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Payment Frictions, Capital Flows, and Exchange Rates

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ABSTRACT: Cross-border payments are changing: existing intermediaries are upgrading their networks and new platforms based on novel digital forms of money are being explored, even as geoeconomic fragmentation is introducing new frictions. We develop a stylized model to assess the potential implications for the level and volatility of capital flows and exchange rates. On levels, we find that lower frictions in cross-border payments reduce UIP deviations and increase capital flows. On volatility, we find that the impact of lower frictions depends on the type of shock and the degree to which frictions decline. For real shocks, lower frictions increase capital flow volatility and reduce exchange rate volatility. For financial shocks, lower frictions increase exchange rate volatility while the impact on capital flow volatility is ambiguous. Specifically, when frictions decline by a small amount, capital flow volatility increases, while the opposite holds when the reduction in frictions is large. An increase in frictions reverses these results.

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WORKING PAPERS

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1 Introduction

Cross-border payments are changing. On one hand, a wide range of initiatives aim to improve upon slow and costly existing systems. These include efforts to upgrade established cross-border payments infrastructures (CPMI, 2024; FSB, 2024b; SWIFT, 2019) and the introduction of new payment rails, including some potentially based on central bank digital currencies (BIS, 2023; Garratt et al., 2024), stablecoins or unbacked crypto assets. On the other hand, geopolitical tensions risk creating new barriers between countries, including to financial flows (IMF, 2023; WEF, 2025). By reversing the economies of scale that result from pooling on the US dollar system, geoeconomic fragmentation could raise the cost of cross-border payments (Eichengreen, 2022).

The net effect of these changes will vary by country-pair, but in all cases the likelihood of a change in cross-border payment frictions is high. Anticipating this, policymakers are keenly interested in whether and how such a change could affect capital flows and exchange rates (IMF, 2024; Kim et al., 2024). For emerging and developing economies, in particular, volatile capital flows have often proven a trigger of financial instability, as have exchange rate movements in the financially dollarized economies among them (Goldberg and Cetorelli, 2011; IMF, 2020; Laeven and Valencia, 2020).

In this paper, we provide a framework to analyze how changes in cross-border payment frictions impact the level and volatility of capital flows and exchange rates. We first document the critical dual role played by intermediaries, who both facilitate the movement of capital across countries and process the vast majority of cross-border payments. We then develop a parsimonious model of trade in goods and financial assets that incorporates this dual role. Using the model, we show how changes in cross-border payment frictions could impact capital flows and exchange rates by affecting intermediaries' ability and willingness to channel funds internationally.

We begin by highlighting the central role of financial intermediaries in cross-border payments. Financial intermediaries execute the vast majority of cross-border payments, primarily to settle trades in financial assets. Since households generally favor safe, local-currency assets, intermediaries are crucial for channeling savings into international markets. Cross-border payment frictions, including both fees and settlement delays, affect intermediaries' profits and hence their willingness to perform this role. If exchange rate risk were constant, a reduction in frictions would increase intermediaries' appetite for foreign assets. However, changing frictions could also affect exchange rate risk in equilibrium, necessitating a model to unpack the implications.

Our model features two endowment economies, each populated by a representative household that consumes tradable and non-tradable goods. Households can save or borrow via domestic bonds, with any imbalances in bond demand intermediated by financiers who facilitate cross-border borrowing and lending, thereby enabling current and capital account imbalances. These financiers thus represent consolidated financial intermediaries, comprising both the operators and the users of cross-border payment rails. For example, in the context of traditional cross-border payments our financiers encompass both the functions of correspondent banks (which establish and service cross-border payment connections) and asset managers (which utilize those connections to send investment funds across borders).

We model a unit mass of financiers with heterogeneous risk-bearing capacity engaging in a two-stage game. In the first stage, financiers decide whether to enter the market for cross-border intermediation, which incurs a fixed cost reflecting the cost of establishing the new payment rail (e.g., becoming a correspondent bank).[1] In the second stage, financiers determine the amount of cross-border intermediation that they are willing to supply. Specifically, and similar to Kekre and Lenel (2024), each financier faces a mean-variance trade-off when determining this quantity, balancing expected profits from intermediation against the risk arising from exchange rate uncertainty. Due to the heterogeneity in risk-bearing capac-

[1]This fixed cost allows the model to match in simplified form the fact that the provision of wholesale payment corridors by correspondent banks is a highly concentrated business where changes in the extensive margin (i.e., the number of correspondents) play an important role (FSB, 2024b). The possibility that new technologies fundamentally alter the structure of cross-border wholesale payments, and the interpretation of such a structural change in the context of our model, is discussed in Section 6.2.

ity, each financier weighs this risk differently. In determining optimal investment quantities, financiers also weigh a variable cost of using the payment rails to send funds abroad.[2]

Our main results describe the impact of changes in intermediaries' fixed and variable costs (hereafter, changes in 'frictions') on the level and volatility of capital flows and exchange rates. On levels, we show that reduced frictions lead to smaller deviations from uncovered interest rate parity (UIP), while capital flows increase. Intuitively, lower fixed costs increase the number of financiers that can operate profitably, while lower variable costs increase the quantity of intermediation that each chooses to provide. Both margins lead to greater intermediation for any given UIP deviation, which increases capital flows and in turn reduces equilibrium UIP deviations.

Turning to volatility, we first note that the effect of reduced frictions on volatility can be understood by determining whether a change in frictions makes capital flows and exchange rates more or less responsive to shocks. We then show that changes in volatility depend on the type of the shock. For a real shock, reduced frictions increase capital flow volatility and decrease exchange rate volatility. To see the intuition for this result, consider two cases: (i) a world with no frictions, such that intermediation is not constrained, UIP always holds and the exchange rate is unrelated to the capital account position, and (ii) a world with frictions, such that larger UIP deviations are required to incentivize more financiers to enter and existing financiers to intermediate larger capital flows. In case (i), a real shock—which affects the current account position—can have no impact on the exchange rate, since it is purely determined by interest rate differentials between the countries. Thus all adjustment must occur on the capital flow margin. In contrast, in case (ii) the exchange rate also adjusts to bring the current account and capital account into equilibrium, reducing the necessary adjustment on capital flows. Comparing these cases, lower frictions reduce the volatility of the exchange rate in response to real shocks, but concomitantly increase the adjustment

[2]For tractability, we model reductions in the variable costs of intermediation as a universal increase in the risk-bearing capacity among financiers. Intuitively, a reduction in variable costs increases the expected profit per unit of risk, allowing financiers to take on more risk.

occurring through changes in capital flows.

In contrast, for a financial shock, lower frictions always increase exchange rate volatility and have an ambiguous effect on capital flow volatility. Specifically, small decreases in frictions increase capital flow volatility, while large enough reductions in frictions decrease capital flow volatility after a financial shock. The intuition for these results rests on two key elements. First, lower frictions increase the responsiveness of the capital account to financial shocks. Specifically, lower fixed costs directly increase the elasticity of financiers' extensive margin decisions (i.e., whether to enter) with respect to financial conditions, while lower variable costs do the same for both financiers' extensive margin decisions and their intensive margin decisions (i.e., how much to intermediate).

Second, smaller frictions also move the capital account-current account equilibrium toward a new equilibrium with larger imbalances that exhibits less responsiveness of capital flows, but more responsiveness of the exchange rate. This reflects that the current account is concave in the exchange rate: since households prefer to smooth consumption over time, a larger initial current account position entails that a larger expected exchange rate movement is required to encourage them to undertake an even larger position in the same direction—since doing so would imply an even greater imbalance of present versus future consumption.

With these elements in hand, we can now consider the impact of the financial shock on exchange rates and capital flows in three cases: (i) an intermediate level of frictions, (ii) a slightly lower level of frictions, and (iii) a very low level of frictions, such that intermediaries are practically unconstrained and UIP almost holds. Comparing cases (i) and (ii), the lower frictions in case (ii) accentuate financiers' response to the financial shock, leading to larger impacts on the exchange rate and capital flows. However, when comparing cases (i) and (iii), the concavity of the current account reverses this result for capital flows while strengthening the impact on the exchange rate. Intuitively, in case (iii) the low level of frictions implies that the pre-shock capital account-current account equilibrium occurs at a level with relatively large flows (i.e., relatively large deficits or surpluses). By the concavity of the current account, shocks to such an equilibrium imply a large move in the level of the exchange rate relative to the move in the current account and capital account. Thus the responsiveness of capital flows can be smaller in case (iii) than in case (i), even as the adjustment of exchange rates is—as in case (ii)—larger.

Overall, our results confirm the intuition that marginally lower cross-border payment frictions could lead to larger and more volatile capital flows. More broadly, our results highlight that policymakers planning for a change in cross-border payment frictions—whether positive or negative—should be attentive to the type of impact that is most relevant in their context, since the effect of a change in frictions on volatility can depend both on the source of shocks (i.e., real or financial) and on the size of the change in frictions.

Related literature. We contribute to two main strands of literature. The first strand considers the macroeconomic implications of the introduction of new means of payment in open economies. With few exceptions, this strand does not model UIP deviations—a necessary condition for net capital flows to react to shocks, since the exchange rate acts as a perfect shock absorber when UIP holds (Dornbusch, 1976). The second strand of literature incorporates and examines UIP deviations, but does not model payment frictions.

Papers in the first strand primarily focus on monetary transmission in open economies when new means of payment are introduced. Several papers build two-country macroeconomic models, including New Keynesian DSGE models, to study the introduction of new forms of digital money, namely central bank digital currencies (CBDCs) (Ferrari Minesso et al., 2022; George et al., 2021; Kumhof et al., 2023) and crypto assets (Benigno et al., 2022; Cova et al., 2022; Ikeda, 2022; Le et al., 2023; Uhlig and Xie, 2021). Most of these papers assume that UIP holds and are thus more distant from our work's focus. Two exceptions are Ferrari Minesso et al. (2022) and Kumhof et al. (2023). Ferrari Minesso et al. (2022) incorporate UIP deviations, but the current account is balanced and therefore the model does not generate net capital flows. Kumhof et al. (2023) allow for nonzero current accounts in addition to UIP deviations, and find that the presence of CBDC in open economies reduces capital flow and exchange rate volatility. However, this finding results from the optimal use of CBDC remuneration as an additional monetary policy tool, rather than from a change in payment frictions, which is our focus.

Closest to us in the second strand of literature are Basu et al. (2023), Dao et al. (2025), Gabaix and Maggiori (2015) and Kekre and Lenel (2024). We share with these papers the notion that the capacity of intermediaries to bear exchange rate risk is a central determinant of cross-border intermediation. Gabaix and Maggiori (2015) were the first to formalize this as a rationale for persistent UIP deviations. In their model, a limited commitment problem between intermediaries and their creditors induces a credit constraint that limits intermediaries' capacity to conduct profitable carry trades.[3,4] Basu et al. (2023) build on this framework to study the optimal use of capital controls and foreign exchange interventions, by incorporating additional frictions from shallow foreign exchange markets and binding borrowing constraints. In a model that shares similarities with Gabaix and Maggiori (2015), Kekre and Lenel (2024) bring in portfolio diversification considerations through mean-variance optimization by intermediaries.[5] Kekre and Lenel (2024) quantify their model and find that shocks to currency intermediation are economically significant drivers of UIP deviations.[6] Dao et al. (2025) use a framework of balance-sheet constrained intermediaries to match observed correlated deviations of UIP and Covered Interest Parity (CIP).[7] To this

[3] Maggiori (2017) models country heterogeneity in such limited commitment frictions to study cyclical risk sharing between a global reserve currency issuer and the rest of the world.

[4] Our results cannot be obtained in the analytical model of Gabaix and Maggiori (2015), as it features a current account that is linear in the exchange rate due to a simplifying assumption.

[5] Itskhoki and Mukhin (2021) also introduce mean-variance optimizing intermediaries in a model that builds on Gabaix and Maggiori (2015). However, their model centers on exchange rate determination and has zero current accounts and net capital flows. We further note that portfolio diversification considerations can drive volatility in gross capital flows in response to shocks also in the absence of UIP deviations (Bacchetta et al., 2022; Davis and van Wincoop, 2018, 2024; Tille and van Wincoop, 2010, 2014).

[6] Other model-based analyses of the role of capital flow or foreign exchange interventions include: Acalin (2023); Adrian et al. (2022a); Chen et al. (2023); Fanelli and Straub (2021); Jeanne and Sandri (2023).

[7] In Malamud et al. (2025), intermediary market power rather than balance-sheet constraints generate UIP and CIP deviations. There is significant empirical support for persistent deviations from UIP and CIP (Accominotti et al., 2025; Albagli et al., 2024; Avdjiev et al., 2019; Bacchetta et al., 2023; Du et al., 2018; Gelos and Sahay, 2023; Miranda-Agrippino and Rey, 2022).

strand of literature, our focus on the role of payment frictions is novel.

The rest of the paper proceeds as follows. The next section provides context for the model, after which Section 3 describes the setup of the model. Section 4 characterizes the equilibrium and Section 5 presents our results. Section 6 discusses the modeling assumptions and the interpretation of our results. Section 7 concludes. Proofs are contained in the Appendix.

2 Context

This section provides context for our model by documenting the pivotal role of intermediaries in cross-border payments and describing the potential for changes in the frictions they face to impact exchange rates and capital flows. We first highlight the scale of intermediaries and relate their asset allocation decisions to cross-border payment frictions. We then discuss how developments in these frictions, through the impact on intermediaries' decisions, could influence exchange rates and capital flows.

The role of intermediaries. Intermediaries dominate cross-border payments. For 77 percent of cross-border payment transactions, the transacting parties are financial intermediaries – and, moreover, most of the remaining 23 percent is also processed by financial intermediaries, but for end-recipients that are households or non-financial businesses (Cerutti et al., 2025b). Back-of-the-envelope comparisons suggest that the vast majority of these cross-border transactions occur to settle the purchase of financial assets. For instance, the value of all global trade (an important alternative purpose for cross-border payments) was USD 30.5 trillion in 2023 (WTO, 2024), compared to total customer-related cross-border payments of USD 190 trillion in 2023 (Cerutti et al., 2025b).[8] Intermediaries also are the largest

[8] Cerutti et al. (2025a), using Swift-recorded payments and other sources, estimate that the global market for cross-border payments approached one quadrillion dollars in 2024. The large difference with the USD 190 trillion estimate is mostly explained by the fact that this lower figure does not include financial institution-related payments (e.g., captured in Swift message type 202), which cover financial institutions' liquidity management, settlement of FX, or securities flows, among other wholesale payments.

players in this market. At the end of 2023, financial intermediaries held 88 percent of global financial assets, with banks comprising 39 percent and non-bank financial intermediaries (NBFIs) 49 percent (FSB, 2024a).

Why do intermediaries play such a central role in the trade of financial assets? A fundamental reason for intermediaries' position in global asset ownership is that most households prefer to hold their savings in safe, local-currency assets, particularly in deposit-insured bank accounts. As of 2021, 76 percent of the world population had an account at a financial institution (including mobile money providers) (World Bank, 2022). By comparison, the fraction of households that owns riskier financial assets is much smaller.[9] For example, only in five countries (Australia, Canada, New Zealand, UK, US) does more than a quarter of the population own stocks. Furthermore, even among the households that own stocks, there is a well-documented preference for domestically-issued assets.[10]

Intermediaries can profitably channel household savings into foreign investments, but in doing so they trade off risk and return. Investing abroad generally comes with exchange rate risk. This risk is particularly pertinent when an intermediary issues domestic-currency liabilities to its customers. How much exchange rate risk an intermediary is willing to bear by purchasing foreign-currency assets depends on the expected return differential between foreign and domestic assets, which in turn is affected by the cost of moving funds across borders.[11]

The role of payment frictions. Payment frictions can affect intermediaries' asset allocation decisions by influencing their risk-return tradeoffs. We define a payment friction as any market imperfection that prevents the costless and instant exchange of money in return for a good or service. The current system of cross-border payments is subject to a wide range of such frictions, detailed in CPMI (2020). Here, we simply consider the aggregate implications

[9] See also the literature on the risk premium puzzle (Jordà et al., 2019; Mehra, 2007).

[10] For reviews of the literature on home bias in investing, see Ardalan (2019) and Cooper et al. (2013).

[11] Other factors also feed into this decision, such as expectations about exchange rate volatility and country risk premia.

of all these underlying imperfections, and highlight that they are quantitatively meaningful.

First, the direct monetary cost of moving funds across borders can significantly reduce the expected return from investing in foreign assets. The acquisition, servicing, and redemption of foreign financial assets necessitate the cross-border movement of funds. Cerutti et al. (2025b) estimate that such wholesale transfers incur, on average, a 10 basis points charge.[12] Depending on the expected return differential between foreign and domestic assets, a total of 20 basis points lost, on average, between purchasing an asset and receiving its returns can be a relevant investment consideration. As an example for comparison, we note that the difference between the yields on 10-year Treasuries issued by Hong Kong SAR and the US—two jurisdictions with comparably low sovereign risk (e.g., AA+ S&P rating as of May 2025) and virtually no exchange rate risk—is below 40 basis points most of the time (as measured during 2014-2024) and rarely exceeds 80 basis points.

Second, completing international transfers takes time, such that cash-in-transit presents significant opportunity costs for asset management. Cross-border transfers generally involve multiple banks: one at home, one abroad, and (at least) one correspondent bank between these.[13] FSB (2024b) reports that for 92 percent of wholesale transfers, the transfer between the correspondent and the recipient bank is completed within a business day. This estimate excludes the leg from originator to correspondent, which further lengthens the settlement process. McKinsey and SWIFT (2018) reports that (as of 2016) at any given moment 794 billion dollars is in-transit at correspondent banks. To understand the significance of settlement delays for asset management, we note that for (US) domestic asset trade, J.P. Morgan (2023) estimates that the continuous reinvestment of cash that is currently locked in during settlement (one business day on the New York Stock Exchange) on US financial

[12] This average likely masks significant fee heterogeneity among payment corridors, with transfers to and from smaller or emerging and developing economies incurring higher fees. FSB (2024b) reports that 7.6 percent of countries had at most two wholesale payment corridors (i.e., active correspondent banks) available to process cross-border transfers, implying limited competition on processing fees.

[13] The investing intermediary could be the domestic bank in this example, although, as previously noted, the modal global asset investor is a NBFI and therefore the most typical transaction chain would involve three intermediaries between the NBFI and the foreign asset seller (or purchaser).

markets reduces portfolio management costs by 22 percent. Thus, settlement delays from wholesale cross-border transfers likely similarly involve non-negligible opportunity costs.

The significance of changes in frictions. If developments in cross-border payment frictions meaningfully affect such direct and/or opportunity costs, this could impact intermediaries' global portfolio allocations. The recognition of the scope of existing cross-border payment frictions has spurred new multinational efforts to ameliorate them (CPMI, 2024; FSB, 2024b; SWIFT, 2019). Several initiatives aim to exploit new forms of digital money to reduce such frictions, including both public sector-led efforts exploring central bank digital currency (BIS, 2023; Garratt et al., 2024), and private sector efforts using stablecoins[14] or unbacked crypto assets. At the same time, geopolitical tensions risk exacerbating existing frictions (IMF, 2023; WEF, 2025). Fragmentation of liquidity across multiple networks can raise costs (Duffie, 2023; Eichengreen, 2022), with some payments corridors seeing costs rise by more than an order of magnitude.

As frictions change, how would intermediaries' portfolio allocations respond, and what would be the knock-on implications? For a given level of exchange rate risk, higher returns net of the (opportunity) costs of transacting across borders could entice intermediaries to hold more foreign assets. However, a change in frictions could also affect exchange rate risk in equilibrium. Thus, assessing the overall impact rigorously necessitates the development of a model, to which we turn in the next section.

3 Model

This section describes a stylized open economy model with two countries, Home and Foreign, two periods, $t = 1, 2$, and two goods, a tradable good T and a non-tradable good N. Each country contains a single representative household that receives an endowment of each good

[14] Examples include a partnership between USDC issuer Circle and Finastra, aimed at bypassing correspondent banks while using stablecoins for settlement, and a similar offering to improve cross-border payments by Stripe.

in each period. Households in Home can save (borrow) by purchasing (selling) a Home bond B, denominated in units of the tradable good, that accrues interest r in the second period. Similarly, households in Foreign can purchase (sell) a Foreign bond B^*, again denominated in units of the tradable good, that accrues interest r^*. Both bonds are supplied (purchased) by a unit mass of financiers, based in the Foreign economy, who intermediate capital flows between the two countries. These financiers face costs that create frictions as detailed below.

Households. The Home household derives utility from consuming a bundle C_t of tradable and non-tradable goods

$$C_t = (C_t^T)^\rho (C_t^N)^{1-\rho} \tag{1}$$

where $\rho \in (0,1)$. The household anticipates (but may discount) future consumption when maximizing expected utility, with period one utility equal to:

$$u_1 = ln(C_1) + \beta \mathbb{E}[ln(C_2)] \tag{2}$$

where $\beta \in (0,1]$. The Home household receives an endowment Q_t^j of each good $j \in \{T, N\}$ in each period. Endowments of the tradable good can be traded internationally at zero cost, but endowments of the non-tradable good can only be consumed. The second-period endowment of the tradable good, Q_2^T, is random and unknown in the first period.

Endowments cannot be stored. The Home household can save by purchasing bonds B from the financiers in the first period, which provides income BR (measured in units of the tradable good) in the second period, where $R \coloneqq 1 + r$ is the bond's gross return.

The Foreign household is identical to the Home household, receiving analogous endowments Q_t^{j*} and making analogous consumption and saving choices C_t^{j*} and B^*, except the Foreign household also receives income from the financiers as described below.[15]

[15] For tractability, we assume that the financiers' profits, when redistributed to households, are negligible for household decisions. In Appendix C, we illustrate numerically that our results are qualitatively robust

Prices and exchange rates. We denote by P_t^j the price of good j in period t in Home currency, and similarly P_t^{j*} for Foreign currency. We denote by P_t the period-t price of the domestic consumption basket in units of domestic currency—i.e., the minimum quantity of domestic currency required to purchase one unit of the composite consumption good C_t. By standard derivations for our Cobb-Douglas setting, this is equal to

$$P_t = (P_t^T)^\rho (P_t^N)^{1-\rho} A \tag{3}$$

where $A \coloneqq \rho^{-\rho}(1-\rho)^{-(1-\rho)}$ is a positive constant. We define the real exchange rate as the relative price of foreign goods P_t^* (defined analogously to P_t) in terms of home goods P_t

$$e_t = \frac{\varepsilon_t P_t^*}{P_t} \tag{4}$$

where ε_t is the nominal exchange rate, defined as the period-t price of one unit of foreign currency in terms of domestic currency. Defining $p_t \equiv \frac{P_t^N}{P_t^T}$ and $p_t^* \equiv \frac{P_t^{N*}}{P_t^{T*}}$ as the relative prices of the non-tradable good in each country and assuming that the law of one price holds for tradable goods (i.e., $\varepsilon_t P_t^{T*} = P_t^T$), this simplifies to

$$e_t = \left(\frac{p_t^*}{p_t}\right)^{1-\rho}. \tag{5}$$

Intuitively, holding Foreign prices constant, a rise in the relative price p_t of the non-tradable good in Home lowers e_t, corresponding to an appreciation of Home's real exchange rate.

Financiers. A continuum of financiers indexed by i are drawn at random from the Foreign population, serve for the single period $t = 1$, and remit any profits they accrue to the Foreign household. At the start of period $t = 1$, each financier decides whether to incur a cost F to enter the market for capital intermediation, then those that enter each decide on a quantity of funds q_i to intermediate. Financiers can trade domestic bonds in both countries but start

to dropping this assumption.

with no capital of their own, so any bond purchases in one country must be matched by bond sales in the other country. Each financier i that enters the market thus purchases q_i worth of Home bonds and sells a corresponding q_i/e_1 of Foreign bonds, both measured in the units of the tradable good.

Financiers that enter choose q_i to maximize risk-adjusted returns, expressed as a mean-variance problem similar to that in Kekre and Lenel (2024):

$$\max_{q_i}\{\Omega q_i - \frac{\gamma_i}{2}\text{Var}\left(\Omega q_i\right)\} \tag{6}$$

where $|\Omega|$ denotes financiers' expected net profits per unit of intermediation, measured in units of the tradable good, and γ_i measures a financier's risk bearing capacity. We assume this risk-bearing capacity γ_i is heterogeneous across financiers and distributed i.i.d. on $(0, 1]$ with cumulative distribution function $G(\gamma) = \gamma^\alpha$, where $\alpha > 1$. Thus financiers with small values of γ_i are close to risk neutral and have high risk bearing capacity, while financiers with large values of γ_i are the reverse.[16] Assuming $\alpha > 1$ implies that there are few financiers with large risk bearing ability and many financiers with low risk bearing ability.[17]

Market clearing. The non-tradable goods market in each country clears when consumption is equal to the endowment in each period:

$$C_t^N = Q_t^N \qquad\qquad C_t^{N*} = Q_t^{N*} \tag{7}$$

[16]We exclude 0 from the support of γ_i to ensure that the financiers' problem is well-defined for all possible realizations of γ_i.

[17]This aligns with the observation that the market for currency intermediation is quite concentrated in practice. For further details, see for example statistics on increasing concentration in correspondent banking from the CPMI.

for $t = 1, 2$. The tradable goods market clears globally, i.e., when total consumption across both countries is equal to total supply:

$$C_t^T + C_t^{T*} = Q_t^T + Q_t^{T*} \tag{8}$$

for $t = 1, 2$. The Home bond market clears when the Home household's bond sales equal the financiers' total bond purchases, both expressed in units of the tradable good:

$$-B = \int_0^1 q_i \, dG_{\gamma_i} \; . \tag{9}$$

Conversely, the Foreign bond market clears when the Foreign household's bond purchases equal the financiers' total bond sales, again both expressed in units of the tradable good:

$$B_t^* = \int_0^1 \frac{q_i}{e_t} \, dG_{\gamma_i} \; . \tag{10}$$

Equilibrium concept. We assume that both households and financiers are fully informed on the structure of the game, but do not know Q_2^T and Q_2^{T*} in the first period. We seek a subgame perfect equilibrium in which all all agents optimize and all markets clear.

Changes in cross-border payment frictions. In this model, cross-border trade in financial assets is subject to two imperfections that prevent costless intermediation. First, each intermediary must pay the fixed cost F to establish a payments channel between Home and Foreign to settle transactions involving financial assets. Second, all intermediaries have limited risk-bearing capacity ($\gamma_i > 0$)—implying that, even after establishing a payments channel, they will only take on additional units of intermediation q_i if they are compensated with greater expected profits. This is isomorphic to a variable cost of intermediation, such as the operational cost of running a payments channel. We consider the implications of changes in both of these frictions. A reduction in F to $F' < F$ increases the extensive margin of intermediation: marginal financiers that do not enter under F do so under F'. An increase in risk-bearing capacity (or equivalently, a reduction in variable costs) from α to $\alpha' < \alpha$ increases the intensive margin of intermediation: for any marginal level of risk-bearing capacity $\bar{\gamma}_i$ defined by a financier being indifferent between intermediating and not intermediating, the inframarginal supply of intermediation (e.g., $\int_0^{\bar{\gamma}_i} q_i \, dG_{\gamma_i}$ in the Home economy) is larger under α' than under α.

Parameter restriction. We assume that financiers' profits per unit of intermediation—i.e., deviations from UIP—are not too large. Specifically, we impose that

$$|\Omega| < 0.5 \frac{R^*}{e_1} \tag{11}$$

i.e., profits per unit of intermediation are less than half the expected gross yield on Foreign bonds.[18] Note that this restriction is rather mild, given that the right-hand side features gross bond yield, and is typically satisfied as long as UIP deviations are less than approximately 50 percentage points.[19]

4 Equilibrium

This section presents the current account and the capital account that result from the model, then characterizes the exchange rate that brings them into balance. We thus derive the equilibrium for a given level of frictions F and α, before turning in the next section to the impact of changes in these frictions.

Lemma 1 (Current account in Home)**.** *Home's current account balance in the first period*

[18] This in turn implies that the capital account reacts in line with deviations from uncovered interest parity (i.e., sign $\left(\frac{\partial \mathrm{KA}}{\partial x}\right)$ = sign $\left(\frac{\partial \Omega}{\partial x}\right)$ for $x = R, R^*, e_1$), and that reduced frictions amplify the reaction of the KA to shocks. See Appendix B for a detailed derivation.

[19] We provide further detail on this restriction in Appendix B.

is given by

$$\mathrm{CA}_1 = Q_1^T - \frac{1}{e_1^{\frac{1}{1-\rho}}} C_1^{T*} \frac{Q_1^N}{Q_1^{N*}} \,. \tag{12}$$

where $C_1^{T*} = \frac{1}{1+\beta^*}\left(Q_1^{T*} + \frac{1}{1+r^*}\mathbb{E}[Q_2^{T*}]\right)$, *which we summarize in the function*

$$\mathrm{CA}_1 = CA(e_1, Q_1^T, Q_1^N) \tag{13}$$

where $CA(\cdot)$ *is increasing and concave in* e_1*.*

Proof of Lemma 1. See Appendix A.1 (p. 36). □

This result reflects standard optimization by the Home household. A depreciation of the Home currency makes the traded good relatively more expensive in the Home economy, increasing Home's net exports of its endowment of the tradable good. The concavity of the current account with respect to movements in the exchange rate results from consumption smoothing. Specifically, a larger current account surplus implies larger net saving—i.e., a greater imbalance of consumption between periods. To compensate for this, an increasingly large movement in the exchange rate is required.

Lemma 2 (Capital account in Home)**.** *Home's capital account balance in the first period is given by:*

$$\mathrm{KA}_1 = \frac{\alpha}{\alpha - 1} \frac{\Omega}{\mathrm{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2} \left(0.5 \frac{\Omega^2}{F \cdot \mathrm{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2}\right)^{\alpha - 1} \,. \tag{14}$$

We can summarize this in the function:

$$\mathrm{KA}_1 = \mathrm{KA}(R, R^*, e_1, \alpha, F) \tag{15}$$

which is decreasing in e_1*.*

Proof of Lemma 2. See Appendix A.2 (p. 39). □

Intuitively, the capital account reflects the aggregate intermediation decisions of all those financiers' whose costs are sufficiently low that they are outweighed by the expected risk-adjusted profits from intermediation. These profits, in turn, result from UIP deviations, on which the intermediaries are able to capitalize. The capital account thus has the same sign as Ω, i.e., the UIP deviation: a capital account deficit is associated with a UIP deviation in favor of the foreign currency, while a capital account surplus implies a UIP deviation in favor of the domestic currency.

To derive the equilibrium exchange rate, it is sufficient to find the exchange rate that brings the current account and capital account into balance.[20] Given that we have two exchange rates in the model, e_1 and $\mathbb{E}[e_2]$, we normalize the latter to $\mathbb{E}[e_2] = 1$ and focus on the relative level of e_1. The equilibrium exchange rate e_1 is thus defined as the exchange rate that solves

$$\mathrm{CA}_1 + \mathrm{KA}_1 = \mathrm{CA}(e_1) + \mathrm{KA}(\Omega, e_1, \alpha, F) = 0 \tag{16}$$

The existence of the equilibrium exchange rate follows from standard arguments. We plot this equilibrium in Figure 1. As Home's currency depreciates (shown by a move up the vertical axis) the current account surplus increases, but at a diminishing rate as described above. Conversely, the depreciation implies a smaller UIP deviation in favor of the foreign currency, reducing the capital account deficit.

Before proceeding to analyze the impact of cross-border frictions on this equilibrium, we first build intuition by also considering the limiting case in which frictions fall toward zero. From the proof of Lemma 2 we have that each financier's expected net profit per unit of

[20] By definition, in this two country model Foreign's current account is the negative of Home's current account, and likewise for Foreign's capital account.

intermediation q_i is:

$$\Omega \equiv R - R^* \frac{\mathbb{E}[e_2]}{e_1} \; . \tag{17}$$

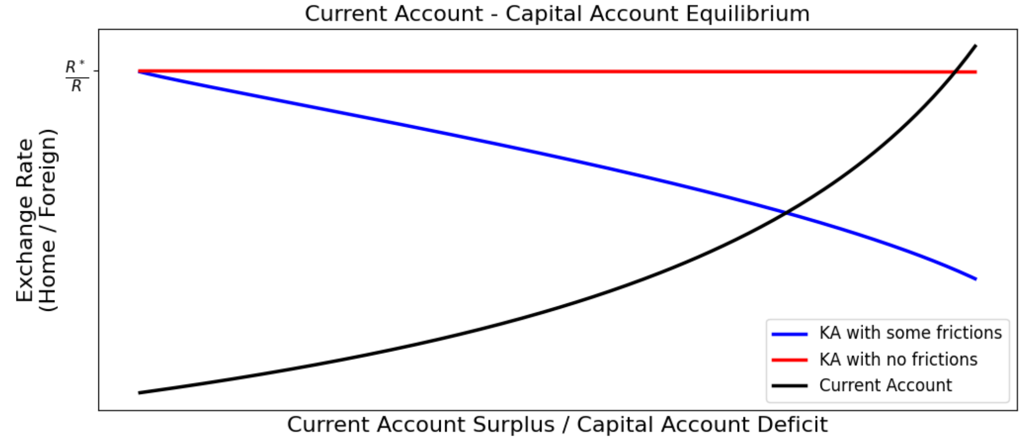
Without frictions, such deviations from uncovered interest parity are eliminated:

Lemma 3 (Frictionless equilibrium.). *In the limit as frictions are eliminated (i.e., as $F \to 0$ and/or $\alpha \to 1$), $\Omega \to 0$ and $e_1 \to \frac{R^*}{R}$.*

Proof of Lemma 3. The result follows immediately from taking appropriate limits in equation 14. For any non-zero value of Ω, KA_t would diverge to $\pm\infty$, so uncovered interest rate parity must hold. Given $\Omega \to 0$, $e_1 \to \frac{R*}{R}$ then follows from equation 17 and the normalization $\mathbb{E}[e_2] = 1$. □

This case is shown by the red line in Figure 1. Intuitively, without frictions the model reduces to a perfect Mundell-Fleming world in which exchange rates always fully adjust to close interest rate differentials. The exchange rate in the first period is then unrelated to Home's current account and capital account positions, simply having a fixed value equal to the ratio of the interest rates in Home and Foreign. In the following sections, we consider the case of an economy that starts with imperfect intermediation ($F > 0$ and $\alpha > 1$) but sees a reduction in frictions toward the frictionless benchmark (for instance, reflecting improvements in cross-border payments infrastructure). An increase in frictions (for instance, reflecting worsening geoeconomic fragmentation) reverses the results.

Figure 1: Baseline equilibrium



This figure shows the period one current account and capital account balances as a function of the exchange rate (retaining the convention of showing prices on the vertical axis and quantities on the horizontal axis). In our baseline model, frictions exist so the capital account follows the blue line. In the limit as frictions approach zero, the capital account converges on the red line.

5 Results

In this section, we consider the implications of changes in cross-border payment frictions for the exchange rate and capital flows. We first consider the impact on the levels of these variables, then turn to the impact on their volatility.

5.1 The impact of changes in frictions on levels

We summarize our results on the level of the exchange rate and the volume of capital flows in the following proposition:

Proposition 1 (Impact on levels). *Lower cross-border payment frictions—i.e., a reduction in F and/or α—results in:*

1. *A smaller UIP deviation $|\Omega|$, which implies:*

   (a) *A depreciation of the exchange rate e_1 if the economy has a current account surplus* $\mathrm{CA}_1 > 0$, *or* *(b) An appreciation of the exchange rate if the economy has a current account deficit* $\text{CA}_1 < 0$.

2. *A larger capital account and current account position (whether surplus or deficit).*

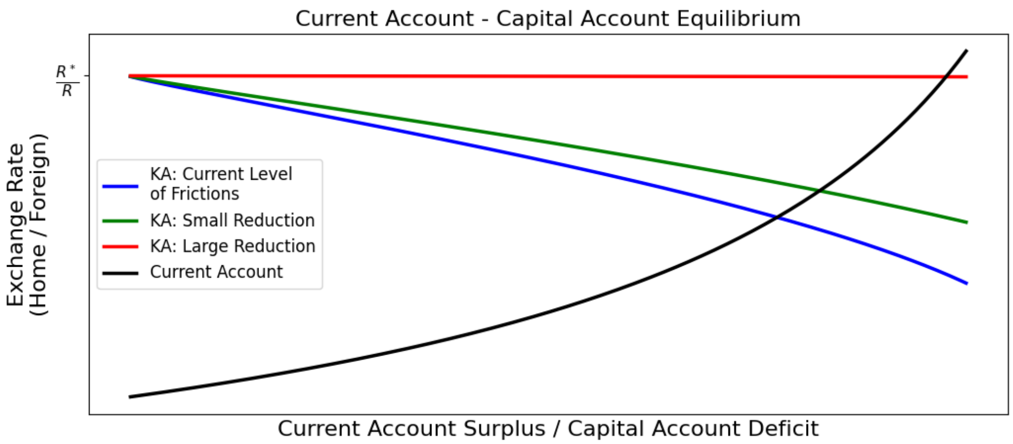
Proof of Proposition 1. See Appendix A.3 (p. 41). □

Intuitively, when the fixed and/or variable costs of intermediation fall, the quantity of intermediation offered by financiers increases for any given UIP deviation $|\Omega|$. Thus the equilibrium UIP deviation must decrease. For countries with a CA surplus, the KA is in deficit, which implies that $\Omega = R - R^* \frac{1}{e_1} < 0$. Since interest rates are exogenously fixed, a reduction in the UIP deviation $|\Omega|$ must be accompanied by an increase in e_1, which is a depreciation of the exchange rate. Analogous logic implies that a reduction in frictions causes an appreciation of the exchange rate e_1 in countries with a CA deficit.

To see why a reduction in frictions increases the capital account and current account position, consider again a country with a CA surplus. As argued above, a reduction in frictions causes the exchange rate e_1 to depreciate. This in turn stimulates net exports, increasing the CA surplus even further. Again, the same logic can be applied to countries with CA deficits by flipping signs.

Figure 2 depicts this outcome for the case of an economy that initially has a current account surplus. Reduced frictions mean that the capital account responds more to any given UIP deviation $|\Omega|$, shifting the capital account from the blue line to the green line. However, when there is no UIP deviation—corresponding to the point where the capital account intersects the y-axis in Figure 2—reduced frictions have no impact. In contrast to the capital account, the current account is unaffected by the reduction in F and/or α. The equilibrium point where the current account surplus and the capital account deficit are balanced therefore shifts outwards, to a point with larger imbalances and a depreciated exchange rate. The extent to which the adjustment occurs primarily on the quantity margin (net trade and financial flows, on the x-axis) or primarily on the price margin (the exchange rate, on the y-axis) depends on the slope of the current account in the initial equilibrium as derived in equation 12.

Figure 2: Equilibrium with reduced cross-border payment frictions



This figure shows the period one current account and capital account balances as a function of the exchange rate, both with an initial level of frictions and after frictions are reduced.

5.2 The impact of changes in frictions on volatility

We now turn to the impact of changes in cross-border payment frictions on the *volatility* of the exchange rate and capital flows. We first describe how we determine the impacts of changes in frictions on volatility. We then examine how such impacts depend on whether the volatility results from real or financial shocks.

Lemma 4. *Let x be the quantity of interest (i.e., capital flows or exchange rates). Then*

(i) The impact of a reduction in cross-border payment frictions on the volatility of x is given by

$$\frac{\partial \text{Var}(x)}{\partial (\text{-Fric})} = 2Cov\left(\frac{\partial x}{\partial (\text{-Fric})}, x\right) .$$

(ii) A reduction in cross-border payment frictions unambiguously increases volatility if, in

reaction to a shock s, it holds that

$$\text{sign}\left(\frac{dx}{ds}\right) = \text{sign}\left(\frac{\partial}{\partial(\text{-Fric})}\left(\frac{dx}{ds}\right)\right) , \tag{18}$$

i.e., the following two objects always move in the same direction: (a) the quantity of interest x, and (b) the responsiveness of x when cross-border payment frictions are reduced, $\frac{\partial x}{\partial(\text{-Fric})}$. If they always move in opposite directions, a reduction in cross-border payment frictions reduces the volatility of x. Otherwise, the impact of a reduction of cross-border payment frictions on the volatility of x is ambiguous.

Proof of Lemma 4. See Appendix A.4 (p. 42). □

Intuitively, consider an exogenous variable that is subject to shocks (e.g., the foreign interest rate R^*). An endogenous variable (e.g., the exchange rate or the capital account) is more volatile with respect to those shocks if its level responds more to them. A reduction in cross-border payment frictions then increases volatility if it amplifies this responsiveness. In other words, a reduction in frictions increases volatility if, when a shock pushes the variable in a certain direction, the reduction in frictions makes the resulting push larger.

Volatility with respect to a real shock. We first consider the impact of lower cross-border payment frictions on exchange rate and capital flow volatility resulting from a shock to the period one current account. For concreteness we focus on a shock to Q_1^T. We summarize our results as follows:

Proposition 2 (Impact on volatility following a real shock)**.** *Following a shock to Q_1^T, lower cross-border payment frictions, i.e., a reduction in F and/or α,*

1. *Decrease exchange rate volatility, and*
2. *Increase capital flow volatility.*

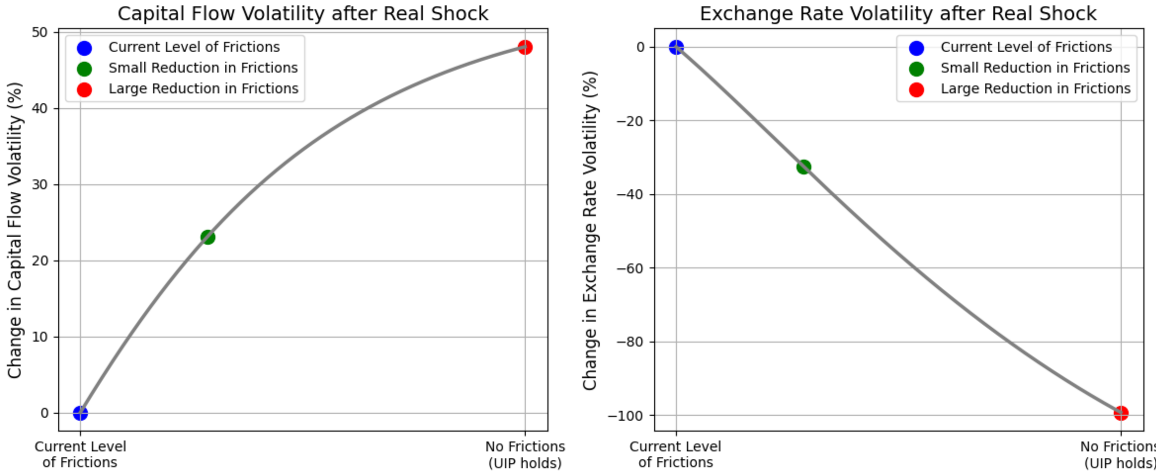
Proof of Proposition 2. See Appendix A.5 (p. 42). □

A shock to Q_1^T shifts the current account of the economy, as shown in Figure 2, by a constant amount to the left (if contractionary) or right (if expansionary). The relative implications of this shift for capital flow and exchange rate volatility depend on the slope of the capital account, which in turn depends on the frictions facing financiers. Intuitively, the lower the frictions, the more aggregate intermediation capacity responds to a given change in the exchange rate.[21] This flattens the capital account (as shown in Figure 2), implying that a given shock to the current account dissipates more through capital account volatility than exchange rate volatility. In the limit, when frictions are reduced by such a large amount that financiers are effectively unconstrained and UIP holds, the capital account is completely flat and the exchange rate is entirely determined by the UIP condition. Then, any shock to the current account must be entirely absorbed through capital flow volatility, while there is no exchange rate volatility at all. Therefore, relative to the status quo, capital flow volatility is increased, while exchange rate volatility declines. This logic generalizes. Whenever frictions decrease relative to the status quo, the capital account curve flattens, implying an increase in capital flow volatility and a decrease in exchange rate volatility to accommodate the movement in the current account caused by the shock. We illustrate these results in Figure 3, with the green and red dots marking a small and a large reduction of frictions as illustrated in Figure 2.

Volatility with respect to a financial shock. We now consider the impact of reduced cross-border payment frictions on exchange rate and capital flow volatility resulting from a change in the foreign interest rate R^*. We summarize our results in the following proposition:

[21]Specifically, lower variable costs directly increase the responsiveness of both financiers' entry and quantity decisions, while lower fixed costs directly increase only the responsiveness of financiers' entry decisions. This difference in the implications of reductions in the two types of costs emerges from the fact that fixed costs—once paid at Stage 1—are sunk, so no longer directly influence a given financier's decision at Stage 2 on how much to intermediate (although they may have indirect, second-round effects via the impact of the total number of financiers on the equilibrium exchange rate). Put differently, each financier always optimizes in Stage 2 in a way that is not dependent on F (except through F's impact on the equilibrium exchange rate), so no change in F directly impacts its decision on how much intermediation to provide—conditional on F always being low enough that the financier does choose to enter.

Figure 3: Capital Flow and Exchange Rate Volatility due to a Real Shock



This figure shows how capital flow and exchange rate volatility following a real shock change as the level of frictions is reduced from a benchmark level. Given the stylized nature of our model, the values on the vertical axes should be considered illustrative rather than quantitative.

Proposition 3 (Impact on volatility following a financial shock)**.** *Following a shock to* R^**, lower cross-border payment frictions, i.e., a reduction in* F *and/or* α*,*

1. *Increase exchange rate volatility, and*
2. *Have an ambiguous effect on capital flow volatility.*

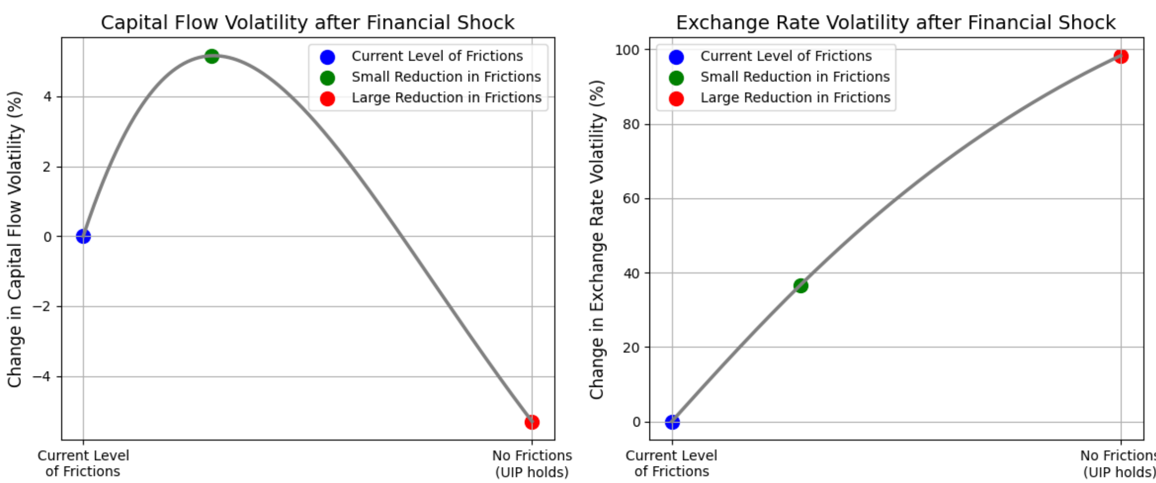
Proof of Proposition 3. See Appendix A.6 (p. 45). □

Lower cross-border payment frictions have two effects that explain the result. First, they increase the responsiveness of the capital account, which amplifies its reaction to the shock.[22] This amplification increases both exchange rate and capital flow volatility. In addition, there is a second effect that needs to be considered. When cross-border payment frictions are lowered, the current account-capital account equilibrium changes and imbalances in the current and capital account increase (cf. Proposition 1). When imbalances are increased, the current account curve steepens (cf. Figure 2), causing larger exchange rate volatility,

[22]Similarly to the case of responsiveness to exchange rates described in footnote 21, lower variable costs directly increase the responsiveness to financial conditions of financiers' entry decisions and their decisions on how much to intermediate, while lower fixed costs do so directly only for financiers' entry decisions.

but lower capital flow volatility in response to a shock, relative to the current account-capital account equilibrium under the current level of frictions. In sum, both the first and the second effect cause increased exchange rate volatility, leading to an unambiguous result of increased exchange rate volatility due to reduced cross-border payment frictions. In contrast, the first effect causes increased capital flow volatility, while the second effect causes decreased capital flow volatility. Depending on which effect dominates, capital flow volatility increases or decreases when cross-border payment frictions are lower. More specifically, the first effect dominates when the reduction in frictions is relatively small, while the second dominates when the reduction in frictions becomes larger, increasing imbalances and moving the equilibrium toward the steeper part of the current account curve. These results are illustrated in Figure 4.

Figure 4: Capital Flow and Exchange Rate Volatility due to a Financial Shock



This figure shows how capital flow and exchange rate volatility following a financial shock (e.g., a shock to R^*) change as the level of frictions is reduced from a benchmark level. Given the stylized nature of our model, the values on the vertical axes should be considered illustrative rather than quantitative.

6 Discussion

Our model is deliberately stylized in order to focus on the core economic mechanisms at play. In this section, we first discuss several of the assumptions and modeling choices underpinning our model, and consider the extent to which our results are sensitive to them. We then help to bridge the gap between the stylized model and its real-world application by providing an extended example that interprets our results through the lens of a specific type of country facing a specific change in frictions.

6.1 Modeling assumptions and robustness

Stylized representative household. We derive our expression for the current account (equation 12) from a stylized representative household with a logarithmic period utility function that consumes a Cobb-Douglas bundle of tradable and non-tradable goods. While this is highly standard (see, for instance, Schmitt-Grohé et al., 2022), we note that our results generalize beyond this particular representation. Specifically, our results hold for any current account that is both increasing and concave in the exchange rate.

Financiers. Financiers in our model encompass both the roles of asset managers and payment conduits. In reality, these could be separate entities in many cases—although not in all cases, given that, for instance, many large financial institutions provide both asset management and correspondent banking services. To the extent that they are different entities in reality, the operating profit created from intermediating trade in financial assets ($|\Omega|$ in our model) is divided between them. This division could take many forms, depending on the market structure of the financial sector serving each country dyad. For tractability, and reflecting our focus on the macroeconomic (rather than intra-financial sector) implications of changes in frictions, we abstract from such considerations in our stylized model by combining both functions into a single agent.

Microfoundations for cross-border payment frictions. As noted in Section 2, ongoing policy initiatives have identified a wide range of frictions affecting cross-border payments (see, for instance, CPMI, 2020). In this paper, we abstract from the precise technical details of these frictions (e.g., the relative importance of limited operating hours versus fragmented and truncated data formats). In Section 3, we simply represent such frictions in two groups: those affecting the fixed cost of intermediating cross-border trade in financial assets (represented by F), and those affecting the variable cost of doing so (represented by α). Our results show that reductions in both groups of frictions have qualitatively the same implications for exchange rates and capital flows, albeit with minor differences in the channels that drive the effects.[23] We leave detailed assessments of the relative quantitative importance of different types of frictions—and of potential reductions in them—for future research.

Cross-border payments and the current account. Our model centers on the relation between cross-border payment frictions and the movement of funds for the purpose of trade in *assets*. In principle, a change in cross-border payment frictions could also affect trade in goods and services. We do not focus on this angle, however, because while a 0.1 percent charge, or a day of settlement delay, might be a meaningful consideration for asset management (as highlighted in Section 2), the same is not true for international trade—where, for instance, frictions in the form of shipping costs or tariffs are orders of magnitude larger than those affecting wholesale payments.

6.2 Example of model interpretation and policy implications

To unpack the implications of our model through a concrete example, we now consider a policymaker in a country that has historically been vulnerable to financial shocks and that is part of a multi-country initiative to create a common financial platform.

Financial platforms that enable direct access to financial assets for intermediaries located

[23]Specifically, fixed costs directly impact financiers' extensive margin, while variable costs directly impact both their extensive and intensive margins (see footnotes 21 and 22).

in different countries are a prime example of a technological improvement to international payment and settlement (Adrian et al., 2022b; Garratt et al., 2024; IMF, 2024). When two financial intermediaries in different countries share access to the same digital platform that allows them to transact directly with each other, using a trusted means of settlement, they no longer require correspondent banking to transfer payments.[24] In the context of our model, the fixed cost is then the cost to a financier of joining the platform, which in practice is likely smaller than the creation of correspondent payment linkages. Similarly, a shared financial platform is likely to improve on both cost and speed efficiency (i.e., variable costs) compared to a correspondent banking network.

We can interpret the expected capital flow and exchange rate implications of the introduction of a financial platform through the lens of our model. For the policymaker in a country historically vulnerable to financial shocks—such as monetary policy shocks emanating from one of the other countries that has joined the financial platform—we can consider the implications of such shocks under both the status quo and in the world after the creation of the platform.

Our model implies that the policymaker should expect larger capital flows and more exchange rate volatility after joining the financial platform. If the policymaker is concerned about exchange rate volatility, for example because the country has a high degree of financial dollarization and volatility can quickly transmit to the stability of firms or financial institutions, then this might call for maintaining a higher level of foreign exchange reserves to smooth short-term volatility following financial shocks. Alternatively, the policymaker could redouble efforts to reduce financial dollarization or aim to maintain larger fiscal buffers to help financial or non-financial corporations weather a large shock, if and when it occurs.

Our model also elucidates the factors determining whether the policymaker should expect larger capital flow volatility. The direction of the impact depends on the current level of cross-border payment frictions, the extent to which these are expected to decline after joining the

[24] Possible means of settlement on such platforms can be issued by central banks (wholesale CBDC) or financial intermediaries themselves (tokenized deposits), or come in the form of stablecoins.

platform, and the elasticities of the current and capital accounts with respect to exchange rates. These inputs can be readily estimated for a given country and combined with our results to provide guidance on the likely direction of change in capital flow volatility.

7 Conclusion

The landscape of cross-border payments is undergoing significant transformations. The combination of accelerating technological innovation and growing geopolitical risk paints an exceptionally uncertain path for the near-term evolution of the costs of conducting payments across borders. Some payment corridors between countries may witness major improvements, while others could face new impediments.

Policymakers are interested in understanding how these changes in payment frictions could influence capital flows and exchange rates. With that in mind, this paper provides a framework that hones in on the central role of intermediaries in the international trade of financial assets and considers how changes in the costs of conducting the payments needed to facilitate such trade impact the level and volatility of capital flows and exchange rates. Our model highlights the importance of intermediaries' fixed and variable costs in determining the extent of cross-border intermediation and the resulting economic outcomes. In particular, our findings indicate that reduced frictions lead to increased capital flows. Lower frictions increase capital flow volatility in response to real shocks while decreasing exchange rate volatility. Conversely, for financial shocks, lower frictions increase exchange rate volatility and have an ambiguous effect on capital flow volatility.

Overall, we highlight that the effect of changes in frictions on volatility can depend on the source of shocks and the direction and magnitude of the change in frictions. Policymakers could thus combine our framework with knowledge of particular countries' characteristics to identify the most likely implications in their contexts. By preparing for such potential outcomes, policymakers can better navigate the evolving landscape of cross-border payments and mitigate the risks associated with changes in the level and volatility of capital flows and exchange rates.

Future work could embed our qualitative framework in quantitatively focused models. In this paper, we focus on a stylized framework to center attention on the fundamental economic mechanisms and to enable the derivation of closed-form analytical results. These mechanisms could in turn be incorporated into existing large-scale DSGE policy models and calibrated to match the elasticities, shocks and frictions faced in a given country, allowing policymakers to produce more precise and tailored policy implications.

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A Proofs Omitted from the Main Text

A.1 Proof of Lemma 1

The Home household's period one budget constraint is

$$P_1^N C_1^N + P_1^T C_1^T + P_1^T B = P_1^N Q_1^N + P_1^T Q_1^T \tag{A.1}$$

and using $p_t \equiv \frac{P_t^N}{P_t^T}$ gives

$$p_1 C_1^N + C_1^T + B = p_1 Q_1^N + Q_1^T \ . \tag{A.2}$$

Similarly the period two budget constraint is

$$p_2 C_2^N + C_2^T = p_2 Q_2^N + Q_2^T + (1+r)B \tag{A.3}$$

which rearranges to

$$B = \frac{1}{1+r}\left[p_2 C_2^N + C_2^T - p_2 Q_2^N - Q_2^T\right] \ . \tag{A.4}$$

Combining these gives the intertemporal budget constraint:

$$\begin{aligned} p_1 C_1^N + C_1^T + \frac{1}{1+r}\left[p_2 C_2^N + C_2^T - p_2 Q_2^N - Q_2^T\right] &= p_1 Q_1^N + Q_1^T \\ p_1 C_1^N + C_1^T + \frac{1}{1+r}\left[p_2 C_2^N + C_2^T\right] &= p_1 Q_1^N + Q_1^T + \frac{1}{1+r}\left[p_2 Q_2^N + Q_2^T\right] \\ p_1 C_1^N + C_1^T + \frac{1}{1+r}\left[p_2 C_2^N + C_2^T\right] &= \bar{Y} \end{aligned} \tag{A.5}$$

where $\bar{Y} \equiv p_1 Q_1^N + Q_1^T + \frac{1}{1+r}\left[p_2 Q_2^N + Q_2^T\right]$ is the household's lifetime income in units of the tradable good in period one.

In period two, the household will always consume all of its income, split optimally between the tradable and non-tradable good. Therefore the household's intertemporal decision (as well as its period one intra-temporal consumption allocation decision) is summarized in its period one maximization problem:

$$\max_{C_1^T, C_1^N, C_2^N} \quad \mathcal{L}_1 = \rho \ln C_1^T + (1-\rho)\ln C_1^N + \beta\rho\mathbb{E}\left[\ln[(1+r)(\bar{Y} - C_1^T - p_1 C_1^N) - p_2 C_2^N]\right] + \beta(1-\rho)\mathbb{E}\left[\ln C_2^N\right] \tag{A.6}$$

where we substitute the budget constraint in for C_2^T. Differentiating with respect to C_1^T, C_1^N and C_2^N then gives respectively:

$$\rho\frac{1}{C_1^T} - \beta(1+r)\rho\mathbb{E}\left[\frac{1}{(1+r)(\bar{Y} - C_1^T - p_1 C_1^N) - p_2 C_2^N}\right] = 0 \tag{A.7}$$

$$(1-\rho)\frac{1}{C_1^N} - p_1\beta(1+r)\rho\mathbb{E}\left[\frac{1}{(1+r)(\bar{Y} - C_1^T - p_1 C_1^N) - p_2 C_2^N}\right] = 0 \tag{A.8}$$

$$-p_2\beta\rho\mathbb{E}\left[\frac{1}{(1+r)(\bar{Y} - C_1^T - p_1 C_1^N) - p_2 C_2^N}\right] + \beta(1-\rho)\mathbb{E}\left[\frac{1}{C_2^N}\right] = 0 \tag{A.9}$$

where the third result follows from using Leibniz's Rule, provided that dominated convergence conditions hold. Rearranging the first condition and substituting the budget constraint back yields

$$\frac{1}{C_1^T} = \beta(1+r)\mathbb{E}\left[\frac{1}{C_2^T}\right] \tag{A.10}$$

which is the Euler equation that equates marginal utility between periods. Rearranging the second optimality condition similarly yields

$$\frac{1}{C_1^N} = \mathbb{E}\left[\frac{\rho}{1-\rho}\frac{\beta(1+r)p_1}{C_2^T}\right] \tag{A.11}$$

which after substituting the Euler equation is equal to

$$C_1^N = \frac{1-\rho}{\rho}\frac{C_1^T}{p_1}\,. \tag{A.12}$$

Similarly, the third equation can be rearranged to yield

$$\mathbb{E}\left[\frac{1}{C_2^N}\right] = \mathbb{E}\left[\frac{\rho}{1-\rho}\frac{p_2}{C_2^T}\right] \tag{A.13}$$

With these terms in hand, we can proceed from the budget constraint to derive an expression for the period one current account as a function of exogenous variables. First, market clearing gives $C_t^N = Q_t^N$, so we can simplify equation A.5 to:

$$C_1^T + \frac{1}{1+r} C_2^T = Q_1^T + \frac{1}{1+r} Q_2^T \ . \tag{A.14}$$

We can then divide by C_2^T to get

$$\frac{C_1^T}{C_2^T} + \frac{1}{1+r} = \frac{Q_1^T + \frac{1}{1+r} Q_2^T}{C_2^T} \ . \tag{A.15}$$

Taking expectations around both sides of the equations and substituting in the Euler equation yields

$$\frac{1}{\beta(1+r)} + \frac{1}{1+r} = \mathbb{E}\left[\frac{1}{\beta(1+r)C_1^T}\left(Q_1^T + \frac{1}{1+r} Q_2^T\right)\right] \tag{A.16}$$

which rearranges to

$$C_1^T = \frac{1}{1+\beta}\left(Q_1^T + \frac{1}{1+r}\mathbb{E}[Q_2^T]\right) \ . \tag{A.17}$$

The current account in period one can therefore be written:

$$\begin{aligned} \text{CA}_1 &= Q_1^T - C_1^T \\ \text{CA}_1 &= Q_1^T - \frac{1}{1+\beta}\left(Q_1^T + \frac{1}{1+r}\mathbb{E}[Q_2^T]\right) \end{aligned} \tag{A.18}$$

Finally, we seek an expression for the current account as a function of the real exchange rate e_1 so we can find the exchange rate that will balance the current account and the capital account. Rearranging equation A.12 for C_1^T and substituting it into equation A.17 gives

$$p_1 \frac{\rho}{1-\rho} C_1^N = \frac{1}{1+\beta}\left(Q_1^T + \frac{1}{1+r}\mathbb{E}[Q_2^T]\right) \tag{A.19}$$

which yields that the current account is equal to

$$\text{CA}_1 = Q_1^T - p_1 \frac{\rho}{1-\rho} Q_1^N \ . \tag{A.20}$$

Noting that our definition of the real exchange rate in equation 5 rearranges to

$$p_1 = \frac{p_1^*}{e_1^{\frac{1}{1-\rho}}} \tag{A.21}$$

in the first period, we can substitute this in to give

$$\text{CA}_1 = Q_1^T - \frac{p_1^*}{e_1^{\frac{1}{1-\rho}}} \frac{\rho}{1-\rho} Q_1^N \,. \tag{A.22}$$

Similarly, we can rearrange the analogue of equation A.12 in the Foreign economy and use the Foreign market clearing condition $C_t^{N*} = Q_t^{N*}$ to give

$$p_1^* = \frac{1-\rho}{\rho} \frac{C^{T*}}{Q_1^{N*}} \tag{A.23}$$

which we can then substitute in to give our final expression for the Home current account:

$$\text{CA}_1 = Q_1^T - \frac{1}{e_1^{\frac{1}{1-\rho}}} C_1^{T*} \frac{Q_1^N}{Q_1^{N*}} \,. \tag{A.24}$$

where

$$C_1^{T*} = \frac{1}{1+\beta^*} \left(Q_1^{T*} + \frac{1}{1+r^*} \mathbb{E}[Q_2^{T*}] \right) \,. \tag{A.25}$$

is the Foreign analogue of equation A.17.

A.2 Proof of Lemma 2

To derive the aggregate capital account, we first solve the financiers' problem by backward induction to derive the amount of intermediation offered by each financier, then we aggregate over all financiers.

Intermediation profits. In period one, each financier purchases q_i worth of Home bonds, measured in units of the tradable good. They finance this purchase by taking an offsetting position in Foreign, i.e., selling q_i/e_1 worth of Foreign bonds. In period two, each financier receives $q_i R$ from their Home bond purchases, and must repay $\frac{q_i R^*}{e_1}$ on their Foreign bond purchases. To raise these funds for the repayment, they must transfer $q_i R^* \frac{e_2}{e_1}$ from Home. Each financier's overall net profit from this intermediation is therefore $q_i R - q_i R^* \frac{e_2}{e_1}$. Thus the financiers' expected net profit in period two, when making this maximization decision in period one, is:

$$\Omega \equiv R - R^* \frac{\mathbb{E}[e_2]}{e_1} \tag{A.26}$$

per unit of intermediation q_i. Intuitively, financiers expect to profit on any deviation from uncovered interest parity. Since each financier's purchases and sales in period one are exactly balanced, equation A.26 also represents each financier's overall expected net profit, across both periods, per unit of intermediation q_i.

Financiers' second stage. In the second stage, financiers that have entered the market choose the amount of funds to intermediate by weighing the expected risk and reward, given their risk-bearing capacity:

$$q_i^* = \arg\max_{q_i}\{\Omega q_i - \frac{\gamma_i}{2}\text{Var}(\Omega q_i)\} \ .$$

This gives the first order condition:

$$\Omega - q_i \gamma_i \text{Var}\left(\Omega\right) = 0$$

Noting that $\text{Var}(\Omega) = \text{Var}(R - R^* \frac{e_2}{e_1}) = \left(\frac{R^*}{e_1}\right)^2 \text{Var}(e_2)$ because e_2 is the random variable, this yields the optimal solution q_i^*:

$$q_i^* = \frac{\Omega}{\gamma_i \left(\frac{R^*}{e_1}\right)^2 \text{Var}(e_2)} \ .$$

Financiers' first stage. In the first stage, financiers enter the market if and only if the expected risk-adjusted profits outweigh the cost of entry—i.e., if and only if the following condition holds:

$$\begin{aligned} \Omega \cdot q_i^* - \frac{\gamma_i}{2}\text{Var}\left(\left(R - R^* \frac{e_2}{e_1}\right) \cdot q_i^*\right) &\geq F \\ \iff \Omega \cdot \frac{\Omega}{\gamma_i \left(\frac{R^*}{e_1}\right)^2 \text{Var}(e_2)} - \left(\frac{\Omega}{\gamma_i \left(\frac{R^*}{e_1}\right)^2 \text{Var}(e_2)}\right)^2 \frac{\gamma_i}{2}\left(\frac{R^*}{e_1}\right)^2 \text{Var}(e_2) &\geq F \\ \iff \frac{1}{2}\frac{\Omega^2}{\gamma_i \left(\frac{R^*}{e_1}\right)^2 \text{Var}(e_2)} &\geq F \end{aligned}$$

We denote by $\hat{\gamma}_i$ the risk bearing ability γ_i of the indifferent financier—i.e., the financier for whom the above inequality holds with equality. Then

$$\hat{\gamma}_i = \frac{1}{2}\frac{\Omega^2}{F \cdot \left(\frac{R^*}{e_1}\right)^2 \mathrm{Var}(e_2)} .$$

Aggregating across financiers. Finally, we aggregate across all financiers to derive the capital account of the economy:

$$\mathrm{KA} = \int_0^1 q^*(\gamma) dG_\gamma = \int_0^{\hat{\gamma}_i} \frac{\Omega}{\gamma_i \left(\frac{R^*}{e_1}\right)^2 \mathrm{Var}(e_2)} \alpha \gamma_i^{\alpha-1} d\gamma_i .$$

After some straightforward calculations, this yields the capital account

$$\mathrm{KA} = \frac{\alpha}{\alpha - 1} \frac{\Omega}{\mathrm{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2} \left(0.5 \frac{\Omega^2}{F \cdot \mathrm{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2}\right)^{\alpha-1} .$$

A.3 Proof of Proposition 1

UIP deviation and exchange rate. We begin by showing that a reduction in cross-border payment frictions leads to a smaller UIP deviation. For a proof by contradiction, suppose that such a reduction leads to a larger Ω. For simplicity, focus on the case of a CA surplus, with the case of a CA deficit following along the same lines. Note that a larger Ω implies an appreciation of the exchange rate e_1. Note that given the shape of the CA, an appreciation of the exchange rate implies a reduction of the CA surplus. However, on the side of the KA, a larger Ω and a reduction in cross-border payment frictions both imply an increase in the KA deficit, which is incompatible with the equilibrium condition $\mathrm{CA}_1 + \mathrm{KA}_1 = 0$. Thus we have a contradiction. Therefore, an reduction in cross-border payment frictions leads to a smaller Ω in equilibrium. The effects on the exchange rate then follows immediately from the formulation of $\Omega = R - R^* \frac{1}{e_1}$.

Capital account and current account. Again, we focus on the case of a CA surplus, with the case of a CA deficit following along similar lines. As the first part of the proof shows, reduced cross-border payment frictions lead to a depreciation of the exchange rate e_1. This leads to an increase in the CA surplus, and by the equilibrium condition $\mathrm{CA}_1 + \mathrm{KA}_1 = 0$ also to a larger KA deficit, that is, the imbalances in the CA and KA increase with reduced cross-border payment frictions.

A.4 Proof of Lemma 4

First, we show that

$$\frac{\partial Var(x)}{\partial(\text{-Fric})} = \mathbb{E}\left[\frac{\partial x^2}{\partial(\text{-Fric})}\right] - \frac{\partial}{\partial(\text{-Fric})}\left(\mathbb{E}[x]\right)^2 \tag{A.27}$$

$$= \mathbb{E}\left[2\frac{\partial x}{\partial(\text{-Fric})}x\right] - 2\mathbb{E}\left[\frac{\partial x}{\partial(\text{-Fric})}\right]\mathbb{E}[x] \tag{A.28}$$

$$= 2Cov\left(\frac{\partial x}{\partial(\text{-Fric})}, x\right) \tag{A.29}$$

Note that we can exchange the order of the expectation operator and differentiation, given that our model produces sufficiently smooth functional forms for both capital flows and exchange rates. Further, note that when $\frac{\partial x}{\partial(\text{-Fric})}$ and x always move in the same direction in reaction to a shock—i.e., when $Corr\left(\frac{\partial x}{\partial(\text{-Fric})}, x\right) = 1$—then this implies that $Cov\left(\frac{\partial x}{\partial(\text{-Fric})}, x\right) > 0$ and hence $\frac{\partial Var(x)}{\partial(\text{-Fric})}$ is positive. Analogously, if $\frac{\partial x}{\partial(\text{-Fric})}$ and x always move in opposite directions in reaction to a shock—i.e., when $Corr\left(\frac{\partial x}{\partial(\text{-Fric})}, x\right) = -1$—then this implies that $Cov\left(\frac{\partial x}{\partial(\text{-Fric})}, x\right) < 0$ and hence $\frac{\partial Var(x)}{\partial(\text{-Fric})}$ is negative. Finally, if these conditions do not hold, distributions exist that place sufficient mass on specific shocks such that the correlation between x and $\frac{\partial x}{\partial(\text{-Fric})}$ can be either positive or negative, implying that the sign of $\frac{\partial Var(x)}{\partial(\text{-Fric})}$ is ambiguous.

A.5 Proof of Proposition 2

A.5.1 Proof that reduced cross-border payment frictions decrease exchange rate volatility in response to a real shock

To show that reduced cross-border payment frictions decrease exchange rate volatility, we have to show that the equilibrium reaction of the exchange rate to the real shock s—i.e., $\frac{de_1}{ds}$—is dampened by a reduction in cross-border payment frictions. That is, when $\frac{de_1}{ds} > 0$, a reduction in cross-border payment frictions must reduce the increase of the exchange rate as a result of the real shock, and the opposite must hold when $\frac{de_1}{ds} < 0$. For convenience, we denote a reduction in cross-border payment frictions by (-Fric) in all proofs of the appendix, unless it is explicitly necessary to distinguish between a reduction in F and α. To prove the proposition, we therefore want to show that

$$\text{sign}\left(\frac{de_1}{ds}\right) \neq \text{sign}\left(\frac{\partial}{\partial(\text{-Fric})}\left(\frac{de_1}{ds}\right)\right)$$

To calculate the equilibrium reaction of the exchange rate to the real shock, $\frac{de_1}{ds}$, recall that the equilibrium condition is that the current and capital account balance, i.e., $\text{CA}(e_1, s) + \text{KA}(e_1, s) = 0$. We can then use the implicit function theorem to calculate $\frac{de_1}{ds}$, which yields that

$$\frac{de_1}{ds} = -\frac{\frac{\partial \text{CA}}{\partial s} + \frac{\partial \text{KA}}{\partial s}}{\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}}$$

We first discuss in some detail the sign of $\frac{de_1}{ds}$, that is, whether the exchange rate increases or declines as a result of the real shock. Note that the denominator of the expression is positive, as $\frac{\partial \text{CA}}{\partial e_1} > 0$ (cf. Lemma 1)and since $\frac{\partial \text{KA}}{\partial e_1} > 0$ by assumption that the capital account KA reacts in line with the UIP deviation. Further, since s is a purely real shock with no effect on the capital account $\frac{\partial \text{KA}}{\partial s} = 0$. This implies that

$$\frac{de_1}{ds} = -\frac{\frac{\partial \text{CA}}{\partial s}}{\underbrace{\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}}_{>0}}$$

and that therefore $\frac{de_1}{ds}$ has opposing signs to $\frac{\partial \text{CA}}{\partial s}$. I.e., an expansionary shock to the current account CA causes the exchange rate e_1 to decline, that is, the domestic currency to appreciate, while a contractionary shock causes the domestic currency to depreciate. This movement of the exchange rate in the opposite direction is necessary to return the current and capital account to equilibrium, as the capital account remains unaffected by the shock.[25]

Next, we derive how the reaction of the exchange rate changes, as the cross-border payment frictions are reduced. For this, we calculate

$$\frac{\partial}{\partial(\text{-Fric})}\left(\frac{de_1}{ds}\right) = -\frac{\left(\left(\frac{\partial^2 \text{CA}}{\partial s \partial(\text{-Fric})}\right)\left(\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}\right) - \frac{\partial \text{CA}}{\partial s}\left(\frac{\partial^2 \text{CA}}{\partial e_1 \partial(\text{-Fric})} + \frac{\partial^2 \text{KA}}{\partial e_1 \partial(\text{-Fric})}\right)\right)}{\left(\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}\right)^2}$$

Since we are only interested in the sign of $\frac{\partial}{\partial(\text{-Fric})}\left(\frac{de_1}{ds}\right)$, we can focus on the numerator of the expression, that is

$$-\left(\left(\frac{\partial^2 \text{CA}}{\partial s \partial(\text{-Fric})}\right)\left(\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}\right) - \frac{\partial \text{CA}}{\partial s}\left(\frac{\partial^2 \text{CA}}{\partial e_1 \partial(\text{-Fric})} + \frac{\partial^2 \text{KA}}{\partial e_1 \partial(\text{-Fric})}\right)\right)$$

Further, note that by assumption cross-border payment frictions do not influence the current

[25] For a visual representation of the intuition, please refer to Figure 1.

account CA, that is $\frac{\partial \text{CA}}{\partial \text{(-Fric)}} = 0$. This implies that $\frac{\partial^2 \text{CA}}{\partial s \partial \text{(-Fric)}} = \frac{\partial^2 \text{CA}}{\partial e_1 \partial \text{(-Fric)}} = 0$, as we can change the order of differentiation. That is, $\frac{\partial^2 \text{CA}}{\partial s \partial \text{(-Fric)}} = \frac{\partial^2 \text{CA}}{\partial \text{(-Fric)} \partial s} = \frac{\partial}{\partial s}(0) = 0$ and the same applies to the partial derivative with respect to the exchange rate e_1. Using this, we can cancel out terms to infer that $\frac{\partial}{\partial \text{(-Fric)}}\left(\frac{de_1}{ds}\right)$ has the same sign as

$$\frac{\partial \text{CA}}{\partial s} \frac{\partial^2 \text{KA}}{\partial e_1 \partial \text{(-Fric)}} > 0$$

Since the capital account KA is increasing in the exchange rate e_1 which is amplified by the reduction of cross-border payment frictions (-Fric), the expression has the same sign as $\frac{\partial \text{CA}}{\partial s}$.

However, as argued before $\frac{de_1}{ds}$ has the opposite sign of $\frac{\partial \text{CA}}{\partial s}$. Thus, $\frac{\partial}{\partial \text{(-Fric)}}\left(\frac{de_1}{ds}\right)$ and $\frac{de_1}{ds}$ have opposing signs, which shows that a reduction in cross-border payment frictions reduces exchange rate volatility in response to a real shock.

A.5.2 Proof that reduced cross-border payment frictions increase capital flow volatility in response to a real shock

To show that reduced cross-border payment frictions increase capital flow volatility in response to a real shock, we have to show that the reaction of the equilibrium quantity of capital flows, given by the current account CA to the real shock s, that is $\frac{d\text{CA}}{ds}$ has the same sign as the effect of reduced cross-border payment frictions on $\frac{d\text{CA}}{ds}$, i.e., $\frac{\partial}{\partial \text{(-Fric)}}\left(\frac{d\text{CA}}{ds}\right)$. That is, we want to show that

$$\text{sign}\left(\frac{d\text{CA}}{ds}\right) = \text{sign}\left(\frac{\partial}{\partial \text{(-Fric)}}\left(\frac{d\text{CA}}{ds}\right)\right)$$

We take a similar implicit function theorem approach as in the preceding section, but use the equilibrium condition that the exchange rate as determined by the current account curve must (in equilibrium) equal the exchange rate as determined by the capital account curve, that is $e_{\text{KA}}(\text{KA}, R^*) = e_{\text{CA}}(\text{CA}, R^*)$, which we write as $e_{\text{KA}}(\text{KA}, R^*) - e_{\text{CA}}(\text{CA}, R^*) = 0$. That is, we here treat the current account CA and the capital account KA as equilibrium quantities (rather than functions of the exchange rate) and consider exchange rate determination as a function of these quantities. The reaction of the current account to the real shock $\frac{d\text{CA}}{ds}$ is:

$$\frac{d\text{CA}}{ds} = -\frac{\frac{\partial e_{\text{KA}}}{\partial s} - \frac{\partial e_{\text{CA}}}{\partial s}}{\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}}}$$

We can simplify this expression, by noting that the real shock only directly affects the current account and not the capital account, thus $\frac{\partial e_{\text{KA}}}{\partial s} = 0$. This yields that

$$\frac{d\text{CA}}{ds} = \frac{\frac{\partial e_{\text{CA}}}{\partial s}}{\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}}}$$

Further, note that the denominator of the expression is negative, as $\frac{\partial e_{\text{CA}}}{\partial \text{CA}} > 0$ and $\frac{\partial e_{\text{KA}}}{\partial \text{CA}} < 0$.[26] Thus, the sign of $\frac{d\text{CA}}{ds}$ is opposite to $\frac{\partial e_{\text{CA}}}{\partial s}$. Next, we calculate the effect of reduced cross-border payment frictions on capital flow volatility as

$$\frac{\partial}{\partial(\text{-Fric})}\left(\frac{d\text{CA}}{ds}\right) = \frac{\frac{\partial^2 e_{\text{CA}}}{\partial s \partial(\text{-Fric})}\left(\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}}\right) - \left(\frac{\partial e_{\text{KA}}}{\partial \text{CA}\partial(\text{-Fric})} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}\partial(\text{-Fric})}\right)\frac{\partial e_{\text{CA}}}{\partial s}}{\left(\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}}\right)^2}$$

where, to determine the sign, it is sufficient to consider the numerator, since the denominator (which is a squared term) is necessarily positive. Note that $\frac{\partial^2 e_{\text{CA}}}{\partial s \partial(\text{-Fric})} = \frac{\partial e_{\text{CA}}}{\partial \text{CA}\partial(\text{-Fric})} = 0$. Thus, the numerator of the expression simplifies to:

$$-\left(\frac{\partial^2 e_{\text{KA}}}{\partial \text{CA}\partial(\text{-Fric})}\right)\left(\frac{\partial e_{\text{CA}}}{\partial s}\right).$$

Further, we know that

$$\left(\frac{\partial^2 e_{\text{KA}}}{\partial \text{CA}\partial(\text{-Fric})}\right) > 0$$

as argued before. This implies that $\frac{\partial}{\partial(\text{-Fric})}\left(\frac{d\text{CA}}{ds}\right)$ has opposing signs to $\frac{\partial e_{\text{CA}}}{\partial s}$. Recall that we had shown that $\frac{d\text{CA}}{ds}$ also has the opposing sign to $\frac{\partial e_{\text{CA}}}{\partial s}$, which implies that $\frac{\partial}{\partial(\text{-Fric})}\left(\frac{d\text{CA}}{ds}\right)$ has the same sign as $\frac{d\text{CA}}{ds}$. Thus, reduced cross-border payment frictions increase capital flow volatility in response to a real shock.

A.6 Proof of Proposition 3

A.6.1 Proof that reduced cross-border payment frictions increase exchange rate volatility in response to a financial shock

In this proof, we show that reduced cross-border payment frictions increase exchange rate volatility in response to a financial shock. To this end, we have to show that $\frac{de_1}{dR^*}$ - the equilibrium reaction of the exchange rate to a shock to the foreign interest rate R^* - has the

[26] These signs hold, as the CA and KA are increasing in the exchange rate and in equilibrium CA $= -$KA.

same sign as $\frac{\partial}{\partial(\text{-Fric})}\left(\frac{de_1}{dR^*}\right)$. That is, we want to show that

$$\text{sign}\left(\frac{de_1}{dR^*}\right) = \text{sign}\left(\frac{\partial}{\partial(\text{-Fric})}\left(\frac{de_1}{dR^*}\right)\right)$$

To calculate the equilibrium reaction of the exchange rate to the real shock, $\frac{de_1}{dR^*}$, recall that the equilibrium condition is that the current and capital account balance, i.e., $\text{CA}(e_1, s) + \text{KA}(e_1, s) = 0$. We can then use the implicit function theorem, which yields that

$$\frac{de_1}{ds} = -\frac{\frac{\partial \text{CA}}{\partial R^*} + \frac{\partial \text{KA}}{\partial R^*}}{\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}}$$

To interpret the shock to the interest rate as a financial shock, we assume that $\frac{de_1}{dR^*} > 0$, such that the foreign currency (e.g., USD) appreciates when its interest rate increases.[27] Next, we calculate, $\frac{\partial}{\partial(\text{-Fric})}\left(\frac{de_1}{dR^*}\right)$:

$$\frac{\partial}{\partial(\text{-Fric})}\left(\frac{de_1}{dR^*}\right) = -\frac{\left(\left(\frac{\partial^2 \text{CA}}{\partial R^* \partial(\text{-Fric})} + \frac{\partial^2 \text{KA}}{\partial R^* \partial(\text{-Fric})}\right)\left(\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}\right) - \left(\frac{\partial^2 \text{CA}}{\partial e_1 \partial(\text{-Fric})} + \frac{\partial^2 \text{KA}}{\partial e_1 \partial(\text{-Fric})}\right)\left(\frac{\partial \text{CA}}{\partial R^*} + \frac{\partial \text{KA}}{\partial R^*}\right)\right)}{\left(\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}\right)^2}$$

To sign this expression, we focus on the numerator because the denominator is a squared value and thus positive. Further, we know that, by the assumption that reduced cross-border payment frictions do not directly affect the current account, together with being able to change the order of differentiation

$$\frac{\partial^2 \text{CA}}{\partial R^* \partial(\text{-Fric})} = \frac{\partial^2 \text{CA}}{\partial e_1 \partial(\text{-Fric})} = 0,$$

Replacing these terms in the numerator, what then remains to be shown is that

$$-\left(\left(\frac{\partial^2 \text{KA}}{\partial R^* \partial(\text{-Fric})}\right)\left(\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}\right) - \left(\frac{\partial^2 \text{KA}}{\partial e_1 \partial(\text{-Fric})}\right)\left(\frac{\partial \text{CA}}{\partial R^*} + \frac{\partial \text{KA}}{\partial R^*}\right)\right) > 0$$

To sign the inequality above, we first introduce a lemma that allows us to easily sign that inequality, and then provide proof that the assumption that is introduced in the lemma holds for our model.

[27] For background, see e.g., Dornbusch (1976), Obstfeld and Rogoff (1995), Engel and Wu (2024).

Lemma 5. *Suppose that*

$$\frac{\partial^2 \text{KA}}{\partial R^* \partial(\text{-Fric})} \frac{\partial \text{KA}}{\partial e_1} = \frac{\partial^2 \text{KA}}{\partial e_1 \partial(\text{-Fric})} \frac{\partial \text{KA}}{\partial R^*}$$

Then,

$$-\left(\left(\frac{\partial^2 \text{KA}}{\partial R^* \partial(\text{-Fric})}\right)\left(\frac{\partial \text{CA}}{\partial e_1} + \frac{\partial \text{KA}}{\partial e_1}\right) - \left(\frac{\partial^2 \text{KA}}{\partial e_1 \partial(\text{-Fric})}\right)\left(\frac{\partial \text{CA}}{\partial R^*} + \frac{\partial \text{KA}}{\partial R^*}\right)\right) > 0$$

Proof. The proof follows directly by multiplying out and canceling terms as per the assumption of the lemma, and then noting that

$$-\left(\underbrace{\frac{\partial^2 \text{KA}}{\partial R^* \partial(\text{-Fric})}}_{<0} \underbrace{\frac{\partial \text{CA}}{\partial e_1}}_{>0} - \underbrace{\frac{\partial^2 \text{KA}}{\partial e_1 \partial(\text{-Fric})}}_{>0} \underbrace{\frac{\partial \text{CA}}{\partial R^*}}_{>0}\right) > 0$$

□

Thus, provided that the assumption in the lemma holds true, we have shown that $\frac{\partial}{\partial(\text{-Fric})}\left(\frac{de_1}{dR^*}\right) > 0$, has the same sign as $\frac{de_1}{dR^*}$. That is, reduced cross-border payment frictions increase exchange rate volatility in response to a financial shock.

To complete the proof, we show that our model indeed fulfills the assumption in the lemma, namely that

$$\frac{\partial^2 \text{KA}}{\partial R^* \partial(\text{-Fric})} \frac{\partial \text{KA}}{\partial e_1} = \frac{\partial^2 \text{KA}}{\partial e_1 \partial(\text{-Fric})} \frac{\partial \text{KA}}{\partial R^*}$$

For that, we replace our general derivative with respect to (-Fric) and explicitly consider the effects of taking the derivative with respect to F and α.

Verifying the assumption for F: We begin by considering F. Note that it is easy to check that the inequality holds true for F since

$$\begin{aligned} \text{KA} &= \frac{\alpha}{\alpha-1}\frac{\Omega}{\text{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2}\left(0.5\frac{\Omega^2}{F\cdot\text{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2}\right)^{\alpha-1} \\ &= \left(\frac{1}{F}\right)^{\alpha-1}\frac{\alpha}{\alpha-1}\frac{\Omega}{\text{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2}\left(0.5\frac{\Omega^2}{\text{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2}\right)^{\alpha-1} \end{aligned}$$

i.e., the expression is basically multiplicative in a monotone function of $h(F) := \left(\frac{1}{F}\right)^{\alpha-1}$, which implies that $\frac{\partial^2\text{KA}}{\partial R^*\partial(\text{-Fric})} = \frac{\partial h(F)}{\partial F}\frac{\partial\text{KA}}{\partial R^*}$ and $\frac{\partial^2\text{KA}}{\partial e_1\partial(\text{-Fric})} = \frac{\partial h(F)}{\partial F}\frac{\partial\text{KA}}{\partial e_1}$ and therefore

$$\frac{\partial^2\text{KA}}{\partial R^*\partial(\text{-Fric})}\frac{\partial\text{KA}}{\partial e_1} = \frac{\partial^2\text{KA}}{\partial e_1\partial(\text{-Fric})}\frac{\partial\text{KA}}{\partial R^*}$$

follows immediately.

Verifying the assumption for α: Next, we repeat the exercise by taking the derivatives with respect to α more explicitly. For brevity, we define

$$\text{KA} = \frac{\alpha}{\alpha-1}\underbrace{\frac{\Omega}{\text{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2}}_{\text{KA}_1}\left(\underbrace{0.5\frac{\Omega^2}{F\cdot\text{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2}}_{\text{KA}_2}\right)^{\alpha-1}$$

Note that

$$\begin{aligned} \frac{\partial\text{KA}}{\partial e_1} &= \frac{\alpha}{\alpha-1}\frac{\partial\text{KA}_1}{\partial e_1}\text{KA}_2^{\alpha-1} + \alpha\text{KA}_1\frac{\partial\text{KA}_2}{\partial e_1}(\text{KA}_2)^{\alpha-2} \\ \frac{\partial^2\text{KA}}{\partial e_1\partial\alpha} &= \frac{\partial}{\partial\alpha}\left(\frac{\alpha}{\alpha-1}\right)\frac{\partial\text{KA}_1}{\partial e_1}\text{KA}_2^{\alpha-1} + \frac{\alpha}{\alpha-1}\frac{\partial\text{KA}_1}{\partial e_1}\text{KA}_2^{\alpha-1}log(\text{KA}_2) \\ &\quad + \text{KA}_1\frac{\partial\text{KA}_2}{\partial e_1}(\text{KA}_2)^{\alpha-2} + \alpha\text{KA}_1\frac{\partial\text{KA}_2}{\partial e_1}log(\text{KA}_2)(\text{KA}_2)^{\alpha-2} \\ &= \frac{\partial\text{KA}_1}{\partial e_1}\underbrace{\frac{1}{\alpha-1}\text{KA}_2^{\alpha-1}\left(-\frac{1}{\alpha-1}+\alpha\cdot log(\text{KA}_2)\right)}_{:=\phi_1} + \frac{\partial\text{KA}_2}{\partial e_1}\underbrace{\text{KA}_1\text{KA}_2^{\alpha-2}\left(1+\alpha\cdot log(\text{KA}_2)\right)}_{:=\phi_2} \end{aligned}$$

similarly, we can determine the partial derivatives with respect to R^*

$$\frac{\partial \mathrm{KA}}{\partial R^*} = \frac{\alpha}{\alpha-1}\frac{\partial \mathrm{KA}_1}{\partial R^*}\mathrm{KA}_2 + \alpha \mathrm{KA}_1 \frac{\partial \mathrm{KA}_2}{\partial e_1}(\mathrm{KA}_2)^{\alpha-2}$$
$$\frac{\partial^2 \mathrm{KA}}{\partial R^* \partial \alpha} = \frac{\partial \mathrm{KA}_1}{\partial R^*}\underbrace{\frac{1}{\alpha-1}\mathrm{KA}_2^{\alpha-1}\left(-\frac{1}{\alpha-1} + \alpha \cdot log(\mathrm{KA}_2)\right)}_{:=\phi_1} + \frac{\partial \mathrm{KA}_2}{\partial R^*}\underbrace{\mathrm{KA}_1\mathrm{KA}_2^{\alpha-2}\left(1+\alpha \cdot log(\mathrm{KA}_2)\right)}_{:=\phi_2}$$

Using this, we can proceed to verify that

$$\frac{\partial^2 \mathrm{KA}}{\partial R^* \partial \alpha}\frac{\partial \mathrm{KA}}{\partial e_1} = \frac{\partial^2 \mathrm{KA}}{\partial e_1 \partial \alpha}\frac{\partial \mathrm{KA}}{\partial R^*}$$

which, after replacing terms, requires us to show that:

$$\left(\frac{\partial \mathrm{KA}_1}{\partial R^*}\phi_1 + \frac{\partial \mathrm{KA}_2}{\partial R^*}\phi_2\right)\left(\frac{\alpha}{\alpha-1}\frac{\partial \mathrm{KA}_1}{\partial e_1}\mathrm{KA}_2^{\alpha-1} + \alpha \mathrm{KA}_1 \frac{\partial \mathrm{KA}_2}{\partial e_1}(\mathrm{KA}_2)^{\alpha-2}\right)$$
$$= \left(\frac{\partial \mathrm{KA}_1}{\partial e_1}\phi_1 + \frac{\partial \mathrm{KA}_2}{\partial e_1}\phi_2\right)\left(\frac{\alpha}{\alpha-1}\frac{\partial \mathrm{KA}_1}{\partial R^*}\mathrm{KA}_2^{\alpha-1} + \alpha \mathrm{KA}_1 \frac{\partial \mathrm{KA}_2}{\partial R^*}(\mathrm{KA}_2)^{\alpha-2}\right)$$

and this simplifies to

$$\frac{\partial \mathrm{KA}_1}{\partial R^*}\frac{\partial \mathrm{KA}_2}{\partial e_1} = \frac{\partial \mathrm{KA}_1}{\partial e_1}\frac{\partial \mathrm{KA}_2}{\partial R^*}$$

For the following, define $D := \mathrm{Var}(e_2)\left(\frac{R^*}{e_1}\right)^2$ for the denominator in the expressions KA_1 and KA_2. Then calculating the dervatives leads to the equation

$$\frac{0.5}{F}\frac{\frac{\partial \Omega}{\partial e_1}D - \frac{\partial D}{\partial e_1}\Omega}{D^2} \cdot \frac{2\frac{\partial \Omega}{\partial R^*}\Omega D - \frac{\partial D}{\partial R^*}\Omega^2}{D^2}$$
$$= \frac{0.5}{F}\frac{\frac{\partial \Omega}{\partial R^*}D - \frac{\partial D}{\partial R^*}\Omega}{D^2} \cdot \frac{2\frac{\partial \Omega}{\partial e_1}\Omega D - \frac{\partial D}{\partial e_1}\Omega^2}{D^2}$$

which can be simplified to

$$\frac{\partial D}{\partial e_1}\frac{\partial \Omega}{\partial R^*} = \frac{\partial D}{\partial R^*}\frac{\partial \Omega}{\partial e_1}$$

and can be further simplified, after plugging in, to yield

$$-2\mathrm{Var}(e_2)\frac{R^{*2}}{e_1^3}\left(-\frac{1}{e_1}\right) = 2\mathrm{Var}(e_2)\frac{R^*}{e_1^2}\left(\frac{R^*}{e_1^2}\right)$$

which is a true equality, and thus proves the assumption of the lemma.

A.6.2 Proof that reduced cross-border payment frictions have an ambiguous effect on capital flow volatility in response to a financial shock

We here prove that reduced cross-border payment frictions can either increase or decrease capital flow volatility in response to a financial shock. That is, we have to show that $\frac{\partial}{\partial\text{(-Fric)}}\left(\frac{de_1}{dR^*}\right)$ can be either positive or negative. As in the preceding section, we take an implicit function theorem approach, but we here use the equilibrium condition that the exchange rate as determined by the current account has to coincide with that given by the capital account. That is, $e_{\text{KA}}(\text{KA}, R^*) = e_{\text{CA}}(\text{CA}, R^*)$, which we write as $e_{\text{KA}}(\text{KA}, R^*) - e_{\text{CA}}(\text{CA}, R^*) = 0$. That is, we here treat the current account CA and the capital account KA as equilibrium quantities (rather than functions of the exchange rate) and consider exchange rate determination as a function of these quantities. The reaction of the current account to the interest rate shock $\frac{d\text{CA}}{dR^*}$ is:

$$\frac{d\text{CA}}{dR^*} = -\frac{\frac{\partial e_{\text{KA}}}{\partial R^*} - \frac{\partial e_{\text{CA}}}{\partial R^*}}{\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}}}$$

To determine the sign of $\frac{d\text{CA}}{dR^*}$, recall that in the previous section we had argued that $\frac{de_1}{dR^*} > 0$. Therefore, since the exchange rate e_1 is increasing in R^* and the current account CA is increasing in the exchange rate e_1, we know that $\frac{d\text{CA}}{dR^*} > 0$. Note that $\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}} < 0$, which holds as $\frac{\partial e_{\text{KA}}}{\partial \text{CA}} = -\frac{\partial e_{\text{KA}}}{\partial \text{KA}} < 0$, and since $\frac{\partial e_{\text{CA}}}{\partial \text{CA}} > 0$. Therefore $\frac{\partial e_{\text{KA}}}{\partial R^*} - \frac{\partial e_{\text{CA}}}{\partial R^*} > 0$.

Next, we calculate the effect of reduced cross-border payment frictions on the response of capital flows to an interest rate shock, that is $\frac{\partial}{\partial\text{(-Fric)}}\left(\frac{d\text{CA}}{dR^*}\right)$:

$$\frac{\partial}{\partial\text{(-Fric)}}\left(\frac{d\text{CA}}{dR^*}\right) = -\frac{\left(\frac{\partial^2 e_{\text{KA}}}{\partial R^*\partial\text{(-Fric)}} - \frac{\partial^2 e_{\text{CA}}}{\partial R^*\partial\text{(-Fric)}}\right)\left(\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}}\right) - \left(\frac{\partial^2 e_{\text{KA}}}{\partial \text{CA}\partial\text{(-Fric)}} - \frac{\partial^2 e_{\text{CA}}}{\partial \text{CA}\partial\text{(-Fric)}}\right)\left(\frac{\partial e_{\text{KA}}}{\partial R^*} - \frac{\partial e_{\text{CA}}}{\partial R^*}\right)}{\left(\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}}\right)^2}$$

Note that the sign of the expression does not depend on the denominator and that $\frac{\partial^2 e_{\text{CA}}}{\partial R^*\partial\text{(-Fric)}} = \frac{\partial^2 e_{\text{CA}}}{\partial \text{CA}\partial\text{(-Fric)}} = 0$, since the CA does not depend on cross-border payment frictions by assumption. Therefore, we only have to determine the sign of the expression

$$-\left(\left(\frac{\partial^2 e_{\text{KA}}}{\partial R^*\partial\text{(-Fric)}}\right)\left(\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}}\right) - \left(\frac{\partial^2 e_{\text{KA}}}{\partial \text{CA}\partial\text{(-Fric)}}\right)\left(\frac{\partial e_{\text{KA}}}{\partial R^*} - \frac{\partial e_{\text{CA}}}{\partial R^*}\right)\right)$$

In particular, to show the result that a reduction in cross-border payment frictions has an ambiguous effect on capital flow volatility in response to a financial shock, we want to show that this expression can both be positive and negative. First, we show that the expression can be positive. For that, note that $\frac{\partial^2 e_{\text{KA}}}{\partial R^*\partial\text{(-Fric)}}$ is 0 at KA $= 0$ and negative at CA large enough. This holds as when KA $= 0$, UIP must hold, which requires that $e_1 = \frac{R^*}{R}$, such that $\frac{\partial^2 e_{\text{KA}}}{\partial R^* \partial (\text{-Fric})} = 0$ at KA $= 0$. Further, note that $\frac{\partial^2 e_{\text{KA}}}{\partial \text{CA} \partial (\text{-Fric})} > 0$, as a reduction in frictions implies a flattening of the capital account curve (cf. Figure 2).

Evaluating the expression above at KA $=$ CA $= 0$ then yields that

$$-\left(\left(\frac{\partial^2 e_{\text{KA}}}{\partial \text{CA} \partial (\text{-Fric})}\right)\left(\frac{\partial e_{\text{KA}}}{\partial R^*} - \frac{\partial e_{\text{CA}}}{\partial R^*}\right)\right) > 0$$

such that reduced cross-border payment frictions cause an amplification to capital flow volatility when the CA is close to 0. Further, note that for CA $\to \infty$ we have that $\frac{\partial e_{\text{CA}}}{\partial \text{CA}} \to \infty$,[28] which implies that the sign will coincide with the sign of

$$-\left(\left(\frac{\partial^2 e_{\text{KA}}}{\partial R^* \partial (\text{-Fric})}\right)\left(\frac{\partial e_{\text{KA}}}{\partial \text{CA}} - \frac{\partial e_{\text{CA}}}{\partial \text{CA}}\right)\right)$$

given that the other expressions are bounded away from 0 and ∞ as needed. Therefore the equation above is negative for CA large enough, such that reduced cross-border payment frictions cause a decrease in capital flow volatility for CA large enough.

B Deriving the Parameter Restrictions

B.1 The Capital Account Reacts in Line with the UIP Deviation

Throughout the paper, we assume that the direction into which the capital account reacts to shocks is in line with how the UIP deviation Ω reacts to shocks, i.e., that

$$\text{sign}\left(\frac{\partial \text{KA}}{\partial x}\right) = \text{sign}\left(\frac{\partial \Omega}{\partial x}\right) \text{ for } x = R, R^*, e_1$$

To derive conditions under which this assumption holds, note that, as derived in earlier sections:

$$\frac{\partial \text{KA}}{\partial x} = \frac{\alpha}{\alpha - 1} \frac{\partial \text{KA}_1}{\partial x} \text{KA}_2^{\alpha-1} + \alpha \text{KA}_1 \frac{\partial \text{KA}_2}{\partial x} (\text{KA}_2)^{\alpha-2}$$

[28] This holds, as an increasingly large current account implies that households save all their endowments and consume nothing in the first period, which implies the result given the typical Inada condition $u'(0) \to \infty$. See also Equation 12 for reference.

Note that multiplying by $\mathrm{KA}_2^{\alpha-2}$ does not change the sign of this derivative, such that it has the same sign as

$$\frac{\alpha}{\alpha-1}\frac{\partial \mathrm{KA}_1}{\partial x}\mathrm{KA}_2+\alpha \mathrm{KA}_1\frac{\partial \mathrm{KA}_2}{\partial x}$$

Next, we substitute in the partial derivatives $\frac{\partial \mathrm{KA}_1}{\partial x}$ and $\frac{\partial \mathrm{KA}_2}{\partial x}$ to arrive at the expression:

$$\frac{\alpha}{\alpha-1}\frac{\frac{\partial \Omega}{\partial x}D-\frac{\partial D}{\partial x}\Omega}{D^2}\mathrm{KA}_2+\alpha \mathrm{KA}_1\left(\frac{0.5}{F}\right)^{\alpha-1}\frac{2\frac{\partial \Omega}{\partial x}\Omega D-\frac{\partial D}{\partial x}\Omega^2}{D^2}$$

Further, note that we can multiply by D^2 without changing the sign of the expression, and that $\mathrm{KA}_1\cdot\Omega\cdot\left(\frac{0.5}{F}\right)^{\alpha-1}=\mathrm{KA}_2$, which implies that we can divide the expression by KA_2 without changing its sign. Therefore, we arrive at the expression

$$\frac{\alpha}{\alpha-1}\left(\frac{\partial \Omega}{\partial x}D-\frac{\partial D}{\partial x}\Omega\right)+\alpha\left(2\frac{\partial \Omega}{\partial x}D-\frac{\partial D}{\partial x}\Omega\right)$$

Now, the first observation is that $\frac{\partial D}{\partial R}=0$, such that for $x=R$ it immediately follows that $\mathrm{sign}\left(\frac{\partial \mathrm{KA}}{\partial R}\right)=\mathrm{sign}\left(\frac{\partial \Omega}{\partial R}\right)$. Next, consider $x=R^*,e_1$ and note that since $D=\left(\frac{R^*}{e_1}\right)^2=\left(-\frac{R^*}{e_1}\right)^2$, it holds that $\frac{\partial D}{\partial x}=-2\frac{\partial \Omega}{\partial x}\frac{R^*}{e_1}$. Substituting this into the expression yields

$$\frac{\alpha}{\alpha-1}\left(\frac{\partial \Omega}{\partial x}D+2\frac{\partial \Omega}{\partial x}\frac{R^*}{e_1}\Omega\right)+\alpha\left(2\frac{\partial \Omega}{\partial x}D+2\frac{\partial \Omega}{\partial x}\frac{R^*}{e_1}\Omega\right)$$

We can now factor out $\frac{\partial \Omega}{\partial x}$, which implies that the expression above has the same sign as $\frac{\partial \Omega}{\partial x}$ if

$$\frac{\alpha}{\alpha-1}\left(D+2\frac{R^*}{e_1}\Omega\right)+\alpha\left(2D+2\frac{R^*}{e_1}\Omega\right)>0 \tag{B.1}$$

Which after some rearranging, is equivalent to

$$\frac{R^*}{e_1}\frac{2\alpha-1}{2\alpha}>-\Omega$$

Note that $\frac{2\alpha-1}{2\alpha}$ is an increasing function of α for $\alpha>1$, which is bounded below by 0.5 at $\alpha=1$. Further, we can take the absolute value of the Ω to arrive at the condition that

$$0.5\frac{R^*}{e_1}>|\Omega|$$

Which means that the assumption holds as long as the UIP deviation is less than half of the expected gross yield on foreign currency bond holdings.

B.2 Reduced Cross-Border Payment Frictions Amplify the Responsiveness of the Capital Account

Further, we show that the assumption derived above is also (almost) sufficient to guarantee that reduced frictions unambiguously increase the responsiveness of the capital account, i..e, that

$$\text{sign}\left(\frac{\partial \text{KA}}{\partial x}\right) = \text{sign}\left(\frac{\partial \text{KA}}{\partial x \partial \text{(-Fric)}}\right)$$

We show that this condition holds, both for derivates with respect to F and α.

The derivative with respect to F: First, consider the impact of reduced cross-border payment frictions through a reduction in the fixed cost, that is, we consider

$$\text{sign}\left(\frac{\partial \text{KA}}{\partial x \partial \text{(-Fric)}}\right) = \text{sign}\left(-\frac{\partial \text{KA}}{\partial x \partial F}\right)$$

As noted above

$$\frac{\partial \text{KA}}{\partial x} = \frac{\alpha}{\alpha - 1}\frac{\partial \text{KA}_1}{\partial x}\text{KA}_2^{\alpha-1} + \alpha \text{KA}_1 \frac{\partial \text{KA}_2}{\partial x}(\text{KA}_2)^{\alpha-2}$$

By defining $\text{KA}_2 \equiv \frac{1}{F}\widehat{\text{KA}_2}$, we can express the equation above more explicitly as a function of the two factors F and α influenced by reduced cross-border payment frictions, noting that neither KA_1 nor $\widehat{\text{KA}_2}$ depend on F, α:

$$\begin{aligned}\frac{\alpha}{\alpha-1}\frac{\partial \text{KA}_1}{\partial x}\left(\frac{1}{F}\right)^{\alpha-1}\widehat{\text{KA}_2}^{\alpha-1} + \alpha \text{KA}_1 \frac{1}{F}\frac{\partial \widehat{\text{KA}_2}}{\partial x}\left(\frac{1}{F}\right)^{\alpha-2}(\widehat{\text{KA}_2})^{\alpha-2} \\ = \left(\frac{1}{F}\right)^{\alpha-1}\left(\frac{\alpha}{\alpha-1}\frac{\partial \text{KA}_1}{\partial x}\widehat{\text{KA}_2}^{\alpha-1} + \alpha \text{KA}_1 \frac{\partial \widehat{\text{KA}_2}}{\partial x}(\widehat{\text{KA}_2})^{\alpha-2}\right)\end{aligned}$$

Then, the derivative of the expression above with respect to $-F$ is equal to

$$(\alpha-1)\left(\frac{1}{F}\right)^{\alpha-2}\left(\frac{\alpha}{\alpha-1}\frac{\partial \text{KA}_1}{\partial x}\widehat{\text{KA}_2}^{\alpha-1} + \alpha \text{KA}_1 \frac{\partial \widehat{\text{KA}_2}}{\partial x}(\widehat{\text{KA}_2})^{\alpha-2}\right)$$

Note that $\alpha > 1$ and that

$$\begin{aligned}
&\operatorname{sign}\left(\frac{\alpha}{\alpha-1}\frac{\partial \mathrm{KA}_1}{\partial x}\mathrm{KA}_2^{\alpha-1} + \alpha \mathrm{KA}_1 \frac{\partial \mathrm{KA}_2}{\partial x}(\mathrm{KA}_2)^{\alpha-2}\right) \\
&= \operatorname{sign}\left(\frac{\alpha}{\alpha-1}\frac{\partial \mathrm{KA}_1}{\partial x}\widehat{\mathrm{KA}_2}^{\alpha-1} + \alpha \mathrm{KA}_1 \frac{\partial \widehat{\mathrm{KA}_2}}{\partial x}(\widehat{\mathrm{KA}_2})^{\alpha-2}\right)
\end{aligned}$$

which shows that

$$\operatorname{sign}\left(\frac{\partial \mathrm{KA}}{\partial x}\right) = \operatorname{sign}\left(-\frac{\partial \mathrm{KA}}{\partial x \partial F}\right)$$

The derivative with respect to α: To show under which conditions

$$\operatorname{sign}\left(\frac{\partial \mathrm{KA}}{\partial x}\right) = \operatorname{sign}\left(-\frac{\partial \mathrm{KA}}{\partial x \partial \alpha}\right)$$

we work with the expression

$$\frac{\partial \mathrm{KA}}{\partial x} = \frac{\alpha}{\alpha-1}\frac{\partial \mathrm{KA}_1}{\partial x}\mathrm{KA}_2^{\alpha-1} + \alpha \mathrm{KA}_1 \frac{\partial \mathrm{KA}_2}{\partial x}(\mathrm{KA}_2)^{\alpha-2}$$

and note that neither KA_1 nor KA_2 depend on α. Then, taking the derivative with respect to $-\alpha$ yields

$$\begin{aligned}
-\frac{\partial^2 \mathrm{KA}}{\partial x \partial \alpha} &= -\frac{\alpha}{\alpha-1}\frac{\partial \mathrm{KA}_1}{\partial x}\log(\mathrm{KA}_2)\mathrm{KA}_2^{\alpha-1} + \frac{1}{(\alpha-1)^2}\frac{\partial \mathrm{KA}_1}{\partial x}\mathrm{KA}_2^{\alpha-1} \\
&\quad - \mathrm{KA}_1 \frac{\partial \mathrm{KA}_2}{\partial x}(\mathrm{KA}_2)^{\alpha-2} - \alpha \mathrm{KA}_1 \frac{\partial \mathrm{KA}_2}{\partial x}\log(\mathrm{KA}_2)(\mathrm{KA}_2)^{\alpha-2} \\
&= \left(\frac{1}{(\alpha-1)^2} - \log(\mathrm{KA}_2)\frac{\alpha}{\alpha-1}\right)\frac{\partial \mathrm{KA}_1}{\partial x}\mathrm{KA}_2^{\alpha-1} + \left(-1 - \log(\mathrm{KA}_2)\alpha\right)\mathrm{KA}_1 \frac{\partial \mathrm{KA}_2}{\partial x}(\mathrm{KA}_2)^{\alpha-2}
\end{aligned}$$

Following along the same lines as in the derivation leading up to equation B.1, it holds that

$$\operatorname{sign}\left(\frac{\partial \mathrm{KA}}{\partial x}\right) = \operatorname{sign}\left(-\frac{\partial \mathrm{KA}}{\partial x \partial \alpha}\right)$$

if

$$\frac{R^*}{e_1}\left(\frac{1}{(\alpha-1)^2} - 2 - \log(\mathrm{KA}_2)\alpha\left(\frac{1}{\alpha-1}+2\right)\right) > -\Omega \cdot 2\left(\frac{1}{(\alpha-1)^2} - 1 - \log(\mathrm{KA}_2)\alpha\left(\frac{1}{\alpha-1}+1\right)\right)$$

Note that KA_2 was defined by the risk bearing capability of the financier that is indifferent between entering the market or not. Note that this implies: (i) $\mathrm{KA}_2 \in (0, 1]$ such that

$\log(\text{KA}_2) < 0$ and that (ii) by defining β to be the mass of financiers that enter the market, we can write $\text{KA}_2 = \beta^{\frac{1}{\alpha}}$ which implies $\log(\text{KA}_2) = \frac{1}{\alpha}\log(\beta)$. Substituting that into the equation, we get

$$\frac{R^*}{e_1}\left(\frac{1}{(\alpha-1)^2} - 2 - \log(\beta)\left(\frac{1}{\alpha-1}+2\right)\right) > -\Omega\cdot 2\left(\frac{1}{(\alpha-1)^2} - 1 - \log(\beta)\left(\frac{1}{\alpha-1}+1\right)\right)$$

That is, an inequality that connects the gross yield on foreign bonds at today's exchange rate, $\frac{R^*}{e_1}$, the deviation from UIP, Ω, the mass of financiers in the market, β and the parameter α. Noting that for $\beta < \frac{1}{e} \approx 37\%$, i.e., that less than 37% of potential financiers enter the market, we have that $-log(\beta) > 1$, which implies that $\left(\frac{1}{(\alpha-1)^2} - 1 - \log(\beta)\left(\frac{1}{\alpha-1}+1\right)\right) > 0$, which then yields the inequality

$$\frac{R^*}{e_1}\frac{\left(\frac{1}{(\alpha-1)^2} - 2 - \log(\beta)\left(\frac{1}{\alpha-1}+2\right)\right)}{2\left(\frac{1}{(\alpha-1)^2} - 1 - \log(\beta)\left(\frac{1}{\alpha-1}+1\right)\right)} > -\Omega$$

Further, note that the coefficient

$$\frac{\left(\frac{1}{(\alpha-1)^2} - 2 - \log(\beta)\left(\frac{1}{\alpha-1}+2\right)\right)}{2\left(\frac{1}{(\alpha-1)^2} - 1 - \log(\beta)\left(\frac{1}{\alpha-1}+1\right)\right)}$$

is an increasing function in α for $\alpha > 1$ when $-\log(\beta) > 1$, with a minimum of 0.5 at $\alpha = 0.5$. Therefore, the condition that

$$\text{sign}\left(\frac{\partial \text{KA}}{\partial x}\right) = \text{sign}\left(-\frac{\partial \text{KA}}{\partial x \partial \alpha}\right)$$

does not impose any additional assumptions relative to the assumption that $0.5\frac{R^*}{e_1} > |\Omega|$ if less than approximately 37% of potential financiers enter the market. Finally, note that even if more than that fraction of financiers enters the market, the signs of $\text{sign}\left(\frac{\partial \text{KA}}{\partial x}\right)$ and $\text{sign}\left(-\frac{\partial \text{KA}}{\partial x \partial \alpha}\right)$ will agree for most of the parameter space of β and α when UIP deviations are small relative to $\frac{R^*}{e_1}$.

C Robustness to Non-Negligible Intermediary Profits

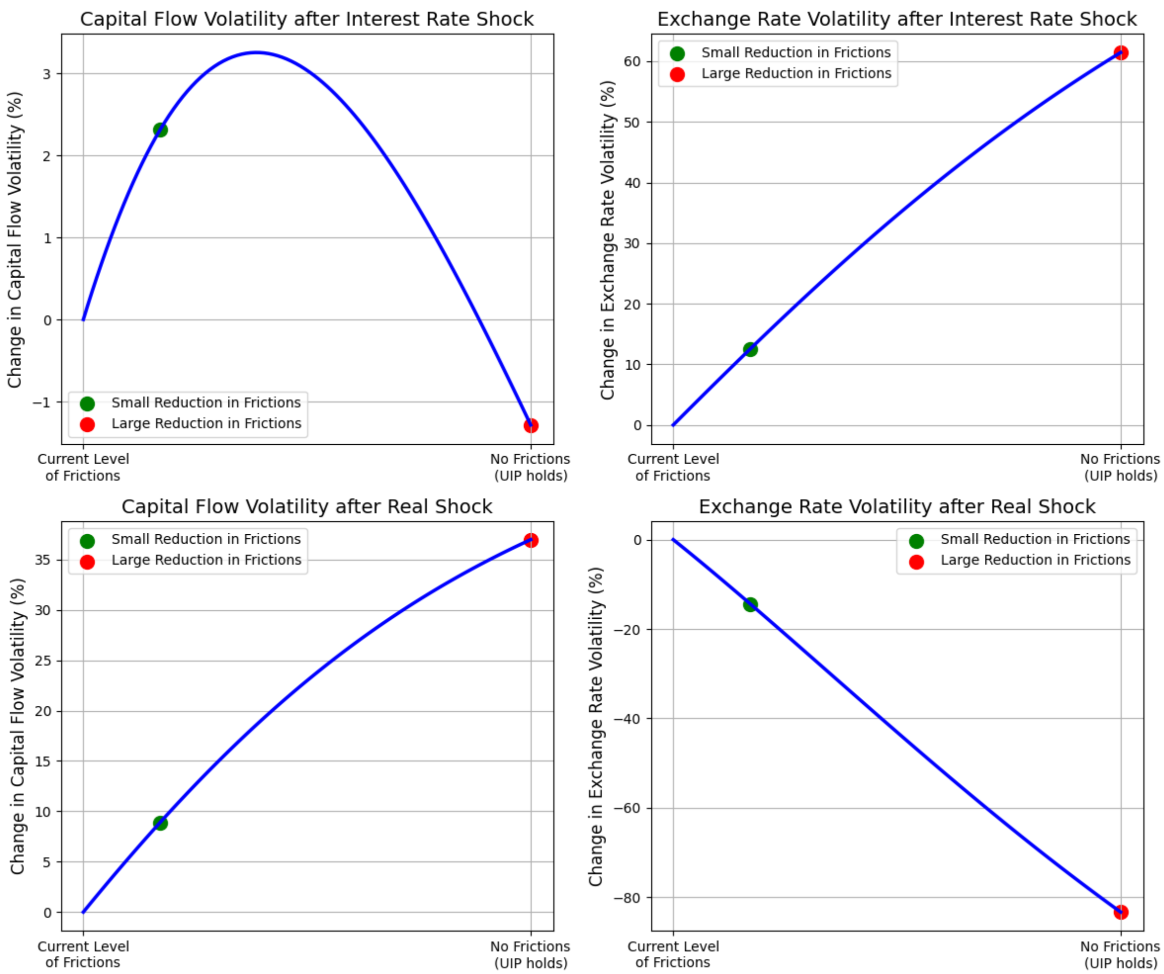
In this section, we illustrate that our results are qualitatively robust to relaxing the assumption that financiers' profits are negligible for household decisions. Specifically, we calibrate the model in the same way as for the figures in the main text (with the parameters summarized in Table C.1), then we augment the Foreign household's budget constraint (the analogue of equations A.1 and A.3) with brokers' aggregate profits. The results, shown in Figure C.1, are qualitatively very similar to those in our baseline model, shown in Figures 3 and 4.

Table C.1: Parameter values for indicative figures

Notation	**Description**	**Value**
Q_1^T	Tradable goods endowment	2
Q_1^N	Non-tradable goods endowment	1
R	Domestic gross interest rate	1.02
R^*	Foreign gross interest rate	1.025
$\text{Var}(e_2)$	Variance of future exchange rate	2
ρ	Elasticity between non-tradables and tradables	0.35
p_1^*	Foreign price level	1
ΔQ_1^T	Shock to tradable endowment	$-0.01\, Q_1^T = -0.02$
ΔR^*	Foreign interest rate shock	0.025

This table shows the parameter values we use to calibrate the figures shown in the paper. Given the stylized nature of our model, these values and the resulting magnitudes in the figures should be considered illustrative rather than quantitative.

Figure C.1: Capital Flow and Exchange Rate Volatility with Non-Negligible Intermediary Profits



This figure shows the period one current account and capital account balances as a function of the exchange rate, both with an initial level of frictions and after frictions are reduced, when intermediaries' profits are included in the Foreign household's income.

PUBLICATIONS

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