] The VIX has a positive and significant effect on sovereign CDS (see Supplemental Appendix I.E.2)

with tightness $\tau_a \equiv D_a/\bar{S}_a$ and matching probabilities:

$$p^B(\tau_a) = (1 - e^{-\tau_a})/\tau_a \qquad \text{(seeker: strictly decreasing, } p^B(0^+) = 1) \quad (8)$$

$$p^S(\tau_a) = 1 - e^{-\tau_a} \qquad \text{(bondholder: strictly increasing, concave, bounded)} \quad (9)$$

The urn-ball function has a natural microfoundation: each of the D_a seekers independently and uniformly targets one of the $\bar{S}_a$ bond units. The probability that a given unit is targeted by at least one seeker is $1 - (1 - 1/\bar{S}_a)^{D_a} \to 1 - e^{-\tau_a}$, yielding $p^S(\tau_a)$. The key economic property is *congestion with saturation*: when τ_a is large, the market is crowded and additional seekers create few new matches because most bond units are already targeted; when τ_a is small, each additional seeker matches with high probability. This absolute sensitivity to tightness — absent in power-law specifications, where only tightness *ratios* matter — is what enables the depth channel.

Assumption 4 (Float asymmetry)**.** $\bar{S}_{US} \gg \bar{S}_T \geq \bar{S}_P > 0$.

Remark 3 (Matching function robustness)**.** *Under any Cobb-Douglas matching function $m = \lambda D^a S^b$, the buyer's probability is $p^B = \lambda \tau^{a-1} S^{a+b-1}$. Equating buyer payoffs across markets, the factor D^{a-1} cancels on both sides, rendering the equilibrium allocation independent of the demand level D. This holds for constant, increasing, and decreasing returns to scale. The urn-ball function breaks this scale invariance because $p^B(\tau)$ is not a power law: the matching probability depends on* absolute *tightness, not just its ratio across markets. Under Cobb-Douglas matching, the depth channel can still operate if the dollar float is state-dependent ($\bar{S}_{US}(G) > \bar{S}_{US}(N)$), provided the supply expansion is large relative to the demand increase; see Remark 6. The fundamentals channel (Parts (ii)–(iii) of Proposition 3) holds under any matching technology with p^B strictly decreasing and p^S strictly increasing.*

2.4.3 Equilibrium

Let $n_a \geq 0$ with $\sum_a n_a = 1$ denote seeker shares, so $D_a = n_a D(\omega)$ and $\tau_a = n_a D(\omega)/\bar{S}_a$.

Definition 1 (Within-period equilibrium)**.** *A* within-period equilibrium *in state ω is an allocation (n_T^*, n_P^*, n_{US}^*) such that for each a with $n_a^* > 0$: $W_a(\tau_a^*, \omega) \geq W_b(\tau_b^*, \omega)$ for all b.*

Define *effective quality* $q_a(\omega)$: $q_T(\omega) \equiv \bar{\kappa}_T(1-\pi_T(\omega))$, $q_P(\omega) \equiv \bar{\kappa}_P(1-\pi_P(\omega))$, and $q_{US} \equiv \bar{\kappa}_{US}(1-\pi_{US}) - \chi$. By Assumptions 1–3, $q_T(\omega) > q_P(\omega) > 0$ and $q_T(\omega) > q_{US} > 0$ for all ω.

Lemma 1 (Existence and uniqueness)**.** *Under Assumptions 1–4, for each ω there exists a unique interior equilibrium. The tightnesses $(\tau_T^*, \tau_P^*, \tau_{US}^*)$ solve:*

$$q_T(\omega)\, p^B(\tau_T) = q_P(\omega)\, p^B(\tau_P) \tag{10}$$

$$q_T(\omega)\, p^B(\tau_T) = q_{US}\, p^B(\tau_{US}) \tag{11}$$

$$\tau_T \bar{S}_T + \tau_P \bar{S}_P + \tau_{US} \bar{S}_{US} = D(\omega) \tag{12}$$

Proof: see the Appendix B.3.

2.4.4 Endogenous Convenience Weights

The bondholder's convenience quality from asset a is:

$$\kappa_a(\omega) = \bar{\kappa}_a \cdot p^S(\tau_a^*(\omega)) \tag{13}$$

The weight depends on the institutional value $\bar{\kappa}_a$ (constant) and the bondholder's matching probability $p^S(\tau_a^*) = 1 - e^{-\tau_a^*}$ (state-dependent through equilibrium tightness). A deeper market (higher τ_a) means the bondholder can more easily deploy her bond.

Default risk affects κ_a *indirectly*: higher $***\pi_a***$ reduces the effective quality q_a, which lowers seekers' demand for bond a, reducing τ_a in equilibrium, and hence lowering $p^S(\tau_a)$ and κ_a. This is the fundamentals channel operating through the equilibrium.

Remark 4 (Separation of channels)**.** *$CY_t^i = (\kappa^T - \kappa^{alt})v'(\theta_t^i / GDP_t^i)$ responds through three distinct objects: $v'(\cdot)$ (scarcity, tested in Section 3 below), $\pi_a(\omega)$ entering seekers' payoffs (fundamentals), and $p^S(\tau_a)$ (depth). Scarcity operates on the aggregate stock θ_t^i (supply). Fundamentals and depth operate on equilibrium tightness τ_a (demand). They coexist without double-counting.*

2.4.5 Safe-Haven Determination

Definition 2 (Local safe asset)**.** *An asset is a* local safe asset *if its convenience yield relative to alternative assets is increasing in π_L and decreasing in π_G. A* global safe asset *satisfies both $\partial CY/\partial \pi_L \geq 0$ and $\partial CY/\partial \pi_G \geq 0$.*

Proposition 3 (Safe-haven determination)**.** *Under Assumptions 1–4 and the urn-ball matching technology:*

(i) ***Depth channel (global demand surge).*** *As D increases with π_a fixed: $d\tau^*_{US}/dD > 0$, while $d\tau^*_T/dD$ and $d\tau^*_P/dD$ are $O(1/\bar{S}_{US})$. Hence κ^{US} increases ***while κ^T and κ^P are approximately unchanged.****

(ii) ***Fundamentals channel (private credit deterioration).*** *When π_P rises with D and π_T fixed: τ^*_T rises, τ^*_P falls, κ^T rises, κ^P falls. The domestic spread $\kappa^T - \kappa^P$ increases. Seekers also enter the dollar market, but this effect is $O(\bar{S}_P/\bar{S}_{US})$: the reallocation is predominantly local.*

(iii) ***Fundamentals channel (sovereign credit deterioration).*** *When π_T rises with D and π_P fixed: τ^*_T falls, τ^*_P and τ^*_{US} rise. Under $\bar{S}_{US} \gg \bar{S}_T$, the number of reallocated seekers going to the dollar market ($\bar{S}_{US}\, d\tau_{US}$) far exceeds those going to P ($\bar{S}_P\, d\tau_P$). Hence κ^T falls, κ^P and κ^{US} rise, and both spreads $\kappa^T - \kappa^P$ and $\kappa^T - \kappa^{US}$ decrease.*

(iv) ***Convenience yields.*** *In state G, channels (i) and (iii) reinforce: the dollar spread $\kappa^T - \kappa^{US}$ falls (depth raises κ^{US}; fundamentals lower κ^T). The domestic spread $\kappa^T - \kappa^P$ falls because κ^T declines; the increase in κ^P is second-order in $\bar{S}_T/\bar{S}_{US}$. In state L, channel (ii) dominates: $\kappa^T - \kappa^P$ rises. Hence:*

$$\frac{\partial \mathbb{E}_t[CY^d]}{\partial \pi_L} > 0, \quad \frac{\partial \mathbb{E}_t[CY^d]}{\partial \pi_G} < 0, \quad \frac{\partial \mathbb{E}_t[CY^f]}{\partial \pi_G} < 0$$

The local government bond satisfies Definition 2.

Proof: see the Appendix B.4.

Remark 5 (Dollar spread and local risk)**.** *The model's prediction for $\partial \mathbb{E}[CY^f]/\partial \pi_L$ depends on the relative magnitude of changes in κ^T and κ^{US} in state L. The fundamentals channel (Part (ii)) reallocates seekers from P to both T and US. In number, most reallocated seekers go to the dollar market ($\bar{S}_{US}\, d\tau_{US} \gg \bar{S}_T\, d\tau_T$), but the tightness change in each market is $O(1/\bar{S}_{US})$: the dollar market is too deep to notice, and the government bond market receives too few additional seekers to change meaningfully. Both κ^T and κ^{US} change by $O(1/\bar{S}_{US})$, with the sign of the dollar spread depending on parameters. The positive coefficient found in the data (Table 4 in Section 4 below) is consistent with κ^T rising proportionally more than κ^{US}, reflecting the higher institutional quality $\bar{\kappa}_T$ (Assumption 2). The cross-currency friction embedded in q_{US} reinforces this pattern: in state L, it makes the dollar market less attractive to displaced seekers, channeling more of the reallocation toward T.*

Remark 6 (Elastic dollar supply)**.** *The results in Part (i) are strengthened if $\bar{S}_{US}(G) > \bar{S}_{US}(N)$, e.g., through Federal Reserve swap lines (Bahaj and Reis, 2022) or expanded Treasury issuance during crises. A larger dollar float deepens the reserve market, amplifying the decline in the dollar spread. This creates a strategic complementarity: high demand enables more issuance at favorable terms, deepening the market and attracting further demand. This mechanism, related to He, Krishnamurthy, and Milbradt (2019), amplifies the depth channel and is a promising direction for future research.*

In the empirical application that follows, Section 3 shows that local-currency sovereign bonds in EMEs are priced for their liquidity attributes. Then, Section 4 uses the estimated liquidity premia to test Proposition 3 and shows these bonds satisfy the definition of a local safe asset.

3 Empirical Analysis

3.1 Data, Sample, and Institutional Setting

The countries in the sample are Brazil, Chile, Colombia, Hungary, Indonesia, Korea, Malaysia, Mexico, Peru, Poland, the Philippines, Thailand, Turkey, and South Africa. Data is obtained at a daily frequency and ends in March 2021, with start dates varying by country.

For all the countries included in the sample, the vast majority of the outstanding debt is denominated in their local currency. This speaks to the relevance of the question of whether this debt serves as a safe asset. Second, in all countries except Turkey, a sizable portion of this local-currency sovereign debt is held by foreigners. Therefore, the convenience yield is unlikely to capture market segmentation and limits to arbitrage between foreign and local markets (more on this later). See Supplemental Appendix I.A.

The theory in Section 2 delivers spread decompositions for two objects: the domestic spread $y_t^P - y_t^T$ between a local private benchmark and the local-currency sovereign, and the dollar spread $y_t^{US} - (y_t^T - \rho_t)$ between a safe dollar asset and the local-currency sovereign swapped into dollars. The two objects occupy different positions in our empirical strategy. The domestic spread is a composite of a convenience-yield differential and a default-risk differential (Proposition 1): we do not attempt to strip the default component from the raw spread, and instead follow Krishnamurthy and Vissing-Jorgensen (2012) in testing whether the spread responds to the supply of government debt and to the policy rate in the way the convenience yield hypothesis predicts. Finding these responses supports the interpretation that the liquidity premium is a quantitatively important driver of the spread. This approach is indirect, in the sense that we show the spread is mostly driven by proxies of non-pecuaniry demand for liquidity, and it is not driven by proxies of risk premia, default risk, and other factors. This approach does not quantify the level of the convenience yield.

By contrast, in the dollar construction we can explicitly account for default risk using CDS spreads, for regulatory risk using the onshore–offshore yield gap, and for residual currency-market frictions. What remains is, under the assumptions of Proposition 2, the differential convenience yield CY_t^f -an object we measure directly rather than infer. We therefore refer throughout the paper to the *domestic spread* and the *dollar convenience yield*, reserving the word "spread" for the unadjusted object and "convenience yield" for the extracted one.

In all the countries considered, government bonds play a central role as a source of market liquidity. Supplemental Appendix I.D. provides a country-by-country description of the liquidity and credit risk associated with different instruments in the domestic currency of the local financial market. Below, we characterize which instruments we use as a benchmark to gauge the liquidity premium of government debt.

Data from the Asian Development Bank, EMTA, and S&P (Gemloc) for these countries confirm the liquidity advantage of local-currency government bonds. Turnover and traded volume are order of magnitudes larger for local-currency government bonds than for local-currency corporate bonds. Bid-ask spreads are comparable to those of developed markets. For example, in 2024 the bid-ask spread of local-currency government bonds in Thailand, Indonesia, Malaysia, Philippines averaged only 4 basis points.

3.2 Liquidity Premia in EMEs: Domestic Spread

In the framework, the domestic spread is given by Equation (2):

$$y_t^P - y_t^T \approx (\lambda_t^{T,d} - \lambda_t^{P,d}) + (l_t^P - l_t^T) + (\xi_t^{T,d} - \xi_t^{P,d}) \tag{14}$$

where $\lambda_t^{T,d} - \lambda_t^{P,d}$ captures a liquidity premium.

Empirically, we use the spread between domestic currency interest rate swaps and the yield on local currency government bonds of the same maturity. Supplemental Appendix I.D. provides a country-by-country description of the liquidity and credit risk associated with different domestic-currency instruments in the local financial market, which we summarize here. In all the countries considered, government bonds play a central role as a source of market liquidity. Most countries in the sample have developed a market for interest rate swaps denominated in their domestic currency. Importantly, in all cases, the counterparty credit risk of these derivatives is minimal, either because they are centrally cleared with margin requirements, or they are bilaterally OTC but they comply with the collateral posting requirements set by the International Swap and Derivatives Association (ISDA).[20]

We could also analyze a measure of a safety premium, using the spread between unsecured interbank loans and collateralized interest rate swaps of the same maturity. The key here would be that the interbank market in these countries operates without collateral requirements. If they are comparably illiquid, they differ only in their credit risk[21]. How-

[20] Chung and Chan (2010) show that once ISDA conducted the Credit Support Annex (CSA), which is the general rules for use of collateral, then swap transactions became collateralized and counterparty credit risk seems to be eliminated.

[21] These countries have not developed a domestic repo market (see the Appendix I.D.).

ever, the domestic interbank market is highly segmented because foreign investors have no acces to it, while their participation in the domestic interest rate swaps is relevant for most countries in the sample. For this reason, we relegate the analysis of the safety premium to Supplemental Appendix I.C. for the interested reader.

Table 1 shows the summary statistics of the domestic spread (domestic currency interest rate swaps minus the yield on local currency government bonds). Regarding magnitudes, Table 1 shows an upper bound for the actual convenience yield since, as Proposition 1 shows, default risk and risk premia might still be present in these spreads (via $l_t^P - l_t^T$)[22]. All of these instruments are denominated in the domestic currency and have a maturity of one year.

In Section 3.4 below we provide evidence that convenience yields are the primary driver of these spreads, and their relative importance is greater than that of risk premia and default risk. In particular, we formally test Prediction 1: we show how proxies for demand for liquidity services are the main drivers of the domestic spread. Note also that we use assets with short-term maturity for which the risk premia are lower (we use 1-year maturity securities here and 3-month in additional results in Supplemental Appendix I.F.1).

The magnitude of the domestic spread is generally very small in Brazil, Chile, Colombia, Korea, Thailand, and South Africa. This is not necessarily due to the credit risk of the government bond. In these countries, bid-offer spreads are low, and market depth in local-currency interest rate swaps is comparable to trading government securities. Hence, investors (foreign investors in particular) prefer to manage risks using derivatives rather than cash positions in fixed-income markets. Malaysia, for example, has only recently taken steps to improve the liquidity of its interest rate swap market. It thus shows a much larger liquidity premium.

The magnitude of the domestic spread in Turkey is particularly high. However, as explained in Supplemental Appendix I.D., the Turkish financial market is the least developed among the countries in the sample, and there is no evidence of the extent to which interest rate swaps are centrally cleared or collateralized; thus, it is very likely that the liquidity

[22] And also its covariance with convenience yields ($\xi_t^{T,d}$). Since investors will derive no safety benefits from an asset with higher credit or liquidity risk, states of higher credit or liquidity risk likely coincide with states of lower convenience yields. Thus, the covariance will be negative.

Table 1: Summary Statistics

	Domestic Sprd.			Dollar Sprd.		
Country	Sample starts	Mean	Std	Sample starts	Mean	Std
Brazil	Mar. 2007	0.65	22.23	Jun. 2010	28.62	30.31
Chile	Oct. 2005	-13.36	22.85	Apr. 2011	45.98	26.61
Colombia	Feb. 2011	-27.92	45.36	Dec. 2007	16.76	26.34
Hungary	Jan. 2004	2.12	29.17	n.a.	n.a.	n.a.
Indonesia	n.a.	n.a.	n.a.	Feb. 2015	27.82	15.71
Korea	Jan. 2004	0.39	11.92	n.a.	n.a.	n.a.
Malaysia	Nov. 2006	29.14	24.49	n.a.	n.a.	n.a.
Mexico	Jan. 2004	31.45	23.28	Dec. 2007	44.42	24.27
Peru	n.a.	n.a.	n.a.	Dec. 2007	29.42	27.00
Philippines	May. 2011	2.43	44.63	Dec. 2007	18.40	31.72
Poland	Jan. 2004	14.78	23.29	n.a.	n.a.	n.a.
South Africa	Jan. 2004	6.02	60.80	Dec. 2013	27.10	35.57
Thailand	Jan. 2014	-7.31	11.23	n.a.	n.a.	n.a.
Turkey	Feb. 2005	97.87	110.7	Dec. 2007	-4.27	27.11

Notes: Daily frequency. The sample ends on March 9, 2021. The dollar spread uses the yield on Refcorp bonds for y_t^{US}.

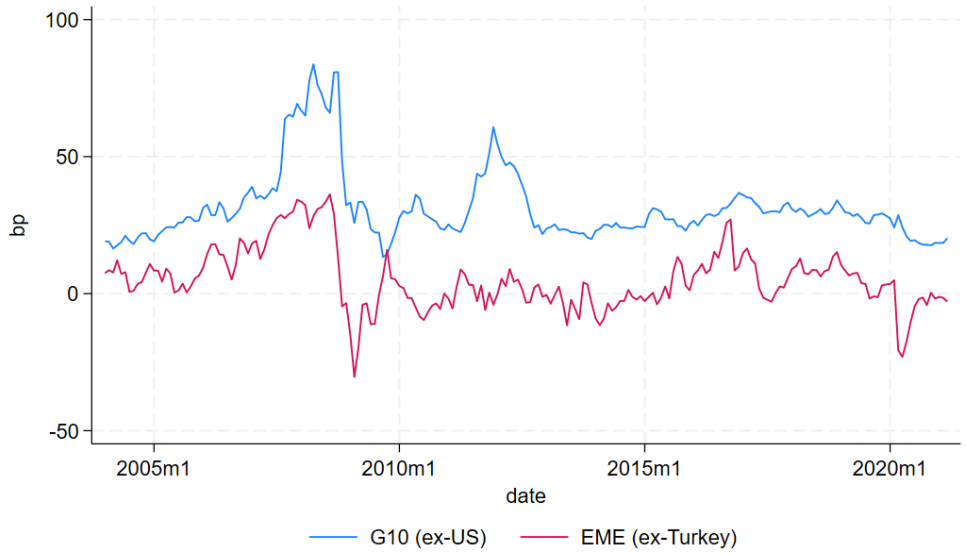
premium includes credit risk or other financial frictions. The interest rate swap for the Philippines uses the Libor rate as the floating leg, so it is more akin to a currency swap[23]. The empirical results in Section 4 will exclude Turkey and the Philippines from the sample.

It is interesting to compare with the domestic spread of G10 countries (excluding the US), using comparable data to build the spread of these advanced economies.

Figure 1 shows that, unlike the G10 group, the average liquidity premium across EME countries in the sample is very small after the 2008 financial crisis (Appendix I.B. shows the same graph for each country). It increased after 2015 when monetary policy in the U.S. and in EMEs became more restrictive, and then dropped sharply in early 2020. Negative values of the liquidity premium should be interpreted as a loss in liquidity attributes, either due to an "inconvenience" yield or risk premia.

[23]The sample for the Philippines, thus, ends when the Libor rate was discontinued. The central bank of the Philippines launched a new domestic-currency interest rate swap as recently as 2024.

Figure 1: Domestic Liquidity Premium (1-year Maturity)



Notes: Figure shows the average liquidity premium from Jan. 2004 to Mar. 2021. The liquidity premium is the latter minus the government bond. All assets are of 1-year maturity. See Table 1 for the list of countries included.

3.3 Liquidity Premia in EMEs: Dollar Convenience Yield

In the framework, the liquidity premium for dollar investors is given by:

$$\begin{aligned} CY_t^f \equiv & \lambda_t^{T,f} - \lambda_t^{US,f} \\ = & (\kappa_t^{T,f} - \kappa_t^{US,f}) v'(\theta_t^f / \text{GDP}_t^f) \\ = & \left[y_{rf,t} - \left(y_t^T - l_t^T + q_t^T - k_t + p_t + \xi_t^{T,f} + \psi_t^{T,f} \right) \right] - \left[y_{rf,t}^{US} - \left(y_t^{US} - l_t^{US} + \xi_t^{US,f} \right) \right] \end{aligned} \tag{15}$$

How do we recover CY_t^f in the data? Data is available for the spread between the two bonds, $y_t^{US} - (y_t^T - \rho_t)$. Then, we will gather data on differential credit risk (through CDS spreads of the same maturity), regulatory risk plus covariances (explained below), and any residual left will be attributable to $\lambda_t^{T,f} - \lambda_t^{US,f}$.

All data corresponds to instruments at the 5-year maturity. The main reasons are data availability and reliability. In particular, 5-year CDS are the most traded for sovereign bonds in EMEs (Du and Schreger, 2016).

There is a subtle difference between how we build the domestic and the dollar spread. The domestic measure is the full spread between the private asset and the local-currency government bond. This spread also captures differential default risk and risk premia, so our strategy is to show that, under the convenience yield hypothesis, the liquidity premium is the main driver of this spread. This is different in the dollar measure, where we can account for each component of the spread, and isolate CY_t^f in the data. The next Section show both measures fully comply with Prediction 1.

There are two main challenges in accounting for CY_t^f. First, how to capture regulatory risk, k_t, and the covariances, $q_t^T + p_t + \xi_t^{T,f} + \psi_t^{T,f}$. Second, how to clean for common financial frictions in EMEs and ensure they do not play a role in the residual attributable to $\lambda_t^{T,f} - \lambda_t^{US,f}$.

To ease the exposition of the paper, we will summarize both strategies here and refer to Appendix C for the details.

The term k_t captures the risk of regulations imposed by the local government that can inflict additional losses upon investors besides explicit default: taxes on capital outflows, currency convertibility restrictions, and other forms of capital controls. These are relevant as most foreign participation in local-currency sovereign bonds has been through domestic markets under domestic law (Onen, Shin, and von Peter, 2023). The framework above assumes that these regulations impose a loss in the same way as a default would[24].

We follow Levy Yeyati et al. (2009), who study the "cross-market premium" between shares of the same companies in EMEs traded simultaneously in the domestic stock market and in New York as depository receipts (DR)[25]. The authors show that when there are no barriers to cross-country capital movement, arbitrage is expected to equalize the prices of the DR and the underlying share. They discuss how full integration of capital markets can be disrupted by two main factors: liquidity and capital controls. There might be a liquidity

[24]These regulations can be imposed and enforced in onshore markets governed by domestic law. However, investors can choose to sign forward contracts offshore that are cash-settled in US dollars and do not require the transfer of the local currency (non-deliverable forwards or NDFs). Therefore, the swapped local currency sovereign bond based on the deliverable currency swap provides the investor with a hedge of the capital control risk and thus should differ from the swapped local currency sovereign bond based on the NDF. Most of the countries in the sample operate NDFs, with the exception of Mexico and South Africa.

[25]As these underlying stocks can be easily transformed into DRs and vice versa, the stock and the DR represent the same asset traded in two different markets.

premium that drives transaction costs upwards and reduces the scope for arbitrage[26]. In addition, government controls on cross-country capital movement are also expected to affect the cross-market premium[27].

Of course, we use the spread between the swapped local-currency bond issued onshore and the bond denominated in foreign currency issued offshore. The latter is generally issued under international law and, therefore, is less subject to the unilateral imposition of capital controls and other regulations.

Appendix C shows that we approximate regulatory risk and the covariances by the spread between the swapped local-currency bond and the bond denominated in foreign currency issued offshore, Φ_t^{FC}, adjusted by the liquidity risk in currency swaps, measured by their bid-ask spread. In the Appendix we explain why this captures capital controls.

Appendix C also explains how do we take into account the convenience of the dollar currency, which they makes any asset denominated in dollars inherit the convenience of that currency (Jiang, Krishnamurthy, and Lustig, 2021); limits to arbitrage and CIP deviations in risk-free rates; limits to arbitrage in bond markets with longer maturities (from global intermediaries' financial constraints); segmentation in offshore vs. onshore FX markets; and bond market segmentation (both in terms of foreign vs domestic investors and foreign vs. domestic markets).

Taking stock, Equation (4) in Proposition 2 can be rearranged to obtain the following:

$$\lambda_t^{T,f} - \lambda_t^{US,f} = y_t^{US} - (y_t^T - \rho_t) + (l_t^T - l_t^{US}) + \Phi_t^{FC} - \tau_t + (\xi_t^{US,f} - \xi_t^{FC,f}) \tag{16}$$

On the left-hand side, we have the convenience yield of EME sovereign bonds against non-Treasury-safe dollar bonds. Appendix A describes all data sources for bond yields, forward premia, credit risk, and Φ_t^{FC} on the right-hand side of Equation (16). τ_t corresponds to the liquidity risk in forward markets. As for $\xi_t^{US,f} - \xi_t^{FC,f}$, a higher credit risk of the non-Treasury dollar assets or the dollar debt of EMEs is very likely associated with a lower

[26]Stocks may not be traded in all markets daily, and stock prices might be sensitive to the trading activity of particular investors because the market is not deep enough.

[27]To the extent that these controls are effective in limiting the ability to transfer funds across borders, the cross-market premium would reflect the desire of investors to purchase the securities inside or outside the country.

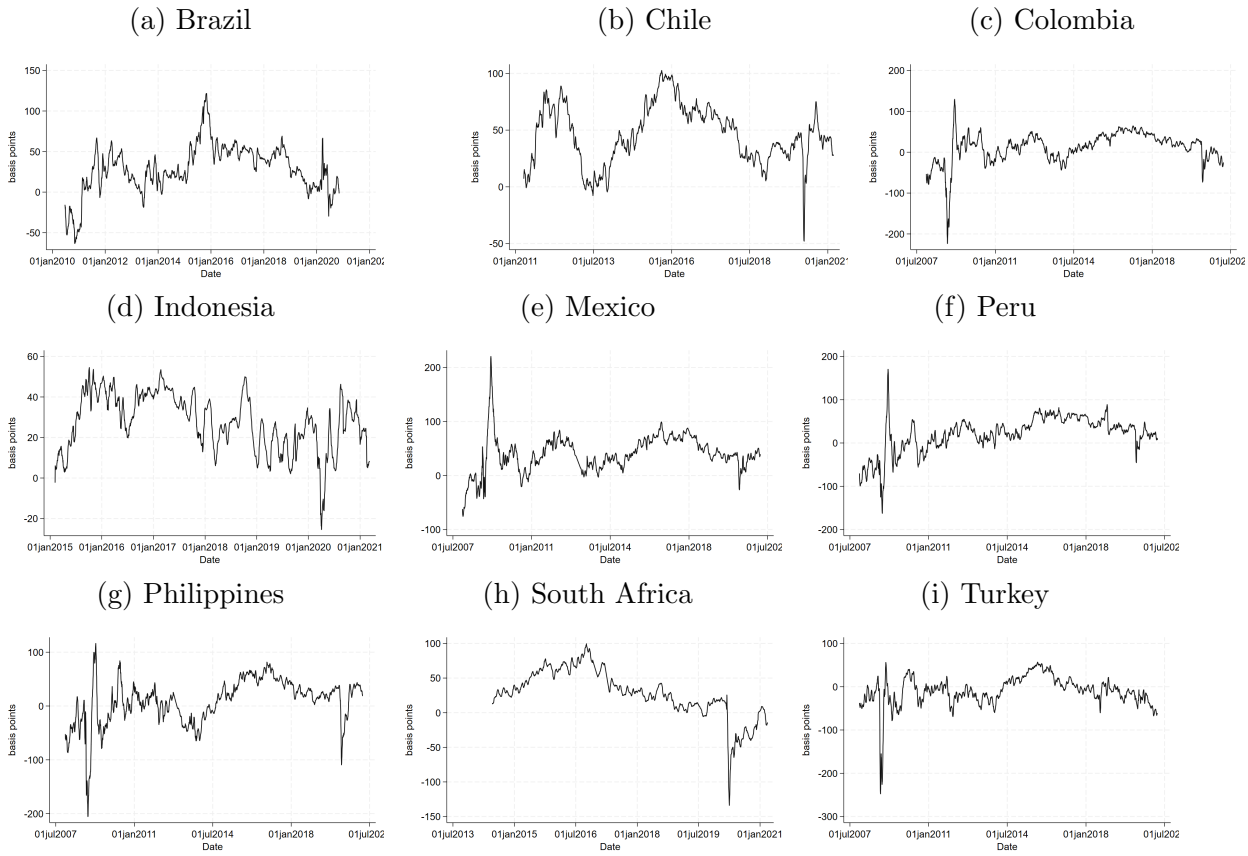
convenience yield (investors are less willing to pay a premium for their safety). Thus, these covariances have the same sign, and the term is $\xi_t^{US,f} - \xi_t^{FC,f}$ will be small.

What are the non-Treasury dollar bonds, y_t^{US}, in the data? Two series are available—first, the 5-year yield on Resolution Funding Corporation (Refcorp) bonds. As suggested by Longstaff (2004), Refcorp bonds are effectively guaranteed by the U.S. government and are subject to the same taxation, but are not as liquid as Treasuries. The other is the ICE Bank of America index for AAA-rated corporate bonds in the US. It tracks the performance of US dollar-denominated investment-grade-rated corporate debt publicly issued in the US domestic market, including all maturities over one year. How do these dollar assets compare with the local currency sovereign bonds in EMEs in terms of safety and liquidity? The Refcorp and AAA-rated corporate bonds have higher credit ratings than the nine EMEs considered. According to Moody's, credit ratings are Baa1 on average, ranging from A1 (for Chile) to B3 (for Turkey). Ultimately, since we will be correcting EME yields by their CDS spread, the dollar spread will capture a liquidity premium rather than a safety premium.

Table 1, Columns 4-6, provide moments for the 5-year maturity-dollar spread ($\lambda_t^{T,f} - \lambda_t^{US,f}$ in Equation (16)) using the yield on Refcorp bonds for y_t^{US}. The selection of countries is based solely on data availability. Column 5 shows that all nine countries for which data are available have a sizable dollar spread. Recall that this is likely capturing a liquidity premium. The only exception is, again, Turkey. This is consistent with the extent of market segmentation. According to BIS data, Turkey has the lowest foreign investors' participation in local-currency sovereign bonds among these nine EMEs, and it falls below 1% at the end of 2021. Given all these features, it would be worrisome if our measure of dollar spread showed a positive and sizeable magnitude for Turkey.

Figure 2 shows the evolution of the dollar spread computed for the 5-year maturity. A typical pattern emerges: first, an increase around 2011-2012 (coinciding with the Euro debt crisis, a period when some EMEs had lower default risk than some European countries), followed by another increase starting around 2014-2015 when the Fed began raising rates and dollar liquidity became scarcer. Second, sharp drops during crises, especially the Covid shock in 2020. Significant drops in dollar spreads happened in Mexico, Peru, Chile, Indonesia, the Philippines, and South Africa, while Brazil did not experience a significant reduction.

Figure 2: Dollar Spread on 5-Year Local-Currency Sovereign Bonds



Notes: Figure shows each country's 14-day moving average of the dollar spread.

The dollar spread takes negative values at many points in the sample. A negative value should be interpreted as the non-Treasury dollar asset providing more liquidity-related services than the EME sovereign bond. It is consistent, then, that there are significant drops during a flight-to-quality episode, such as the Covid pandemic.

In the Appendix I.E.3., we perform additional analysis on the evolution of the EME dollar spread computed against the U.S. Treasury (the "U.S. Treasury premium" as calculated in Du, Im, and Schreger (2018) for G10 countries).

3.4 Test of the Convenience Yield Hypothesis

This Section provides empirical evidence suggesting that the spreads price a convenience yield, capturing non-pecuniary services related to liquidity. In particular, we formally test Prediction 1. The intuition behind Prediction1 is that, under the hypothesis that liquidity is a

priced attribute, the yield spread between these pairs of assets should reflect the equilibrium price of liquidity. Thus, changes in government debt supply or money-like assets should significantly affect these yield spreads. The results fully support Prediction 1, indicating that EME government bonds offer liquidity, so that changes in the supply of government debt separately change the equilibrium prices of liquidity.

We follow KV (2012), Greenwood, Hanson, and Stein (2015), and Nagel (2016) and set up the following regression[28]:

$$cy_{i,t} = \beta_1(\text{Gov. debt supply/GDP})_{i,t-1} + \beta_2 i^{MP}_{i,t-1} + \beta_3 i^{US}_{t-1} + \beta_4 X_{i,t-1} + c_i + \tau_t + \epsilon_{i,t} \quad (17)$$

where i is currency/country, t is time (monthly), and $cy_{i,t}$ is either the dollar spread or the domestic liquidity spreads. Prediction 1 implies $\hat{\beta}_1 < 0$, $\hat{\beta}_2 > 0$ and/or $\hat{\beta}_3 > 0$, even after controlling for default risk and risk premia.

Table 2 presents the results for the domestic spread and the dollar convenience yield. The independent variables are lagged one month to avoid endogeneity and reverse causality as much as possible. The variables c_i and τ_t are country and time-fixed effects, respectively. Time-fixed effects capture time-varying unobserved variables common to all countries. In this sense, it controls for global variables other than the supply of U.S. debt and the federal funds rate level. We double-clustered the standard errors across time and currency.

Recall that, for the domestic spread, we use the spread between domestic currency collateralized interest rate swaps and the yield on local currency government bonds. All assets are denominated in the domestic currency and have a 1-year maturity. For the dollar measure, we use non-Treasury dollar assets to ensure the liquidity premium of US Treasuries does not drive results. This spread captures a liquidity premium in dollar terms, and these assets have a 5-year maturity.

Prediction 1 states that under the convenience yield hypothesis, increases in EME government debt supply should reduce liquidity spreads, and that increases in US Treasury supply should reduce EME liquidity spreads in dollar terms. The theoretical measure of the convenience benefit is $v'(\theta^i_t/\text{GDP}^i_t)$, $i \in \{d, f\}$, where θ^i_t includes both EME sovereign debt

[28]Appendix A describes the data sources for each country.

Table 2: Determinants of Domestic and Dollar Spreads

	Dep. var.: Domestic Spread			Dep. var.: Dollar Spread		
	(1)	(2)	(3)	(4)	(5)	(6)
Local MP rate$_{t-1}$	6.564***	10.18***	11.24***	0.350	0.083	0.343
	(1.141)	(1.416)	(1.569)	(0.547)	(0.739)	(0.544)
U.S. MP rate$_{t-1}$	8.156	7.067	4.832	11.58***	9.131**	10.90***
	(3.623)	(3.378)	(5.422)	(3.817)	(3.857)	(4.012)
$\log(\frac{\text{Local gov debt}}{GDP_{local}})_{t-1}$	-43.83***	-26.56***	-19.00***	8.27	2.89	8.219
	(7.218)	(4.392)	(5.538)	(8.510)	(8.288)	(8.51)
$\log(\frac{\text{U.S. gov debt}}{GDP_{US}})_{t-1}$	-2.816	4.694	-16.41	-135.9***	-132.0***	-137.2***
	(29.24)	(33.49)	(37.93)	(45.04)	(43.63)	(46.86)
slope$_{local,t-1}$		5.884***	7.879***		-0.107	
		(1.299)	(2.117)		(1.550)	
slope$_{US,t-1}$						-1.378
						(4.019)
log(Default prob.)$_{t-1}$			-1.899			
			(2.533)			
Constant	-153.3**	-160.9**	-169.7***	-345.1***	-338.9***	-345.3***
	(61.47)	(66.16)	(55.29)	(82.13)	(80.29)	(83.10)
Observations	1,972	1,905	1,501	1,137	1,103	1,137
R-squared	0.475	0.511	0.564	0.660	0.676	0.663

Notes: Data are at a monthly frequency. All columns include country and year-fixed effects. The domestic spread is the sum of the safety and the liquidity premium. The dollar spread uses the yield on Refcorp bonds for y_t^{US}. Standard errors are double-clustered by country and year. Start dates vary among countries, but they all end in March 2021. U.S. debt and EME local-currency debt-to-GDP variables are net of the central bank's holdings. *** p<0.01, ** p<0.05, * p<0.1

and private-sector convenience assets. Propositions 1 and 2 state that the convenience yield is declining in θ_t^i/GDP_t^i.

Table 2 presents regressions confirming these predictions. The variable (Gov. debt supply/GDP)$_t$ is proxied by either the local-currency sovereign debt to local GDP or the U.S. government debt supply to US GDP.

Column 1 shows a significant negative coefficient, confirming the existence of a priced liquidity attribute driven by EME debt supply, and Column 4 shows a negative effect on the dollar measure driven by US Treasury supply[29]. The regression coefficient on debt supply should be interpreted as reflecting the effect, net of the private sector supply response, of a change in sovereign debt on the bonds' convenience yield[30].

[29]Notice that the supply of local-currency bonds has a significant adverse effect on the domestic spread, and the supply of U.S. government debt decreases the dollar spread. This suggests that both spreads capture the convenience yields in the relevant currencies for each investor.

[30]If there is no special demand for liquidity, then we are back to the standard CAPM model (the spread

The variables i_{t-1}^{MP} and i_{t-1}^{US} correspond to the level of the monetary policy rate in each EME and the U.S., respectively. As explained in Nagel (2016) and Diamond and Van Tassel (2023), these proxy the price of the most liquid asset in the economy: money or its near substitutes, such as central bank reserves or private liquid deposits. Suppose government debt shares the money properties of very liquid assets. In that case, its convenience yield should respond positively to the price of money, i.e., the level of the monetary policy rate. In terms of the model above, this is a proxy for θ_t^M and $\theta_t^{\$M}$. Higher levels of interest rates are associated with a lower supply of money assets, driving up their convenience yield.

Columns 1 and 4 show that both measures respond positively to the level of the monetary policy rate. As expected, the local monetary policy rate has a more significant effect on the domestic spread, whereas the U.S. monetary policy rate has a significant impact on the dollar measure. The magnitudes of the coefficients are in line with those in Nagel (2016) for the US.

In columns 2-3 and 5-6, we show that the impact of sovereign debt supply and the monetary policy rate on the spreads is robust to including controls for default risk and risk premia, captured by the variable X_{t-1} in regression (17). Notice that in Proposition 1-2, the variables l_t^P, l_t^T, l_t^{US} capture both the expected loss upon default and the premia demanded by investors.

As a control for default risk, we include a number of variables. First, the probability of default of the sovereign within one year or five years[31]. We include this variable only for the domestic spread because the dollar measure already corrects for CDS spreads. Results are robust to including a proxy for losses on the private asset, for which we use the expected loss upond default of the domestic banking system, as computed by Chari et al. (2024) for emerging markets.

As a control for risk premia, we include the slope of the yield curve, which is a measure of the state of the business cycle. It is known to predict the excess returns on stocks, and it is a commonly used risk factor when estimating risk premia in bond markets (Campbell and Shiller, 1991; Baumeister, 2023). For example, investors who are more risk-averse in

$cy_{i,t}$ would capture only a relative credit risk premium, $l_t^P - l_t^T$, and the supply of debt should play no significant role, $\hat{\beta}_1 = 0$).

[31] These are available in Refinitiv, and are computed from CDS contracts or Refinitiv's own pricing models.

a recession will demand a higher risk premium to hold the sovereign bond or its private equivalents. Thus, the slope of the yield curve serves as a measure of variation in the risk premium component of the bond spread. We also note that to the extent that sovereign and corporate default risk is likely to vary with the business cycle, the slope variable can also help control for the expected default and liquidity risks in the yield spread.

We measure the slope as the spread between the 10-year sovereign bond yield and the 3-month yield, both with domestic yields $slope_{local}$ and US dollar yields, $slope_{US}$. The results in column 2 show that the slope measure is informative for the domestic spread. Crucially, the coefficient on log(debt/GDP) remains highly significant and of roughly the same magnitude as in other specifications. Regarding the dollar measure, the slope measure is statistically not different from zero in column 6. This is probably due to the fact that credit risk is already accounted for by using CDS spreads.

Furthermore, the economic effects of changes in the slope measure on the domestic spread are modest compared to the effect of debt supply and the monetary policy rate. A decrease of one within-country standard deviation of the local monetary policy rate (a proxy for a larger supply of money-like assets such as central bank reserves) decreases the domestic spread by 23 basis points, whereas a one within-country standard deviation decrease in the slope of the yield curve (signaling higher recession risk or risk aversion) reduces it by six basis points.

The Supplemental Appendix I.E.1 replicates the dollar spread regression using the ICE index for AAA-rated corporate US bonds for the yield y_t^{US} and shows that results generally hold[32]. In the Internet Appendix I.E.2, we run the regression (17) but with credit risk (measured as the differential CDS spread) as a dependent variable. If our decomposition accurately disentangled local-currency bond premiums from default risk, then the determinants should differ. In contrast to convenience yields, credit risk does not respond to the debt supply, which is what standard asset pricing predicts for risk premia.

[32]The issue with this measure is that the index includes corporate bonds of all maturities longer than one year, so in this case, the spread includes some standard term premia

3.5 Discussion: Measurement and Identification

In the current empirical approach, the convenience yield is inferred rather than measured. Indeed, this is an indirect approach (see KV, 2012), and it is the best available approach for a panel of EMEs where comparable data is limited. This approach relies on showing that residual spreads (after adjusting for known risks for which data is available) respond mostly to proxies of non-pecuniary liquidity demand. This is the point of Section 3.4, which relies on the yield decomposition in Appendix B. The strategy is very transparent in claiming these spread capture an upper bound for the *magnitude* of the liquidity premia, but shows the liquidity premium is important and a relevant component of the spread.

A second concern could be that many of the adjustments rely on assumptions that are strong or potentially sensitive to measurement error, especially for EMEs where CDS markets, offshore markets, and forward markets can behave differently from developed markets. The dollar measure relies on an equilibrium decomposition in which each adjustment is treated as orthogonal and correctly measured. In practice, sovereign CDS prices, forward-implied yields, and offshore bond pricing all reflect overlapping risks, heterogeneous investor bases, and country-specific frictions that are difficult to disentangle. As long as the empirical strategy depends on subtracting multiple model-based adjustments to recover a residual, it can be hard to rule out competing interpretations that attribute part of this residual to unmeasured risk premia, segmentation, or other country-specific frictions.

All the concerns listed are acknowledged in the paper: bond segmentation (countries in the sample have meaningful participation of foreigners in local-currency markets, except for Turkey, as shown in Appendix I.A.), offshore vs onshore frictions, liquidity of CDS contracts (5-year CDS are the most traded for EME sovereigns), liquidity of FX markets (explicitly proxied for), and FX market segmentation. In the latter, I currently use data for onshore and offshore forward exchange rates depending on the degree of segmentation, and there is plenty of evidence to document and address FX market regulations and segmentation by country (e.g., Cerutti and Zhou, 2024).

Equilibrium assumptions and assumptions on orthogonal risks are strong. However, the proper identification of each risk when they are overlapping would very likely require a

separate finance paper for each of the risks involved, each with its different models, implementation, and assumptions. Overall, the point with these concerns is that there is a trade-off: either we provide evidence on "local safe assets" for a panel of EMEs, in which case country-specific issues are dealt with to the extent there is comparable data available (the current approach); or we write a separate paper for one country at a time, with a model for each local market that accounts for any remaining friction, but with limited external validity. This paper takes the first direction and leaves the latter for future research.

3.6 Discussion: Relation to Recent Empirical Findings

Are convenience yields compatible with recent findings of demand-based asset pricing for EME sovereign bonds and the role of heterogeneous investors?

Fang, Hardy, and Lewis (2022) analyze investor demand for sovereign debt using a demand system approach based on low-frequency country-level data of sovereign debt ownership split by banks and non-banks, both foreign and domestic. They find that private non-banks absorb most new debt issuance and are the creditor group most responsive to the yield. Zhou (2024) focuses on a more detailed foreign investor split: investment funds (prone to risk-sensitive redemptions) and banks, insurers, and pension funds with a more stable demand structure. The author finds that foreign insurers and pension funds tilt their emerging market portfolios towards securities with higher credit quality, and their sensitivity to shifts in the VIX index is lower than that of foreign investment funds. Moreover, during the Taper Tantrum and the Covid pandemic, foreign banks, insurers, and pension funds responded by buying EME sovereign debt, while investment funds became net sellers. In the same line, Converse, Levy-Yeyati, and Williams (2023) show that exchange-traded funds (ETFs) amplify EMEs' sensitivity to the global financial cycle.

According to these findings, the behavior of foreign insurers and pension funds is consistent with a convenience yield in dollar terms. Their demand structure is more stable and less sensitive to global risk factors. They have a downward-sloping demand curve for EME sovereign debt and do not face the strong redemption pressure that investment funds encounter during episodes of heightened global uncertainty.

Similarly, the results support recent attempts to introduce a liquidity role for government

bonds in banks' balance sheets in EMEs (Perez, 2018) and the external finance cost of global intermediaries who lend to EME sovereign bonds (Morelli, Ottonello, and Perez, 2022). These papers could rationalize the existence of a liquidity premium for domestic banks and a "bond inconvenience" for global banks in response to global shocks, respectively.

Moretti et al. (2024) present evidence of downward-sloping demand curves for risky sovereign bonds, which works to discourage the government from borrowing too much. Their paper features a structural model with a demand structure that includes active and passive investors. The equilibrium bond price includes a function that captures the demand's downward-sloping nature and which they identify with a "convenience yield". However, by construction, this function decreases the bond price, so they assume an "inconvenience yield". Within their paper, this is consistent because they calibrate the model to Argentina. While their notion of "convenience yields" refers to anything that makes demand inelastic, the approach by KV (2012) and Du, Im, and Schreger (2018) can be seen as a price-based way to link more specifically a spread between assets to a demand for safety and liquidity.

4 The Local Safe Asset Status

Proposition 3 characterizes the safe-haven status of the local-currency sovereign bond through the response of its expected convenience yield to local and global risk: it rises with the probability of a local shock and falls with the probability of a global shock. Definition 2 translates these signs into a status: an asset that satisfies both inequalities is a *local safe asset*. This section takes the model's signs to the data.

4.1 Empirical Specification

Linearizing the expected convenience yield around the unconditional means $(\bar{\pi}_L, \bar{\pi}_G)$ delivers

$$\mathbb{E}_t[CY^i_{t+1}] \;\approx\; \overline{CY}^i \;+\; \underbrace{\upsilon'\Delta\Gamma_L}_{\gamma_2}(\pi_{L,t} - \bar{\pi}_L) \;+\; \underbrace{\upsilon'\Delta\Gamma_G}_{\gamma_1}(\pi_{G,t} - \bar{\pi}_G), \tag{18}$$

where $\Delta\Gamma_L \equiv [\kappa^T(L) - \kappa^{alt}(L)] - [\kappa^T(N) - \kappa^{alt}(N)]$ and $\Delta\Gamma_G$ is defined analogously. Proposition 3 establishes $\gamma_2 > 0$ and $\gamma_1 < 0$. We test these sign restrictions on observable proxies

for $(\pi_{L,t}, \pi_{G,t})$. The estimating equation is

$$cy_{i,t} = \gamma_1 \, \rho_{t-1}^{US} + \gamma_2 \, \rho_{i,t-1}^{EM} + c_i + \tau_t + \epsilon_{i,t}, \tag{19}$$

where ρ_t^{US} is the observable proxy for global risk, $\rho_{i,t}^{EM}$ the observable proxy for local risk, i indexes country, t is monthly, the dependent variable $cy_{i,t}$ is either the domestic spread or the dollar convenience yield, c_i are country fixed effects, τ_t are time fixed effects, and standard errors are double-clustered by country and time. The independent variables are lagged one month to mitigate reverse-causality concerns. Proposition 3 predicts

$$\widehat{\gamma}_1 < 0 \quad \text{and} \quad \widehat{\gamma}_2 > 0.$$

If the data confirm both signs, the local-currency sovereign bond satisfies Definition 2 and qualifies as a local safe asset.

The proxies for ρ_t^{US} capture investor risk sentiment over the global economy but are also informative about the financial frictions on global intermediaries that limit their arbitrage capacity (Gabaix and Maggiori, 2015; Morelli, Ottonello, and Perez, 2022); we control for the latter below to isolate the risk-sentiment channel. The proxies for $\rho_{i,t}^{EM}$ capture country-specific risk sentiment and frictions arising from domestic policy uncertainty.

To capture global risk sentiment, we utilize the VIX and the global risk factor introduced by Miranda-Agrippino and Rey (2020, 2022). The latter is built on global asset prices, including equity prices[33], commodity prices excluding precious metals, and corporate bond indices. This global factor accounts for approximately a quarter of the variance in risky asset prices and about 35% of the variance in gross capital flows.

How important are global factors for EMEs? González-Rozada and Levy Yeyati (2008) find that the evolution of global factors such as risk appetite and global liquidity explains a significant fraction of the time variability of EME bond spreads. In particular, they find that international risk appetite and international liquidity are two exogenous risk factors that explain over 50% of the long-run time variability of EME spreads. By contrast, debt-specific factors, such as credit ratings or outlook changes, lag spread movements and elicit

[33]Covering Europe, North America, Latin America, Asia Pacific, and Australia

little to no additional effect on spreads.

We employ the Economic Policy Uncertainty (EPU) index, developed by Baker, Bloom, and Davies (2016), to capture local risk sentiment. The index is available for Brazil, Chile, Colombia, and Mexico. To complement and as a robustness check, we also employ the risk index from the International Country Risk Guide (ICRG) dataset, which provides data on a country's political, economic, and financial risks for more than 140 countries at a monthly frequency.

How important are these variables for EMEs? The selection of these variables is based on the findings of Kalemli-Ozcan and Varela (2023), who show that these capture a relevant factor explaining country-specific systematic risk in emerging market economies. In particular, country-specific policy uncertainty differs from default risk, as it stems from volatility in a broad set of policies, including monetary policy uncertainty, fiscal policy uncertainty, expropriation risk, and democratization risk.

The EPU index is built using monthly counts of articles in local newspapers that convey the extent of uncertainty. In the case of the indices for Brazil, Chile, Colombia, and Mexico, the keywords an article must contain to be considered in the index are "uncertainty" and "economy/economic".

The ICRG gives a score for each source of risk in a country. We will include the financial and economic risk variables, each of which has five components, and their assessments are based solely on objective data. Economic risk encompasses GDP per capita, real GDP growth, inflation rate, budget balance as a percentage of GDP, and current account balance as a percentage of GDP. Financial risk includes foreign debt to GDP, foreign debt service over exports of goods and services, current account over exports of goods and services, net international liquidity as months of import cover, and exchange rate stability. Notice that, while these two variables are country-specific, a broad distinction can still be made between them. Economic risk captures the country fundamentals and the business cycle. Financial risk, on the other hand, is related to government debt service and the liquidity available to governments, especially in relation to foreign debt. As we shall see below, the financial risk will have a different effect on the safety premium.

Table 3: Domestic Spread and Risk Factors

Dep. var.: dom. spread	(1)	(2)	(3)	(4)	(5)	(6)
VIX_{t-1}	-1.000***		-0.712**		-0.717**	
	(0.247)		(0.323)		(0.332)	
mar_{t-1}		-12.67***		-10.44***		-10.90***
		(2.653)		(3.886)		(3.902)
EPU_{t-1}	13.31***	12.59***				
	(2.229)	(2.151)				
Economic $risk_{t-1}$			-2.502	-2.578		
			(2.589)	(2.670)		
Financial $risk_{t-1}$					3.154**	3.781**
					(1.509)	(1.575)
Observations	595	595	1,153	1,153	1,153	1,153
R-squared	0.574	0.568	0.303	0.306	0.307	0.309
Country & Year FE	Y	Y	Y	Y	Y	Y
MP rate & Debt supply	Y	Y	Y	Y	Y	Y
Risk Premia	Y	Y	Y	Y	Y	Y
K inflows	Y	Y	Y	Y	Y	Y

Notes: *mar* is the global risk factor in Miranda-Agrippino and Rey (2020). All assets are of 1-year maturity. *EPU* is the economic policy uncertainty index of Baker, Bloom, and Davis (2016) -available for fewer countries. Regressions exclude data for Turkey and the Philippines. Data are at a monthly frequency. Standard errors are double-clustered by country and month. Start dates vary among countries, but ICRG data is available until April 2019. *** p<0.01, ** p<0.05, * p<0.1

4.2 Results

Table 3 shows the results for the domestic spread. Recall that for the remainder of this Section, regressions exclude Turkey and the Philippines. *mar* is the global risk factor in Miranda-Agrippino and Rey (2020). The risk variables from the ICRG are standardized by each country's mean and standard deviation (higher values reflect higher risk).

The domestic liquidity premium exhibits varying responses depending on the nature of the risk. The liquidity value significantly decreases with global risk, but it increases with local risk. In terms of our framework, this suggests that local-currency sovereign bonds qualify as local safe assets.

In G10 countries, the liquidity premium (measured with the same spread) increases with global risk, marking a key departure from EMEs (see Appendix I.F.2).

To further address the concern about the presence of credit risk premia in these spreads, the Internet Appendix I.F.1 replicates Table 3 for the 3-month maturity, where arguably risk premia are very small. In the case of the US, it is well known that short-term T-bills are the most money-like in the term structure (Greenwood, Hanson, and Stein, 2015; Du, Im, and

Table 4: Dollar CY and Risk Factors

Dep. var.: dollar CY	(1)	(2)	(3)	(4)	(5)	(6)
VIX_{t-1}	-0.828***		-0.939***		-1.061***	
	(0.306)		(0.283)		(0.264)	
mar_{t-1}		-21.32*		-15.03		-22.81**
		(12.20)		(11.75)		(11.05)
EPU_{t-1}	13.27***	12.33***				
	(2.478)	(2.253)				
Economic $risk_{t-1}$			2.195	3.254		
			(2.155)	(2.182)		
Financial $risk_{t-1}$					5.610***	4.538**
					(2.013)	(2.264)
Country & Year FE	Y	Y	Y	Y	Y	Y
MP rate & Debt supply	Y	Y	Y	Y	Y	Y
Risk Premia	Y	Y	Y	Y	Y	Y
K Inflows	Y	Y	Y	Y	Y	Y
Observations	540	540	873	873	873	873
R-squared	0.738	0.719	0.706	0.695	0.709	0.700

Notes: *mar* is the global risk factor in Miranda-Agrippino and Rey (2020). *EPU* is the economic policy uncertainty index of Baker, Bloom, and Davis (2016) -available for fewer countries. Regressions exclude data for Turkey. Data are at a monthly frequency. Standard errors are double-clustered by country and month. Start dates vary among countries, but ICRG data is available until April 2019. Capital inflows-to-GDP variables are standardized by the mean and standard deviation of each country. *** p<0.01, ** p<0.05, * p<0.1

Schreger, 2018). Results hold, although with different magnitudes. Notably, the liquidity premium at the 3-month maturity responds positively to global risk, suggesting a pattern similar to that in the US.

Table 4 shows the results for the dollar measure. Overall, the picture is similar to the domestic liquidity premium. While the dollar measure responds positively to local risk, it responds negatively and strongly to global risk.

Notably, this suggests that the local currency sovereign bond serves as a safe haven against local or country-specific risk, compared to a foreign asset. At the same time, it does not work as a safe haven against global uncertainty. In Du, Im, and Schreger (2018), an analogous spread for G10 countries shows a strong positive reaction to global risk measured by the VIX[34].

All columns control for measures of credit risk premia, the responses of the monetary policy rate, and the supply of government debt. This indicates that results are not driven

[34]As they work with advanced economies, Du, Im, and Schreger (2018) adjust for CDS spreads and other CIP deviations, but not for capital controls risks.

by the responses of the central bank and the fiscal authority, which could alter the supply of safe and liquid assets in response to varying levels of uncertainty.

In addition, all columns add capital inflows over GDP as controls. As explained above, the global factor can capture both the role of investors' risk appetite and also the role of financial constraints of global intermediaries (Gabaix and Maggiori, 2015). In the case of EMEs, these constraints can lead to an intermediation premium on sovereign debt (Morelli, Ottonello, and Perez, 2022). Capital inflows work as a proxy for the latter because they have been shown to strongly correlate with financial constraints of global intermediaries (Hau and Rey, 2006; Gabaix and Maggiori, 2015; Basu et al., 2020). Results are also robust to including alternative measures of global intermediaries' balance sheet constraints, such as the He, Kelly, and Manela (2017) index. If the coefficient of the global factor remains significant after controlling for these, this would confirm that global uncertainty has a negative effect on its own. We added capital inflows disaggregated by the sector they are directed to (government, bank, or corporate debt), using data from Adjiev et al. (2022).

4.3 Mechanisms

The previous subsections established a reduced-form fact: convenience yields respond to local and global risk in the asymmetric pattern that defines a local safe asset (regression 19). This subsection uses a natural experiment to discipline the key mechanisms behind this fact. The Covid-19 shock of March–June 2020 is a flight-to-safety episode, and we use it to test the mechanism behind regression 19: in particular, to identify which of the two channels of Proposition 3—relative fundamentals or relative float—drives the asymmetric response of convenience yields to global risk.[35]

We estimate

$$cy_{i,t} = \alpha\, \mathbf{1}_{\text{shock},t} + \boldsymbol{\beta}\big(\mathbf{X}_{i,t-1} \times \mathbf{1}_{\text{shock},t}\big) + \boldsymbol{\delta}\mathbf{X}_{i,t-1} + c_i + \tau_t + \epsilon_{i,t}, \tag{20}$$

where $\mathbf{1}_{\text{shock},t}$ is a dummy for the relevant episode and $\mathbf{X}_{i,t-1}$ collects the determinants of

[35]This episode is widely treated as exogenous and unanticipated for EMEs. The Covid shock encompasses many simultaneous developments; we restrict attention to the early phase to isolate the flight-to-safety component, as evidenced by the spike in the VIX.

Table 5: Effect of the Covid-19 Shock

Dep.var.:	dom. sprd	dom. sprd	dollar cy	dollar cy
	(1)	(2)	(3)	(4)
Non-interacted regressors	Yes	Yes	Yes	Yes
Covid-19$_{t-1}$	-19.43***	-18.46**	-34.43***	-31.82***
	(7.469)	(7.333)	(5.350)	(5.163)
MP rate$_{t-1}$ × Covid-19		-9.696***		1.664
		(1.975)		(1.026)
$\log(\frac{\text{US debt to GDP}}{\text{Debt to GDP}})_{t-1}$ × Covid-19		42.27***		-1.940***
		(11.53)		(0.600)
slope$_{local,t-1}$ × Covid-19		9.158***		1.412
		(3.043)		(2.805)
Constant	-48.43***	-52.46***	228.8***	239.2***
	(15.80)	(16.51)	(25.69)	(26.32)
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	1,627	1,627	1,228	1,228
R-squared	0.301	0.316	0.655	0.657

Notes: TT is a dummy variable taking the value one from May to December 2013. Covid-19 is a dummy variable taking the value one from March to June 2020. All columns include country and year fixed effects *** p<0.01, ** p<0.05, * p<0.1

regressions 17 and 19—the local monetary policy rate, the relative supply of U.S. Treasuries to local government debt, and the slope of the local yield curve. The interaction coefficients $\boldsymbol{\beta}$ identify which determinants drive the response of the convenience yield during the episode, and therefore which channel of the model is operative. We use the relative supply $\log((\text{US debt/GDP}_{US}) \,/\, (\text{Local debt/GDP}_{i}))$ rather than each level separately; under Proposition 3, the float channel operates through this relative quantity, and its use also delivers a less noisy estimate. The two quantities are net of central bank holdings, to proxy for the actual float available to investors.

Covid-19: testing the float channel of Proposition 3. Under regression 19, a rise in global risk should lower the dollar convenience yield ($\hat{\gamma}_1 < 0$). Proposition 3 attributes this fall to two channels: relative fundamentals and relative float. The Covid shock allows us to ask which channel does the work. Column 3 confirms an unconditional drop in the dollar CY of about 34 basis points. Column 4 attributes this drop to the relative-float channel: the interaction log(US debt/Local debt) × Covid is negative and highly significant (-1.94, p< 0.01), indicating that the dollar CY collapses precisely when the global reserve asset is in

larger relative supply—the signature of seeker coordination on the deeper-float asset, as in Proposition 3, Part (i). The slope of the yield curve, a standard proxy for risk aversion and the fundamentals channel, has a statistically insignificant interaction. Notably, this result is informative beyond a mechanical credit-risk story: if the drop in the dollar CY were driven by rising EME default risk (already controlled for) or by global investors charging a higher risk premium, the slope interaction would carry the action.

Covid-19: the domestic spread. Columns 1 and 2 of Table 5 repeats the exercise with the domestic spread on the left-hand side. Proposition 3, applied to T versus P, predicts that a global shock compresses the domestic spread through the *fundamentals* channel rather than the float channel: the relative-float comparison $\bar{S}_T$ versus $\bar{S}_P$ is far smaller than $\bar{S}_{US}$ versus $\bar{S}_T$, so the float channel cannot drive the domestic-spread response. Instead, in a global flight, T's idiosyncratic-risk advantage over P shrinks because seekers reallocate toward the dollar reserve since T is the closer substitute to US within the domestic basket. This worsens the fundamentals of T relative to P.

The estimates in Column 2 support this interpretation. The interaction of the monetary policy rate and the relative float have the opposite sign as their non-interacted regressors, which suggests that the effect of these channels reverse during this episode. On the other hand, the slope regressor significantly increases with the Covid interaction, suggesting its importance increases in these events.

Together with Column 4, this delivers a sharp identification of the mechanism: the fall in the dollar CY against global risk operates through float, while the fall in the domestic spread against global risk operates through fundamentals. Both responses are predicted by Proposition 3, but they are driven by different channels of the model—a discipline that a single-spread analysis cannot provide.

5 Conclusions

This paper characterizes local safe assets as assets denominated in local currency, that serve as a safe haven against country-specific uncertainty but not against global risk. Local-

currency sovereign bonds in EMEs fall into this category. These bonds are priced for their liquidity attributes, captured by a convenience yield. This is robust to the alternative asset used as a benchmark: either a private domestic asset, or a private foreign dollar asset. Convenience yields increase against local risk factors but decline against global risk factors, fully capturing the local safe asset characterization. Evidence from the Covid episode suggests that the drop in dollar liquidity premia does not rest on higher credit risk or risk premia, but rather on the much larger float of the reserve asset, which drives coordination towards foreign dollar assets.

The response of safety and liquidity to global shocks has important implications for EMEs that call for more research on this topic. Our results could have implications for the investor base in EMEs. In addition, the safe asset status could affect interest rate volatility and the fiscal capacity of EME governments. Additionally, safety and liquidity together form a channel for the effectiveness of large-scale asset purchases by central banks. Indeed, many EME central banks conducted such purchases during the Covid crisis. Therefore, if the safety and liquidity attributes from global investors drop during a crisis, that will limit the effectiveness of LSAPs. Future research can aim to understand better how standard policies for EMEs interact with safety and liquidity, such as reserve accumulation, different forms of capital controls, or foreign exchange intervention. We can also learn more about what forces are necessary for an emerging market to start having a "safe haven" debt, both in terms of a large average premium as well as the sensitivity to risk events.

Looking further ahead, the concept of local safe assets may prove central to understanding a changing global financial order. The international monetary system has relied heavily on US Treasuries as the dominant safe asset for decades. Whether due to concerns about US fiscal sustainability, geopolitical fragmentation, or deliberate efforts by other countries to develop alternatives, this dominance may not persist indefinitely. Understanding how local safe assets emerge, what sustains their status, and how they interact with global safe assets is essential preparation for a potentially multipolar financial future.

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Appendix

A. Data Sources

The expression for the dollar spread in the main text is: $\lambda_t^{T,f} - \lambda_t^{US,f} = y_t^{US} - (y_t^T - \rho_t) + (l_t^T - l_t^{US}) + \Phi_t^{FC} - \tau_t + (\xi_t^{US,f} - \xi_t^{FC,f})$. The sources for each component on the right-hand side are:

Bond yields and forward premia. We used data from the Resolution Funding Corporation (Refcorp) bonds for various maturities for yields of non-Treasury-safe dollar bonds. As suggested by Longstaff (2004), Refcorp bonds are effectively guaranteed by the U.S. government and are subject to the same taxation, but are not as liquid as Treasuries. As in Longstaff (2004), we measured the yields by taking the differences between the constant maturity on the Bloomberg Fair Value curves for Refcorp zero-coupon bonds. Maturities available are 6-month, 1-, 2-, 3-, 4-, 5-, 7-, 10-, and 20-year.

The other two yields for non-Treasury safe dollar bonds correspond to the ICE Bank of America AAA and BBB US Corporate Index. These track the performance of US dollar-denominated corporate debt issued in the US domestic market, with AAA and BBB credit ratings, respectively. They include all maturities greater than one year. The series were retrieved from FRED, Federal Reserve Bank of St. Louis.

EME bond yields data came from Bloomberg and Thomson Reuters. The value of the forward premium for each country was taken from the database of Du et al. (2018). The authors provide estimations of CIP deviations of sovereign bonds for ten developed and 18 developing countries to U.S. Treasuries. The data are at a daily frequency between approximately 2000 and March 9, 2021, although the start date varied among countries. Data are available for maturities at 3-months, 1-, 2-, 3-, 5- and 10-years. Since forward contracts are, in general, not very liquid, they compute $\rho_{i,t}$ from a hedging strategy involving interest rate swaps and cross-currency swaps

Default risk differentials ($l_t^{US} - l_t^T$) and Φ_t^{FC}. We proxied $l_{i,t}$ with data on CDS spreads. We obtained the CDS spread series for EMEs' sovereign bonds of different maturities from Bloomberg at a daily frequency. We used the CDS spreads for foreign-currency debt,

Table 6: Private local-currency domestic assets (Bloomberg tickers)

Country	Interbank rate	Interest rate swap
Brazil	–	PREDI 360 Index
Chile	CLTN360N Index	CHSWP1
Colombia	–	CLSWIB1 Curncy
Hungary	BUBOR01Y Index	HFSW1
Korea	KRBO12M Index	KWSWO1 Curncy
Malaysia	KLIB12M Index	MRSWNI1 Curncy
Mexico	–	MPSW1A Curncy
Philippines	PREF1YR Index	PPSWO1 Curncy
Poland	WIBR1Y Index	PZSW1 Curncy or PZOSW1
Thailand	BOFX1Y Index	TBSWNI1 or TBSWI1
South Africa	JIBA12M Index	SASW1 Curncy
Turkey	TRLXB1Y Index	TYSWF Curncy

as their data are more widely available and show greater liquidity than local-currency CDS. Therefore, we assumed that the risk of default on foreign-currency debt also applies to local-currency bonds. As discussed in Du and Schreger (2016), this assumption is not much different from reality as default events in EMEs since the late 1990s show that the incidence of default on domestic-currency debt is comparable with the incidence of external foreign-currency defaults. For y_t^{FC}, we used the Bloomberg Fair Value curves (BFV) for the prices of foreign-currency sovereign bonds for each EME. These are at par yield curves, so they must be adjusted to represent zero-coupon yields.

Liquidity risk of forwards contracts (τ_t). τ_t is measured as half the bid-ask spread of each cross-currency swap. Daily data is available on Bloomberg. For Brazil, Colombia, Indonesia, Peru, Philippines, and Turkey, the cross-currency swap is the non-deliverable swap between the fixed local rate and the floating U.S. Libor. For Chile, Mexico, and South Africa, it corresponds to the bid-ask spread of the interest rate swap used to construct the cross-currency swap in Du and Schreger (2016).

Domestic spread The yield on the 1-year local-currency sovereign bond comes from the dataset in Du et al. (2018). The private local-currency domestic assets used for each country are listed in Table 6. All yields are for the 1-year maturity.

B. Proofs of Propositions of Section 2

B.1. Proof of Proposition 1

Denote the domestic price level at date t as Q_t. If the investor buys a zero-coupon nominal domestic sovereign bond for a price P_t^T, her real holdings θ_t^T rise by P_t^T/Q_t. The first order condition for this bond holdings is, then,

$$-\frac{P_t^T}{Q_t}u'(C_t) + \beta E_t\left[\frac{P_{t+1}^T}{Q_{t+1}}u'(C_{t+1})\right] + \frac{P_t^T}{Q_t}v'(\theta_t^d/\text{GDP}_t^d)u'(C_t) = 0 \tag{21}$$

Define the pricing kernel for nominal payoffs as

$$M_{t+1} = \beta\frac{u'(C_{t+1})}{u'(C_t)}\frac{Q_t}{Q_{t+1}} \tag{22}$$

so that, in the absence of default risk, we would have:

$$P_t^T = E_t[M_{t+1}P_{t+1}^T\Lambda_{t+1}^{T,d}] \tag{23}$$

where $\Lambda_t^{T,d} \equiv 1/(1 - v'(\theta_t^d/\text{GDP}_t^d))$ captures the marginal benefits investor d derives from these local-currency sovereign bonds of the EME. A positive marginal value of convenience, $v'(\cdot)$, raises $\Lambda_t^{T,d}$, and therefore raises the price of the bond, P_t^T.

Suppose that the EME sovereign can default next period with probability π_t^T, and L_{t+1}^T measures the amount of losses suffered in default (a random variable). If the bond does not default, it is worth P_{t+1}^T. Then, its price satisfies,

$$P_t^T = \pi_t^T E_t[M_{t+1}\Lambda_{t+1}^{T,d}(1 - L_{t+1}^T)|\text{Default}] + (1 - \pi_t^T)E_t[M_{t+1}P_{t+1}^T\Lambda_{t+1}^{T,d}|\text{No Default}] \tag{24}$$

For simplicity, assume continuously compounded yields and consider the case of one-period bonds (so $P_{t+1}^T = 1$). Define $\tilde{L}_{t+1}^T$ as a random variable that is equal to zero if there is no default and equal to L_{t+1}^T if there is a default. Then, the expression for the price of the

bond is

$$\begin{aligned} e^{-y_t^T} = P_t^T &= E_t[M_{t+1}\Lambda_{t+1}^{T,d}] - E_t[M_{t+1}]E_t[\tilde{L}_{t+1}^T] - \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^T] - \text{cov}_t[\Lambda_{t+1}^{T,d}, \tilde{L}_{t+1}^T] \\ &\approx e^{\lambda_{t+1}^{T,d} - \pi_t^T (E_t[L_{t+1}^T] + \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}]) - \text{cov}_t[\lambda_{t+1}^{T,d}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}]} E_t[M_{t+1}] \end{aligned} \tag{25}$$

where $\lambda_t^{T,d} \approx v'(\theta_t^d/\text{GDP}_t^d)$ and $\text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}]$ is a risk premium if default events coincide with bad states. Take logs on both sides to get :

$$y_t^T \approx y_t^{rf} - \lambda_t^{T,d} + l_t^T - \xi_t^{T,d} \tag{26}$$

where $y_t^{rf} = -\log M_{t+1}$ (no arbitrage condition); $l_t^T = \pi_t^T(E_t[L_{t+1}^T] + \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}])$ denotes the compensation for default (expected losses plus premium); $\lambda_t^{T,d}$ is the convenience yield (how much the total yield is reduced because of the marginal services provided by the bond); and $\xi_t^{T,d} = \text{cov}_t[\lambda_{t+1}^{T,d}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}]$ denotes the covariance between default risk and the convenience yield.

The decomposition of the yield of the private asset follows the same logic,

$$y_t^P \approx y_t^{rf} - \lambda_t^{P,d} + l_t^P - \xi_t^{P,d} \tag{27}$$

Take the spread between the two yields of the same maturity to get:

$$y_t^P - y_t^T \approx (\lambda_t^{T,d} - \lambda_t^{P,d}) + (l_t^p - l_t^j) + (\xi_t^{T,d} - \xi_t^{P,d}) \tag{28}$$

□

B.2. Proof of Proposition 2

Denote the US price level at date t as $Q_t^\$$. If the investor buys a zero-coupon nominal non-Treasury safe U.S. bond for a dollar price P_t^{US}, her real holdings θ_t^{US} rise by $P_t^{US}/Q_t^\$$. The first order condition for this bond holdings is then

$$-\frac{P_t^{US}}{Q_t^\$}u'(C_t) + \beta E_t\left[\frac{P_{t+1}^{US}}{Q_{t+1}^\$}u'(C_{t+1})\right] + \frac{P_t^{US}}{Q_t^\$}v'(\theta_t^f/\text{GDP}_t^f)u'(C_t) = 0 \tag{29}$$

Define the pricing kernel for nominal payoffs as

$$M_{t+1} = \beta \frac{u'(C_{t+1})}{u'(C_t)} \frac{Q_t^\$}{Q_{t+1}^\$} \tag{30}$$

so that, in the absence of default risk, we would have:

$$\begin{aligned} P_t^{US} &= E_t[M_{t+1} P_{t+1}^{US}] + P_t^{US} v'(\theta_t^f / \text{GDP}_t^f) \Rightarrow \\ P_t^{US} &= E_t[M_{t+1} P_{t+1}^{US} \Lambda_{t+1}^{US,f}] \end{aligned} \tag{31}$$

where $\Lambda_t^{US,f} \equiv 1/(1 - v'(\theta_t^f / \text{GDP}_t^f))$ captures the marginal benefits investor f derives from these non-Treasury safe bonds. A positive marginal value of convenience, $v'(\cdot)$, raises $\Lambda_t^{US,f}$, and therefore raises the price of the bond, P_t^{US}.

To add default risk, suppose that the issuer may default next period with probability π_t and, in default, pays $1 - L_{t+1}^{US}$, where L_{t+1}^{US} measures the amount of losses suffered in default (and is a random variable). If the bond does not default, it is worth P_{t+1}^{US}. Then, its price satisfies,

$$P_t^{US} = \pi_t E_t[M_{t+1} \Lambda_{t+1}^{US,f} (1 - L_{t+1}^{US}) | \text{Default}] + (1 - \pi_t) E_t[M_{t+1} P_{t+1}^{US} \Lambda_{t+1}^{US,f} | \text{No Default}] \tag{32}$$

For simplicity, assume continuously compounded yields and consider the case of one-period bonds (so $P_{t+1}^{US} = 1$). Define $\tilde{L}_{t+1}^{US}$ as a random variable that is equal to zero if there is no default and equal to L_{t+1}^{US} if there is a default. Then, the expression for the price of the bond is

$$\begin{aligned} e^{-y_t^{US}} = P_t^{US} &= E_t[M_{t+1} \Lambda_{t+1}^{US,f}] - E_t[M_{t+1}] E_t[\tilde{L}_{t+1}^{US}] - \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^{US}] - \text{cov}_t[\Lambda_{t+1}^{US,f}, \tilde{L}_{t+1}^{US}] \\ &\approx e^{\lambda_{t+1}^{US,f} - \pi_t (E_t[L_{t+1}^{US}] + \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^{US}] / E_t[M_{t+1}]) - \text{cov}_t[\lambda_{t+1}^{US,f}, \tilde{L}_{t+1}^{US}] / E_t[M_{t+1}]} E_t[M_{t+1}] \end{aligned} \tag{33}$$

where $\lambda_t^{US,f} \approx v'(\theta_t^f / \text{GDP}_t^f)$ and $\text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^{US}] / E_t[M_{t+1}]$ is a risk premium if default events coincide with bad states. Take logs on both sides to get :

$$y_t^{US} \approx y_{rf,t}^{US} - \lambda_t^{US,f} + l_t^{US} - \xi_t^{US,f} \tag{34}$$

where $y^{US}_{rf,t} = -\log M_{t+1}$ (no arbitrage condition); $l^{US}_t = \pi_t(E_t[L^{US}_{t+1}] + \text{cov}_t[M_{t+1}, \tilde{L}^{US}_{t+1}]/E_t[M_{t+1}])$ denotes the compensation for default (expected losses plus premium); $\lambda^{US,f}_t$ is the convenience yield (how much the total yield is reduced because of the marginal services provided by the bond); and $\xi^{US,f}_t = \text{cov}_t[\lambda^{US,f}_t, \tilde{L}^{US}_{t+1}]/E_t[M_{t+1}]$ denotes the covariance between default risk and the convenience yield. □

Again, denote the price level at date t as $Q^{\$}_t$. Let the price of the EME sovereign bond be P^T_t. If the investor purchases one unit, her real holdings θ^T_t rise by $P^T_t/Q^{\$}_t \times 1/S_t$, where S_t is the nominal exchange rate. The first order condition for holdings of the synthetic bond is

$$-\frac{P^T_t}{Q^{\$}_t}\frac{1}{S_t}u'(C_t) + \beta E_t\left[\frac{P^T_{t+1}}{Q^{\$}_{t+1}}\frac{1}{F_{t+1}}u'(C_{t+1})\right] + \frac{P^T_t}{Q^{\$}_t}\frac{1}{S_t}v'(\theta^f_t/\text{GDP}^f_t)u'(C_t) = 0 \tag{35}$$

As before, for simplicity, assume one-period bonds, so $P^T_{t+1} = 1$ and the forward rate is a one-period ahead rate, $F_{t+1} = F^1_t$. In the absence of other risks, we would have:

$$\begin{aligned} P^T_t\frac{F^1_t}{S_t} &= E_t[M_{t+1}] + P^T_t\frac{F^1_t}{S_t}v'(\theta^f_t/\text{GDP}^f_t) \Rightarrow \\ P^T_t\frac{F^1_t}{S_t} &= E_t[M_{t+1}\Lambda^{T,f}_{t+1}] \end{aligned} \tag{36}$$

where $\Lambda^{T,f}_t \equiv 1/(1 - v'(\theta^f_t/\text{GDP}^f_t))$ captures the marginal benefits investor f derives from the bond issued by the EME sovereign.

Recall that the EME sovereign can default next period with probability π^T_t, and L^T_{t+1} measures the amount of losses suffered in default (a random variable). The synthetic bond faces an additional loss upon default. If the sovereign defaults, the currency hedging becomes imperfect, and the investor f loses L^T_{t+1} and still needs to unwind the swap position with unmatched local EME currency cash flows. Regarding positively correlated default and currency risk, the local currency depreciates more upon default than the non-default state. The investor f holding the synthetic bond has a net long position in dollars in the event of default, corresponding to additional currency gains. As a consequence, in the default state, the bond pays $[1 - L^T_{t+1} + L^T_{t+1}(1 - F_{t+1}/S_{t+1})]$.

Du and Schreger (2016) show that the pricing impact of the foreign exchange hedging error, $L^T_{t+1}(1 - F_{t+1}/S_{t+1})$, is precisely equal to $\frac{\text{cov}_t(1-L^T_t, 1/S_{t+1})}{E_t(1-L^T_{t+1})E_t(1/S_{t+1})}$. We will denote this term

q_t^T and refer to it as the covariance between default and currency risks.

Analogously, assume that the EME sovereign can enact regulations on local-currency assets with probability $\tilde{\pi}_t^T$ (for example, capital controls or currency convertibility restrictions), and this event imposes a loss of K_{t+1} on the investor (a random variable). This loss will also produce a hedging error in the swap position of the investor, as in the case of default losses. Equivalently, define the bond payoff in the event of capital controls as $[1 - K_{t+1} + K_{t+1}(1 - F_{t+1}/S_{t+1})]$. The hedging error term will be exactly equal to $\frac{\text{cov}_t(1-K_t, 1/S_{t+1})}{E_t(1-K_{t+1})E_t(1/S_{t+1})}$, term which we will denote as p_t and refer to it as the covariance between capital control risk and currency risk.

In the end, the losses in the event of default and regulations impositions are $L_{t+1}^T - q_t^T$ and $K_{t+1} - p_t$, respectively. Define $\tilde{L}_{t+1}^T$ as a random variable that is equal to zero if there is no default and equal to $L_{t+1}^T - q_t^T$ if there is a default. Equivalently, define $\tilde{K}_{t+1}$ as a random variable that is equal to zero if capital controls are not imposed and equal to $K_{t+1} - p_t$ if they are set. Then, the expression for the price of the synthetic bond is

$$\begin{aligned} e^{-y_t^T + \rho_t} = P_t^T \frac{F_{t+1}}{S_t} &= E_t[M_{t+1}\Lambda_{t+1}^{T,f}] - E_t[M_{t+1}]E_t[\tilde{L}_{t+1}^T] - E_t[M_{t+1}]E_t[\tilde{K}_{t+1}] \\ &\quad - \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^T] - \text{cov}_t[M_{t+1}, \tilde{K}_{t+1}] - \text{cov}_t[\Lambda_{t+1}^{T,f}, \tilde{L}_{t+1}^T] - \text{cov}_t[\Lambda_{t+1}^{T,f}, \tilde{K}_{t+1}] \\ &\approx e^{\lambda_{t+1}^{T,f} - \pi_t^T(E_t[L_{t+1}^T] + \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}]) + q_t^T - \tilde{\pi}_t^T(E_t[K_{t+1}] + \text{cov}_t[M_{t+1}, \tilde{K}_{t+1}]/E_t[M_{t+1}])} \\ &\quad \times e^{p_t - \text{cov}_t[\Lambda_{t+1}^{T,f}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}] - \text{cov}_t[\Lambda_{t+1}^{T,f}, \tilde{K}_{t+1}]/E_t[M_{t+1}]} \times E_t[M_{t+1}] \end{aligned} \tag{37}$$

Taking logs on both sides gives:

$$y_t^T - \rho_t \approx y_{rf,t}^{US} - \lambda_t^{T,f} + (l_t^T - q_t^T) + (k_t - p_t) - \xi_t^{T,f} - \psi_t^{T,f} \tag{38}$$

where $y_{rf,t}^{US} = -\log M_{t+1}$; $\lambda_t^{T,f} \approx v'(\theta_t^f/\text{GDP}_t^f)$ is the convenience yield on the local-currency bond; $l_t^T = \pi_t^T(E_t[L_{t+1}^T] + \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}])$ and $k_t = \tilde{\pi}_t^T(E_t[K_{t+1}] + \text{cov}_t[M_{t+1}, \tilde{K}_{t+1}]/E_t[M_{t+1}])$ are the extra yield demanded for default and regulatory losses; and $\xi_t^{T,f} = \text{cov}_t[\Lambda_t^{T,f}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}]$ and $\psi_t^{T,f} = \text{cov}_t[\Lambda_t^{T,f}, \tilde{K}_{t+1}]/E_t[M_{t+1}]$ are the covariances of the convenience yield with default risk and regulatory risk, respectively. □

B.3. Proof of Lemma 1

Since $q_T > q_P$ and $q_T > q_{US}$, at equal tightness $W_T > W_P$ and $W_T > W_{US}$. Equalizing payoffs requires $\tau_T > \tau_P$ and $\tau_T > \tau_{US}$ (the more attractive market must be more congested). Consider (10): increasing τ_T decreases $q_T p^B(\tau_T)$ (since p^B is strictly decreasing). For the equality to hold, $q_P p^B(\tau_P)$ must also decrease, which requires τ_P to increase. Hence τ_P is a strictly increasing function of τ_T. By the same argument applied to (11), τ_{US} is strictly increasing in τ_T. Substituting into (12), the left-hand side is continuous, strictly increasing in τ_T, equals 0 at $\tau_T = 0$, and diverges as $\tau_T \to \infty$. By the intermediate value theorem, a unique τ_T^* exists. □

B.4. Proof of Proposition 3

The system (10)–(12) defines $(\tau_T, \tau_P, \tau_{US})$ as implicit functions of (D, q_T, q_P). Define $a \equiv q_T|p^{B\prime}(\tau_T)| > 0$, $b \equiv q_P|p^{B\prime}(\tau_P)| > 0$, $c \equiv q_{US}|p^{B\prime}(\tau_{US})| > 0$. The Jacobian of the system with respect to $(\tau_T, \tau_P, \tau_{US})$ is:

$$J = \begin{pmatrix} -a & b & 0 \\ -a & 0 & c \\ \bar{S}_T & \bar{S}_P & \bar{S}_{US} \end{pmatrix}, \quad \det(J) = ac\bar{S}_P + ab\bar{S}_{US} + bc\bar{S}_T > 0 \tag{39}$$

Part (i). The perturbation from increasing D is $\partial \mathbf{F}/\partial D = (0, 0, -1)^\top$. By the implicit function theorem, $J\, d\boldsymbol{\tau} = (0, 0, 1)^\top dD$. Cramer's rule gives:

$$\frac{d\tau_T}{dD} = \frac{bc}{\det(J)}, \quad \frac{d\tau_P}{dD} = \frac{ac}{\det(J)}, \quad \frac{d\tau_{US}}{dD} = \frac{ab}{\det(J)} \tag{40}$$

All strictly positive. Under $\bar{S}_{US} \gg \bar{S}_T, \bar{S}_P$: $\det(J) \approx ab\bar{S}_{US}$, so $d\tau_T/dD \approx c/(a\bar{S}_{US}) \to 0$ and $d\tau_{US}/dD \approx 1/\bar{S}_{US}$. Local markets barely respond; the dollar market absorbs the demand. Since p^S is increasing: $\kappa^{US} = \bar{\kappa}_{US} p^S(\tau_{US})$ increases, while κ^T, κ^P are approximately unchanged.

Part (ii). When q_P decreases (π_P rises): $\partial \mathbf{F}/\partial q_P = (-p^B(\tau_P), 0, 0)^\top$. Applying $J\, d\boldsymbol{\tau} =$

$(p^B(\tau_P), 0, 0)^\top dq_P$:

$$\frac{d\tau_T}{dq_P} = \frac{-p^B(\tau_P)\, c\bar{S}_P}{\det(J)} < 0, \quad \frac{d\tau_P}{dq_P} = \frac{p^B(\tau_P)(a\bar{S}_{US} + c\bar{S}_T)}{\det(J)} > 0, \quad \frac{d\tau_{US}}{dq_P} = \frac{-p^B(\tau_P)\, a\bar{S}_P}{\det(J)} < 0 \tag{41}$$

Since $dq_P < 0$: $d\tau_T > 0$ (seekers enter T), $d\tau_P < 0$ (seekers leave P), and $d\tau_{US} > 0$ (some seekers enter US). The dollar market effect is $O(\bar{S}_P/\bar{S}_{US})$: seekers leaving P reallocate predominantly to T, since the cross-currency friction χ embedded in q_{US} makes the dollar market less attractive. Hence $\kappa^T = \bar{\kappa}_T p^S(\tau_T)$ rises and $\kappa^P = \bar{\kappa}_P p^S(\tau_P)$ falls, while κ^{US} is approximately unchanged. The domestic spread $\kappa^T - \kappa^P$ increases.

Part (iii). When q_T decreases (π_T rises): $\partial \mathbf{F}/\partial q_T = (p^B(\tau_T), p^B(\tau_T), 0)^\top$. Applying $J\, d\boldsymbol{\tau} = -(p^B(\tau_T), p^B(\tau_T), 0)^\top dq_T$:

$$\frac{d\tau_T}{dq_T} = \frac{p^B(\tau_T)(c\bar{S}_P + b\bar{S}_{US})}{\det(J)} > 0 \tag{42}$$

$$\frac{d\tau_P}{dq_T} = \frac{-p^B(\tau_T)\, c\bar{S}_T}{\det(J)} < 0, \quad \frac{d\tau_{US}}{dq_T} = \frac{-p^B(\tau_T)\, b\bar{S}_T}{\det(J)} < 0 \tag{43}$$

Since $dq_T < 0$: $d\tau_T < 0$ (seekers leave T), $d\tau_P > 0$ and $d\tau_{US} > 0$ (seekers arrive). Under $\bar{S}_{US} \gg \bar{S}_P$, the number of reallocated seekers going to US ($= \bar{S}_{US}\, d\tau_{US}$) far exceeds those going to P ($= \bar{S}_P\, d\tau_P$), since their ratio is $b\bar{S}_{US}/(c\bar{S}_P) \gg 1$. The domestic spread falls because κ^T declines (a first-order effect, since $d\tau_T/dq_T \approx p^B/a$ for large $\bar{S}_{US}$); the increase in κ^P is $O(\bar{S}_T/\bar{S}_{US})$. Both $\kappa^T - \kappa^P$ and $\kappa^T - \kappa^{US}$ decrease.

Part (iv). In state G: $D(G) > D(N)$ (Part (i) applies: κ^{US} rises) and $\pi_T(G) > \pi_T(N)$ (Part (iii) applies: seekers leave T predominantly for the dollar market, so κ^T falls while κ^{US} rises). Both channels lower $\kappa^T - \kappa^{US}$. The domestic spread $\kappa^T - \kappa^P$ falls because κ^T falls; the increase in κ^P from Part (iii) is second-order in $\bar{S}_T/\bar{S}_{US}$.

In state L: $\pi_P(L) > \pi_P(N)$ (Part (ii) applies: seekers leave P for T, so κ^T rises and κ^P falls). The domestic spread rises.

The expected convenience yields are $\mathbb{E}_t[CY^i] = v' \sum_\omega \pi_\omega [\kappa^T(\omega) - \kappa^{alt}(\omega)]$. Therefore:

$$\frac{\partial \mathbb{E}[CY^d]}{\partial \pi_L} = v'\{[\kappa^T(L) - \kappa^P(L)] - [\kappa^T(N) - \kappa^P(N)]\} > 0 \tag{44}$$

$$\frac{\partial \mathbb{E}[CY^d]}{\partial \pi_G} = v'\{[\kappa^T(G) - \kappa^P(G)] - [\kappa^T(N) - \kappa^P(N)]\} < 0 \tag{45}$$

$$\frac{\partial \mathbb{E}[CY^f]}{\partial \pi_G} = v'\{[\kappa^T(G) - \kappa^{US}(G)] - [\kappa^T(N) - \kappa^{US}(N)]\} < 0 \tag{46}$$

establishing the result. □

C. Regulatory Risk and Financial Frictions (Section 3)

C.1. Regulatory Risk

As explained in the main text, the term k_t captures the risk of regulations imposed by the local government that can inflict additional losses upon investors besides explicit default: taxes on capital outflows, currency convertibility restrictions, and other forms of capital controls. We rely on the spread between the swapped local-currency bond and the bond denominated in foreign currency issued offshore. The latter is generally issued under international law and, therefore, is less subject to the unilateral imposition of capital controls and other regulations. This proxy is based on an analogous exercise carried by Levy Yeyati et al. (2009) who study the "cross-market premium" between shares of the same companies in EMEs traded simultaneously in the domestic stock market and in New York as depository receipts (DR).

The following Proposition shows that the same should apply to sovereign bonds issued in the same currency but in different markets:

Proposition 4. *Let Φ_t^{FC} denote the spread between the yield of the dollar synthetic bond, $y_t^T - \rho_t$, and the yield of the sovereign bond of the same EME issued offshore in dollars, y_t^{FC}. Then,*

$$\begin{aligned} \Phi_t^{FC} &\equiv y_t^T - \rho_t - y_t^{FC} \\ &\approx (\lambda_t^{FC,f} - \lambda_t^{T,f}) + (l_t^T - l_t^{FC} - q_t^T) + (k_t - p_t) + (\xi_t^{FC,f} - \xi_t^{T,f}) - \psi_t^{T,f} \end{aligned} \tag{47}$$

where $\lambda_t^{FC,f}$ and l_t^{FC} are the convenience yield and the default risk of the sovereign bond issued in dollars, respectively.

Proof: Following the same reasoning as in the proofs of Propostions 1 and 2, the price of an EME sovereign bond issued offshore in dollars, $\hat{P}_t^T$, is given by:

$$\hat{P}_t^T = E_t[M_{t+1}\hat{P}_{t+1}^T\hat{\Lambda}_{t+1}^{T,f}] \tag{48}$$

Assume the local government can default on this bond with probability $\hat{\pi}_t^T$, imposing a loss of $\hat{L}_{t+1}^T$ on the investor. In this case, $\tilde{L}_{t+1}^T$ is a random variable taking the value $\hat{L}_{t+1}^T$ in the case of default and zero otherwise. However, since the bond is issued in dollars and offshore, the government cannot impose capital controls or currency convertibility restrictions. Therefore, assuming again one-period bonds and continuous compounding, the price is given by

$$\begin{aligned} e^{-\hat{y}_t^T} = \hat{P}_t^T &= E_t[M_{t+1}\hat{\Lambda}_{t+1}^{T,f}] - E_t[M_{t+1}]E_t[\tilde{L}_{t+1}^T] - \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^T] - \text{cov}_t[\hat{\Lambda}_{t+1}^{T,f}, \tilde{L}_{t+1}^T] \\ &\approx e^{\hat{\lambda}_{t+1}^{T,f} - \hat{\pi}_t^T(E_t[\hat{L}_{t+1}^T] + \text{cov}_t[M_{t+1}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}]) - \text{cov}_t[\hat{\lambda}_{t+1}^{T,f}, \tilde{L}_{t+1}^T]/E_t[M_{t+1}]}E_t[M_{t+1}] \end{aligned} \tag{49}$$

Taking logs on both sides gives:

$$\hat{y}_t^T \approx y_{rf,t}^{US} - \hat{\lambda}_t^{T,f} + \hat{l}_t^T \tag{50}$$

where variables have the same interpretation as in the previous two proofs. Now, define Φ_t^{FC} as the spread between the yield of the synthetic bond (Equation (38)) and the yield on the foreign currency-denominated bond (Equation (50)). Then,

$$\begin{aligned} \Phi_t^{FC} \equiv& y_t^T - \rho_t - \hat{y}_t^T \\ &\approx (y_{rf,t}^{US} - \lambda_t^{T,f} + (l_t^T - q_t^T) + (k_t - p_t) - \xi_t^{T,f} - \psi_t^{T,f}) - (y_{rf,t}^{US} - \hat{\lambda}_t^{T,f} + \hat{l}_t^T) \\ &= (\hat{\lambda}_t^{T,f} - \lambda_t^{T,f}) + (l_t^T - \hat{l}_t^T - q_t^T) + (k_t - p_t) - \xi_t^{T,f} - \psi_t^{T,f} \end{aligned} \tag{51}$$

□.

The expression Φ_t^{FC} will be approximately equal to the term on regulatory risk plus

covariances in (4). However, it also adds two new terms. The first is the differential credit risk between foreign-currency and local-currency bonds. We will assume that $l_t^{FC} \approx l_t^T$. We refer to the discussion by Du and Schreger (2016), where they conclude that recent history in emerging markets does not give a clear higher probability of defaults or higher haircuts in either currency. None of the countries in the sample defaulted during the time covered (starting in December 2007). Before that, only Turkey selectively defaulted on local-currency debt in 1999, and Indonesia selectively defaulted on foreign-currency debt in 2002.

Second, the differential convenience yield between foreign currency bonds and swapped local currency bonds, $\lambda_t^{FC,f} - \lambda_t^{T,f} \equiv \tau_t$. Both convenience yields are in dollars and could differ if the two bonds have different credit risks (already discussed) or different liquidity. As for liquidity, forward contracts used in the swapped local-currency bond have significantly larger bid-ask spreads and lower trading volume than bonds. Since investors in the swapped local currency bonds have short positions in the less liquid swap market, they have better liquidity overall than holding bonds denominated in foreign currency[36]. We will subtract the liquidity risk in currency swaps, measured by their bid-ask spread, from the bond's convenience yield, to ensure that the dollar spread measure does not include a liquidity premium coming from the forward market[37].

We provide an idea of how relevant this adjustment is by using the example of Brazil. Figure 3 plots the time series of $\Phi_t^{FC,i}$ for the period 2010-2021.

The spread is positive and large at the beginning of the sample. Importantly, this period coincides with the Brazilian government's imposition of capital outflow taxes. In October 2009, the government introduced a tax on financial transactions (the IOF) of 2% on foreign investment in fixed-income instruments. In 2010, the tax was raised to 4 and then to 6%, and stayed at that level until it was abandoned in June 2013. Consistent with this timing, the

[36]Du and Schreger (2016), for a sample of 10 EMEs between 2005 and 2014, find that the mean bid-ask spread for local currency debt is 11.1 basis points, and for foreign currency debt is 14.5 basis points. The mean bid-ask spread on five-year currency swaps is 38.2 basis points. Regarding trading volumes, the mean quarterly trading volume is around $49 billion for local currency bonds, $25 billion for foreign currency bonds, and $9 billion for cross-currency swaps.

[37]A further friction that could explain this spread are short-selling constraints on swapped local-currency sovereign bonds in EMEs. Du and Schreger (2016) show that the inventories available for lending and inventory utilization are lower than for foreign-currency debt. Shorting the swapped local-currency bond costs more than the foreign-currency bond (31 basis points against 21 basis points, according to their data). This issue could potentially lower Φ_t^{FC}

Figure 3: Local vs. Foreign jurisdiction spread for Brazil



Notes: The Figure shows the spread between the swapped local-currency sovereign bond and the foreign-currency-denominated bond.

spread $\Phi_t^{FC,i}$ moved around 200-500 basis points. A negative value of this spread (relevant after 2016) means that the positive covariance of currency risk with other risks is more significant than the risk of capital controls and other regulations.

C.2. Financial Frictions

Convenience of the dollar currency. The correction using the bid-ask spread of currency swaps also addresses the empirical findings of Jiang, Krishnamurthy, and Lustig (2021), who estimate that, for the sample of G10 countries, most of the convenience of swapped local-currency bonds comes from being swapped into dollars, not from the actual bond. This follows from the liquidity of the dollar currency, which they claim makes any asset denominated in dollars inherit the convenience of the currency. We take the view that, in the case of swapped local currency bonds, their "dollarness" must depend on the liquidity of the forward markets. Suppose a foreigner is investing in a swapped local currency bond. In that case, the liquidity of the dollar currency is well captured by how easy it is to swap the local currency into dollars, which will depend on the liquidity of the EME forward market.

Limits to arbitrage. Engel and Wu (2023) and Du, Im, and Schreger (2018) also consider an additional source of swap market frictions: it could be that the observed forward premium, ρ_t, is different than the hypothetical premium that ensures CIP for risk-free rates. In this case, we would have $\tau_t^{CIP} \equiv y_{rf,t} - \rho_t - y_{rf,t}^{US} > 0$, and the empirical counterpart in

Equation 5 would no longer capture the full dollar convenience yield[38].

In the case of EMEs, several other regulations can create limits to arbitrage and CIP deviations in risk-free rates. For example, limits on onshore net open positions of forwards, prohibition of resident participation in offshore FX derivatives, tax treatment of non-residents participating in onshore derivatives, or documentation requirements of underlying investments for non-residents[39].

After replacing $\rho_t \equiv y_{rf,t} - \tau_t^{CIP} - y_{rf,t}^{US}$ in the Equations above, the term τ_t^{CIP} shows up twice: in the spread between the dollar bond and the swapped EME bond (in Equation (4) and again in the spread between the swapped EME bond and the foreign currency bond in Equation (47)). As we replace Φ_t^{FC} in (4), the term τ_t^{CIP} cancels out.

However, this correction might not be sufficient, as limits to arbitrage can also arise in bond markets with longer maturities. More generally, recent papers have shown the role of global intermediaries' financial constraints in determining exchange rates (Gabaix and Maggiori, 2015) and the external finance premium (intermediation premium) for EME sovereigns (Morelli, Ottonello, and Perez, 2022). Moreover, financing constraints of domestic financial institutions play a role in the dynamics of short-term local-currency interest rates (De Leo, Gopinath, and Kalemli-Ozcan, 2022).

Since we do not have direct proxies for these, the empirical results in the following Sections will control for the financial constraints of intermediaries by using capital inflows as a percentage of GDP. The literature has shown theoretically that capital inflows are related to the financial constraints of global intermediaries (Hau and Rey, 2006; Gabaix and Maggiori, 2015; Basu et al., 2020).

Cerutti and Zhou (2024) measure the degree of segmentation in FX markets for a large group of EMEs, by computing CIP deviations in offshore vs. onshore FX markets. In segmented FX markets, offshore CIP devitions are sensitive to changes in global risk factors, while onshore CIP deviations are largely unresponsive. Moreover, the sensitivity of offshore CIP deviations to global factors for currencies with segmented FX markets is stronger than

[38]Du, Tepper, and Verdelhan (2018) explain that CIP deviations in risk-free rates can arise when the dollar rate is lower than the swapped foreign rate, and banks face balance sheet costs that prevent them from arbitraging the difference.

[39]See Cerutti and Zhou (2024) for an analysis of some of these regulations, the gap between onshore and offshore FX markets in EMEs, and their implication for CIP deviations.

thier counterparts with integrated FX markets.

They find evidence of high segmentation in FX markets for Brazil, Indonesia, Malaysia, the Philippines, and Thailand. For the rest of he countries in our sample, there is evidence of little FX market segmentation. Accordingly, when computing the forward premium for the synthetic-dollar sovereign bond in Brazil, Indonesia, Malaysia, the Philippines, and Thailand, we use the NDF (and not the onshore currency swap) to better capture the pricing faced by a foreign investor.

Bond market segmentation. Finally, a further friction in EME bond markets is market segmentation. Foreign investors might only hold dollar assets (non-Treasury safe dollar bonds and EME debt denominated in foreign currency), and local-currency debt might only be held by domestic investors (such as local pension funds). Alternatively, foreign investors might hold local-currency sovereign debt only under foreign jurisdiction (Eurobonds), and domestic investors hold local-currency bonds issued under domestic law. In all these cases, marginal investors for dollar and local currency assets are different, and the spread in (4) captures incomplete arbitrage between the two markets due to arbitrageurs' limited capital and risk aversion.

Appendix I.A. addresses the extent of market segmentation between foreign and local investors, as well as between foreign and domestic currency. Overall, foreign investors are active and relevant holders of local-currency sovereign bonds in all countries in the sample of this paper. The country in the sample most affected by market segmentation is Turkey, and the analysis in the following subsection shows that this results in a very low dollar spread.

A second dimension of market segmentation can arise between local-currency bonds issued under international and domestic law. In this case, it might be that the whole share of local-currency government bonds owned by foreigners correspond to bonds governed by international law (Eurobonds), while local investors own only the bonds issued under domestic law. Our data does not feature Eurobonds (local-currency sovereign bonds issued under international law and thus not subject to regulatory risk). Moreover, Onen et al. (2023) show that most of the increase in foreign ownership of local-currency sovereign bonds in the past two decades has come from foreigners increasingly participating in the *domestic* market.

Supplemental Appendix

I.A. Holders of Local-Currency Sovereign Bonds

This Section shows that, for all the countries included in the sample, the vast majority of the outstanding debt is denominated in their local currency. This speaks to the relevance of the question of whether this debt serves as a safe asset or not.

Second, it shows that, in all countries except Turkey, a sizable portion of this local-currency sovereign debt is held by foreigners. Therefore, the dollar convenience yield is unlikely to capture market segmentation and limits to arbitrage between foreign and local markets.

The data presented here comes from Onen et al. (2023), who study the evolution of the currency denomination of sovereign debt in a large set of emerging economies. The dataset covers sovereign bonds, defined as long-term debt securities with original maturities exceeding one year, issued by general governments in both domestic and international markets. The general government comprises central, state, and local government and social security funds, but excludes state-owned companies and the central bank. Outstanding amounts and foreign holdings are in nominal value where available, and market values otherwise, and expressed in current US dollars at end-of-period exchange rates.

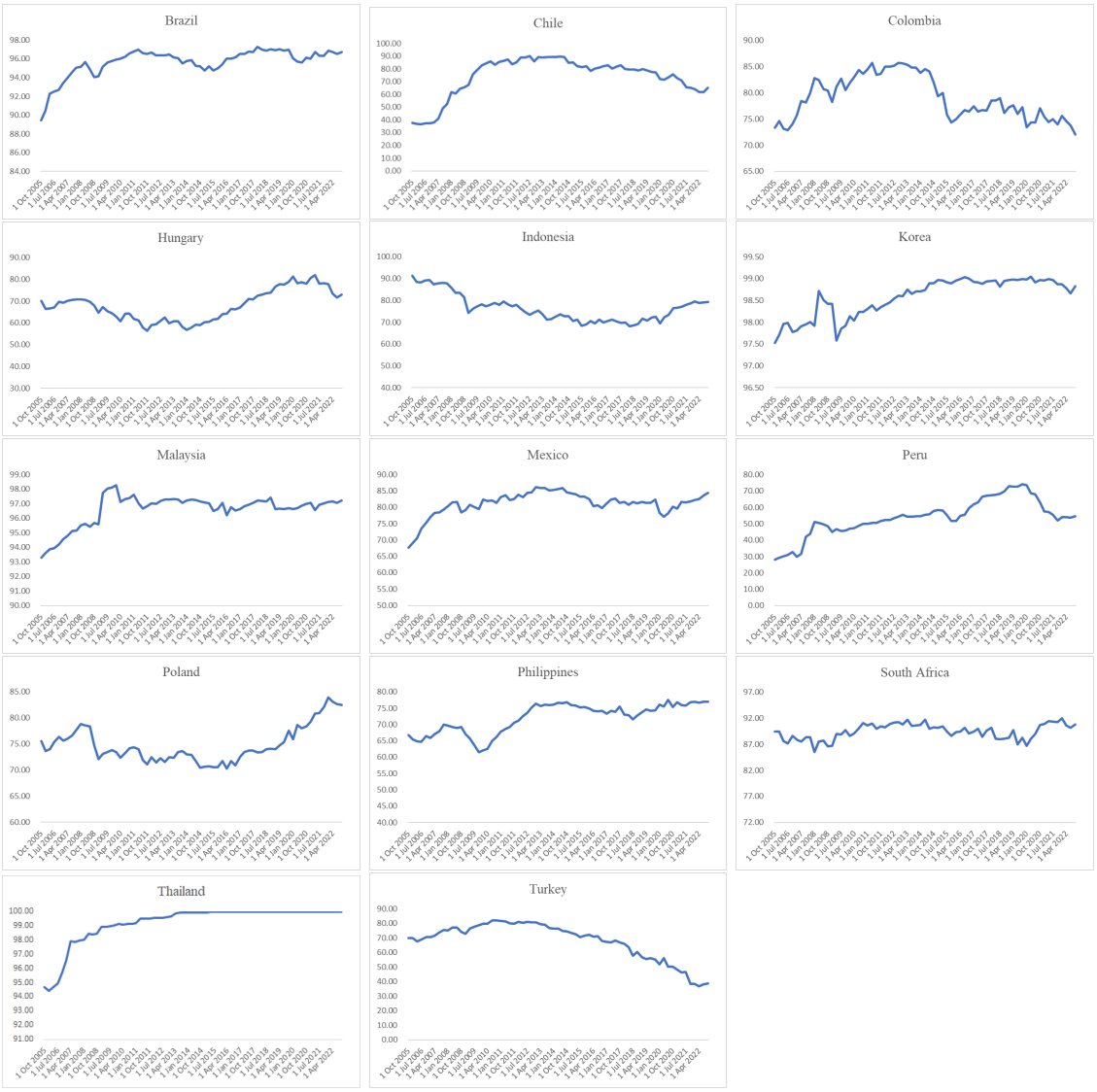
Figure 4 shows, for each country, the share of local currency in government bonds (as % of total outstanding debt in all currencies).

Figure 5 shows, for each country, the foreign investor share in local-currency bond market (as % of local-currency bonds outstanding). Thus, it shows the percentage of all sovereign bonds issued in domestic currency held by foreign investors.

I.B. Domestic Spread by Country

Figure 6 shows the domestic spread of Section 3.1 by country.

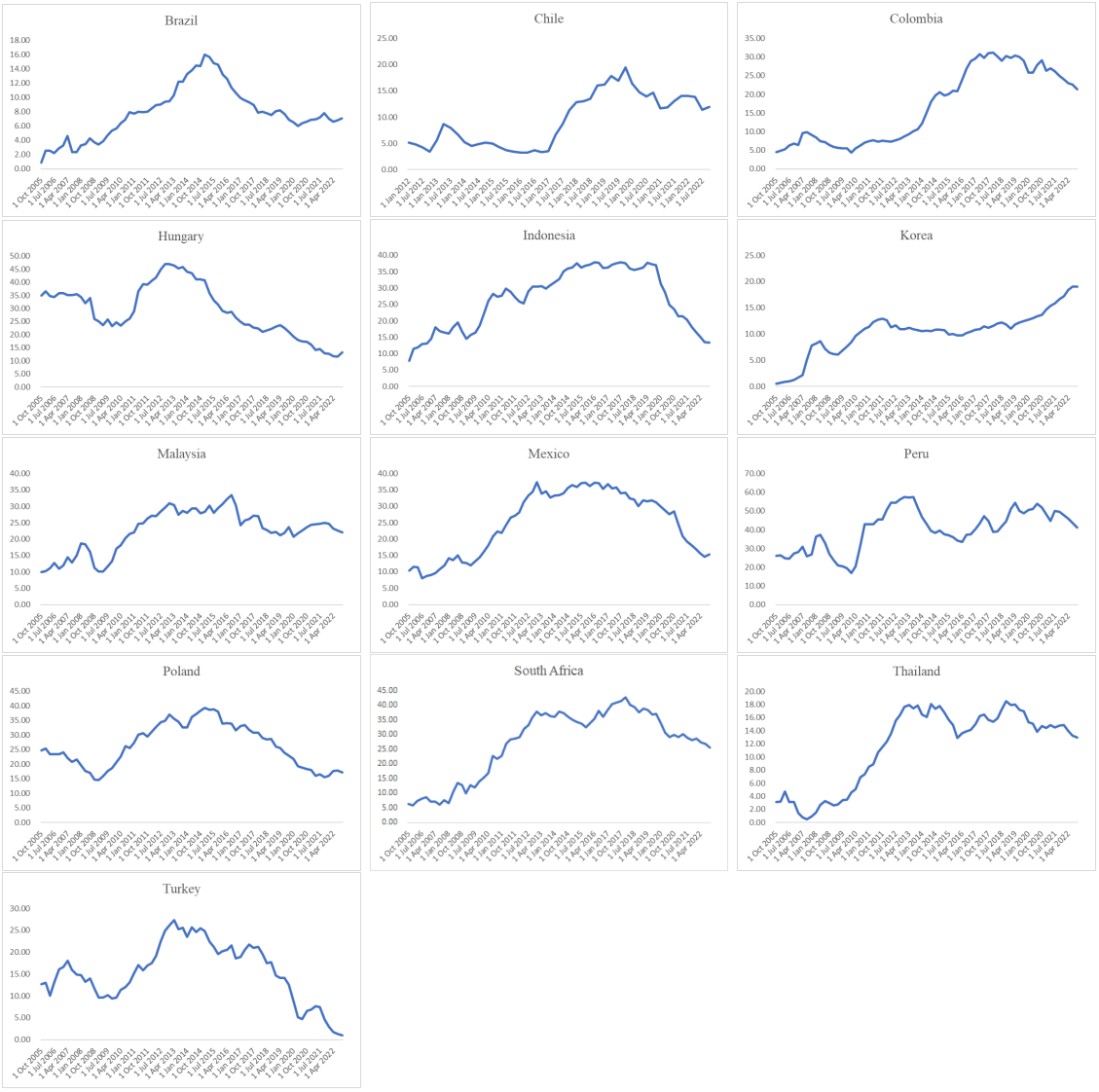
Figure 4: Share of Outstanding Long-Term Sov. Bonds Denominated in Local Currency



I.C. Analysis of the Safety Premia

This Section analysis the domestic spread, but this time computed as the difference between 1-year interbank loans and 1-year local-currency interest rate swaps. As explained in the main text, the key here would be that the interbank market in these countries operates without collateral requirements. If they are comparably illiquid, they differ only in their credit risk. However, the domestic interbank market is highly segmented because foreign investors have no acces to it, while their participation in the domestic interest rate swaps market is relevant for most countries in the sample. For this reason, this spread could capture

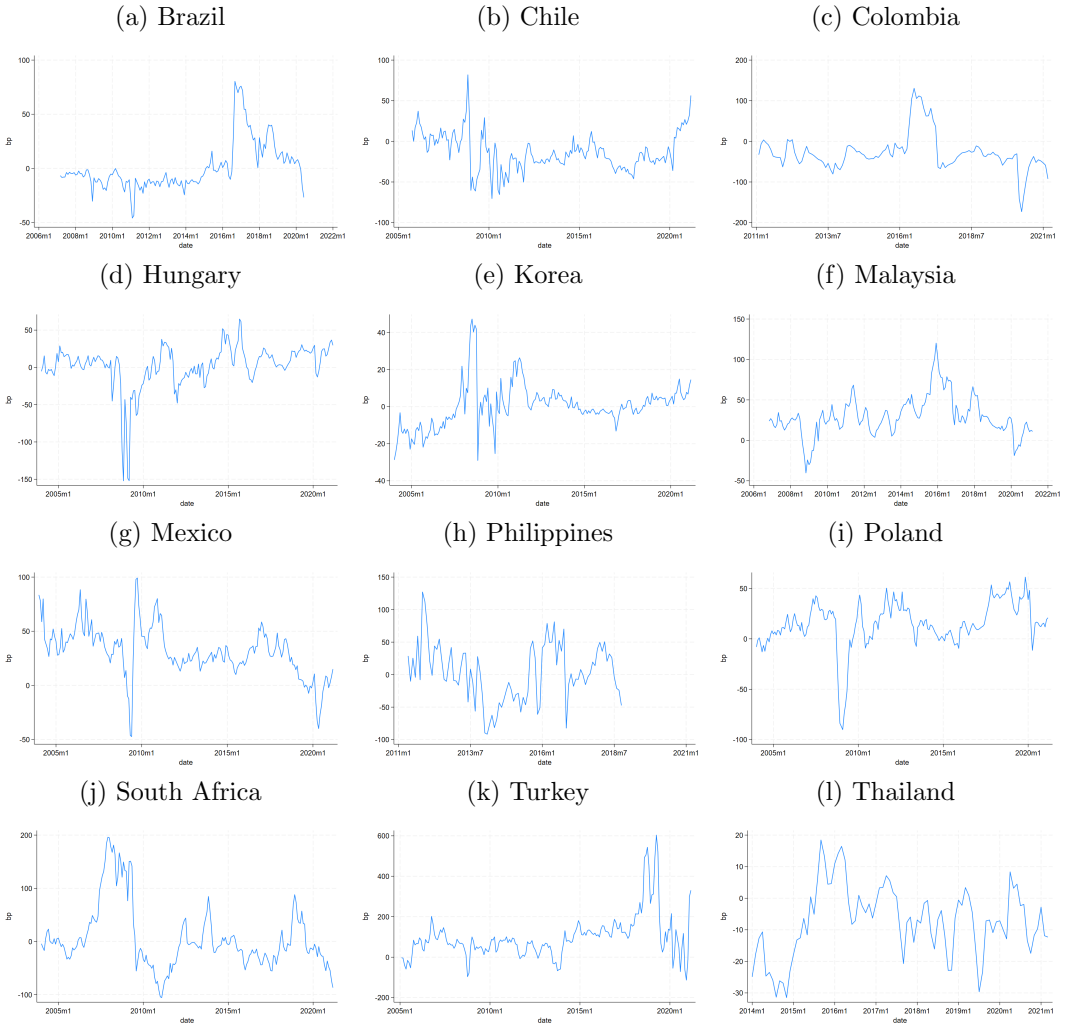
Figure 5: Share of Local-Currency Long-Term Sov. Bonds Held By Foreign Investors



the pricing of different marginal investors.

Krishnamurthy and Vissing-Jorgensen (2011) explain the difference between the safety premium and the sovereign spread that has been widely studied in the context of emerging markets. The latter refers to the spread between two risky assets determined in a standard consumption-based capital asset pricing model that mostly captures risk aversion by investors. The safety premium (a component of the convenience yield) refers to a different concept. For bonds that have very low default risk, the yield decreases as a function of the bond's safety, more so than predicted by the standard asset pricing kernel. Why? There might be investors with an inelastic demand for assets that promise a stable nominal

Figure 6: Domestic Spread by Country (1-year Maturity)



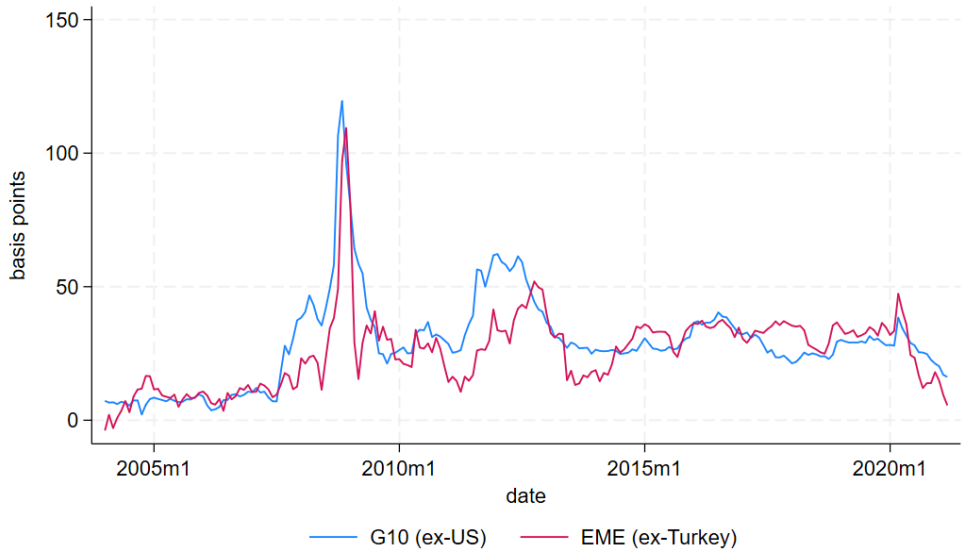
Notes: Figure shows each country's liquidity premium.

repayment or can be easily sold, and who derive non-pecuniary benefits from holding them.

Figure 7 shows that the safety premium remains sizeable for most of the time span, and of a magnitude comparable to those of the G10 countries. These are countries with arguably very low sovereign credit risk. Interestingly, the safety premium spikes during the 2008 crisis, increases around 2012 (during the European debt crisis), and sharply decreases during the early months of the COVID pandemic.

Table 7 replicates Section 4 for this version of the domestic spread. The domestic safety premium correlates positively with both the global risk factor and the country-specific factor that measures economic risk. This suggests that, compared to private domestic assets, the local currency sovereign bond works as a safe haven for both types of risks. The negative

Figure 7: Domestic Safety (1-year Maturity)



Notes: Figure shows the average safety premium from Jan. 2004 to Mar. 2021. The safety premium is the interbank rate minus the collateralized interest rate swap. All assets are of 1-year maturity. See Table 1 for the list of countries included.

effect of the financial risk index can stem from its more direct relationship to government debt service capacity (foreign debt to GDP and foreign debt service as a percentage of exports of goods and services) and the liquidity available to governments (net international liquidity, expressed as months of import cover). Not surprisingly, the safety premium declines with these risk factors.

I.D. Financial Markets By Country

We provide country-by-country evidence on the (1) central role played by domestic currency government bonds in the local financial market, (2) extent to which the interbank markets rely on unsecured and illiquid loans, and (3) extent to which domestic currency interest rate swaps carry low credit risk. Sources include the Financial Sector Assessment Program documents by the IMF and the World Bank, internal documents from local central banks, and various reports by the BIS. These are all available upon request to the authors.

Brazil. Government bonds are the centerpiece of the securities markets and comprise the bulk of liquid fixed-income instruments. Brazilian investors have a strong preference for

Table 7: Safety Premium and Risk Factors

Dep. var.: dom. spread	(1)	(2)	(3)	(4)
VIX_{t-1}	1.388***		1.374***	
	(0.273)		(0.313)	
mar_{t-1}		16.33***		16.09***
		(3.808)		(4.273)
Economic $risk_{t-1}$	7.713***	7.706***		
	(1.898)	(1.922)		
Financial $risk_{t-1}$			-2.977**	-2.918**
			(1.188)	(1.195)
Observations	719	719	719	719
R-squared	0.779	0.777	0.767	0.764
Country & Year FE	Y	Y	Y	Y
MP rate & Debt supply	Y	Y	Y	Y
Risk Premia	Y	Y	Y	Y
K inflows	Y	Y	Y	Y

Notes: *mar* is the global risk factor in Miranda-Agrippino and Rey (2020). *EPU* is the economic policy uncertainty index of Baker, Bloom, and Davis (2016) -available for fewer countries. Regressions exclude data for Turkey and the Philippines. Data are at a monthly frequency. Standard errors are double-clustered by country and month. Start dates vary among countries, but ICRG data is available until April 2019. *** p<0.01, ** p<0.05, * p<0.1

high quality short term liquid investments. Brazil's history of economic instability drives investors towards short term liquid investments of the highest credit quality such as overnight repos and short-term government bonds. Most participants in the government bond market are buy-and-hold investors. Investors use interest rate and FX derivatives markets to price and manage risks. These markets are sophisticated, deep, liquid and have sound infrastructure such Central Counterparties (CCPs) to clear transactions. Interest rate derivatives markets based on both the CDI and SELIC rate exist but almost all trading occurs versus the overnight CDI rate. Bid-offer spreads are low and market depth is high relative to trading government securities hence investors manage risk using derivatives as opposed to trading in cash money market or fixed income instruments. Most money market instruments have shallow markets. The overnight unsecured interbank CDI rate captures few overnight interbank transactions.

Chile. The OTC derivatives market in Chile continues to grow and currently it is estimated that notional amounts of non-delivery forwards (NDFs) on foreign currency and interest rate swaps have reached approximately US$300 billion, nearly 70% of which is represented by interest rate swaps. Main actors in the OTC derivatives market are commercial

banks, which concentrate approximately 95% of the total notional amount. In July 2015, ComDer, Contraparte Central S.A (hereinafter "ComDer") was established as a central counterparty for over-the-counter derivatives. ComDer was established as a response of the banking system to the exponential growth of the over-the-counter (OTC) derivatives market and to achieve compliance with international standards and G20 expectations. In particular, ComDer uses good and conservative practices with regard to collateral, e.g. it accepts only cash and debt securities issued by the Central Bank or the National Treasury as collateral, marks collateral and participant positions to market daily, and applies conservative haircuts that also incorporate crisis scenarios thus reducing the need for pro-cyclical adjustments. The interbank money market is unsecured, equivalent to less than three percent of bank assets and under one percent of liabilities. Interbank trading takes the unusual form of the issuance of CDs (42 percent, down from 59 percent in 2018), unsecured deposits (42 percent, up from 21 percent in 2018), and bank bonds (16 percent, down from 20 percent in 2018).

Colombia. Colombia's capital markets reflect mainly activity in government debt and equity markets, with capitalization reaching 60 percent of GDP at end-2011. Non-government fixed income remains undeveloped (4 percent of GDP) and dominated by financial sector issues. The derivatives clearing house CRCC has prospered since 2008 without access to intra-day central bank credit, but it is growing very fast and becoming more systemically important. As a central counterparty, CRCC interposes itself in the accepted operations becoming buyer of every seller and seller of every buyer, thus mitigating the counterparty risk and generating operational efficiencies to the market through reliable risk management systems. CRCC provides us with an appropriate risk management in order to guarantee security and efficiency in the Colombian capital market.

Mexico. The government bond market is highly liquid and is also the most liquid of Mexico's securities markets. The liquidity of government securities is underpinned by a diverse investor base and the availability of interest rate derivatives for risk management. In contrast to the deep and liquid public debt market, corporate debt and equity markets are characterized by few issuers. Institutional investors, such as pension funds and mutual funds, hold most of their assets in fixed-income securities, mostly government bonds. The most important derivatives market in Mexico is the over-the-counter (OTC) derivatives mar-

ket. Foreign exchange derivatives remain the most important segment of the OTC derivatives market, followed by interest rate derivatives. The TIIE swap is the most important contract in the OTC interest rate derivatives market. Mexico's onshore and offshore OTC derivatives markets are fully integrated. As a result, participants in these markets can benefit from lower costs and greater liquidity and price transparency relative to the local exchange-traded market. Transactions in the OTC market can be conducted either with a domestic or foreign bank in Mexico, or directly with an offshore dealer. Foreign investors prefer trading offshore since they feel more comfortable with documentation and the credit quality of offshore counterparties. Counterparty risk to end users in these markets is relatively low since the major derivatives dealers are investmentgrade institutions. Among domestic corporates and investors, access to the OTC derivatives market is generally limited to those with high credit ratings and conducting relatively large transactions.

South Africa. The South African financial markets are the most developed and liquid in Africa and well developed by global standards, as well, reflecting credible and independent policy making, a diverse economy and strong financial institutions. The government bond and interest rate swap yield curves go out to 20 years. The central bank operates independently and at a high capacity, providing a sound footing for market functioning. The secondary market for Treasury Bills (short-term) is underdeveloped compared to its size and importance. Although the outstanding amount is high, around 450 billion rand, there are no market making arrangements in place—despite the presence of a primary dealer system in South Africa. The derivatives markets are dominated by interest rate derivatives, mainly forward rate agreements and interest rate swaps. These are dominated by foreign investors and global banks. ISDA Market Agreements with Credit Support Annex (CSA) and Global Repo Market Agreements (GMRA) are market standards among major market participants, but a significant portion of transactions between local banks and their domestic counterparts are underdocumented. However, currently there is no central clearing counterparty for OTC derivative trades. The interbank market is primarily unsecured which increases credit risk in transactions and tend to close banks with less strong credit standing out of the market.

Turkey. Capital markets and long-term savings are underdeveloped, while foreign investors have withdrawn from Turkey. At end-2021, outstanding public and private debt

amounted to 40 and $7\frac{1}{2}$ percent of GDP respectively, while stock market capitalization was 30 percent of GDP, below peers. Government bonds account for more than 90 percent of debt securities. SOBs own around 38 percent of government bonds, while the CBRT holds just over 4 percent. Foreign investor holdings of public debt declined from 20 percent in 2017 to just 1.6 percent in mid-2022. Counterparty concern appears less of an issue for Turkish banks than underlying swap rollover or interest rate risks. London-based global banks are the main swap counterparts, with 89 percent of the total swap transactions. While swap contracts are done on an OTC basis, counterparts typically have credit support annex (CSA) agreements and daily margining between each other to mitigate credit risks. Measures to support the development of derivatives markets and improve issuance regulations, disclosure, and governance standards for capital market products would be helpful. Policies to support the consolidation of an interest rate derivatives market and stimulate liquidity in government and corporate bond markets could facilitate hedging against interest rate fluctuations and enhance demand for capital market products.

Poland. The government bond market has steadily expanded while the corporate bond market has remained shallow. As the size of the government bond market increased from PLN533 billion in 2013 to PLN621 billion in 2017, market infrastructure improved and the interest of domestic and foreign investors was sustained. Foreign investors are drawn to Poland for its relatively deep and liquid government securities market, which enables them to take positions not just on Poland but indirectly on the region as well. The risk of sudden reversal is mitigated by a relatively stable and diversified bond investor base, high domestic liquidity, and sound hedging practices. The interest rate swaps are relatively common in Poland. According to market participants, IRS transactions between banks as well as banks and large players usually use CCP to mitigate counterparty credit risk (the majority of PLN-denominated interest rate derivatives have to be centrally cleared due to the clearing obligation introduced by the EU law), but this is not yet the case with respect to transactions between banks and non-financial medium and small entities, where both parts can be exposed to counterparty credit risk. It is worth mentioning that the scope of the clearing obligations is gradually widened. At the moment, it applies to large financial institutions (encompassing virtually all interbank transactions and the vast

majority of turnover in general) and starting from June 2019, it will also apply to Category 3 entities – i.e. remaining, smaller, financial counterparties. Moreover, notwithstanding the aforementioned clearing obligation credit risk in bilaterally cleared transactions is mitigated by the mandatory exchange of collateral (in accordance with EU law provisions and ISDA recommendations). Currently all counterparties are obliged to provide variation margins covering risk associated with valuation of their derivatives transactions. Larger entities are additionally required to exchange initial margins (the scope of the initial margin requirement is also gradually increased to encompass all entities falling under EMIR).

Thailand. The interest rate swap market in Thailand is liquid and widely utilised by local and foreign participants to manage their interest rate exposures both from investment and borrowing. It also allows players to take an interest rate view without much need for cash funding, and hence represents a good way for nonresidents to take rate exposures in Thailand. Market contacts report that the IRS market is very active. Market participants also note that the nondeliverable IRS has become very active in the last 6–12 months, partly as a consequence of the restrictions placed on foreign investors' entry into the Thai market directly. Foreign banks with a presence in Thailand appear to intermediate effectively between both the on- and offshore markets, equating prices across both. Thai domestic banks have a limited presence in the international swaps market, as they typically do not meet international counterparty risk standards. Although swap market is an OTC market it has developed in many aspects. For instance, reducing counterparty risk, increasing transparency and improving infrastructure. In particular, when the International of Swaps and Derivatives (ISDA) was established for improving the swap market to be more standard.

Philippines. Onshore interest rate swaps were launched on 18 August 2003 among six foreign banks (Deutsche Bank, HSBC, Standard Chartered, Citibank, JP Morgan and ING). The floating leg is the three-month PHIREF or Philippine Interbank Reference Rate. The PHIREF is the implied peso rate derived from all dealt USD/PHP swap and forward interbank transactions. There is not much information on central clearing, ISDA agreements, etc.

Malaysia. Most banks hold some government securities for collateral and liquidity reasons. OTC derivatives are largely plain vanilla. In 2011, foreign exchange derivatives com-

prised 70 percent of total OTC derivatives, followed by interest rate derivatives which account for 27 percent. Trades on both the securities and derivatives exchanges are cleared and settled through central clearing houses that have detailed and transparent provisions designed to protect the markets against a default by any participant. The widely accepted market standard is the International Swap & Derivatives Association, Inc. (ISDA). In November 2020, a pilot program was launched to provide flexibility for participating onshore banks and their overseas offices to trade ringgit-denominated IRS with non-resident banks without any underlying commitment to any onshore bank. This flexibility encouraged the participation of non-resident banks in the onshore IRS market, thus promoting liquidity. There is one securities exchange (Bursa Malaysia Securities) and one derivatives exchange (Bursa Malaysia Derivatives) operating in Malaysia under authorization granted by the Minister. Both exchanges, along with the securities and derivatives clearing houses, central securities depository and the operator of an electronic trading platform for the trading and reporting of bonds are subsidiaries of the Bursa Malaysia Berhad, a holding company also authorized by the Minister under the CMSA. To improve accessibility, Bursa Malaysia Derivatives entered into a strategic partnership with Chicago Mercantile Exchange (CME) in 2010. This arrangement includes the licensing of CPO futures settlement prices and global distribution of Bursa Malaysia Derivatives' products through the CME's Globex electronic trading platform.

Hungary. The Hungarian government securities market is now a developed and mature market. Hungarian government bonds are issued for five benchmark maturities, by the Government Debt Management Agency. The majority of (fixed-for-floating) forint interest rate swap transactions are concluded by foreign banks (typically headquartered in London) with one another and with their similarly non-resident clients, e.g. various fund managers. Interest rate swap transactions by themselves contain a minimal non-performance risk. The default risk is further reduced by the netting of interest payments, which is even further reduced by the application of daily margining, which has become widespread in the forint interest rate swap market. According to market participants' estimates, the turnover of the forint interest rate swap market in London is approximately 2-4 times higher than that of the domestic market. Anecdotal information suggests that all significant investment banks

in London participate in the London-based forint interest rate swap market, although only some of them can be considered as real market makers. Market makers in the domestic market include some of the major commercial banks. They mainly trade with non-resident clients, mostly banks, and only a relatively small portion of their turnover is with domestic partners. Moreover, in most cases the domestic partners are also banks. Apart from them only a certain number of fund managers and insurance corporations are present in the market, while other companies practically do not conclude interest rate swaps in Hungary.

I.E. Robustness for Section 3

I.E.1 The Convenience Yield Hypothesis

Table 8 shows the estimation of regression (17) of Section 3.4 with alternative dependent variables. Column 1 replicates regression (17) with the safety premium component as the dependent variable. Here, we omit the monetary policy rate from the independent variables because there is no formal link with the safety premium in the literature (unlike with the liquidity premium). We add the 1-year CDS spread to further control for default risk. Column 2 regresses the liquidity premium component. Overall, both columns show similar results to those in the main text.

Columns 1 and 2 test the prediction that the convenience yield on EME sovereign debt is a reflection of two priced attributes: liquidity and safety. Columns 1 and 2 consider, respectively, pairs of assets with different safety but similar liquidity and with different liquidity but similar safety. These two Columns present evidence for the existence of a unique demand for short-term safe assets leading to a positive convenience price of the safety and liquidity attribute.

Column 3 replicates regression (17) with the ICE index of AAA-rated US corporate bonds as the proxy for y_t^{US} instead of the Refcorp bonds. Results are generally robust to the use of this alternative dollar safe asset. The coefficient on the supply of US government debt is negative and significant, as in Section 3.2. The issue with this ICE index is that it combines corporate debt of all maturities greater than one year. In this case, it also captures variation

Table 8: Domestic and Dollar Spread - Alternative Specifications

	(1)	(2)	(3)
	Domestic Spread		Dollar Spread
Dep. var.:	Safety Premium	Liquidity Premium	y_t^{US}: AAA US corp. bonds
$\log(\frac{\text{Local gov debt}}{GDP_{local}})_{t-1}$	-23.31***	-8.376**	
	(3.895)	(3.236)	
$\log(\frac{\text{U.S. gov debt}}{GDP_{US}})_{t-1}$	50.93	-19.54	-290.1**
	(40.42)	(30.95)	(118.8)
slope_{t-1}	-4.125***	4.463***	
	(1.517)	(1.311)	
1-year CDS_{t-1}	0.094***		
	(0.030)		
Local MP rate_{t-1}		3.629***	
		(1.185)	
U.S. MP rate_{t-1}		6.048	-21.54**
		(3.856)	(8.915)
$\text{slope}_{US,t-1}$			-26.85***
			(9.745)
Constant	79.75	-106.3	-352.0*
	(62.51)	(62.78)	(190.4)
Observations	995	1,627	1,137
R-squared	0.701	0.302	0.567

Notes: Data are at monthly frequency. All columns include country and year-fixed effects. Standard errors are double-clustered by country and year. Start dates vary among countries but end in March 2021 for all. U.S. debt and EME local-currency debt-to-GDP variables are net of the central bank's holdings. *** p<0.01, ** p<0.05, * p<0.1

in the US term premium. The negative sign of the monetary policy rate can relate to this issue.

I.E.2. Credit risk as the dependent variable

If the estimation of convenience yields in Section 2 successfully disentangled differential default risk from differential convenience yields, then default risk should respond differently to the determinants of convenience yields analyzed in Section 2. The representative-agent asset pricing model says that standard credit risk does not depend on the supply of debt.

Table 9 replicates the regressions in Section 2.3 but with the CDS for each country as the dependent variable. The larger number of observations is because we had data for CDS spreads for a few more countries than we had convenience yield estimates. Unlike the EME local-currency convenience yield, credit risk is unaffected by the supply of government debt,

Table 9: Determinants of Credit Risk (5-Year Sovereign Bond)

Dep. var: $cds_{i,t}$	(1)	(2)	(3)	(4)	(5)
MP rate$_{t-1}$	11.94***	11.48***	11.65***	11.70***	6.214***
	(1.410)	(1.377)	(1.404)	(1.413)	(1.924)
$\log(\frac{\text{US debt to GDP}}{\text{Debt to GDP}})_{t-1}$	-8.027	-4.336	-8.776	-9.849	-30.78**
	(16.09)	(14.86)	(16.37)	(16.47)	(12.11)
US fed funds$_{t-1}$	-14.66**	-11.31	-13.86*	-14.09*	-11.77
	(7.115)	(7.349)	(7.149)	(7.177)	(7.894)
vix$_{t-1}$	4.575***	4.352***	4.429***	4.339***	4.271***
	(0.420)	(0.456)	(0.421)	(0.442)	(0.520)
K flows	N	Y	Y	Y	Y
ToT	N	N	N	Y	Y
Inflation	N	N	N	N	Y
Constant	-1.286	-28.20	-7.972	1,110	1,058
	(88.08)	(86.53)	(91.53)	(875.5)	(746.5)
Observations	1,338	1,338	1,338	1,338	1,213
R-squared	0.689	0.702	0.698	0.700	0.734

Notes: All columns include country and year-fixed effects. *** p<0.01, ** p<0.05, * p<0.1

suggesting that the spread accurately captures the demand for safety and liquidity. The local monetary policy rate level increased credit risk since it likely increased the cost of servicing the debt. The VIX index also positively impacted credit risk, which is consistent with intuition. Interestingly, debt inflows to government debt significantly reduced credit risk, which is expected as foreigners' buying local debt increases the chance of repayment. The same happened with inflows into bank debt, which is consistent with sovereign debt being mostly held by banks in EMEs.

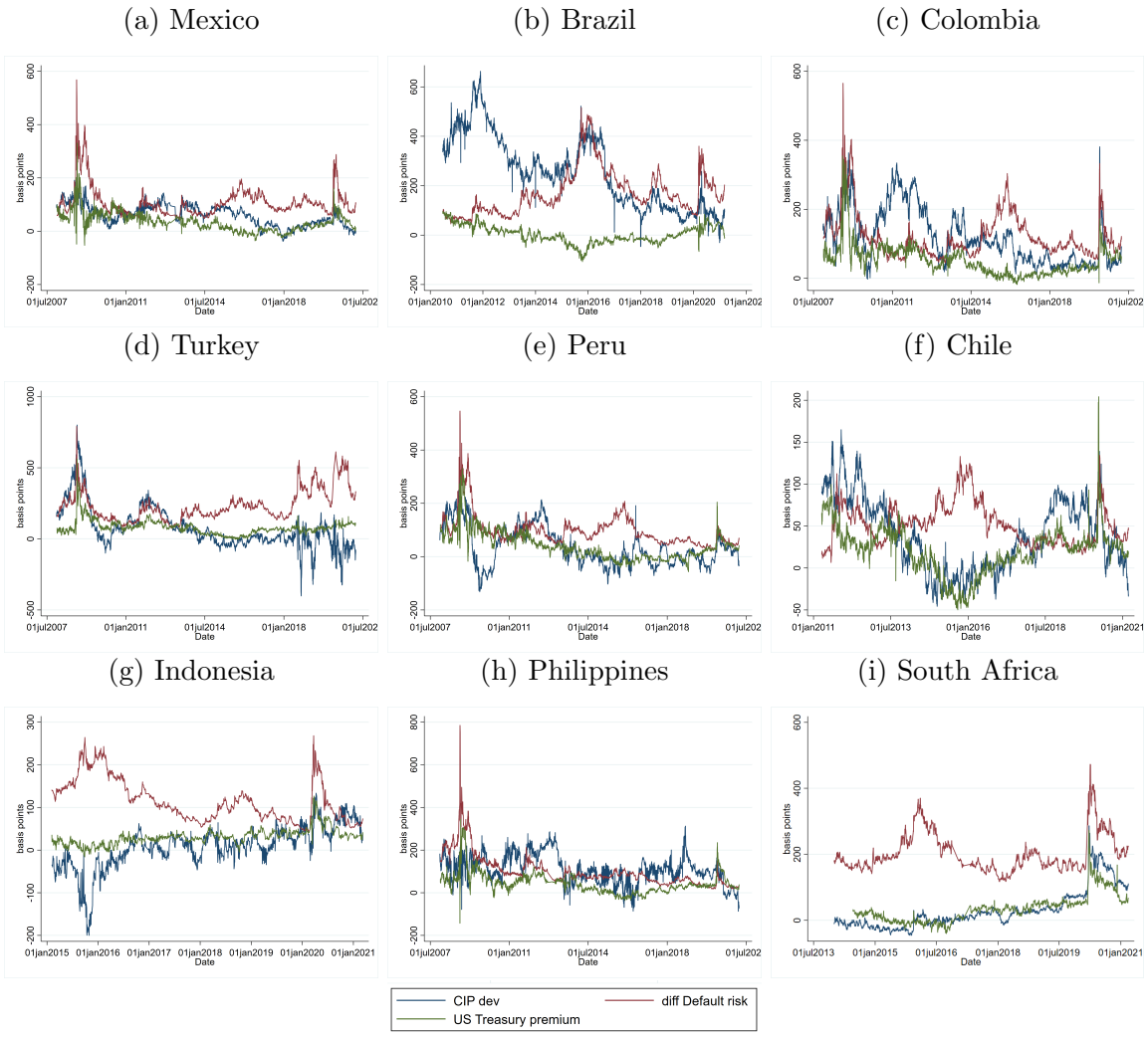
I.E.3 Analysis of the U.S. Treasury Premium

We replicate the analysis of the dollar spread, but with the U.S. Treasuries as the benchmark asset instead of the non-Treasury safe assets. This exercise resembles the one for G10 countries shown in Du, Im, and Schreger (2018).

In this case, $y_t^T - \rho_t - y_t^{US}$ corresponds to the CIP deviation between the two sovereign bonds (notice that now we are subtracting the U.S. yield from the swapped EME bond). The term $\lambda_t^{US,f} - \lambda_t^{T,f}$ corresponds to the U.S. Treasury premium (how much investors pay for the safety/liquidity of U.S. Treasuries against EME local-currency bonds).

Figure 8 compares the evolution of CIP deviations and two components: differential

Figure 8: CIP Deviation and Components, 5-Year Local-Currency Sovereign Bonds



default risk and the U.S. Treasury premium. CIP deviations spiked during crises (i.e., in 2008 and 2020), which was driven by an increase in differential default risk and the U.S. Treasury premium. The increase in the U.S. Treasury premium aligns with intuition: During financial distress, investors prefer the liquidity and safety of U.S. Treasuries. After 2008, the U.S. Treasury premium steadily declined until 2015-2016. This suggests that during this period, investors were willing to pay a lower premium for the safety and liquidity of U.S. government debt versus debt of EMEs. This premium then increased again until the end of the sample.

These patterns starkly contrast with the G10 counterparts in Du, Im, and Schreger (2018). In that paper, the authors showed that the U.S. Treasury premium for long maturities

became consistently negative after 2010, meaning that investors were no longer willing to pay an extra price for the safety and liquidity of U.S. Treasuries compared to the sovereign bonds of the G10 countries. Based on this result, some authors have cast doubt on the safety status of long-term U.S. Treasuries. Figure 8 shows that this is not the case for EMEs.

Surprisingly, CIP deviations outside of financial crises closely followed the U.S. Treasury premium dynamics -and not the dynamics of default risk- for Mexico, Colombia, Peru, Chile, Indonesia, and South Africa. In these countries, even though differential credit risk significantly increased in 2015-16, CIP deviations decreased, following the dynamics of the U.S. Treasury premium. One final note of caution is needed for Turkey in 2018-2019. The series for CIP deviations became very noisy and turned negative. These were years of severe capital outflows and recession in Turkey, and the negative values of the CIP deviation likely arose because of market segmentation, in which only local investors predominantly hold local-currency sovereign bonds.

The role of capital control risk (absent in Du, Im, and Schreger, 2018) can be seen in Figure 8 by the vertical distance between the CIP deviation (blue line) and the two components shown (red and green lines). This was accounted for by the sum of the capital control risk term plus the covariances term Equation (4). Two episodes in the data stand out: Brazil during 2010-2014 and Colombia soon after 2010. In the case of Brazil, the government imposed a tax on financial transactions in October 2009 to curb portfolio investment flows and cross-border derivative trading. Still, the tax was lifted in June 2013.

I.F. Robustness for Section 4

I.F.1. Domestic Spreads and Risk Factors (3-month maturity)

To further address the concern about the presence of standard risk premia, we replicate Table 3 in the main text for the 3-month maturity, where arguably risk premia are very small. Table 10 shows the results.

Results hold, although with lower magnitudes. Notably, although the safety premium still responds positively to global risk, it now correlates negatively with local risk, suggesting

Table 10: Domestic Spread and Risk Factors (3m Maturity)

Dep. var.: dom. spread	(1)	(2)	(3)	(4)
	A. Safety Premium			
VIX_{t-1}	-0.065		0.170**	
	(0.078)		(0.067)	
mar_{t-1}		-0.901		2.013**
		(1.050)		(0.894)
Economic $risk_{t-1}$	-3.626***	-3.624***		
	(0.810)	(0.809)		
Financial $risk_{t-1}$			-4.325***	-4.321***
			(0.817)	(0.801)
Observations	1,063	1,063	1,063	1,063
R-squared	0.792	0.792	0.794	0.794
	B. Liquidity Premium			
VIX_{t-1}	-0.357		1.035***	
	(0.293)		(0.396)	
mar_{t-1}		-5.440		10.20*
		(3.492)		(5.180)
EPU_{t-1}	11.12***	11.12***		
	(2.892)	(2.873)		
Financial $risk_{t-1}$			-1.704	-1.338
			(2.150)	(2.253)
Observations	595	595	1,229	1,229
R-squared	0.380	0.380	0.355	0.352
Country & Year FE	Y	Y	Y	Y
MP rate & Debt supply	Y	Y	Y	Y
K inflows	Y	Y	Y	Y

Notes: *mar* is the global risk factor in Miranda-Agrippino and Rey (2020). *EPU* is the economic policy uncertainty index of Baker, Bloom, and Davis (2016) -available for fewer countries. Regressions exclude data for Turkey and the Philippines. Data are at a monthly frequency. Standard errors are double-clustered by country and month. Start dates vary among countries, but ICRG data is available until April 2019. *** p<0.01, ** p<0.05, * p<0.1

that short-term uncertainty may be more relevant than medium-term uncertainty.

On the other hand, the liquidity premium at the 3-month maturity responds positively to global risk, which suggests that very short-term government debt shares more money-like properties than medium-term bonds. This is the case of the US, where it is well known that short-term T-bills are the most money-like in the term structure (Greenwood, Hanson, and Stein, 2015; Du, Im, and Schreger, 2018).

I.F.2. Domestic Spreads and Risk Factors (G10 Countries)

We replicate the response of the domestic spread to local and global factors in Section 4 with data for G10 countries (excluding the US). The spreads are calculated using equivalent

Table 11: Domestic Spread and Risk Factors (G10 Countries)

Dep. var.: dom. spread	(1)	(2)	(3)	(4)
	A. Safety Premium			
VIX_{t-1}	1.130***		0.852***	
	(0.135)		(0.165)	
mar_{t-1}		13.65***		12.40***
		(1.735)		(2.135)
Economic $risk_{t-1}$	-1.065			
	(0.694)			
Financial $risk_{t-1}$		-0.565		
		(1.160)		
EPU_{t-1}			7.061***	7.129***
			(1.464)	(1.606)
Observations	1,006	1,006	632	632
R-squared	0.701	0.690	0.697	0.704
	B. Liquidity Premium			
VIX_{t-1}	0.231**		0.253**	
	(0.109)		(0.104)	
mar_{t-1}		1.976		2.383*
		(1.458)		(1.350)
Economic $risk_{t-1}$	3.162***	3.111***		
	(0.519)	(0.517)		
Financial $risk_{t-1}$			-5.450***	-5.412***
			(1.301)	(1.302)
Observations	1,256	1,256	1,256	1,256
R-squared	0.660	0.659	0.662	0.661
Country & Year FE	Y	Y	Y	Y
MP rate & Debt supply	Y	Y	Y	Y
K inflows	Y	Y	Y	Y

Notes: *mar* is the global risk factor in Miranda-Agrippino and Rey (2020). *EPU* is the economic policy uncertainty index of Baker, Bloom, and Davis (2016) -available for fewer countries. Regressions exclude data for Turkey and the Philippines. Data are at a monthly frequency. Standard errors are double-clustered by country and month. Start dates vary among countries, but ICRG data is available until April 2019. *** p<0.01, ** p<0.05, * p<0.1

domestic assets for these advanced economies (unsecured interbank loans, collateralized interest rate swaps, and government bonds). All assets are in the domestic currency and have 1-year maturity.