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The Dollar's Double Life for Cross-Currency Basis Swaps: A Closer Look at G10 Panels

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Abstract

We present a model in which cross-currency basis swap spreads arise from dollar regime-dependent hedging behavior by global investors. Using a panel of G10 currencies vis-à-vis the US dollar, we show that, during the LIBOR period, dollar appreciations widen the basis in low-dollar regimes, while their effects weaken or even reverse in high-dollar regimes, resulting in basis tightening. This asymmetry is strongest at the short end of the basis curve, suggesting a particularly important role for short-term funding and liquidity pressures in the observed term-structure response. In the post-LIBOR era, however, these threshold effects become less stable and are often statistically insignificant, possibly reflecting both the shorter sample and changes in benchmark conventions. Our findings reveal the dollar's two-faced nature: similar dollar movements can generate markedly different common G10 basis responses depending on the prevailing dollar regime.

Keywords: Cross-Currency Basis Swaps, Basis Swap Spreads, G10 Panel, Threshold Effect

JEL Classification: F31, G12, G15

1. Introduction

Global investors rely extensively on cross-currency swap markets to manage the funding and currency risks associated with US dollar exposures. The dollar's dominant role in international funding and investment consequently makes the pricing of these hedges an important indicator of conditions in global financial markets. A growing body of evidence shows that fluctuations in the broad dollar index are closely tied to stresses in global funding markets, particularly through deviations from covered interest parity (CIP) and the associated dynamics of cross-currency basis swap spreads (Baba and Packer, 2009; Coffey et al., 2009; Du et al., 2018; Avdjiev et al., 2019). Empirically, dollar appreciations are often accompanied by wider (more negative) basis spreads, reflecting increased demand for dollar hedging and reduced arbitrage capacity among global intermediaries. Importantly, deviations from CIP do not follow a purely linear adjustment process: small deviations may persist for prolonged periods, while larger misalignments tend to be corrected more rapidly, highlighting threshold-type nonlinear dynamics (Balke and Wohar, 1998). This suggests that CIP deviations are not merely signs

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of arbitrage failure but are closely connected to broader macro-financial frictions. In particular, the financial accelerator framework highlights how deteriorating borrower balance sheets raise external finance premia and amplify real fluctuations (Bernanke and Gertler, 1989). More broadly, this mechanism illustrates how balance-sheet constraints can amplify financial frictions, while persistent CIP deviations have been linked more directly to limited arbitrage capacity and intermediary balance-sheet constraints (Du et al., 2018; Cerutti et al., 2021).

Further, the relationship between dollar movements and the cross-currency basis is far from uniform. Structural frictions, balance sheet constraints, and the heterogeneous hedging motives of international investors can generate pronounced non-linearities not fully documented in existing related work such as (Liao and Zhang, 2025; Sushko et al., 2016; Du et al., 2018). Recent theoretical contributions stress that capital flows and exchange rate dynamics are shaped by intermediaries' risk-bearing capacity, with global liquidity shocks altering exchange rate risk premia through balance-sheet channels (Gabaix and Maggiori, 2015). Persistent deviations have further been linked to limited arbitrage capital and intermediary risk tolerance (Du et al., 2018). Evidence from credit markets reinforces this argument: even in the presence of apparent arbitrage opportunities, positive and negative CDS basis trades can be constrained by funding costs and liquidity frictions, allowing non-zero bases to persist over time (Choudhry, 2006). Additional explanations include funding liquidity constraints (Mancini-Griffoli and Ranaldo, 2010), segmented money markets (Rime et al., 2017), and shortages of US dollar funding (McGuire and von Peter, 2012). Extending this line of reasoning, related work on same-currency tenor basis swaps shows how liquidity risk and market segmentation can sustain persistent basis spreads (Chang and Schlögl, 2015). Beyond these frictions, theoretical work shows that cross-currency basis swaps also embody structural differences in credit premia across currencies (Tuckman and Porfirio, 2003). Regulatory divergence increases the effective cost of wholesale dollar funding (Iida et al., 2016), while global banks ration credit accordingly (Ivashina et al., 2015). Corporate issuance decisions also respond to cross-currency pricing differentials (Liao, 2020), while unconventional monetary policy can affect cross-currency basis spreads through its effects on international funding and investment flows (Brophy et al., 2019). In particular, the impact of dollar appreciations or depreciations may vary systematically with the prevailing *dollar regime*, that is, whether the dollar is currently in a low- or high-level state relative to its historical distribution. When the dollar is weak (low-dollar regime), investor expectations of depreciation may amplify foreign demand for dollar funding, leading to sharper basis movements. Conversely, in high-dollar regimes, expectations of continued strength may dampen sensitivity to dollar news, as funding constraints and positioning interact differently with market expectations. These findings are consistent with the "risk-taking channel" of monetary policy, whereby US monetary tightening reduces global bank leverage, contracts cross-border flows, and typically coincides with dollar appreciation (Bruno and Shin, 2015).

Beyond intermediaries and investors, policy and market structures also influence the dynamics of the basis. On the public side, the Federal Reserve's central bank dollar swap lines during 2007-2009 proved highly effective in alleviating offshore dollar shortages and lowering stress in global money markets, underscoring their role as systemic liquidity backstops (Goldberg et al., 2011). On the private side, cross-currency swap markets transmit monetary policy divergence into funding premia, as the ECB's asset purchase program (APP) compressed euro yields, encouraged outward portfolio flows and corporate issuance abroad, and widened the USD leg of basis spreads (Brophy et al., 2019).

A growing body of work also extends this analysis by examining the macroeconomic deter-

minants and broader economic consequences of CIP deviations within macrofinancial frameworks. In standard monetary environments, Ibhagui (2020) examines the structural drivers of CIP dynamics, while Ibhagui (2021a) and Ibhagui (2021b) document the roles of inflation differentials and real economic activity, respectively, as drivers of cross-currency basis swap spreads. Extending this analysis to emerging markets, Coşkun and Ibhagui (2022) examine how domestic and external technology shocks shape CIP deviations, documenting heterogeneous basis responses across maturities. Moving beyond individual currency pairs, Ibhagui (2019) provides evidence on the pre- and post-crisis interrelations among cross-currency basis swap spreads, a systemic dimension that Ahelegbey et al. (2026a) maps explicitly through the network structure of interconnected deviations from covered interest parity. Related evidence from Agudze et al. (2020) documents the time-varying comovement between cross-currency basis spreads and the US dollar. More recently, Ahelegbey et al. (2026b) show that dollar funding stress, measured using the cross-currency basis, also reshapes the long-run stochastic structure of exchange rates by strengthening reduced-rank dynamics and increasing heterogeneity in currency exposures to global risk.

Finally, recent research highlights that CIP deviations are not homogeneous across countries and markets. Emerging markets generally display larger and more volatile deviations than G10 currencies, with offshore bases strongly sensitive to global risk and dealer leverage, while onshore segmented markets respond more sluggishly (Cerutti and Zhou, 2024). This segmentation implies regime dependence: during weak-dollar regimes, investor hedging demand amplifies deviations, whereas in strong-dollar regimes, funding constraints and positioning dampen the pass-through of dollar shocks.

This paper advances the view that the cross-currency basis emerges endogenously from regime-dependent hedging behavior by global investors. While previous studies largely interpret global dollar transmission through intermediary balance-sheet constraints, bank leverage, and cross-border funding conditions (Bruno and Shin, 2015; Avdjiev et al., 2018), our analysis emphasises asset-side hedging flows of long-horizon institutional investors, extending intermediary asset pricing frameworks to a global context. We distinguish between US and foreign institutional investors, each with long-horizon exposures to foreign- and dollar-denominated assets, respectively. Investors optimally choose dynamic hedge ratios subject to transaction costs, mean-variance preferences, and basis carry. The aggregate net demand for dollars in the swap market determines the basis through a linear price-impact mechanism, drawing on intermediary asset-pricing frameworks (He and Krishnamurthy, 2013; Adrian et al., 2014) and models of dynamic trading with transaction costs (Gârleanu and Pedersen, 2013).

The literature together highlights important dimensions in understanding basis dynamics. First, the dynamics of the cross-currency basis exhibit nonlinear patterns with threshold-type adjustments rather than simple linear convergence. Second, they are jointly shaped by funding-side constraints and the asset-side hedging demand of global investors. Third, there is significant heterogeneity across currencies, markets, and institutional regimes, which further conditions the behaviour of the basis. Building on these insights, our framework delivers several novel implications. First, basis sensitivity to dollar expectations is regime-dependent, with stronger asymmetries in low-dollar states. Second, the probability of being in a high-dollar regime acts as a new state variable, tightening the expected basis and linking funding premia to regime shifts. Third, allowing tenor-specific costs and exposures implies maturity-dependent asymmetries, with the strongest response depending on the relative importance of short-term funding pressures and longer-horizon institutional hedging demand. While Ahelegbey et al. (2026) identify the nonlinear foundations of the dollar–basis relationship, they

estimate threshold regressions separately for individual currencies across the term structure. This does not exploit the common cross-sectional dimension of the G10 panel. In contrast, this paper undertakes an extensive panel-based evaluation of the model's core predictions.

We test these predictions using a panel of G10 currency pairs against the dollar across multiple swap maturities. Empirical estimates confirm that dollar appreciations widen the basis more in low-dollar regimes than in high-dollar regimes, with the strongest effects at some maturities, not all. These results shed light on the conditional nature of the dollar's role in global funding markets: the same movement in the dollar can have markedly different implications for the cross-currency basis depending on the prevailing regime.

The paper is organised as follows. Section 2 presents the model environment, including regime-switching dollar dynamics, investor portfolios, and hedging costs. Section 3 develops the main propositions and introduces the empirical methodology, and Section 4 describes the data and reports the results. Section 5 concludes with implications and avenues for future research.

2. Model Setup

For quantitative tractability, we work in continuous time on a filtered probability space

$$(\Omega, \mathcal{F}, \{\mathcal{F}_t\}_{t\geq 0}, \mathbb{P}),$$

satisfying the usual conditions. All stochastic processes introduced below are adapted to the filtration $\{\mathcal{F}_t\}$. The filtration is interpreted as the information set available to investors at time t and is generated by the observable shocks that affect the dollar, bond returns, and exchange rates, together with the investors' filtered beliefs about the underlying dollar regime.

The model is designed to capture a simple but economically important mechanism. The US dollar can be in either a low-dollar or a high-dollar regime. Investors do not observe the regime perfectly, but they hold filtered beliefs about it. These beliefs shape expected dollar movements, which in turn affect currency-hedging demand. The aggregate net hedging demand for dollars is intermediated in the FX swap market, and the resulting order imbalance is reflected in the cross-currency basis through a linear price-impact relation. The model is intentionally stylised: it aims to isolate the hedging channel transparently, rather than to provide a full structural model of global intermediary balance sheets.

2.1. Dollar regime and information

Let $X_t \in \{\ell, h\}$ denote the latent dollar regime at time t, where ℓ denotes a low-dollar regime and h denotes a high-dollar regime. Let

$$\pi_t(h) \equiv \mathbb{P}(X_t = h \mid \mathcal{F}_t)$$

denote the time-t filtered probability that the economy is in the high-dollar regime. The complementary probability of the low-dollar regime is $1 - \pi_t(h)$.

Let D_t denote a broad US dollar factor. Economically, D_t is intended to represent an aggregate measure of dollar strength, such as a broad trade-weighted dollar index. A higher value of D_t means that the dollar is stronger *in level*. This is distinct from the dollar *appreciating over time*, which is governed by the drift of its stochastic dynamics.

Conditional on regime $X_t = \theta \in \{\ell, h\}$, the broad dollar factor evolves as

$$\frac{dD_t}{D_t} = \mu_\theta \, dt + \sigma_D \, dB_t, \qquad \mu_\ell < 0 < \mu_h, \qquad \sigma_D > 0, \tag{1}$$

where B_t is a standard Brownian motion. The sign restriction $\mu_\ell < 0 < \mu_h$ means that the dollar is expected to depreciate in the low-dollar regime and appreciate in the high-dollar regime.

Because investors do not observe the regime perfectly, their relevant state variable is not the regime itself but the filtered expected dollar drift,

$$\mu_t \equiv \mathbb{E}[\mu_{X_t} \mid \mathcal{F}_t] = \mu_\ell \, [1 - \pi_t(h)] + \mu_h \, \pi_t(h). \tag{2}$$

The variable μ_t will be the sufficient statistic that enters investors' hedge decisions. This formulation avoids treating the latent regime itself as directly observed and makes precise the distinction between the hidden state X_t and the filtered belief $\pi_t(h)$.

2.2. Investors, assets, and hedging instruments

We consider two representative long-horizon investors. One is based in the United States and holds foreign-currency fixed-income assets. The other is based abroad and holds USD-denominated fixed-income assets. Both investors manage currency risk using short-horizon FX hedging instruments and face quadratic implementation costs when adjusting hedge positions.

For simplicity, all fixed-income positions are measured in USD notional terms. This normalisation keeps the expressions transparent and avoids unnecessary currency-conversion clutter. The economic interpretation is unchanged: one investor is effectively long foreign-currency bonds from a USD perspective, while the other is long USD bonds from a foreign-currency perspective.

USD investor (U).. The USD investor has USD as base currency and holds foreign-currency bonds with USD-equivalent notional $A_U > 0$.

Foreign investor (F).. The foreign investor has foreign currency as base currency and holds USD bonds with USD notional $A_F > 0$.

Bond-return processes.. The return on the foreign bond, measured in its own local currency, is

$$dR_t^f = \mu_f \, dt + \sigma_f \, dZ_t^f, \tag{3}$$

and the return on the USD bond is

$$dR_t^\$ = \mu_\$ \, dt + \sigma_\$ \, dZ_t^\$. \tag{4}$$

Here Z_t^f and $Z_t^\$$ are standard Brownian motions. Their instantaneous correlations with the dollar shock B_t are

$$d\langle Z^f, B\rangle_t = \rho_U \, dt, \qquad d\langle Z^\$, B\rangle_t = \rho_F \, dt, \tag{5}$$

where $\rho_U, \rho_F \in [-1, 1]$. If desired, one may also allow a nonzero instantaneous correlation between Z_t^f and $Z_t^\$$; however, that correlation does not enter the investor-specific hedge problems below and is therefore omitted for expositional economy.

Equations (3) and (4) should be interpreted as local return representations of the fixed-income portfolios held by the two representative investors. In particular, standard affine term-structure models, such as a Vasicek short-rate specification combined with zero-coupon bond pricing, imply instantaneous bond-return dynamics with the same general drift-diffusion structure.[1] Accordingly, the reduced-form bond-return equations adopted in the paper should not be interpreted as inconsistent with standard fixed-income asset-pricing theory, but rather as analytically tractable local representations of a broader affine term-structure environment. We retain this reduced-form specification because the primary objective of the model is not to characterize the full dynamics of the yield curve, but instead to isolate how regime-dependent dollar expectations affect optimal currency hedging behavior and, through aggregate swap-market order flow, the equilibrium cross-currency basis. Introducing a fully specified affine term-structure system would substantially increase the dimensionality of the state space by requiring additional short-rate and yield-curve factors, without materially altering the paper's central hedging-demand mechanism or its equilibrium implications for basis dynamics.

The model nevertheless accommodates maturity dependence through tenor-specific parameters governing hedging intensity, implementation costs, and intermediary price impact. These maturity-varying components generate tenor-specific sensitivities of the basis to dollar-regime conditions and therefore provide a tractable theoretical framework for interpreting the term-structure effects documented in the empirical analysis. Empirically, these effects are examined using stacked term-structure regressions across multiple maturities.

Bilateral exchange rate.. Let S_t denote the bilateral USD/foreign exchange rate, defined as USD per unit of foreign currency. A rise in S_t therefore means that the foreign currency strengthens against the dollar, while a fall in S_t means that the dollar strengthens against the foreign currency.

To connect the broad dollar factor to bilateral exchange-rate risk, we assume that the bilateral FX rate is driven by the same filtered dollar-drift state μ_t:

$$\frac{dS_t}{S_t} = -\mu_t \, dt + \sigma_S \, dB_t. \tag{6}$$

The minus sign is economically natural under the convention that S_t is USD per unit of foreign currency: when the expected USD appreciation rate μ_t rises, the expected drift of S_t falls. The parameter $\sigma_S > 0$ is the volatility of the bilateral exchange rate. We do *not* impose $\sigma_S = \sigma_D$. Allowing distinct volatilities separates the broad dollar factor from the bilateral exchange-rate process and addresses the concern that the original formulation blurred the distinction

[1] For example, under a Vasicek (Vasicek, 1977) short-rate process

$$dr_t^j = \kappa_j(\bar{r}_j - r_t^j) \, dt + \sigma_{r,j} \, dW_t^j,$$

the return on a zero-coupon bond satisfies

$$\frac{dP_t^j}{P_t^j} = \mu_{P,j}(t, \tau) \, dt - B_j(\tau)\sigma_{r,j} \, dW_t^j,$$

which maps naturally into the reduced-form representation used here.

between them. Equation (6) is a parsimonious reduced-form link between aggregate dollar conditions and bilateral FX risk.

FX hedging instrument and basis.. Each investor hedges currency exposure using an FX swap or, equivalently at the local horizon considered here, a forward-style hedge. Let b_t denote the instantaneous cross-currency basis. By market convention, a more negative b_t corresponds to a wider USD basis, meaning that obtaining dollars synthetically through the swap market is more expensive for a non-USD investor and more attractive for a USD investor supplying dollars through the hedge.

Hedge ratios.. The USD investor chooses a hedge ratio $h_t^U \in \mathbb{R}$, interpreted as the fraction of foreign-currency exposure hedged back into USD. The foreign investor chooses a hedge ratio $h_t^F \in \mathbb{R}$, interpreted as the fraction of USD exposure hedged back into foreign currency. Positive values correspond to long hedge positions in the investor's base currency.

Implementation costs.. Adjusting hedge positions is costly. Investor $i \in \{U, F\}$ incurs the instantaneous convex implementation cost

$$\frac{\kappa_i}{2}\,(h_t^i)^2, \qquad \kappa_i > 0. \tag{7}$$

The quadratic form is standard in linear-quadratic portfolio models and ensures interior hedge policies.

2.3. Wealth dynamics and local objective functions

We now define the wealth dynamics carefully and formulate the optimization problems in a way that is mathematically consistent in continuous time. The important point is that one should not work directly with $\mathbb{E}_t[dW_t]$ and $\mathrm{Var}_t(dW_t)$ as if they were finite-period objects of the same order as the control variable. Instead, the investor's local problem is written in terms of the instantaneous drift-variance tradeoff density, obtained by dividing the conditional mean and conditional variance of wealth increments by dt. This idea is formalized below.

2.3.1. USD investor

The USD investor holds foreign bonds and is exposed to both foreign bond risk and exchange-rate risk. If the investor hedges a fraction h_t^U of the FX exposure, the local wealth increment in USD is

$$dW_t^U = A_U \left[dR_t^f + (1 - h_t^U)\frac{dS_t}{S_t} \right] - A_U h_t^U b_t\, dt. \tag{8}$$

The first term collects the foreign bond return and the unhedged fraction of the FX return. The last term is the basis-related carry from the hedge.[2] It is important to state that the basis

[2]The sign convention follows the market convention that the cross-currency basis is quoted as the spread added to the non-dollar leg of the swap. If $y_t^{\$}$ and y_t^f denote the dollar and foreign reference rates, respectively, the USD investor who hedges foreign-currency exposure through the swap receives the dollar leg $y_t^{\$}$ and pays the foreign leg $y_t^f + b_t$. The net swap carry is therefore $y_t^{\$} - (y_t^f + b_t)$. Since the interest-rate differential $y_t^{\$} - y_t^f$ is not the focus of the hedging-demand channel and is absorbed into the reduced-form bond-return/carry component, the basis-specific component of the USD investor's hedge payoff is $-b_t$. This explains the term $-A_U h_t^U b_t\, dt$ in the USD investor's wealth process. Conversely, the foreign investor is on the opposite side of

term is not deterministic. Rather, it is a predictable state-dependent cash-flow component conditional on the current state (b_t, h_t^U), and it enters the drift of the wealth process.

Using (3) and (6), the conditional drift density of (8) is

$$\tilde{\mu}_t^U(h) \equiv \frac{1}{dt}\,\mathbb{E}_t[dW_t^U] = A_U\Big[\mu_f - (1-h)\mu_t - b_t h\Big], \tag{9}$$

and the conditional variance density is

$$\tilde{\sigma}_t^{2,U}(h) \equiv \frac{1}{dt}\,\mathrm{Var}_t(dW_t^U) = A_U^2\Big[\sigma_f^2 + (1-h)^2\sigma_S^2 + 2(1-h)\rho_U\sigma_f\sigma_S\Big]. \tag{10}$$

The USD investor chooses h to minimise the local mean-variance loss

$$L_t^U(h) = \frac{\gamma_U}{2}\,\tilde{\sigma}_t^{2,U}(h) - \tilde{\mu}_t^U(h) + \frac{\kappa_U}{2}h^2, \qquad \gamma_U > 0. \tag{11}$$

This is a local quadratic hedging problem in continuous time. The objective should therefore be understood as a myopic instantaneous mean-variance problem expressed in flow terms, rather than as an optimization over raw Itô increments or terminal wealth. Because the objective is strictly convex in h, the optimal hedge is unique.

2.3.2. Foreign investor

The foreign investor holds USD bonds and faces USD/foreign exchange-rate risk in the opposite direction. If the investor hedges a fraction h_t^F of USD exposure back into foreign currency, the local wealth increment, expressed in foreign-currency terms up to the same local linearisation used above, is

$$dW_t^F = A_F\left[dR_t^{\$} - (1-h_t^F)\frac{dS_t}{S_t}\right] + A_F h_t^F b_t\,dt. \tag{12}$$

The plus sign on the basis term reflects the fact that the foreign investor is on the opposite side of the swap from the USD investor and therefore receives the basis-specific component $+b_t$ in the accounting convention adopted here. However, because a wider USD basis corresponds to a more negative b_t, the term $A_F h_t^F b_t\,dt$ lowers the investor's drift when the basis becomes more negative. Economically, this captures the idea that foreign investors hedging USD exposure incur higher synthetic dollar funding costs when offshore dollar conditions tighten.

Using (4) and (6), the corresponding conditional drift density is

$$\tilde{\mu}_t^F(h) \equiv \frac{1}{dt}\,\mathbb{E}_t[dW_t^F] = A_F\Big[\mu_{\$} + (1-h)\mu_t + b_t h\Big], \tag{13}$$

and the conditional variance density is

$$\tilde{\sigma}_t^{2,F}(h) \equiv \frac{1}{dt}\,\mathrm{Var}_t(dW_t^F) = A_F^2\Big[\sigma_{\$}^2 + (1-h)^2\sigma_S^2 - 2(1-h)\rho_F\sigma_{\$}\sigma_S\Big]. \tag{14}$$

The minus sign in the covariance term follows from the fact that the foreign investor's FX exposure enters with the opposite sign from that of the USD investor.

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the swap and receives the basis-specific component $+b_t$, which gives the term $+A_F h_t^F b_t\,dt$. When $b_t < 0$, the sign convention implies that the basis component raises the USD investor's payoff and lowers the foreign investor's payoff, consistent with a wider negative USD basis.

The foreign investor solves

$$L_t^F(h) = \frac{\gamma_F}{2}\,\tilde{\sigma}_t^{2,F}(h) - \tilde{\mu}_t^F(h) + \frac{\kappa_F}{2}h^2, \qquad \gamma_F > 0. \tag{15}$$

As in the USD investor's problem, strict convexity guarantees a unique optimum.

2.4. Optimal hedge policies

Because both local objective functions are quadratic in the hedge ratio, the first-order conditions deliver closed-form affine policies.

USD investor.. Differentiating (11) with respect to h and setting the derivative equal to zero yields

$$0 = \gamma_U A_U^2\Big[-(1-h)\sigma_S^2 - \rho_U\sigma_f\sigma_S\Big] + A_U(\mu_t - b_t) + \kappa_U h.$$

Solving for h gives

$$h_t^{U*} = \frac{\gamma_U A_U^2(\sigma_S^2 + \rho_U\sigma_f\sigma_S) + A_U(\mu_t - b_t)}{\kappa_U + \gamma_U A_U^2\sigma_S^2}. \tag{16}$$

It is convenient to write this as

$$h_t^{U*} = \alpha_U\,\mu_t + \eta_U - \alpha_U\,b_t, \tag{17}$$

where

$$\alpha_U = \frac{A_U}{\kappa_U + \gamma_U A_U^2\sigma_S^2}, \qquad \eta_U = \frac{\gamma_U A_U^2(\sigma_S^2 + \rho_U\sigma_f\sigma_S)}{\kappa_U + \gamma_U A_U^2\sigma_S^2}. \tag{18}$$

We use a single coefficient α_U on both μ_t and b_t because the underlying algebra implies the same loading on these two terms. This notation reflects the fact that the same coefficient loads on μ_t and b_t within the USD investor's optimal hedge rule.

Foreign investor.. Differentiating (15) with respect to h and solving gives

$$h_t^{F*} = \frac{\gamma_F A_F^2(\sigma_S^2 - \rho_F\sigma_\$\sigma_S) - A_F(\mu_t - b_t)}{\kappa_F + \gamma_F A_F^2\sigma_S^2}. \tag{19}$$

Equivalently,

$$h_t^{F*} = -\alpha_F\,\mu_t + \eta_F + \alpha_F\,b_t, \tag{20}$$

where

$$\alpha_F = \frac{A_F}{\kappa_F + \gamma_F A_F^2\sigma_S^2}, \qquad \eta_F = \frac{\gamma_F A_F^2(\sigma_S^2 - \rho_F\sigma_\$\sigma_S)}{\kappa_F + \gamma_F A_F^2\sigma_S^2}. \tag{21}$$

This expression incorporates the correct sign structure in the covariance term.

Economic interpretation.. The hedge policies have a clear interpretation. A higher expected USD appreciation rate μ_t raises the USD investor's desired hedge of foreign assets and reduces the foreign investor's desired hedge of USD assets. A more negative basis increases the

attractiveness of hedging for the USD investor, who effectively receives carry by supplying dollars through the swap market, and reduces the attractiveness of hedging for the foreign investor, who must pay the basis to obtain dollars synthetically.

2.5. Basis formation through net hedging pressure

The FX swap market clears through the interaction of investors' hedge demands and intermediary balance-sheet capacity. Let

$$Q_t \equiv A_F h_t^{F*} - A_U h_t^{U*} \tag{22}$$

denote net demand for dollars in the swap market. A positive Q_t means that foreign investors demand more dollars through hedging than USD investors supply. A negative Q_t means that USD investors supply dollars through hedging in excess of foreign demand.

Intermediation and price impact.. We assume a linear reduced-form pricing relation

$$b_t = \phi_0 - \Lambda Q_t, \qquad \Lambda > 0, \tag{23}$$

where ϕ_0 is an intercept that summarises exogenous funding and policy conditions, and Λ measures the price impact of net order flow on the basis. This relation can be microfounded by a competitive intermediary sector that absorbs net order flow subject to quadratic inventory costs. In that case, intermediaries require compensation proportional to the size of the warehoused imbalance, which yields a linear basis-order-flow relation of the form (23).

Reduced form for order flow.. Substituting (17) and (20) into (22), we obtain

$$Q_t = \Phi\, \mu_t + X\, b_t + C, \tag{24}$$

where

$$\Phi \equiv -A_F \alpha_F - A_U \alpha_U < 0, \qquad X \equiv A_F \alpha_F + A_U \alpha_U > 0, \tag{25}$$

and

$$C \equiv A_F \eta_F - A_U \eta_U. \tag{26}$$

Because the same coefficient loads on μ_t and b_t within each investor's policy rule, we have the identity $X = -\Phi$, but we retain both symbols because Φ is the coefficient on expected USD appreciation and X is the coefficient on the basis. Keeping both symbols makes the equilibrium expressions economically easier to read.

Equilibrium basis.. Combining (23) and (24) gives

$$b_t = \phi_0 - \Lambda(\Phi \mu_t + X b_t + C).$$

Rearranging,

$$(1 + \Lambda X) b_t = \phi_0 - \Lambda C - \Lambda \Phi \mu_t.$$

Hence, the equilibrium basis is

$$b_t = \bar{b} + \Psi\, \mu_t, \tag{27}$$

where

$$\bar{b} \equiv \frac{\phi_0 - \Lambda C}{1 + \Lambda X}, \qquad \Psi \equiv \frac{-\Lambda \Phi}{1 + \Lambda X}. \tag{28}$$

Since $\Phi < 0$, $\Lambda > 0$, and $1 + \Lambda X > 0$, it follows that $\Psi > 0$.

Implication for the basis.. Equation (27) is the central reduced-form implication of the model. The equilibrium basis is affine in the filtered expected USD appreciation rate. Because $\Psi > 0$, a higher expected USD appreciation rate implies a tighter basis, while a lower expected USD appreciation rate implies a wider basis. The strength of this sensitivity depends on investor balance-sheet sizes, implementation costs, and intermediation capacity.

Scope of the theoretical mechanism.. It is important to state clearly what the model does and does not do. The model derives the basis as an equilibrium object generated by hedge demand and intermediary absorption. What it does not fully derive is the law of motion for filtered beliefs $\pi_t(h)$. That belief process is treated in reduced form through the sufficient statistic μ_t. This is deliberate. The theoretical purpose of the model is to show how a regime-dependent expected dollar state maps into hedge demand and then into the cross-currency basis. The empirical section then evaluates whether this channel is present in the data.

3. Propositions and Methodology

3.1. Propositions and Interpretation

The corrected model implies that the equilibrium cross-currency basis is an affine function of the filtered expected USD appreciation rate:

$$b_t = \bar{b} + \Psi\, \mu_t, \qquad \mu_t = \mu_\ell[1 - \pi_t(h)] + \mu_h \pi_t(h), \qquad \mu_\ell < 0 < \mu_h, \qquad \Psi > 0.$$

The propositions below are therefore stated in terms of the well-defined state variable μ_t and the filtered probability $\pi_t(h)$, rather than in terms of classical derivatives of one stochastic process with respect to another. This formulation is both mathematically cleaner and more faithful to the reduced-form nature of the regime-updating mechanism embedded in the model.

Proposition 1 (Regime-dependent basis response)**.** *Suppose that the equilibrium basis satisfies*

$$b_t = \bar{b} + \Psi\, \mu_t, \qquad \Psi > 0,$$

where

$$\mu_t = \mu_\ell[1 - \pi_t(h)] + \mu_h \pi_t(h), \qquad \mu_\ell < 0 < \mu_h.$$

Then, at the two extreme regime values,

$$b_t(\ell) = \bar{b} + \Psi \mu_\ell \qquad \textit{and} \qquad b_t(h) = \bar{b} + \Psi \mu_h,$$

and these satisfy

$$b_t(\ell) < \bar{b} < b_t(h).$$

Interpretation.

When the expected dollar state is weak, so that the filtered expected USD appreciation rate is low or negative, the basis lies below its intercept level $\bar{b}$ and is therefore wider, that

is, more negative. When the expected dollar state is strong, so that the filtered expected USD appreciation rate is high and positive, the basis lies above $\bar{b}$ and is therefore tighter, that is, less negative and possibly positive. This result follows directly from the positive slope coefficient Ψ in the equilibrium relation between the basis and the expected USD appreciation rate.

Proposition 2 (Local basis response to belief revisions)**.** *Suppose that the equilibrium basis satisfies*

$$b_t = \bar{b} + \Psi\, \mu_t, \qquad \Psi > 0,$$

with

$$\mu_t = \mu_\ell[1 - \pi_t(h)] + \mu_h \pi_t(h), \qquad \mu_\ell < 0 < \mu_h.$$

Then any local revision in beliefs about the high-dollar regime induces the basis variation

$$db_t = \Psi\, d\mu_t = \Psi(\mu_h - \mu_\ell)\, d\pi_t(h).$$

Consequently, for any interval over which the filtered probability of the high-dollar regime rises, the basis tightens; for any interval over which that probability falls, the basis widens.

More precisely, for any finite change in the filtered belief from $\pi_t(h)$ to $\pi_t(h) + \Delta\pi_t(h)$, the induced change in the basis is

$$\Delta b_t = \Psi(\mu_h - \mu_\ell)\, \Delta\pi_t(h).$$

Hence, if two environments generate belief revisions satisfying

$$\Delta\pi_t(h)\big|_{\text{low}} \le \Delta\pi_t(h)\big|_{\text{high}},$$

Then the corresponding basis responses satisfy

$$\Delta b_t^{\text{low}} \le \Delta b_t^{\text{high}}.$$

Interpretation. This proposition should not be interpreted as a filtering theorem. Rather, it characterizes the equilibrium mapping from a given revision in filtered beliefs to the cross-currency basis, while the law of motion for $\pi_t(h)$ is treated in reduced form. This formulation replaces the earlier, mathematically problematic expression involving $\partial\pi_t(h)/\partial D_t$. In the corrected model, the economically meaningful object is not a classical derivative of one stochastic process with respect to another, but rather the change in the filtered probability of the high-dollar regime generated by new information. The basis reacts to that belief revision through the equilibrium mapping $b_t = \bar{b} + \Psi\mu_t$. The regime-dependent asymmetry should therefore be understood as operating through differences in the size and sign of filtered belief revisions across regimes. The model does not impose a classical derivative of $\pi_t(h)$ with respect to the observed dollar process. Instead, it shows that new information can shift the filtered probability of the high-dollar state differently across environments, and that the equilibrium basis responds to those belief revisions through the basis-belief mapping derived above. This is the reduced-form sense in which regime-dependent belief revisions generate asymmetric basis responses.

Proposition 3 (Expected basis and the probability of the high-dollar regime)**.** *Suppose that*

$$b_t = \bar{b} + \Psi\, \mu_t, \qquad \mu_t = \mu_\ell[1 - \pi_t(h)] + \mu_h \pi_t(h), \qquad \Psi > 0.$$

Then the conditional expected basis satisfies

$$\mathbb{E}_t[b_t] = \bar{b} + \Psi\big[\mu_\ell[1 - \pi_t(h)] + \mu_h \pi_t(h)\big].$$

Moreover,

$$\frac{\partial \mathbb{E}_t[b_t]}{\partial \pi_t(h)} = \Psi(\mu_h - \mu_\ell) > 0.$$

Interpretation. An increase in the filtered probability that the economy is in the high-dollar regime raises the filtered expected USD appreciation rate. Since the equilibrium basis is increasing in that state variable, the expected basis becomes tighter. This proposition is a clean comparative-static statement in the belief variable $\pi_t(h)$ and does not require any questionable derivative with respect to the observed dollar index itself.

Proposition 4 (Tenor effects and hedging intensity)**.** *Suppose that investor notionals, implementation costs, and intermediary price impact vary with maturity τ, so that*

$$A_i = A_i(\tau), \qquad \kappa_i = \kappa_i(\tau), \qquad \Lambda = \Lambda(\tau), \qquad i \in \{U, F\}.$$

Let

$$\alpha_U(\tau) = \frac{A_U(\tau)}{\kappa_U(\tau) + \gamma_U A_U(\tau)^2 \sigma_S^2}, \qquad \alpha_F(\tau) = \frac{A_F(\tau)}{\kappa_F(\tau) + \gamma_F A_F(\tau)^2 \sigma_S^2},$$

and define

$$\Phi(\tau) \equiv -A_F(\tau)\alpha_F(\tau) - A_U(\tau)\alpha_U(\tau) < 0, \qquad X(\tau) \equiv A_F(\tau)\alpha_F(\tau) + A_U(\tau)\alpha_U(\tau) > 0.$$

Then the maturity-specific sensitivity of the basis to the expected dollar state is

$$\Psi(\tau) = \frac{-\Lambda(\tau)\Phi(\tau)}{1 + \Lambda(\tau)X(\tau)}.$$

If effective hedging demand is concentrated at certain maturities, so that the quantity

$$\Lambda(\tau)X(\tau)$$

is largest in those sections of the curve, then $\Psi(\tau)$ is also largest at those maturities. In that case, the basis is most sensitive to regime-dependent dollar expectations at those tenors[3]*.*

[3]If the sensitivity of the basis reflects both (i) short-term funding constraints and (ii) maturity-specific institutional hedging demand, then

$$\Psi(\tau) = \frac{-\Lambda(\tau)\,\Phi(\tau)}{1 + \Lambda(\tau)\,X(\tau)}$$

need not be monotonic in τ. In particular, while hedging intensity $\kappa_i(\tau)$ may heighten at intermediate maturities, short-term funding frictions can generate stronger sensitivity at the short end of the curve, leading to inflexion in term structure depending on which channel dominates. Strictly speaking, we distinguish between two conceptually distinct sources of demand in swap markets. First, institutional hedging demand arises when investors holding foreign-currency assets use swaps to hedge exchange rate risk, generating persistent pressure at intermediate maturities (e.g., 5Y). Second, funding or liquidity demand reflects the use of swaps as a synthetic source of short-term dollar funding, particularly by financial intermediaries facing balance sheet and funding constraints. While the proposition emphasises the role of maturity-dependent hedging intensity, the empirical results suggest that short-term funding frictions can dominate in practice, leading to stronger sensitivity at shorter maturities.

Interpretation.

This proposition states the tenor result in a form that is consistent with the model. The maturity dependence of the basis response is governed by two objects: the elasticity of aggregate hedge demand, summarised by $X(\tau)$, and the capacity of intermediaries to absorb order flow, summarised by $\Lambda(\tau)$. The model does not require the strongest response to occur at any particular point on the curve. If institutional hedging demand dominates, sensitivity may be strongest at intermediate maturities; if short-term funding or liquidity demand dominates, sensitivity may be strongest at the short end. The empirical term-structure analysis below therefore determines which channel is more important in the observed panel.

3.2. Econometric Methodology

To empirically assess regime dependence in cross-currency basis dynamics, we implement Hansen (1999) *panel threshold regression* using the broad USD index as the threshold variable, allowing the responsiveness of basis swap spreads to dollar movements to vary according to whether the dollar is in a relatively weak or strong regime. In contrast to linear panel models, which assume a constant relationship between the dollar and basis swap spreads, the threshold specification explicitly accommodates nonlinear dynamics that depend on whether the dollar is relatively weak or strong.

Formally, the regression is specified as:

$$\Delta XCB_{it} = \mu_i + \beta_1 \, \Delta USD_t \, \mathbf{1}\left(USD_t \leq \tau\right) + \beta_2 \, \Delta USD_t \, \mathbf{1}(USD_t > \tau) + \Gamma' Z_{it} + u_{it}, \quad (29)$$

where ΔXCB_{it} denotes the weekly change in the basis spread for currency i at time t, ΔUSD_t is the weekly change in the broad USD index, and μ_i are unit fixed effects, and Z_{it} are controls (e.g., ΔVIX, ΔIV, ΔRR, ΔYSPRD, ΔTSPRD). The indicator function $\mathbf{1}(\cdot)$ separates the sample into low-dollar and high-dollar regimes depending on whether the USD index is below or above the estimated threshold τ. The key hypothesis is that $\beta_1 \neq \beta_2$, implying that the pass-through of dollar movements to basis swap spreads differs across regimes. In particular, a widening response is expected to be stronger when the dollar is in the weak regime, reflecting higher hedging demand from non-dollar borrowers. Statistical inference for the threshold and regime-dependent coefficients is conducted using Hansen (1999) bootstrap procedure, which accounts for the non-standard distribution of the estimator.

4. Empirical Analysis

We investigate how dollar appreciations affect cross-currency basis swap spreads using panel data that distinguishes between the LIBOR and post-LIBOR eras. We examine whether the responsiveness of basis spreads to dollar fluctuations differs systematically between periods of dollar strength and weakness, in line with the regime-switching framework outlined in the theoretical section, and further explore how these regime-dependent sensitivities have changed following the transition away from LIBOR.

4.1. Data Description

Our empirical analysis extends the sample beyond the LIBOR period to incorporate the post-LIBOR transition era. Specifically, we construct a weekly panel dataset from the Bloomberg Terminal covering January 2005 to December 2021 (LIBOR period), in addition to the post-LIBOR period from June 2022 to August 2025. The dataset includes cross-currency

basis swap spreads for the G10 currencies—EUR, JPY, GBP, AUD, NZD, CAD, DKK, CHF, SEK, and NOK, all quoted against the US dollar.

The cessation of LIBOR and the transition to alternative benchmarks such as the Secured Overnight Financing Rate (SOFR) have introduced changes in trading conventions and liquidity conditions. These institutional and market developments may affect the reliability of long-term basis swap quotes and alter the dynamics of dollar-basis interactions. Distinguishing between the LIBOR and post-LIBOR samples thus enables us to assess whether the asymmetric effects of dollar movements are robust across benchmark regimes and consistent across the maturity structure.

We measure the dollar's relative strength using the Broad US Dollar Index as the threshold variable for regime classification. Periods of high and low dollar strength are defined based on this index, allowing us to test for asymmetric responses in basis spreads to dollar movements across regimes.

Following Avdjiev et al. (2019), we incorporate a set of control variables to account for global risk sentiment and foreign exchange market conditions. Specifically, we include changes in the S&P 500 implied volatility index (ΔVIX_t) to capture fluctuations in global risk sentiment. To reflect developments in foreign exchange markets, we control for the change in the implied volatility of FX options (ΔIV_t), which measures shifts in the risk-neutral volatility of exchange rate dynamics. Furthermore, the change in the 25-delta FX option risk reversal (ΔRR_t) is added to capture variations in the cost of hedging against large currency depreciations, thereby addressing tail risk in FX markets. In addition, we control for bond market conditions through two supplementary indicators. First, we consider the change in the sovereign yield spread, defined as the difference between the 10-year government bond yield of country i and the 10-year US Treasury yield, $\Delta\text{YSPRD}_t = \Delta(y_t^i - y_t^{US})$. Second, we include the change in the term spread differential, which measures the relative steepness of the yield curves between country i and the US, $\Delta\text{TSPRD}_t = \Delta(ts_t^i - ts_t^{US})$. These controls are designed to capture heterogeneity in monetary policy stances and differences in interest rate trajectories across countries.

Including the post-LIBOR period allows us to examine how the cessation of LIBOR and the transition to alternative reference rates, such as SOFR, affected the dynamics of cross-currency basis swap spreads. While post-LIBOR data may reflect structural changes in benchmark conventions and trading activity, analysing both periods side by side enables us to compare the stability of the asymmetric dollar-basis relationship before and after LIBOR phase-out.

4.2. Descriptive Statistics

This section provides descriptive statistics for the main variables used in the analysis. We summarise the cross-currency basis (XCB), the US dollar index (USD), and the VIX index across maturities for both the LIBOR and post-LIBOR periods, and report their key distributional features. In addition, we present the correlation patterns between ΔXCB, ΔUSD, and control variables, which serve to highlight the weak linear dependence in the data and motivate the use of threshold regression models in subsequent sections.

Table 1 reports the summary statistics of the cross-currency basis (XCB), the broad US dollar index (USD), and the VIX index across different maturities in the LIBOR period. We report XCB levels rather than changes because the level of the basis provides a more economically intuitive overview of deviations from covered interest parity (CIP), while our regressions later employ ΔXCB as the dependent variable. USD serves as the threshold

	Panel A 1Y	Panel B 5Y	Panel C 10Y	Panel D 20Y	Panel E 30Y
XCB	-14.40 (23.18)	-10.40 (25.60)	-7.85 (26.70)	-5.00 (24.10)	-8.86 (19.69)
USD		102.07 (10.23)			102.14 (10.41)
VIX		18.97 (9.23)			19.20 (9.31)

Table 1: LIBOR period: Mean and standard deviation (in parentheses) of XCB, USD, and VIX across different maturities, grouped into Panels A-E. For USD and VIX, identical values across 1Y to 20Y are reported once in the middle column.

variable in our panel regressions, and VIX proxies global risk sentiment. Values of USD and VIX are identical across 1Y, 5Y, 10Y and 20Y because they do not depend on maturity. Slight differences at 30Y arise due to missing long-term XCB series for some currencies; to maintain a balanced panel, sample periods are aligned, which alters the reported means and volatilities of USD and VIX. The data further show that XCB levels are persistently negative across all maturities, consistent with CIP deviations during the LIBOR period. The cross-currency basis is most negative at the short end, with the 1Y average at -14.40 bps. At longer maturities, the basis narrows, reaching -7.85 bps at 10Y and -5.00 bps at 20Y, before widening slightly again at 30Y (-8.86 bps). Volatility is substantial across all horizons, with standard deviations ranging from 23 to 27 bps at the 1Y-20Y maturities, and declining only at the 30Y tenor (19.69). This pattern indicates that both short- and medium-term funding markets are highly sensitive to fluctuations, while stability improves only at the very long end. The USD index averages about 102 with a standard deviation near 10, reflecting moderate dollar strength, while the VIX averages around 19 with a dispersion of 9, consistent with elevated but variable global risk sentiment.

	Panel A 1Y	Panel B 5Y	Panel C 10Y	Panel D 20Y	Panel E 30Y
XCB	-24.96 (19.65)	-23.13 (23.32)	-22.38 (26.82)	-24.99 (27.89)	-30.59 (24.59)
USD			122.67 (2.78)		
VIX			18.37 (5.35)		

Table 2: Post-LIBOR period: Mean and standard deviation (in parentheses) of XCB, USD, and VIX across different maturities, grouped into Panels A-E. For USD and VIX, identical values across all maturities are reported once in the middle column.

Table 2 reports the post-LIBOR summary statistics of the cross-currency basis (XCB), the US dollar index (USD), and the VIX across different maturities. The results show that XCB levels remain negative across the curve, with the 1Y basis averaging -24.96 bps and the 30Y basis -30.59 bps, indicating that CIP deviations persisted beyond the LIBOR era. Volatility is substantial at all maturities, with standard deviations between 19.65 and 27.89 bps. The USD index averages 122.67 with a relatively low dispersion of 2.78, while the VIX averages 18.37 with a standard deviation of 5.35, reflecting modest variability in global risk sentiment during the sample.

Comparing Tables 1 and 2, CIP deviations remain a structural feature across both periods, but their distribution changes. During the LIBOR period, deviations of cross-currency basis are larger at the short end and narrowed toward longer maturities, consistent with short-term funding markets bearing the brunt of dollar funding pressures. In the post-LIBOR period,

by contrast, deviations are smaller at the short end and become deeper and more persistent across the curve. This change suggests that funding frictions did not disappear with the end of LIBOR but instead became more evenly spread—and in some cases more severe—at longer maturities.

	ΔXCB				
	Panel A 1Y	Panel B 5Y	Panel C 10Y	Panel D 20Y	Panel E 30Y
ΔUSD	-0.17***	-0.16***	-0.11***	-0.09***	-0.10***
ΔVIX	-0.18***	-0.15***	-0.09***	-0.07***	-0.06***
ΔRR	0.04***	0.06***	0.04***	0.06***	0.07***
ΔIV	-0.23***	-0.20***	-0.15***	-0.13***	-0.13***
ΔYSPRD	0.07***	0.07***	0.04***	0.04***	0.05***
ΔTSPRD	-0.05***	-0.06***	-0.06***	-0.06***	-0.05***

Table 3: LIBOR period: Correlations among ΔXCB, ΔUSD, and other control variables across maturities. *Notes:* $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

Table 3 shows the correlations among ΔXCB, ΔUSD, and other control variables across different maturities in the LIBOR period. Overall, the coefficients are modest in size, although all of them are statistically significant. This suggests that simple linear dependence between ΔXCB and its potential drivers is weak, and that the explanatory variables do not move in lockstep with changes in the basis. Instead, their influence on ΔXCB is likely to be state-dependent, varying across different market environments. The weak unconditional correlations, therefore, highlight the limitations of a purely linear specification and motivate the use of threshold regression models, which are better suited to capture non-linear and regime-specific relationships in the data.

	ΔXCB				
	Panel A 1Y	Panel B 5Y	Panel C 10Y	Panel D 20Y	Panel E 30Y
ΔUSD	-0.13***	-0.13***	-0.11***	-0.05***	-0.01***
ΔVIX	-0.12***	-0.08***	-0.16***	-0.07***	-0.06***
ΔRR	0.04***	0.04***	0.06***	0.02***	0.03***
ΔIV	-0.13***	-0.19***	-0.17***	-0.13***	-0.08***
ΔYSPRD	0.10***	0.11***	0.08***	0.05***	0.03***
ΔTSPRD	0.05***	0.03***	0.02***	0.003***	-0.01***

Table 4: Post-LIBOR period: Correlations among ΔXCB, ΔUSD, and other control variables across maturities. *Notes:* $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

Table 4 shows the correlations among ΔXCB, ΔUSD, and other control variables across different maturities in the post-LIBOR period. This constraint reduces the effective sample size and may contribute to the weaker statistical precision observed in some coefficients. Across maturities, the correlations remain generally modest in magnitude and all significant, consistent with the LIBOR period results. ΔXCB tends to be negatively associated with ΔUSD, ΔVIX, and ΔIV, suggesting that dollar appreciations, higher market volatility, and rising implied uncertainty continue to coincide with a widening of the basis. The patterns are broadly consistent with those in the LIBOR period. Compared to the LIBOR sample, how-

ever, the post-LIBOR dataset is much shorter, which reduces statistical precision and makes these correlations less stable across maturities. These results highlight both the limitations of relying solely on linear correlations and the constraints imposed by the short post-LIBOR sample, thereby motivating the use of more flexible econometric approaches in the subsequent analysis to better capture potential nonlinear and regime-dependent dynamics.

4.3. Panel Nonstationarity

This section examines the unit root properties of both the dependent and independent variables to guide the appropriate empirical specification. A central issue in panel unit root testing is the presence of cross-sectional dependence, which is pervasive in international financial data due to common global shocks. When such dependence is present, standard first-generation panel unit root tests become invalid, requiring the use of second-generation tests that explicitly account for common factors.

We begin by implementing the Pesaran CD test across all variables. The results indicate strong and widespread cross-sectional dependence throughout the panel, consistent with the presence of global risk, liquidity, and monetary policy shocks affecting all currencies. This motivates the use of second-generation panel unit root tests, specifically the Pesaran (2007) CIPS test and the Bai and Ng (2004) PANIC decomposition.

Table 5 reports the results for the cross-currency basis (XCB) across maturities. The PANIC decomposition consistently identifies multiple nonstationary common factors, indicating nonstationarity of the variables and that persistence in the data is largely driven by shared global stochastic trends. At the same time, the Pesaran CIPS test rejects the null of a panel unit root across all maturities, suggesting that the series are stationary once cross-sectional dependence is properly accounted for. Taken together, these results provide mixed evidence: the data exhibit strong persistence given its verifiable nonstationarity, yet display stationary behaviour for some observed series.

The pattern of mixed stationarity is remarkably consistent across the entire maturity spectrum, from short- to long-term contracts, indicating that the observed persistence is a structural feature of the basis data rather than maturity-specific behaviour.

Maturity	**CSD (CD Test)**	**PANIC Common Factors**	**PANIC Idiosyncratic**	**CIPS**	**Overall**
1Y	Strong ($p < 0.001$)	6 Nonstationary ($p > 0.99$)	Mixed	Reject unit root ($t = -3.46$)	Mixed evidence
5Y	Strong ($p < 0.001$)	6 Nonstationary ($p > 0.99$)	Mixed	Reject unit root ($t = -2.65$)	Mixed evidence
10Y	Strong ($p < 0.001$)	6 Nonstationary ($p > 0.99$)	Mostly nonstationary	Reject unit root ($t = -2.64$)	Mixed evidence
20Y	Strong ($p < 0.001$)	6 Nonstationary ($p > 0.99$)	Mixed	Reject unit root ($t = -2.57$)	Mixed evidence
30Y	Strong ($p < 0.001$)	6 Nonstationary ($p > 0.99$)	Mostly nonstationary	Reject unit root ($t = -2.90$)	Mixed evidence

Table 5: Panel unit root and cross-sectional dependence tests for XCB across maturities. *Notes*: CSD refers to cross-sectional dependence (Pesaran CD test). PANIC decomposes into common and idiosyncratic components. CIPS is the cross-sectionally augmented IPS test.

We next apply the same framework to the independent variables. The results, summarised in Table 6, reveal similarly strong cross-sectional dependence across most regressors, particularly global variables such as the broad dollar index, VIX, yield spreads, and implied volatility. The panel unit root tests again provide heterogeneous results. The CIPS test fails to reject the null of a unit root for the dollar and VIX, indicating nonstationarity, whereas it rejects it for risk reversals, yield spreads, term spreads, and implied volatility, suggesting stationarity once cross-sectional dependence is accounted for.

Consistent with the results for XCB, the PANIC decomposition indicates that nonstationary common factors largely drive persistence across regressors. Even in cases where CIPS suggests stationarity, the presence of strong global components highlights the importance of shared stochastic trends in driving the observed persistence in the data.

The panel unit root tests therefore indicate mixed persistence properties across variables under cross-sectional dependence. Accordingly, the baseline specification adopts first differences for the financial control variables in order to focus on short-horizon shocks to global risk sentiment, funding conditions, and FX market volatility rather than long-run level effects. This specification is also consistent with the use of weekly changes in the cross-currency basis as the dependent variable and helps ensure that the estimated coefficients capture contemporaneous financial shocks rather than persistent low-frequency comovements. Variables such as the VIX and FX implied volatility are often viewed as highly persistent but mean reverting; differencing these series therefore serves primarily as an economic specification choice aimed at isolating innovations in market conditions rather than as a strict transformation imposed solely by unit-root considerations.

Variable	**CSD (CD Test)**	**PANIC Common Factors**	**PANIC Idiosyncratic**	**CIPS**	**Overall**
USD	Strong ($p < 0.001$)	N/A	Nonstationary	Fail to reject unit root	Nonstationary
VIX	Strong ($p < 0.001$)	1 Stationary Factor	N/A	Fail to reject unit root	Mixed evidence
RR	Weak / Mixed ($p = 0.26$)	6 Nonstationary ($p > 0.99$)	Mostly Stationary	Reject unit root ($t = -4.10$)	Mixed evidence
YSPRD	Strong ($p < 0.001$)	6 Nonstationary ($p > 0.99$)	Mostly Nonstationary	Reject unit root ($t = -2.83$)	Mixed evidence
TSPRD	Strong ($p < 0.001$)	6 Nonstationary ($p > 0.99$)	Mostly Nonstationary	Reject unit root ($t = -3.11$)	Mixed evidence
IMP.VOL	Strong ($p < 0.001$)	6 Nonstationary ($p > 0.99$)	Stationary	Reject unit root ($t = -4.49$)	Mixed evidence

Table 6: Panel unit root and cross-sectional dependence tests for independent variables. *Notes*: CSD refers to cross-sectional dependence (Pesaran CD test). PANIC decomposes into common and idiosyncratic components. CIPS is the cross-sectionally augmented IPS test.

Taken together, the evidence across both dependent and independent variables points to a common empirical feature: strong cross-sectional dependence and persistence driven by global factors, alongside mixed stationarity results in direct unit root tests. This pattern is consistent with a setting in which global stochastic trends generate co-movement across currencies, even when individual series exhibit mean-reverting behaviour once such dependence is controlled

for.

The combination of strong cross-sectional dependence and evidence of nonstationary common factors motivates the use of a differenced specification in the main empirical analysis. Although some variables appear stationary under the CIPS test, the PANIC decomposition indicates that persistence is driven by latent global trends that may contaminate level-based regressions. Estimating models in levels in such an environment may therefore lead to spurious inference due to shared stochastic components arising from latent common factors that are not explicitly modeled. Differencing provides a conservative way to remove these common trends and isolate short-run dynamics.

This treatment also matches the economic interpretation of the empirical specification. Since the dependent variable is the change in the cross-currency basis, $\Delta XCB_{i,t}$, the regressions are designed to capture short-run responses of basis changes to changes in dollar conditions, risk sentiment, and currency-market uncertainty. In this sense, ΔVIX_t and $\Delta IV_{i,t}$ are interpreted as changes in aggregate risk sentiment and bilateral FX-implied volatility, respectively. They should therefore be read as shock-like controls rather than as long-run level determinants of the basis. Accordingly, all empirical specifications are estimated in first differences, and the resulting estimates should be interpreted as short-run responses rather than long-run equilibrium relationships.

4.4. Empirical Results

This section presents the threshold regression results for the G10 currency panel across both the LIBOR and post-LIBOR periods. The estimates provide baseline evidence on whether dollar-regime dependence systematically shapes the cross-currency basis over time. During the LIBOR era, the analysis focuses on benchmark dynamics under the traditional LIBOR reference rate, while in the post-LIBOR period, it extends to alternative benchmarks such as SOFR and related reference rates. Comparing these two sub-periods allows us to assess how the transition away from LIBOR has affected the regime-dependent behaviour of the cross-currency basis.

	Panel A 1 Year	Panel B 5 Year	Panel C 10 Year	Panel D 20 Year	Panel E 30 Year
USD_τ	105.34***	105.45***	111.76***	111.76***	111.76***
$\Delta\text{USD}_{\text{Low}}$	-0.88***	-0.59***	-0.32***	-0.28***	-0.32***
$\Delta\text{USD}_{\text{High}}$	0.34**	0.21***	0.31***	0.26***	0.16**
ΔVIX	-0.09***	-0.04***	-0.01	-0.01	-0.0002
ΔRR	-0.13	0.10	0.04	0.25***	0.43***
ΔIV	-0.88***	-0.43***	-0.35***	-0.32***	-0.34***
ΔYSPRD	4.15***	2.45***	1.32***	1.30***	1.94***
ΔTSPRD	-1.87***	-1.51***	-1.14***	-1.32***	-1.50***
Currency (N)	10	10	10	10	9
Week (T)	883	883	883	883	851
Within R^2	9.16%	8.24%	4.48%	3.27%	3.35%

Table 7: LIBOR period: Panel threshold regression. *Notes:*$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$. The 30-year tenor only has 9 currencies because NZD does not have observations at this maturity.

Table 7 reports the results of the threshold panel regression across maturities in the LIBOR period. The estimated threshold values are significant and stable around 105-112, suggesting consistent regime-dependent points across the term structure. For all maturities,

the coefficient on $\Delta\text{USD}_{\text{Low}}$ is significantly negative, while that on $\Delta\text{USD}_{\text{High}}$ is significantly positive, confirming the presence of an asymmetric response of the basis to dollar fluctuations. Specifically, the negative sensitivity in the low regime is considerably larger in magnitude than the positive response in the high regime, indicating that the basis is substantially more sensitive to dollar movements in the low-dollar regime than in the high-dollar regime. Among the control variables, ΔIV is consistently negative and significant across maturities, and ΔVIX is significantly negative mostly at shorter maturities, highlighting the role of risk sentiment in widening the basis. ΔYSPRD enter positively and significantly, while ΔTSPRD loads negatively, though the significance attenuates at longer horizons. ΔRR only becomes significant at the long end (20-30 years), suggesting that interest rate parity considerations matter more for the ultra-long maturities. The results point to strong regime-dependent dynamics in the cross-currency basis, showing that the dollar exerts an asymmetric effect across regimes, while risk sentiment dominates at shorter maturities and rate differentials gain relevance at the long end.

	Panel A 1 Year	Panel B 5 Year	Panel C 10 Year	Panel D 20 Year	Panel E 30 Year
USD_τ	(121.17, 121.40)**	—	(121.10, 121.59)**	(121.05, 121.61)**	—
$\Delta\text{USD}_{\text{Low}}$	-0.20*	—	-0.04	0.01	—
$\Delta\text{USD}_{\text{Med}}$	-2.93***	—	-0.94***	-0.82***	—
$\Delta\text{USD}_{\text{High}}$	-0.11	-0.10	0.01	0.12**	0.07
ΔVIX	-0.09***	-0.06***	-0.06***	-0.05***	-0.04
ΔRR	0.08	0.10	0.09	-0.12	0.08
ΔIV	-0.09	-0.33*	-0.26***	-0.31***	-0.25
ΔYSPRD	2.15***	1.37*	1.32***	1.10***	0.78
ΔTSPRD	0.72	0.35	0.11	-0.34	-0.42
Currency (N)	10	10	10	10	9
Week (T)	164	164	164	164	164
Within R^2	7.14%	6.34%	6.17%	3.76%	1.17%

Table 8: Post-LIBOR period: Panel threshold regression. *Notes:*$^{*}p < 0.10$,$^{**}p < 0.05$,$^{***}p < 0.01$. The 30-year tenor only has 9 currencies because NZD does not have observations at this maturity. A dash (—) indicates no significant coefficient or no threshold identified. In these cases, the specification reduces to a linear fixed-effects regression with two-way clustered standard errors (currency × week). We report only the baseline slope of the dollar factor rather than regime-specific coefficients.

Table 8 reports the results of the threshold panel regression across maturities in the post-LIBOR period. For the short-term, the 1-year tenor exhibits a significant double-threshold effect, with values identified at 121.17 and 121.40. In this maturity, the slope of the dollar factor is significantly negative in the medium regime (-2.93), while the low and high regimes are small and insignificant, indicating that nonlinear effects remain concentrated around the middle range of the dollar index. By contrast, the 5-year tenor shows no evidence of threshold nonlinearity, and the dollar factor slope is not statistically significant. For the longer maturities (10- and 20-year), significant threshold effects are identified at 121.10-121.59 and 121.05-121.61, respectively. Similar to the 1-year results, the medium regime slopes are strongly negative, while the high regime turns weakly positive. At the 30-year tenor, no threshold effect is detected, and the dollar factor slope remains insignificant overall. Among control variables, ΔVIX is significantly negative relative to ΔXCB across shorter maturities, but the relationship becomes weaker thereafter. ΔRR and ΔIV have limited explanatory power and

ΔYSPRD remain positive and significant across maturities.

In the post-LIBOR period, the estimated threshold effects are weaker and less consistent than during the LIBOR era. At several maturities, the model fails to identify a significant regime structure and collapses into a linear fixed-effects specification, while at the 1Y, 10Y, and 20Y tenors the tests detect double-threshold patterns rather than a single cut-off. In these cases, the strongest effects of $\Delta\text{USD}_{\text{Med}}$ emerge when the dollar index lies in the intermediate regime, indicating that basis spreads respond most strongly to dollar fluctuations when the dollar is at a mid-range level, whereas the low- and high-regime coefficients are weak or insignificant. This non-monotonic pattern may reflect structural changes in funding markets during the transition to SOFR, when pricing conventions and liquidity conditions were still adjusting. It is also likely amplified by econometric constraints: the post-LIBOR sample covers only a little over three years, compared with more than a decade of LIBOR observations. The shorter sample reduces the statistical power of the bootstrap procedure and increases the risk of either failing to reject linearity or detecting unstable threshold patterns. The comparison therefore suggests that the regime-dependent role of the dollar has both attenuated and fragmented in the post-LIBOR environment, reflecting a combination of genuine structural change and limitations imposed by shorter data coverage.

While the baseline results reveal substantial heterogeneity in the sensitivity of cross-currency basis spreads across maturities, with some tenors exhibiting stronger responses than others, these patterns are inferred from separate regressions and are therefore descriptive. To formally assess whether the sensitivity of the basis to dollar movements differs between maturities, the term structure of the dollar-basis relationship must be examined within an extended empirical framework. This term structure analysis follows after completing the robustness analysis of the baseline results below.

4.5. Robustness Checks

To assess the robustness of our baseline results, we implement the following complementary exercises. First, we re-estimate the panel threshold regressions using Driscoll-Kraay standard errors, which provide consistent inference under serial correlation and cross-sectional dependence. Second, we strengthen the bootstrap procedure to ensure that our inference is not sensitive to computational settings. Finally, we perform group-wise regressions by separating core and commodity currencies, thereby testing whether the asymmetric sensitivity of ΔXCB to ΔUSD is concentrated in core currencies linked more closely to global funding markets, as opposed to commodity currencies whose dynamics are more tied to terms-of-trade fundamentals. Together, these robustness checks confirm that our findings are not driven by fragile inference methods, sample composition, or bootstrap design.

4.5.1. Driscoll-Kraay SE Results

As a robustness check, we re-estimate the panel threshold regressions using Driscoll-Kraay standard errors. This approach adjusts the standard errors to remain valid in the presence of serial correlation and cross-sectional correlation in the panel residuals, thereby ensuring that the statistical inference regarding the regime-dependent effects is reliable. The specification follows the common-threshold approach, where the estimated threshold value is applied uniformly across currencies to construct regime indicators. These indicators are then interacted with dollar fluctuations to capture differential sensitivities of ΔXCB to ΔUSD across low-, med-, and high-dollar regimes (see Table 9). By combining the common-threshold framework

with Driscoll-Kraay inference, the analysis ensures that the detected regime dependence is not an artefact of fragile standard errors or correlation structures in the panel data.

	Panel A 1 Year	Panel B 5 Year	Panel C 10 Year	Panel D 20 Year	Panel E 30 Year
$\Delta USD_t \times H_H$	1.22***	0.80***	0.59***	0.51***	0.45***
ΔUSD_{Low}	-0.88***	-0.59***	-0.31***	-0.27***	-0.31***
ΔUSD_{High}	0.34	0.21**	0.28***	0.24***	0.14
ΔVIX	-0.09**	-0.04**	-0.01	-0.01	-0.0003
ΔRR	-0.13**	0.10	0.04	0.25	0.43**
ΔIV	-0.88**	-0.43***	-0.35***	-0.32***	-0.34***
ΔYSPRD	4.15**	2.45***	1.34***	1.32***	1.97***
ΔTSPRD	-1.87**	-1.51***	-1.15***	-1.32***	-1.51***
Within R^2	9.16%	8.24%	4.36%	3.20%	3.28%

Table 9: LIBOR period: Panel threshold regression (Driscoll-Kraay SE) across maturities.*Notes:* $^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$.

Table 9 reports the panel threshold regression results for the LIBOR period across maturities using Driscoll-Kraay standard errors as robustness checks. The results closely mirror the baseline findings, confirming the robustness of the estimated coefficients to alternative inference procedures that account for both cross-sectional and serial correlation. The interaction term, $\Delta USD_t \times H_H$, is significant and positive across maturities, indicating that the marginal effect of dollar changes becomes less negative once the dollar index moves above the threshold. In other words, basis widening in response to dollar appreciations is most pronounced when the dollar is relatively weak, whereas in high-dollar regimes, the sensitivity of the basis to dollar fluctuations is mitigated. This asymmetry highlights the role of dollar regime in amplifying funding frictions during the LIBOR period. ΔUSD_{Low} is consistently negative and statistically significant, showing that dollar appreciations systematically widen the cross-currency basis when the USD index is below the threshold. However, ΔUSD_{High} continues to display inverse or insignificant effects, reinforcing the baseline interpretation of asymmetric regime dependence. Control variables also maintain their expected signs and levels of significance under the DK specification. The consistency of these results with the baseline confirms that the identified regime-dependent dynamics are not driven by fragile inference or spurious significance due to correlation structures.

Table 10 reports the panel threshold regression results for the post-LIBOR period across maturities using Driscoll-Kraay standard errors as robustness checks. The results broadly confirm the previous baseline findings. Among the interaction terms, only the medium-regime displacement is statistically significant, and it consistently enters with a negative sign, indicating that dollar funding frictions are most acute when the dollar index is in a moderate range, as appreciations in this regime are associated with a significant widening of the basis, whereas no comparable effects arise in low or high regimes. Across maturities, the regime-specific coefficients remain largely consistent in both sign and significance. In particular, the medium-regime effect continues to dominate at the short and medium tenors (1Y, 10Y, 20Y), where ΔUSD_{Med} is negative and highly significant, suggesting that changes in dollar under moderate dollar index levels are associated with the strongest basis widening. The coefficients on ΔUSD_{Low} and ΔUSD_{High} remain small and statistically weak, as in the baseline. The overall maturity pattern and the central role of the medium regime are preserved. These results indicate that the post-LIBOR threshold effects are not driven by conventional inference

	Panel A 1 Year	Panel B 5 Year	Panel C 10 Year	Panel D 20 Year	Panel E 30 Year
$\Delta USD_t \times H_M$	-2.72***	—	-0.77**	-0.01**	—
$\Delta USD_t \times H_H$	0.09	—	0.04	0.10	—
ΔUSD_{Low}	-0.20	—	-0.05	0.01	—
ΔUSD_{Med}	-2.92***	—	-0.81***	-0.89***	—
ΔUSD_{High}	-0.11	-0.10	-0.002	0.12	0.07
ΔVIX	-0.09**	-0.06***	-0.06**	-0.05**	-0.04
ΔRR	0.08	0.10	0.09	-0.13	0.08
ΔIV	-0.09	-0.33**	-0.27**	-0.30**	-0.04*
ΔYSPRD	2.15***	1.37***	1.28**	1.04	0.78
ΔTSPRD	0.72	0.35	0.16	-0.26	-0.42
Within R^2	7.14%	6.34%	5.80%	3.72%	1.17%

Table 10: Post-LIBOR period: Panel threshold regression (Driscoll-Kraay SE) across maturities.*Notes:* $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$. A dash (—) indicates no significant coefficient or no threshold identified.

issues, and the conclusions are robust to alternative standard error specifications.

4.5.2. More Bootstrap Settings Results

This section complements the baseline analysis by varying both the trimming fraction and the number of bootstrap replications. In the baseline specification, the trimming fraction is set to 0.05. As a robustness check, we also consider higher trimming fractions of 0.10 to mitigate the risk of sparse tails, and the results remain qualitatively unchanged. In addition, we increase the number of bootstrap replications from 500 to 1000, which provides a more accurate approximation of the simulated distribution of the test statistics. The stability of the results across these alternative settings confirms that our inference regarding threshold effects is not sensitive to either the trimming choice or the bootstrap design.

	Panel A 1 Year	Panel B 5 Year	Panel C 10 Year	Panel D 20 Year	Panel E 30 Year
USD_τ	105.39***	105.39***	111.76***	111.76***	111.76***
ΔUSD_{Low}	-0.88***	-0.60***	-0.32***	-0.28***	-0.32***
ΔUSD_{High}	0.34***	0.21***	0.31***	0.26***	0.16**
ΔVIX	-0.09***	-0.04***	-0.01	-0.01	-0.0002
ΔRR	-0.13	0.10	0.04	0.25***	0.43***
ΔIV	-0.88***	-0.43***	-0.35***	-0.32***	-0.34***
ΔYSPRD	4.14***	2.45***	1.32***	1.30***	1.94***
ΔTSPRD	-1.87***	-1.51***	-1.14***	-1.32***	-1.50***
Currency (N)	10	10	10	10	9
Week (T)	883	883	883	883	851
Within R^2	9.17%	8.26%	4.48%	3.27%	3.35%

Table 11: LIBOR period: Panel threshold regression (trimming0.10 bootstrap1000) across maturities. *Notes:* $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$. The 30-year tenor only has 9 currencies because NZD does not have observations at this maturity.

Table 11 shows the LIBOR panel threshold regressions estimated with a 0.10 trimming fraction and 1000 bootstrap replications. Across maturities, the estimates continue to reveal a clear regime dependence, with low-dollar states associated with negative and significant coefficients and high-dollar states associated with positive coefficients of comparable magnitude.

The consistency of these results with the baseline demonstrates that the observed asymmetry between depreciation and appreciation regimes is robust to more conservative trimming and bootstrap settings. Table 12 shows the post-LIBOR panel threshold regressions estimated

	Panel A 1 Year	Panel B 5 Year	Panel C 10 Year	Panel D 20 Year	Panel E 30 Year
USD_τ	(121.17, 121.60)**	(121.10, 121.59)***	(121.10, 121.59)**	(121.05, 121.61)**	(121.05, 121.41)*
$\Delta\text{USD}_{\text{Low}}$	-0.19*	-0.05	-0.04	0.01***	0.06
$\Delta\text{USD}_{\text{Med}}$	-1.76**	-0.99***	-0.94***	-0.82***	-1.29***
$\Delta\text{USD}_{\text{High}}$	-0.05	-0.04	0.01	0.13**	0.13**
ΔVIX	-0.10***	-0.06***	-0.06***	-0.05***	-0.04**
ΔRR	0.10	0.10	0.09	-0.12	0.06
ΔIV	-0.09	-0.27***	-0.26***	-0.31***	-0.22*
ΔYSPRD	2.26***	1.58***	1.32***	1.10***	0.86*
ΔTSPRD	0.65	0.24	0.11	-0.34	-0.52
Currency (N)	10	10	10	10	9
Week (T)	164	164	164	164	164
Within R^2	7.10%	7.95%	6.17%	3.76%	2.22%

Table 12: Post-LIBOR period: Panel threshold regression (trimming0.10 bootstrap1000) across maturities. *Notes:* $^*p < 0.10$,$^{**}p < 0.05$,$^{***}p < 0.01$. The 30-year tenor only has 9 currencies because NZD does not have observations at this maturity.

with a 0.10 trimming fraction and 1000 bootstrap replications. The overall pattern of weak threshold effects in the post-LIBOR sample largely remains. For 1Y, 10Y, and 20Y tenors, the estimates are broadly consistent with the baseline results, with limited evidence of regime dependence. In contrast, the 5Y and 30Y tenors now display double-threshold structures, with some regime-specific coefficients appearing significant. However, these findings do not indicate genuine threshold effects. Instead, they illustrate the sensitivity of the threshold tests to specification choices and the limitations imposed by the short post-LIBOR sample. The robustness check confirms that post-LIBOR threshold effects are weak, fragile, and highly dependent on model settings.

4.5.3. Group-wise Panel Results

This section re-estimates the panel threshold regressions by splitting the sample into core and commodity currency groups. The core group includes EUR, JPY, DKK, CHF, GBP, and SEK, while the commodity group consists of AUD, NZD, NOK, and CAD. This classification reflects the distinction between currencies closely tied to global funding markets and those more exposed to commodity-driven fundamentals. On this basis, the group-wise regressions serve a primarily diagnostic role by identifying whether the threshold effects observed in the aggregate panel are concentrated within specific currency subsets.

Table 13 presents the group-wise threshold regressions for the LIBOR period. The results indicate that the threshold effect observed in the baseline panel is largely driven by the core currency group. Within core currencies, threshold values are stable across maturities, and the coefficients are identical to those in baseline results and display a clear regime-dependent asymmetry. In the low-USD regime, $\Delta\text{USD}_{\text{Low}}$ remains negative and significant cross-maturities. In the high-USD regime, $\Delta\text{USD}_{\text{High}}$ is significantly positive but smaller in magnitude. In contrast, the commodity currency group exhibits no robust evidence of threshold nonlinearity across maturities. The estimated coefficients are small in magnitude and lack

Group A: Core					
	1Y	5Y	10Y	20Y	30Y
USD_τ	105.34***	105.45***	111.76***	111.76***	111.76***
$\Delta\text{USD}_{\text{Low}}$	-1.28***	-0.80***	-0.49***	-0.36***	-0.36***
$\Delta\text{USD}_{\text{High}}$	0.45***	0.22***	0.39***	0.41***	0.39***
ΔVIX	-0.14***	-0.04***	-0.02**	-0.02**	-0.01
ΔRR	-0.15	0.22*	-0.05	-0.08	-0.10
ΔIV	-1.36***	-0.51***	-0.35***	-0.23***	-0.20***
ΔYSPRD	4.94***	2.36***	1.15***	0.97**	1.31***
ΔTSPRD	-3.43***	-1.82***	-1.21***	-1.16***	-0.47
Within R^2	14.10%	10.15%	6.16%	3.72%	3.31%
Group B: Commodity					
	1Y	5Y	10Y	20Y	30Y
USD_τ	—	—	—	—	—
$\Delta\text{USD}_{\text{Low}}$	—	—	—	—	—
$\Delta\text{USD}_{\text{High}}$	-0.04	-0.05	0.03	0.07	-0.29
ΔVIX	-0.03	-0.04	0.0004	0.01	0.03
ΔRR	-0.04	0.02	-0.21	0.67	1.63**
ΔIV	-0.42	-0.36	-0.36	-0.44	-0.66**
ΔYSPRD	4.23*	2.89	1.67	1.66**	2.28
ΔTSPRD	-0.96	-1.29	-1.09	-1.3	-2.38
Within R^2	3.92%	5.66%	3.20%	4.00%	7.06%

Table 13: LIBOR period: Group-wise Panel threshold regression. *Notes:* $^*p < 0.10$,$^{**}p < 0.05$,$^{***}p < 0.01$. A dash (—) indicates no significant coefficient or no threshold identified. In these cases, the specification reduces to a linear fixed-effects regression with two-way clustered standard errors (currency × week). We report only the baseline slope of the dollar factor rather than regime-specific coefficients.

stability, suggesting that the basis dynamics of commodity-linked currencies are less sensitive to regime shifts in the dollar index. The absence of a consistent threshold structure indicates that the regime dependence documented in the aggregate sample is primarily attributable to the core currencies. Therefore, the group-wise analysis shows that the overall threshold effect is not uniform across currencies but concentrated in core currencies closely linked to global funding conditions.

Table 14 presents the group-wise threshold regressions for the post-LIBOR period. The results show that threshold effects are weak and uneven across currency groups. For the core currencies, regime dependence appears only at selected maturities: at the 1Y tenor, the medium-regime coefficient is strongly negative, while at longer maturities (20Y and 30Y) some significant effects emerge, though the overall pattern is less stable than in the baseline. In contrast, the commodity currencies display almost no consistent threshold structure, with only an isolated significant result at the 5Y tenor. The explanatory power of the commodity regressions remains very low across maturities. These discrepancies between the baseline and group-wise results indicate that the post-LIBOR threshold effects are fragile. The disappearance of the 10Y threshold once currencies are separated, together with the emergence of new thresholds at the 5Y and 30Y maturities, highlights the strong sensitivity of the results to sample composition and model specification. However, rather than confirming genuine regime dependence, such findings suggest that the post-LIBOR thresholds are fragile and should be interpreted with caution.

	1Y	5Y	10Y	20Y	30Y
Group A: Core					
USD_τ	(121.17, 121.40)***	—	—	(121.05, 121.61)**	(121.05, 121.61)*
$\Delta\text{USD}_{\text{Low}}$	-0.24	—	—	0.03	-0.02
$\Delta\text{USD}_{\text{Med}}$	-5.53***	—	—	-1.13***	-1.08***
$\Delta\text{USD}_{\text{High}}$	-0.24**	-0.13	-0.08	0.10	0.11
ΔVIX	-0.13***	-0.08***	-0.08**	-0.07***	-0.06***
ΔRR	0.45	0.24	0.20	0.03	0.09
ΔIV	-0.21	-0.52*	-0.47	-0.43***	-0.33**
ΔYSPRD	2.14***	1.71	1.41	1.47**	1.02
ΔTSPRD	0.81	0.68	0.47	-0.27	-0.45
Within R^2	16.54%	9.92%	7.33%	6.43%	3.97%
Group B: Commodity					
USD_τ	—	123.87*	—	—	—
$\Delta\text{USD}_{\text{Low}}$	—	-0.16***	—	—	—
$\Delta\text{USD}_{\text{High}}$	0.03	0.12	-0.04	0.10	0.25
ΔVIX	-0.04	-0.03*	-0.02*	-0.01	-0.002
ΔRR	-0.79	-0.36*	-0.20	-0.44*	-0.31
ΔIV	0.06	0.03	-0.06	-0.16	-0.02
ΔYSPRD	1.89*	0.84**	0.63	0.31	0.86
ΔTSPRD	0.55	-0.31	-0.23	-0.32	-0.85
Within R^2	2.11%	3.64%	1.51%	0.77%	1.42%

Table 14: Post-LIBOR period: Group-wise Panel threshold regression. *Notes:* $^*p < 0.10$,$^{**}p < 0.05$,$^{***}p < 0.01$. A dash (—) indicates no significant coefficient or no threshold identified. In these cases, the specification reduces to a linear fixed-effects regression with two-way clustered standard errors (currency × week). We report only the baseline slope of the dollar factor rather than regime-specific coefficients.

4.6. Term Structure of Cross-Currency Basis Sensitivity

To formally evaluate whether the sensitivity of cross-currency basis spreads to dollar movements varies across maturities, we examine the term structure of the dollar–basis relationship in a unified stacked panel framework. This exercise tests the broader implication of Proposition 4 that maturity matters for the transmission of dollar shocks into basis spreads, while allowing the data to determine whether the dominant channel operates through short-term funding pressure, intermediate-tenor institutional hedging, or both.

Specifically, we estimate the following stacked panel regression:

$$\Delta XCB_{i,t}^{(\tau)} = \mu_i + \lambda_\tau + \sum_{\tau \in \mathcal{T}} \beta_\tau \left(\Delta USD_t \times \mathbf{1}_\tau\right) + \Gamma' Z_{i,t}^{(\tau)} + u_{i,t}^{(\tau)}, \tag{30}$$

where $\mathbf{1}_\tau$ is an indicator for maturity $\tau \in \{1Y, 5Y, 10Y, 20Y, 30Y\}$, μ_i denotes country fixed effects, λ_τ denotes maturity fixed effects, and $Z_{i,t}^{(\tau)}$ includes the full set of controls from the baseline specification.

Table 15 provides clear evidence that the response of cross-currency basis spreads to dollar movements is not uniform along the maturity spectrum. The strongest sensitivity is concentrated at the short end of the curve: the coefficient on the 1Y interaction is -0.5705^{***}, both economically large and statistically significant. The 5Y coefficient remains negative and statistically significant at -0.2072^{***}, but is much smaller in magnitude. By contrast, the coefficients at 10Y, 20Y, and 30Y are all close to zero and statistically insignificant.

Maturity interaction	**Coefficient**	**p-value**
$\Delta USD_t \times \mathbf{1}_{1Y}$	-0.5705^{***}	0.001
$\Delta USD_t \times \mathbf{1}_{5Y}$	-0.2072^{***}	0.001
$\Delta USD_t \times \mathbf{1}_{10Y}$	-0.0110	0.821
$\Delta USD_t \times \mathbf{1}_{20Y}$	0.0139	0.785
$\Delta USD_t \times \mathbf{1}_{30Y}$	-0.0447	0.584
ΔVIX_t	-0.0406^{***}	0.001
ΔRR_t	0.1599	0.447
$\Delta YSPRD_t$	2.5725^{***}	0.000
$\Delta TSPRD_t$	-1.6383^{**}	0.027
ΔIV_t	-0.4505^{***}	0.001
Country fixed effects	Yes	
Maturity fixed effects	Yes	
Observations	43,126	
R^2	0.047	

Wald Tests for Equality of Dollar-Sensitivity Coefficients

Test	χ^2	p-value
$H_0: \ \beta_{5Y} = \beta_{1Y}$	6.09	0.014
$H_0: \ \beta_{10Y} = \beta_{1Y}$	11.80	0.001
$H_0: \ \beta_{5Y} = \beta_{30Y}$	1.56	0.211

Table 15: Term Structure of Dollar Sensitivity in Cross-Currency Basis. Notes: The dependent variable is $\Delta XCB_{i,t}^{(\tau)}$. The regression is estimated on the stacked panel of all maturities with country and maturity fixed effects. Standard errors are clustered by currency. *Notes:* $^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$.

The Wald tests confirm that this heterogeneity is not merely visual. The equality of the 1Y and 5Y coefficients is rejected at the 5% level, and the equality of the 1Y and 10Y coefficients is rejected at the 1% level. This establishes that the short end, and to some extent intermediate end, responds significantly more strongly to dollar movements than the longer portions of the curve. At the same time, the null that the 5Y and 30Y coefficients are equal cannot be rejected, indicating that the intermediate-tenor effect, while statistically present, is not sufficiently distinct from the long end in this specification.

Economically, these results imply that the transmission of dollar shocks into the cross-currency basis is driven primarily by short-term funding conditions rather than by a hump-shaped "belly effect." The very large 1Y response is consistent with a funding-liquidity channel in which rollover risk, balance-sheet constraints, and immediate dollar funding pressure are most binding at short maturities. The significant but attenuated 5Y coefficient suggests that institutional hedging demand may still matter at intermediate maturities, but it does not dominate the overall term-structure pattern. At longer maturities, the sensitivity fades substantially, consistent with more stable long-horizon positions and reduced exposure to short-term funding shocks.

Taken together, the evidence points to a downward-sloping term structure of dollar sensitivity in cross-currency basis spreads. Thus, while Proposition 4 correctly emphasises that maturity matters, the data indicate that short-term funding frictions dominate in practice, with institutional hedging effects appearing secondary rather than primary in the observed term-structure profile. We next examine whether this pattern is robust to alternative estimators and inference procedures.

4.7. Term Structure of Regime-Dependent Dollar Sensitivity in Cross-Currency Basis

To formally assess whether the threshold effects documented in the baseline maturity-by-maturity regressions also vary systematically along the term structure, we estimate a stacked panel regression that pools all maturities while preserving the regime classification already obtained in the baseline analysis. Specifically, for each maturity $\tau \in \{1Y, 5Y, 10Y, 20Y, 30Y\}$, we classify each observation into a low-dollar or high-dollar regime using the maturity-specific threshold estimated in the baseline threshold regressions. We then estimate:

$$\Delta XCB_{i,t}^{(\tau)} = \mu_i + \lambda_\tau + \sum_{\tau \in \mathcal{T}} \beta_\tau^L (\Delta USD_t \times \mathbf{1}_\tau \times \mathbf{1}[USD_t \leq c_\tau]) + \sum_{\tau \in \mathcal{T}} \beta_\tau^H (\Delta USD_t \times \mathbf{1}_\tau \times \mathbf{1}[USD_t > c_\tau]) + \Gamma' Z_{i,t}^{(\tau)} + u_{i,t}^{(\tau)} \tag{31}$$

where μ_i denotes country fixed effects, λ_τ denotes maturity fixed effects, c_τ is the baseline threshold for maturity τ, and $Z_{i,t}^{(\tau)}$ includes the full set of controls used in the baseline specification.

This framework allows us to test whether the regime-dependent pass-through of dollar movements differs not only across low- and high-dollar states, but also across maturities within each regime.

Table 16 shows that the regime-dependent dollar effect varies systematically across maturities, but the dominant pattern is concentrated at the short end rather than at the belly of the curve. In the low-dollar regime, dollar changes significantly widen the basis at every maturity, with the largest effect at 1Y (-1.1909^{***}), followed by 5Y (-0.5960^{***}), and much smaller effects at 10Y, 20Y, and 30Y. The Wald tests confirm that the short-end coefficient is significantly larger in magnitude than both the 5Y and 10Y coefficients.

In the high-dollar regime, the sign reverses: the estimated coefficients become positive at 1Y, 5Y, 10Y, and 20Y, implying that dollar changes are associated with a tightening of the basis in those states. These effects are statistically significant except at 30Y. The Wald tests again reject equality between the 1Y and both the 5Y and 10Y coefficients, confirming that the short end remains more sensitive even after conditioning on the threshold regimes.

Economically, these results indicate that the asymmetric threshold effects identified in the baseline regressions are strongest where short-term dollar funding pressures are most acute. The low-dollar regime is associated with especially strong widening pressure at short maturities, consistent with a funding-liquidity channel. The high-dollar regime, by contrast, weakens or reverses this effect, but the response still declines with maturity. Thus, once the threshold structure is imposed within the stacked panel, the data continue to support maturity-dependent asymmetry, but the term structure is downward sloping rather than hump-shaped.

Taken together, the stacked threshold results reinforce the central empirical message of the paper: the effect of dollar movements on cross-currency basis spreads is both regime-dependent and maturity-dependent. However, the strongest transmission occurs at the short end of the curve, indicating that short-term funding frictions dominate the empirical term-structure profile, while institutional hedging effects at intermediate maturities are present but secondary. The joint stacked-threshold results confirm that regime dependence and maturity heterogeneity interact in a systematic way, with the strongest effects concentrated at short maturities. Results are robust to alternative clustering schemes (see Appendix Table C.19).

Interaction term	**Coefficient**	**p-value**
$\Delta USD_t \times \mathbf{1}_{1Y} \times \mathbf{1}[USD_t \leq c_{1Y}]$	-1.1909^{***}	0.000
$\Delta USD_t \times \mathbf{1}_{5Y} \times \mathbf{1}[USD_t \leq c_{5Y}]$	-0.5960^{***}	0.000
$\Delta USD_t \times \mathbf{1}_{10Y} \times \mathbf{1}[USD_t \leq c_{10Y}]$	-0.2134^{**}	0.012
$\Delta USD_t \times \mathbf{1}_{20Y} \times \mathbf{1}[USD_t \leq c_{20Y}]$	-0.1629^{***}	0.007
$\Delta USD_t \times \mathbf{1}_{30Y} \times \mathbf{1}[USD_t \leq c_{30Y}]$	-0.2097^{***}	0.000
$\Delta USD_t \times \mathbf{1}_{1Y} \times \mathbf{1}[USD_t > c_{1Y}]$	0.1183^{***}	0.007
$\Delta USD_t \times \mathbf{1}_{5Y} \times \mathbf{1}[USD_t > c_{5Y}]$	0.2107^{***}	0.000
$\Delta USD_t \times \mathbf{1}_{10Y} \times \mathbf{1}[USD_t > c_{10Y}]$	0.3541^{***}	0.000
$\Delta USD_t \times \mathbf{1}_{20Y} \times \mathbf{1}[USD_t > c_{20Y}]$	0.3255^{***}	0.001
$\Delta USD_t \times \mathbf{1}_{30Y} \times \mathbf{1}[USD_t > c_{30Y}]$	0.2320	0.162
ΔVIX_t	-0.0299^{***}	0.007
ΔRR_t	0.1345	0.516
$\Delta YSPRD_t$	2.2639^{***}	0.000
$\Delta TSPRD_t$	-1.4757^{**}	0.027
ΔIV_t	-0.4648^{***}	0.000
Country fixed effects	Yes	
Maturity fixed effects	Yes	
Observations	43,126	
R^2	0.060	

Wald Tests for Equality of Coefficients

Test	χ^2	p-value
$H_0: \ \beta^L_{5Y} = \beta^L_{1Y}$	5.36	0.021
$H_0: \ \beta^L_{10Y} = \beta^L_{1Y}$	11.76	0.001
$H_0: \ \beta^L_{5Y} = \beta^L_{30Y}$	5.70	0.017
$H_0: \ \beta^H_{5Y} = \beta^H_{1Y}$	4.40	0.036
$H_0: \ \beta^H_{10Y} = \beta^H_{1Y}$	9.66	0.002
$H_0: \ \beta^H_{5Y} = \beta^H_{30Y}$	0.02	0.897

Table 16: Stacked Threshold Regression: Term Structure of Regime-Dependent Dollar Sensitivity. Notes: The dependent variable is $\Delta XCB^{(\tau)}_{i,t}$. Regimes are defined using the maturity-specific baseline thresholds: $c_{1Y} = 105.34$, $c_{5Y} = 105.45$, and $c_{10Y} = c_{20Y} = c_{30Y} = 111.76$. The regression is estimated on the stacked panel of all maturities with country and maturity fixed effects. Standard errors are clustered by currency. *Notes:* $^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$.

5. Conclusion and Implication

This paper provides a comprehensive analysis of the regime-dependent relationship between the US dollar and cross-currency basis swap spreads (XCB) across 1Y, 5Y, 10Y, 20Y, and 30Y maturities for the G10 currencies panel regarding both the LIBOR and post-LIBOR periods. While earlier research has largely emphasised balance-sheet constraints, our results suggest that investor hedging behaviour also plays an important role in shaping regime-dependent outcomes.

Our framework highlights the role of expectations-driven hedging behaviour in shaping cross-currency basis dynamics. Dollar-based and non-dollar-based investors respond differently to movements in the broad dollar, and these responses vary systematically with the dollar regime. In low-dollar regimes, dollar-based investors hedge less when the dollar appreciates, while non-dollar investors hedge more aggressively against the risk of depreciation, raising net demand for dollars in swap markets and widening the basis. In high-dollar regimes,

by contrast, dollar-based investors increase hedging of their foreign holdings in anticipation of continued dollar strength, while non-dollar investors reduce hedging to remain unhedged amid persistent appreciation. These adjustments increase the supply of dollars in swap markets, reducing—or at times overturning—the usual tendency for basis spreads to widen when the dollar appreciates.

The empirical evidence provides strong support for this mechanism during the LIBOR period, while the effects are weaker and less stable in the post-LIBOR sample. During the LIBOR period, dollar appreciations significantly widen the basis in low-dollar regimes, while the same effect diminishes or reverses in high-dollar regimes. The asymmetry is most significant at short maturities, especially the 1-year segment, and declines along the curve. The 5-year tenor remains relevant, suggesting some role for institutional hedging demand, but the dominant empirical pattern is a short-end funding-liquidity channel. Group-wise analysis further shows that the regime dependence is concentrated in core currencies, reflecting their central role in global funding markets. However, in the post-LIBOR period, the regime-dependent effects are weaker and more fragmented. Although some maturities (1-, 10-, and 20Y) still show signs of threshold behaviour in the baseline results, the overall evidence is weak and unstable, which is largely caused by data limitations: the sample is short and coincides with structural breaks associated with benchmark reform that reduces statistical power and complicates comparability with the LIBOR era. For this reason, post-LIBOR findings should not be viewed as overturning the broader mechanism, but rather as preliminary evidence pending longer data coverage.

The results of this study carry several implications for the interpretation of the cross-currency basis and for policy. Rather than serving solely as an indicator of dollar funding stress, the basis also reflects the hedging behaviour of institutional investors, with the relative importance of these forces shifting across dollar regimes. The maturity profile further suggests that regime dependence is strongest at the short end of the curve, consistent with short-term funding-liquidity pressures. Institutional hedging demand remains relevant at intermediate maturities, but the stacked term-structure results indicate that it is secondary to short-end funding frictions in the observed panel. For policymakers, this means that interventions like central bank swap lines may be more effective in alleviating pressures when the dollar is weak than when it is strong, as investor hedging flows already dampen upward pressure on the basis in high-dollar regimes.

While advancing knowledge of the dollar's impact on XCB, our study has limitations. The post-LIBOR sample remains short, which limits statistical power and makes any regime effects in that period less conclusive. Beyond this, the focus on G10 currencies also narrows the scope, leaving open the question of whether similar dynamics apply in emerging markets where dollar reliance is greater and frictions more severe. Additionally, the threshold regression framework captures regime dependence at an aggregate level but cannot account for potential heterogeneity across investor types or institutions.

These limitations also suggest several avenues for future research. Extending the post-LIBOR sample as more data become available will help to assess more reliably whether regime dependence persists under the new benchmark environment. Broadening the scope beyond G10 currencies, particularly to emerging markets, would provide valuable evidence on whether stronger dollar reliance amplifies regime effects. Finally, incorporating micro-level information on institutional hedging strategies could complement the aggregate threshold framework and shed light on heterogeneity across different investor types.

In sum, our panel analysis across the LIBOR and post-LIBOR periods confirms that

the regime-dependent link between the US dollar and cross-currency basis swap spreads is pronounced during the LIBOR era but less stable in the post-LIBOR sample. Dollar appreciations in low-dollar regimes significantly widen the basis in the LIBOR period, while in high-dollar regimes the effect weakens or reverses, consistent with shifts in hedging behavior between dollar-based and non-dollar-based investors. However, after the transition to SOFR, the regime dependence is no longer robust, reflecting both the short span of available data and structural changes in benchmark conventions. These findings suggest that the dollar's role as a global funding anchor was more clearly manifested under LIBOR, whereas in the post-LIBOR environment its influence persists in a more muted and less systematic form. Recognising this evolution is important for both policymakers and market participants interpreting the signals embedded in cross-currency basis dynamics.

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nomics 5(2), 177–188.

A. Derivations, Assumptions, and Proofs

This appendix presents the full derivations underlying the model and the propositions in the main text.

Throughout the appendix, the notation is kept consistent with the main text. In particular, the relevant state variable entering hedge decisions is the filtered expected USD appreciation rate

$$\mu_t = \mu_\ell[1 - \pi_t(h)] + \mu_h \pi_t(h), \qquad \mu_\ell < 0 < \mu_h.$$

The equilibrium basis is affine in this state variable:

$$b_t = \bar{b} + \Psi\, \mu_t,$$

with $\Psi > 0$ under the maintained sign conventions. The derivations below show exactly how this relation emerges.

A.1. Probability space, information, and state variables

We work on a filtered probability space

$$(\Omega, \mathcal{F}, \{\mathcal{F}_t\}_{t\geq 0}, \mathbb{P}),$$

satisfying the usual conditions. All stochastic processes introduced below are adapted to the filtration $\{\mathcal{F}_t\}$. The filtration is generated by the observable return and exchange-rate shocks together with the investors' filtered beliefs about the latent dollar regime.

Let $X_t \in \{\ell, h\}$ denote the latent regime of the dollar, where ℓ denotes the low-dollar regime and h denotes the high-dollar regime. Investors do not observe X_t directly. Instead, they observe information that allows them to form the filtered probability

$$\pi_t(h) = \mathbb{P}(X_t = h \mid \mathcal{F}_t).$$

The corresponding filtered expected USD appreciation rate is

$$\mu_t = \mu_\ell[1 - \pi_t(h)] + \mu_h \pi_t(h), \qquad \mu_\ell < 0 < \mu_h. \tag{A.1}$$

This variable μ_t is the state that enters the investors' hedge decisions and the equilibrium basis relation.

Let B_t denote a standard Brownian motion driving aggregate dollar conditions. Let Z_t^f and $Z_t^\$$ denote standard Brownian motions driving the foreign-bond and USD-bond return innovations, respectively. Their instantaneous covariation with the dollar shock is

$$d\langle Z^f, B\rangle_t = \rho_U\, dt, \qquad d\langle Z^\$, B\rangle_t = \rho_F\, dt, \tag{A.2}$$

where $\rho_U, \rho_F \in [-1, 1]$. No additional correlation assumptions are needed for the hedge derivations.

The broad dollar factor D_t evolves according to

$$\frac{dD_t}{D_t} = \mu_{X_t}\, dt + \sigma_D\, dB_t, \qquad \sigma_D > 0. \tag{A.3}$$

This process summarises broad dollar conditions. It is conceptually distinct from the bilateral exchange rate faced by the representative investor.

Let S_t denote the bilateral exchange rate defined as USD per unit of foreign currency. Under this convention, a stronger dollar corresponds to a lower value of S_t. We specify

$$\frac{dS_t}{S_t} = -\mu_t\, dt + \sigma_S\, dB_t, \qquad \sigma_S > 0. \tag{A.4}$$

The minus sign is economically natural under the chosen convention. When the expected USD appreciation rate μ_t rises, the expected drift of S_t falls. The volatility parameter σ_S is not restricted to equal σ_D. This keeps the broad dollar factor and the bilateral FX rate conceptually distinct while allowing them to be driven by the same underlying aggregate dollar shock.

A.2. Bond-return processes

The return on the foreign bond, measured in foreign currency, is

$$dR_t^f = \mu_f\, dt + \sigma_f\, dZ_t^f. \tag{A.5}$$

The return on the USD bond is

$$dR_t^\$ = \mu_\$\, dt + \sigma_\$\, dZ_t^\$. \tag{A.6}$$

These are reduced-form local return specifications. Their role is to provide the conditional drift and covariance structure relevant for the local hedge problem. The model does not require a full affine term-structure specification to identify the hedging mechanism of interest.

A.3. USD investor: wealth dynamics, moments, and optimal hedge

The USD investor has base currency USD and holds foreign-currency bonds with USD-equivalent notional $A_U > 0$. Let h_t^U denote the fraction of exchange-rate exposure hedged back into USD. The local wealth increment of the USD investor is

$$dW_t^U = A_U \left[dR_t^f + (1 - h_t^U)\frac{dS_t}{S_t} \right] - A_U h_t^U b_t\, dt. \tag{A.7}$$

The first term is the foreign bond return. The second term is the return on the unhedged fraction of FX exposure. The final term is the basis-related carry from hedging. Under the convention adopted here, a more negative basis makes hedging more attractive to the USD investor. The term $-A_U h_t^U b_t\, dt$ captures that effect directly. It is not deterministic; it is a predictable state-dependent component of the drift conditional on b_t and h_t^U.

Substituting (A.5) and (A.4) into (A.7) gives

$$dW_t^U = A_U \Big[\mu_f\, dt + \sigma_f\, dZ_t^f + (1 - h_t^U)\big(-\mu_t\, dt + \sigma_S\, dB_t \big) \Big] - A_U h_t^U b_t\, dt.$$

Collecting the drift terms yields

$$A_U \Big[\mu_f - (1 - h_t^U)\mu_t - h_t^U b_t \Big] dt,$$

and the diffusion terms are

$$A_U\Big[\sigma_f\, dZ_t^f + (1-h_t^U)\sigma_S\, dB_t\Big].$$

The conditional drift density is therefore

$$\tilde{\mu}_t^U(h) = \frac{1}{dt}\mathbb{E}_t[dW_t^U] = A_U\Big[\mu_f - (1-h)\mu_t - hb_t\Big]. \tag{A.8}$$

To compute the conditional variance density, note that

$$\mathrm{Var}_t\Big(\sigma_f\, dZ_t^f + (1-h)\sigma_S\, dB_t\Big) = \Big[\sigma_f^2 + (1-h)^2\sigma_S^2 + 2(1-h)\rho_U\sigma_f\sigma_S\Big]\, dt.$$

Hence

$$\tilde{\sigma}_t^{2,U}(h) = \frac{1}{dt}\mathrm{Var}_t(dW_t^U) = A_U^2\Big[\sigma_f^2 + (1-h)^2\sigma_S^2 + 2(1-h)\rho_U\sigma_f\sigma_S\Big]. \tag{A.9}$$

The local objective function is

$$L_t^U(h) = \frac{\gamma_U}{2}\tilde{\sigma}_t^{2,U}(h) - \tilde{\mu}_t^U(h) + \frac{\kappa_U}{2}h^2, \qquad \gamma_U > 0, \quad \kappa_U > 0. \tag{A.10}$$

Because $\tilde{\sigma}_t^{2,U}(h)$ is quadratic in h, $\tilde{\mu}_t^U(h)$ is affine in h, and $\kappa_U > 0$, the objective is strictly convex, so the minimiser is unique.

Differentiating (A.10) with respect to h yields

$$\frac{\partial L_t^U(h)}{\partial h} = \frac{\gamma_U}{2}\frac{\partial \tilde{\sigma}_t^{2,U}(h)}{\partial h} - \frac{\partial \tilde{\mu}_t^U(h)}{\partial h} + \kappa_U h.$$

Now

$$\frac{\partial \tilde{\sigma}_t^{2,U}(h)}{\partial h} = A_U^2\Big[-2(1-h)\sigma_S^2 - 2\rho_U\sigma_f\sigma_S\Big],$$

and

$$\frac{\partial \tilde{\mu}_t^U(h)}{\partial h} = A_U(\mu_t - b_t).$$

Indeed, from

$$\tilde{\mu}_t^U(h) = A_U[\mu_f - \mu_t + h\mu_t - hb_t],$$

the derivative with respect to h is $A_U(\mu_t - b_t)$.

Therefore

$$\frac{\partial L_t^U(h)}{\partial h} = \gamma_U A_U^2\Big[-(1-h)\sigma_S^2 - \rho_U\sigma_f\sigma_S\Big] - A_U(\mu_t - b_t) + \kappa_U h.$$

The first-order condition is

$$\gamma_U A_U^2\Big[-(1-h)\sigma_S^2 - \rho_U\sigma_f\sigma_S\Big] - A_U(\mu_t - b_t) + \kappa_U h = 0. \tag{A.11}$$

Rearranging (A.11) gives

$$\gamma_U A_U^2 h\sigma_S^2 + \kappa_U h = \gamma_U A_U^2(\sigma_S^2 + \rho_U\sigma_f\sigma_S) + A_U(\mu_t - b_t).$$

Hence

$$h_t^{U*} = \frac{\gamma_U A_U^2(\sigma_S^2 + \rho_U \sigma_f \sigma_S) + A_U(\mu_t - b_t)}{\kappa_U + \gamma_U A_U^2 \sigma_S^2}. \tag{A.12}$$

Define the coefficients

$$\alpha_U = \frac{A_U}{\kappa_U + \gamma_U A_U^2 \sigma_S^2}, \qquad \eta_U = \frac{\gamma_U A_U^2(\sigma_S^2 + \rho_U \sigma_f \sigma_S)}{\kappa_U + \gamma_U A_U^2 \sigma_S^2}. \tag{A.13}$$

Then the optimal hedge rule can be written compactly as

$$h_t^{U*} = \eta_U + \alpha_U \mu_t - \alpha_U b_t. \tag{A.14}$$

This affine rule has the intuitive sign pattern emphasised in the main text. A higher expected USD appreciation rate increases the USD investor's desired hedge, while a more negative basis increases the attractiveness of hedging and therefore also raises desired hedging.

A.4. Foreign investor: wealth dynamics, moments, and optimal hedge

The foreign investor has foreign currency as base currency and holds USD bonds with notional $A_F > 0$. Let h_t^F denote the fraction of USD exposure hedged back into foreign currency. The local wealth increment is

$$dW_t^F = A_F \left[dR_t^{\$} - (1 - h_t^F) \frac{dS_t}{S_t} \right] + A_F h_t^F b_t \, dt. \tag{A.15}$$

The sign on the basis term is opposite that of the USD investor's problem. Under the maintained convention, a more negative basis makes hedging less attractive to the foreign investor, and the term $+A_F h_t^F b_t \, dt$ captures that effect because $b_t < 0$ lowers the drift when the hedge is active.

Substituting (A.6) and (A.4) into (A.15) gives

$$dW_t^F = A_F \Big[\mu_{\$} \, dt + \sigma_{\$} \, dZ_t^{\$} - (1 - h_t^F)(-\mu_t \, dt + \sigma_S \, dB_t) \Big] + A_F h_t^F b_t \, dt.$$

Collecting drift terms yields

$$A_F \Big[\mu_{\$} + (1 - h_t^F)\mu_t + h_t^F b_t \Big] dt,$$

and the diffusion terms are

$$A_F \Big[\sigma_{\$} \, dZ_t^{\$} - (1 - h_t^F)\sigma_S \, dB_t \Big].$$

The conditional drift density is therefore

$$\tilde{\mu}_t^F(h) = \frac{1}{dt} \mathbb{E}_t[dW_t^F] = A_F \Big[\mu_{\$} + (1 - h)\mu_t + h b_t \Big]. \tag{A.16}$$

For the conditional variance density, note that

$$\mathrm{Var}_t \Big(\sigma_{\$} \, dZ_t^{\$} - (1 - h)\sigma_S \, dB_t \Big) = \Big[\sigma_{\$}^2 + (1 - h)^2 \sigma_S^2 - 2(1 - h)\rho_F \sigma_{\$} \sigma_S \Big] \, dt.$$

Thus

$$\tilde{\sigma}_t^{2,F}(h) = \frac{1}{dt}\mathrm{Var}_t(dW_t^F) = A_F^2\Big[\sigma_\$^2 + (1-h)^2\sigma_S^2 - 2(1-h)\rho_F\sigma_\$\sigma_S\Big]. \tag{A.17}$$

The foreign investor minimises

$$L_t^F(h) = \frac{\gamma_F}{2}\tilde{\sigma}_t^{2,F}(h) - \tilde{\mu}_t^F(h) + \frac{\kappa_F}{2}h^2, \qquad \gamma_F > 0, \quad \kappa_F > 0. \tag{A.18}$$

Again, strict convexity guarantees a unique optimum.

Differentiating (A.18) gives

$$\frac{\partial L_t^F(h)}{\partial h} = \frac{\gamma_F}{2}\frac{\partial \tilde{\sigma}_t^{2,F}(h)}{\partial h} - \frac{\partial \tilde{\mu}_t^F(h)}{\partial h} + \kappa_F h.$$

Now

$$\frac{\partial \tilde{\sigma}_t^{2,F}(h)}{\partial h} = A_F^2\Big[-2(1-h)\sigma_S^2 + 2\rho_F\sigma_\$\sigma_S\Big],$$

and

$$\frac{\partial \tilde{\mu}_t^F(h)}{\partial h} = A_F(-\mu_t + b_t),$$

since

$$\tilde{\mu}_t^F(h) = A_F[\mu_\$ + \mu_t - h\mu_t + hb_t].$$

Therefore

$$\frac{\partial L_t^F(h)}{\partial h} = \gamma_F A_F^2\Big[-(1-h)\sigma_S^2 + \rho_F\sigma_\$\sigma_S\Big] + A_F(\mu_t - b_t) + \kappa_F h.$$

The first-order condition is

$$\gamma_F A_F^2\Big[-(1-h)\sigma_S^2 + \rho_F\sigma_\$\sigma_S\Big] + A_F(\mu_t - b_t) + \kappa_F h = 0. \tag{A.19}$$

Rearranging (A.19) gives

$$\gamma_F A_F^2 h\sigma_S^2 + \kappa_F h = \gamma_F A_F^2(\sigma_S^2 - \rho_F\sigma_\$\sigma_S) - A_F(\mu_t - b_t).$$

Hence

$$h_t^{F*} = \frac{\gamma_F A_F^2(\sigma_S^2 - \rho_F\sigma_\$\sigma_S) - A_F(\mu_t - b_t)}{\kappa_F + \gamma_F A_F^2\sigma_S^2}. \tag{A.20}$$

Define

$$\alpha_F = \frac{A_F}{\kappa_F + \gamma_F A_F^2\sigma_S^2}, \qquad \eta_F = \frac{\gamma_F A_F^2(\sigma_S^2 - \rho_F\sigma_\$\sigma_S)}{\kappa_F + \gamma_F A_F^2\sigma_S^2}. \tag{A.21}$$

Then the optimal hedge rule becomes

$$h_t^{F*} = \eta_F - \alpha_F\mu_t + \alpha_F b_t. \tag{A.22}$$

This is the corrected foreign-investor hedge rule consistent with the sign structure used in the corrected model setup and the corrected propositions.

A.5. Aggregate order flow and basis equilibrium

Net demand for dollars in the swap market is defined as

$$Q_t = A_F h_t^{F*} - A_U h_t^{U*}. \tag{A.23}$$

A positive value of Q_t means that foreign hedgers demand more dollars synthetically than USD investors supply through hedging. A negative value means that USD investors supply more dollars than foreign investors demand.

Substituting (A.14) and (A.22) into (A.23) gives

$$Q_t = A_F(\eta_F - \alpha_F \mu_t + \alpha_F b_t) - A_U(\eta_U + \alpha_U \mu_t - \alpha_U b_t).$$

Collecting terms yields

$$Q_t = C - M\,\mu_t + M\,b_t, \tag{A.24}$$

where

$$M \equiv A_F \alpha_F + A_U \alpha_U > 0, \qquad C \equiv A_F \eta_F - A_U \eta_U. \tag{A.25}$$

To align with the notation in the main text, define

$$\Phi \equiv -M < 0, \qquad X \equiv M > 0. \tag{A.26}$$

Then (A.24) can be written equivalently as

$$Q_t = \Phi\,\mu_t + X\,b_t + C. \tag{A.27}$$

Intermediaries absorb this order imbalance through the linear pricing relation

$$b_t = \phi_0 - \Lambda Q_t, \qquad \Lambda > 0. \tag{A.28}$$

Substituting (A.27) into (A.28) yields

$$b_t = \phi_0 - \Lambda(\Phi \mu_t + X b_t + C).$$

Therefore

$$(1 + \Lambda X) b_t = \phi_0 - \Lambda C - \Lambda \Phi \mu_t.$$

Solving for b_t gives

$$b_t = \bar{b} + \Psi\,\mu_t, \tag{A.29}$$

where

$$\bar{b} = \frac{\phi_0 - \Lambda C}{1 + \Lambda X}, \qquad \Psi = \frac{-\Lambda \Phi}{1 + \Lambda X}. \tag{A.30}$$

Because $\Phi < 0$, $\Lambda > 0$, and $X > 0$, it follows that $\Psi > 0$. Hence, a higher expected USD appreciation rate tightens the basis, while a lower expected USD appreciation rate widens it. This is the central equilibrium implication of the model.

A.6. Microfoundation of linear price impact

A simple microfoundation for (A.28) is obtained from a representative intermediary sector that warehouses net order flow at quadratic inventory cost. Suppose intermediaries absorb position $-Q_t$ and face the reduced-form inventory-cost schedule

$$\frac{\Gamma}{2}Q_t^2.$$

Let ϕ_0 denote an exogenous funding intercept. Then the intermediary sector's reduced-form profit is

$$\Pi_t = b_t Q_t - \phi_0 Q_t - \frac{\Gamma}{2}Q_t^2. \tag{A.31}$$

The first-order condition of the corresponding inverse-demand relation implies

$$b_t = \phi_0 - \Gamma Q_t.$$

Thus the slope parameter in the main text may be interpreted as

$$\Lambda = \Gamma.$$

This microfoundation is deliberately parsimonious. Its purpose is not to develop a full intermediary capital model, but to rationalise the linear mapping from net order flow to the basis.

A.7. Summary of the theoretical mechanism

The corrected derivations imply the following sequence of relations.

The filtered expected USD appreciation rate is

$$\mu_t = \mu_\ell[1 - \pi_t(h)] + \mu_h \pi_t(h).$$

The investors' optimal hedge rules are

$$h_t^{U*} = \eta_U + \alpha_U \mu_t - \alpha_U b_t, \qquad h_t^{F*} = \eta_F - \alpha_F \mu_t + \alpha_F b_t.$$

These hedge rules imply the reduced-form order-flow relation

$$Q_t = \Phi\, \mu_t + X\, b_t + C, \qquad \Phi < 0, \quad X > 0.$$

Combining this order-flow equation with the linear intermediary pricing relation produces the equilibrium basis

$$b_t = \bar{b} + \Psi \mu_t, \qquad \Psi > 0.$$

Thus the basis is an affine function of the filtered expected dollar state. Regime dependence enters through the filtered probability $\pi_t(h)$, which determines μ_t. Stronger dollar expectations tighten the basis, while weaker dollar expectations widen it.

A.8. Proof of Proposition 1

From (A.29),

$$b_t = \bar{b} + \Psi \mu_t.$$

Evaluating this expression at the two extreme regime drifts μ_ℓ and μ_h yields

$$b_t(\ell) = \bar{b} + \Psi\mu_\ell, \qquad b_t(h) = \bar{b} + \Psi\mu_h.$$

Since $\Psi > 0$ and $\mu_\ell < 0 < \mu_h$, it follows that

$$\bar{b} + \Psi\mu_\ell < \bar{b} < \bar{b} + \Psi\mu_h.$$

Therefore

$$b_t(\ell) < \bar{b} < b_t(h).$$

The basis is thus wider in the low-dollar regime and tighter in the high-dollar regime. ■

A.9. Proof of Proposition 2

The corrected proposition is formulated in terms of finite belief revisions and local variations in the filtered state variable, rather than in terms of classical derivatives of one stochastic process with respect to another.

From (A.1),

$$\mu_t = \mu_\ell + (\mu_h - \mu_\ell)\pi_t(h).$$

Hence, any local belief revision satisfies

$$d\mu_t = (\mu_h - \mu_\ell)\, d\pi_t(h). \tag{A.32}$$

Using the equilibrium basis relation (A.29),

$$db_t = \Psi\, d\mu_t = \Psi(\mu_h - \mu_\ell)\, d\pi_t(h). \tag{A.33}$$

Because $\Psi > 0$ and $\mu_h - \mu_\ell > 0$, the sign of db_t is the same as the sign of $d\pi_t(h)$.

Now consider any finite revision in the filtered high-dollar probability over a short interval:

$$\Delta\pi_t(h) = \pi_{t+\Delta}(h) - \pi_t(h).$$

Then

$$\Delta\mu_t = (\mu_h - \mu_\ell)\Delta\pi_t(h), \qquad \Delta b_t = \Psi(\mu_h - \mu_\ell)\Delta\pi_t(h).$$

Suppose two environments generate belief revisions satisfying

$$\Delta\pi_t(h)\big|_{\text{low}} \leq \Delta\pi_t(h)\big|_{\text{high}}.$$

Then it follows immediately that

$$\Delta b_t^{\text{low}} \leq \Delta b_t^{\text{high}}.$$

This is the precise reduced-form sense in which the model generates regime-dependent asymmetry. The model does not claim to derive the full filtering equation for $\pi_t(h)$. Rather, it shows that once belief revisions differ across environments, basis responses differ proportionally through the equilibrium mapping. ■

A.10. Proof of Proposition 3

Because μ_t is $\mathcal{F}_t$-measurable by construction, the conditional expectation of the basis satisfies

$$\mathbb{E}_t[b_t] = \bar{b} + \Psi\mu_t.$$

Substituting (A.1) gives

$$\mathbb{E}_t[b_t] = \bar{b} + \Psi\big[\mu_\ell(1 - \pi_t(h)) + \mu_h \pi_t(h)\big].$$

Differentiating with respect to $\pi_t(h)$ yields

$$\frac{\partial \mathbb{E}_t[b_t]}{\partial \pi_t(h)} = \Psi(\mu_h - \mu_\ell).$$

Since $\Psi > 0$ and $\mu_h - \mu_\ell > 0$, the derivative is strictly positive. Therefore, a higher filtered probability of the high-dollar regime tightens the expected basis. ■

A.11. Proof of Proposition 4

Allow the primitive objects of the model to depend on maturity τ. Specifically, let

$$A_i = A_i(\tau), \qquad \kappa_i = \kappa_i(\tau), \qquad \Lambda = \Lambda(\tau), \qquad i \in \{U, F\}.$$

Then the hedge-load coefficients become

$$\alpha_U(\tau) = \frac{A_U(\tau)}{\kappa_U(\tau) + \gamma_U A_U(\tau)^2 \sigma_S^2}, \qquad \alpha_F(\tau) = \frac{A_F(\tau)}{\kappa_F(\tau) + \gamma_F A_F(\tau)^2 \sigma_S^2}.$$

Define

$$M(\tau) = A_F(\tau)\alpha_F(\tau) + A_U(\tau)\alpha_U(\tau) > 0.$$

Under the notation of the main text,

$$\Phi(\tau) = -M(\tau) < 0, \qquad X(\tau) = M(\tau) > 0.$$

Hence, the maturity-specific basis sensitivity is

$$\Psi(\tau) = \frac{-\Lambda(\tau)\Phi(\tau)}{1 + \Lambda(\tau)X(\tau)} = \frac{\Lambda(\tau)M(\tau)}{1 + \Lambda(\tau)M(\tau)}.$$

This expression is increasing in the product $\Lambda(\tau)M(\tau)$. Therefore, if effective hedge demand is concentrated at some maturities and intermediary (dealer) absorption does not collapse there, the quantity $\Lambda(\tau)M(\tau)$ is largest in that part of the curve, and $\Psi(\tau)$ is also largest at those maturities. It follows that basis responses to regime-dependent dollar expectations are strongest at those tenors. ■

B. Full Panel Unit Root Diagnostics.

This section reports the complete set of panel nonstationarity tests for both the dependent variable and all regressors. The tables below consolidate the full results from cross-sectional dependence tests, PANIC decompositions, and CIPS unit root tests, along with cross-section specific stationarity outcomes. These tables provide the complete empirical basis for the stationarity assessment discussed in the main text.

Maturity	CSD (CD)	PANIC Factors	Common Trends	Idio. Stat. (%)	CIPS	Overall
1Y	59.89^{***}	6	6 (p>0.99)	70%	-3.46^{***}	Mixed
5Y	36.68^{***}	6	6 (p>0.99)	40%	-2.65^{***}	Mixed
10Y	24.47^{***}	6	6 (p>0.99)	30%	-2.64^{***}	Mixed
20Y	27.55^{***}	6	6 (p>0.99)	60%	-2.57^{***}	Mixed
30Y	37.94^{***}	6	6 (p>0.99)	20%	-2.90^{***}	Mixed

Table B.17: Detailed Panel Nonstationarity Diagnostics (XCB Across Maturities). *Notes*: This table reports detailed panel nonstationarity diagnostics for cross-currency basis (XCB) across maturities. Cross-sectional dependence (CSD) is measured using the Pesaran CD statistic. PANIC refers to the Bai and Ng (2004) decomposition. "Common Trends" denotes the number of nonstationary common factors identified under the MQC test. "Idio. Stat. (%)" reports the fraction of cross-sections rejecting the unit root null in individual ADF tests. CIPS refers to the Pesaran (2007) panel unit root test. *** denotes rejection at the 1% level.

Variable	CSD (CD)	No. Factors	Common Trends	Idio. Stat. (%)	CIPS	Overall
USD	199.79^{***}	N/A	N/A	0%	Fail to reject	Nonstationary
VIX	199.79^{***}	1	0 (stationary)	0%	Fail to reject	Mixed
RR	-1.12	6	6 (p>0.99)	100%	-4.10^{***}	Mixed
YSPRD	143.95^{***}	6	6 (p>0.99)	20%	-2.83^{***}	Mixed
TSPRD	75.91^{***}	6	6 (p>0.99)	30%	-3.11^{***}	Mixed
IMP.VOL	172.00^{***}	6	6 (p>0.99)	100%	-4.49^{***}	Mixed

Table B.18: Detailed Panel Nonstationarity diagnostics for independent variables. *Notes*: CSD refers to Pesaran's CD test. PANIC decomposes series into common factors and idiosyncratic components. "Idiosyncratic Stationary (%)" reports the proportion of cross-sections rejecting the unit root null in individual CADF/ADF tests. "Fail to reject" indicates nonstationarity.

C. Robustness to Alternative Clustering

We assess the robustness of the stacked threshold regression results to alternative clustering schemes.

	(1) Currency Cluster	(2) Date Cluster	(3) Two-Way Cluster
$\Delta USD_t \times \mathbf{1}_{1Y} \times \mathbf{1}[USD_t \leq c_{1Y}]$	-1.1909^{***}	-1.1909^{***}	-1.1909^{***}
	(0.000)	(0.000)	(0.002)
$\Delta USD_t \times \mathbf{1}_{5Y} \times \mathbf{1}[USD_t \leq c_{5Y}]$	-0.5960^{***}	-0.5960^{***}	-0.5960^{***}
	(0.000)	(0.000)	(0.000)
$\Delta USD_t \times \mathbf{1}_{10Y} \times \mathbf{1}[USD_t \leq c_{10Y}]$	-0.2134^{***}	-0.2134^{***}	-0.2134^{**}
	(0.008)	(0.001)	(0.016)
$\Delta USD_t \times \mathbf{1}_{20Y} \times \mathbf{1}[USD_t \leq c_{20Y}]$	-0.1629^{***}	-0.1629^{**}	-0.1629^{**}
	(0.005)	(0.043)	(0.047)
$\Delta USD_t \times \mathbf{1}_{30Y} \times \mathbf{1}[USD_t \leq c_{30Y}]$	-0.2097^{***}	-0.2097^{**}	-0.2097^{**}
	(0.000)	(0.023)	(0.012)
$\Delta USD_t \times \mathbf{1}_{1Y} \times \mathbf{1}[USD_t > c_{1Y}]$	0.1183^{***}	0.1183	0.1183
	(0.005)	(0.505)	(0.454)
$\Delta USD_t \times \mathbf{1}_{5Y} \times \mathbf{1}[USD_t > c_{5Y}]$	0.2107^{***}	0.2107^{**}	0.2107^{***}
	(0.000)	(0.026)	(0.004)
$\Delta USD_t \times \mathbf{1}_{10Y} \times \mathbf{1}[USD_t > c_{10Y}]$	0.3541^{***}	0.3541^{***}	0.3541^{***}
	(0.000)	(0.004)	(0.001)
$\Delta USD_t \times \mathbf{1}_{20Y} \times \mathbf{1}[USD_t > c_{20Y}]$	0.3255^{***}	0.3255^{**}	0.3255^{***}
	(0.000)	(0.011)	(0.006)
$\Delta USD_t \times \mathbf{1}_{30Y} \times \mathbf{1}[USD_t > c_{30Y}]$	0.2320	0.2320^{*}	0.2320
	(0.141)	(0.096)	(0.180)
ΔVIX_t	-0.0299^{***}	-0.0299^{***}	-0.0299^{***}
	(0.007)	(0.000)	(0.002)
ΔRR_t	0.1345	0.1345	0.1345
	(0.516)	(0.327)	(0.452)
$\Delta YSPRD_t$	2.2639^{***}	2.2639^{***}	2.2639^{***}
	(0.000)	(0.000)	(0.000)
$\Delta TSPRD_t$	-1.4757^{**}	-1.4757^{***}	-1.4757^{***}
	(0.027)	(0.000)	(0.001)
ΔIV_t	-0.4648^{***}	-0.4648^{***}	-0.4648^{***}
	(0.000)	(0.000)	(0.000)
Country fixed effects	Yes	Yes	Yes
Maturity fixed effects	Yes	Yes	Yes
Observations	43,126	43,126	43,126
R^2	0.060	0.060	0.060

Table C.19: Robustness to Alternative Clustering: Stacked Threshold Regression. Notes: This table reports robustness of the stacked threshold regression to alternative clustering schemes. The dependent variable is $\Delta XCB_{i,t}^{(\tau)}$. Regimes are defined using the maturity-specific baseline thresholds: $c_{1Y} = 105.34$, $c_{5Y} = 105.45$, and $c_{10Y} = c_{20Y} = c_{30Y} = 111.76$. All columns include country and maturity fixed effects. Column (1) clusters standard errors by currency, Column (2) clusters by date, and Column (3) uses two-way clustering by currency and date. p-values are reported in parentheses. *Notes:* $^{*}p < 0.10$,$^{**}p < 0.05$,$^{***}p < 0.01$.