Competing Rails for Cross-Border Payments: Banks, Fintechs, and Stablecoins *

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Abstract

Cross-border payments remain slow and expensive despite significant improvements in digital financial infrastructure over the past several decades. This paper compares the cost of sending cross-border payments across three payment rails: traditional banks operating through the correspondent banking system and SWIFT, non-bank money transmitters such as Wise, Remitly, and Western Union, and stablecoin-based transfers. We construct harmonized all-in costs measures across these three rails for different corridors and payment values. We examine whether stablecoin rails can match or undercut existing cross-border payment architecture and discuss implications for regulation and the future structure of cross-border payment systems.

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1 Introduction

Over the past decade, many countries have adopted fast domestic electronic payment systems. However, cross-border retail payments remain slow and expensive. For retail payments, despite decades of efforts to enhance transparency and competition, the global average cost of sending $200 internationally remains well above the G20's target of reducing remittance prices to below 3 percent (Financial Stability Board (2025)).

Traditional cross-border payments rely on the correspondent banking system, in which banks maintain bilateral nostro/vostro accounts in different jurisdictions and use the Society for Worldwide Interbank Financial Telecommunication (SWIFT) network for messaging. This architecture does not work well for small-value transfers, as lengthy intermediary chains introduce significant fees and delays, with substantial cost and speed heterogeneity across corridors.

Over the past decade, two sets of innovations have challenged the dominance of correspondent banking. The first is the rise of non-bank money transfer operators (MTOs), such as Wise, Remitly, Moneygram, and Western Union. These entities bypass the corresponding banking system and directly establish local settlement accounts with local banks. These non-banks have significantly lowered costs, particularly in high-volume corridors where customer flows can be matched internally and where access to local banking systems is straightforward.

A more recent development is the use of stablecoins, which are crypto-tokens pegged to fiat currencies, as a cross-border settlement instrument. Remittances via stablecoins typically involve a "stablecoin sandwich": the sender converts local fiat into a USD-linked stablecoin, transfers the asset on-chain via a public blockchain, and the recipient converts back into local fiat currency, often through a centralized crypto exchange that supports the

local fiat currency redemption. Stablecoin rails can be used by retail users but also by fintech money transmitters themselves. A notable example is Felix Pago, a payment company that uses the stablecoin sandwich to help customers send remittances from the United States to Mexico via Whatsapp (Circle (2026)).

With the help of a foreign-currency stablecoin, a "double-decker" stablecoin sandwich can also be used for cross-border payments. In this case, the sender converts local fiat into a USD stablecoin, transfers the asset on-chain via a public blockchain, converts the USD stablecoin into a foreign-currency stablecoin, and then redeems the foreign currency stablecoin into foreign currency fiat. So far, most stablecoins in circulation are denominated in the U.S. dollar, so the use of the "double-decker" stablecoin sandwich is quite limited. However, compared to the conventional stablecoin sandwich, the double-decker stablecoin sandwich can also perform the foreign exchange (FX) transaction on chain, using decentralized protocals, such as Uniswap, which offers on-chain price discovery and atomic settlement. A good example of a "double-decker" stablecoin is to make payment between USD and EUR using Circle's USD stablecoin USDC, and EUR stablecoin, EURC (Adams et al. (2023)).

This paper compares the cost of sending cross-border payments across three architectures, traditional banks, non-bank money transmitters, and stablecoin-based transfers. Our data sources include the World Bank's Remittance Prices Worldwide index, which provides systematic pricing data for banks and MTOs at quarterly frequency. We supplement the World Bank data with our own manual collection of pricing from MTOs at the intraday frequency, together with a small sample of bank wire transfer costs. On the stablecoin rails, we collect data on stablecoin-fiat exchange rate pair transaction prices from Coindesk, commissions on centralized crypto exchanges, gas fees on public blockchains, and Defi transaction fees. As a reference benchmark, we use intraday FX rates from Bloomberg BFIX.

Our findings yield five main takeaways for the structure of cross-border payment markets. First, retail cross-border payment costs primarily reflect payment architecture rather than underlying FX market illiquidity. Wholesale FX markets for major currencies are deep and trade at minimal spreads, yet retail FX markups for FX wires done by large global banks can reach 200–400 basis points even for the most liquid currency pairs. This wedge likely reflects the significant fixed costs of establishing correspondent banking arrangements, as well as the substantial market power banks hold in the provision of retail payment services.

Second, fintech MTOs have significantly compressed spreads relative to traditional retail bank wires. Across a broad range of currencies, the average costs of sending cross-border payments via MTOs range from 40 to 150 basis points with scale economies as transfer size increases. MTOs' advantage arises from internal flow netting, pre-funded local liquidity, digitalized compliance processes, and transparent pricing models. Meanwhile, these firms continue to depend on regulated banking partners and wholesale FX markets to manage residual imbalances. As a result, cost heterogeneity across currency tiers persists, and transfers involving emerging-market currencies remain materially more expensive.

Third, stablecoin-based payment rails reduce certain settlement and balance sheet frictions, but they do not eliminate intermediation. For major currencies, the FX component of the stablecoin sandwich can be executed close to benchmark FX rates, and blockchain transfer fees are economically negligible. At the same time, explicit exchange trading fees, withdrawal charges, and reliance on centralized on- and off-ramp providers introduce new costs. Crypto exchanges effectively perform functions analogous to correspondent intermediaries. Stablecoin rails therefore reallocate intermediation across institutions rather than remove it.

Fourth, stablecoins exhibit some competitive advantage in capital-controlled or seg-

mented FX markets. In several emerging-market corridors, stablecoin-implied FX rates are more favorable than benchmark official rates for outbound transfers, consistent with a stablecoin access premium driven by demand for dollar exposure. In these environments, stablecoin rails may undercut traditional remittance channels not because of superior technological efficiency alone, but because they operate partly outside conventional capital account constraints. These cost advantages arise from capital control distortions, not from technological efficiency. Our finding of stablecoin access premium in emerging markets with capital control is consistent with the Bitcoin premium as documented in von Luckner, Reinhart, and Rogoff (2023) and von Luckner, Koepke, and Sgherri (2024).

Fifth, liquidity constraints in stablecoin-linked FX markets currently limit the scalability of stablecoin payment rails. Stablecoin–fiat trading volumes remain negligible relative to global FX markets, and implied spreads are volatile across many currencies. Limited market depth restricts the transaction sizes for which favorable pricing can be reliably obtained. The USD stablecoin–euro pair is the most liquid stablecoin FX market, with average daily volumes of about $185 million on centralized exchanges (CEXs) and roughly $15 million on decentralized exchanges (DEXs). This combined $200 million in daily volume is dwarfed by the approximately $2.7 trillion in daily EUR turnover in traditional FX markets.

The remainder of the paper is organized as follows. Section 2 describes the traditional correspondent banking system and SWIFT, the rise of non-bank money transmitters, and the stablecoin sandwich architecture. Section 3 introduces the data. Section 4 discusses methodology used to construct harmonized cost measures. Section 5 presents empirical results comparing costs of bank and fintech-based FX across corridors. Section 6 shows similar analysis for stablecoin-based FX methods. Section 7 compares these payment rails across infrastructure, speed, cost, liquidity, trust, regulation and user experiences. Section 8

concludes.

2 Background: Cross-Border Payment Architectures

2.1 Correspondent Banking and the SWIFT Network

The dominant architecture for retail and wholesale cross-border payments today is the correspondent banking system. Banks typically do not maintain direct accounts with every foreign institution. Instead, when a customer in country A sends funds to a beneficiary in country B, the sending bank routes the payment through a chain of intermediary banks that hold correspondent (nostro/vostro) accounts for one another. Settlement occurs by adjusting these interbank account balances.

Communication across the chain relies heavily on SWIFT. SWIFT provides secure, standardized messaging for payment instructions but does not perform settlement itself.[1] Settlement takes place in correspondent accounts or through domestic real-time gross settlement systems. As a result, the speed, cost, and transparency of cross-border transfers depend on the structure of correspondent relationships, as well as each intermediary's operational processes, risk management, and compliance checks.

Three features of this architecture are central to understanding its cost structure. First, payments often traverse multiple correspondent banks. Each intermediary charges its own handling fee or FX spread, and multi-hop chains introduce uncertainty about the final amount received. Second, correspondent banks must hold liquidity in multiple currencies to facilitate payments and absorb intraday timing frictions. Holding nostro balances occu-

[1] Cipriani, Goldberg, and La Spada (2023) provide a comprehensive overview of the SWIFT system. Cerutti, Firat, and Hengge (2025) studies characteristics and payments of cross-border payments using SWIFT data.

pies scarce balance sheet capacity, interacts with capital and liquidity regulations, and often requires daylight overdraft arrangements. These costs are recovered through fees and FX markups. Third, the AML/CFT regime imposes extensive sanctions screening, customer due diligence, and monitoring obligations. These checks are often duplicated along the chain, leading to slow processing, requests for additional information, or outright rejections. The resulting operational overhead contributes meaningfully to costs.

Despite improvements in messaging (e.g., SWIFT Global Payment Innovation) and regulatory technology, correspondent banking remains expensive, slow, and non-transparent relative to domestic digital payment systems.

2.2 Non-Bank Money Transfer Operators

Over the past decade, fintech money transmitters have emerged as dominant players in consumer cross-border payments. Examples include Wise, Remitly, Revolut, Western Union and MoneyGram. These firms operate under money-service business or payment-institution regulatory frameworks rather than banking licenses.

Their business model modifies, but does not fully replace, correspondent banking. They maintain local accounts in each jurisdiction (usually through partner banks). When a customer sends money from country A to B, the firm often pays out of its local balance in B directly, avoiding a cross-border transaction at the moment of customer transfer. They internalize FX and netting: customer flows in opposite directions are offset internally, with only residual imbalances settled through wholesale FX markets or cross-border bank transfers. This reduces reliance on correspondent chains. They also digitize onboarding, KYC, and operations, which reduces marginal processing cost per transaction. Relative to banks, they typically provide more transparent pricing, a fixed fee plus a clearly disclosed FX rate

ahead of the transfer.

This architecture can significantly reduce costs in high-volume corridors where flow netting is feasible and liquidity can be pre-funded cheaply. However, these firms often still rely on correspondent banks for liquidity rebalancing, local banking partners for cash payout, and traditional FX markets for hedge or imbalance settlement. Thus, although fintechs re-optimize the traditional architecture, they do not fully bypass it. The degree of bypass is corridor-specific and depends on capital controls, domestic payment infrastructure, and access to local banking systems.

2.3 Stablecoins and the Stablecoin Sandwich

A newer and rapidly developing cross-border payment mechanism uses stablecoins, which are crypto-tokens pegged to fiat currencies, typically USD (e.g., USDT, USDC). These tokens can be transferred globally on public blockchains without relying on correspondent banks or bank-operated messaging networks.

Cross-border value transfer via stablecoins typically takes the form of a *stablecoin sandwich*. A sender in country A converts local fiat currency into stablecoins using a centralized exchange, OTC broker, or peer-to-peer marketplace. The sender then transfers the stablecoins across borders via a blockchain such as Ethereum, Tron, or Solana. Finally, the recipient in country B converts the received stablecoins into local fiat.

This structure decomposes the payment into two FX conversions plus an on-chain transfer:

$$\text{Fiat}_A \rightarrow \text{Stablecoin}_{USD} \Rightarrow \text{on-chain transfer} \Rightarrow \text{Stablecoin}_{USD} \rightarrow \text{Fiat}_B.$$

The economics depend on the stablecoin–foreign currency fiat pairs market depth, on- and off-ramp fees (including exchange deposit and withdrawal fees), and blockchain gas

fees. Stablecoins can signficantly lower transfer costs in some emerging-market corridors, particularly where there are important capital control barriers. Compared to the MROs, the stablecoin-based rail does not require pre-funding of local currency liquidity. However, the payment companies often need to partner with crypto exchanges and different fintech intermediaries to complete all pieces of the sandwich.

2.4 DeFi FX Markets and Multi-Currency Stablecoins

A further development relevant to cross-border payments is the emergence of on-chain FX markets facilitated by decentralized finance (DeFi) protocols. These markets allow users to trade fiat-denominated stablecoins, such as USDC (USD-pegged) and EURC (EUR-pegged), without traditional FX intermediaries, relying instead on automated market makers (AMMs) such as Uniswap and PancakeSwap.

The availability of multi-currency stablecoins enables decentralized FX pairs. For example, the USDC–EURC pair functions as an on-chain EUR/USD market. In a constant-product AMM with reserves x_{USDC} and y_{EURC}, the implied EUR/USD rate is:

$$\text{EUR/USD price} = \frac{y_{\text{EURC}}}{x_{\text{USDC}}}.$$

Trades move these balances and therefore the price, while arbitrageurs ensure that on-chain rates track traditional FX markets, subject to gas costs and liquidity depth.

For cross-border payments, we now have a double-decker stablecoin sandwich with two stablecoins involved:

$$\text{Fiat}_{USD} \rightarrow \text{USDC} \rightarrow \text{EURC} \rightarrow \text{Fiat}_{EUR},$$

substituting the on-chain FX step for traditional FX conversion. When USDC–EURC liq-

uidity is deep, this structure can produce spreads comparable to institutional FX markets, offering a potentially lower-cost alternative for EUR-denominated payouts or for corridors where wholesale EUR access is expensive or restricted.

3 Data Sources

This section describes the various datasets used to measure cross-border payment costs spanning traditional banks, non-bank fintech payment providers, and stablecoin-based payment rails.

3.1 World Bank Remittance Prices Worldwide (RPW)

One historical data source for cross-border payments is the Remittance Prices Worldwide (RPW) database maintained by the World Bank.[2] The RPW dataset is based on pricing information from FXC Intelligence, which collects data from a wide range of bank and non-bank money transmitters across more than 300 remittance corridors. For each provider–corridor pair, the database reports the explicit fee charged to the sender, the foreign exchange (FX) margin relative to the mid-market exchange rate, and the resulting total cost expressed as a percentage of the amount sent. Costs are reported for standardized transaction sizes of $200 and $500, allowing for consistent cross-corridor comparability.

The data are available at a quarterly frequency, with one daily observation per quarter for each money transmitter. Because the dataset focuses on remittances, the vast majority of corridors run from developed to developing markets. While there are a small number of corridors between developing economies, the dataset does not cover transfers between

[2]The World Bank, Remittance Prices Worldwide, available at http://remittanceprices.worldbank.org.

advanced economies.

3.2 Real-Time Data Collection from Fintech Money Transmitters

To complement the RPW data, we collect real-time pricing information directly from the publicly accessible websites of four leading fintech non-bank money transmitters. This allows us to construct an intraday dataset sampled at 30-minute intervals, covering approximately 100 corridors and transaction amounts of $200, $500, $10,000, and $50,000.

The primary advantage of this dataset is that it enables the study of cross-border payment costs between advanced economies, which are largely absent from the RPW database. In addition, the high-frequency nature of the data permits a more precise measurement of FX costs and allows us to analyze pricing dynamics during periods when FX markets are closed. A limitation of this dataset is its relatively short time span: data collection began in January 2026, precluding an analysis of pricing behavior prior to that date.

3.3 FX Wire Transactions via a B2B Fintech Platform

In addition to real-time quoted rates, we use data from historical FX wire transfers provided by a community bank and an educational institution. Both executed their outgoing FX wires through the same B2B fintech payments platform.

We observe anonymized outgoing FX wire transactions, including transaction dates, amounts, currencies, and applied exchange rates. The data cover the period 2024–2025 for the community bank and 2025 for the educational institution.

3.4 Personal FX Wire Transactions

To supplement data on retail-level FX wire transfers conducted through large global banks, we also collect a small anecdotal dataset based on personal transactions. This dataset includes a limited number of transfers across the United States, Europe, the United Kingdom, and Singapore, all executed via major international banks. Although comprehensive data on the costs of cross-border payments across these advanced-economy corridors are not available, this limited collection nonetheless provides useful transparency into the payment rails most commonly used by bank customers.

3.5 Crypto Market Data

We obtain data on stablecoin–fiat currency transactions involving USDT and USDC from all centralized crypto exchanges available through CoinDesk. We collect transaction prices and volumes at a 30-minute frequency. To the extent possible, we also gather platform-specific fees from the websites of these exchanges, including trading commissions as well as withdrawal and deposit fees.

In addition, we collect data on blockchain gas fees from Token Terminal to account for the cost of transferring stablecoins on-chain. We assemble data on on-chain FX trading in DeFi protocols involving USD-denominated stablecoins and foreign-currency stablecoins using Dune Analytics. We collect both transaction prices and protocol-level fees to get a complete picture of the price of conducting FX on decentralized exchanges.

3.6 Bloomberg FX Data

For daily data, we use Bloomberg BGN rates for FX pairs at the New York close as benchmark reference rates. To align with our intraday fintech and crypto datasets, we also use

Bloomberg BFIX pricing, which consists of executable FX quotes on the Bloomberg trading platform sampled at 30-minute intervals.

For most of the analysis, we use spot exchange rates with standard $T+2$ settlement. For many currency pairs, we additionally collect same-day ($T+0$) exchange rates. When direct $T+0$ quotes are unavailable, we construct the $T+0$ rate by adjusting the $T+2$ spot rate using implied forward points derived from overnight (O/N) and tomorrow/next (T/N) FX swaps.

4 Methodology

Our objective is to construct a harmonized measure of the all-in cost of cross-border payments that is comparable across heterogeneous payment architectures, including traditional bank wires, non-bank fintech money transmitters, and stablecoin-based payment rails. For each transaction or quoted price observation, we express total costs as a percentage of the amount sent and decompose them into an implicit FX markup component and explicit fees, if possible.

4.1 FX Cost

We benchmark all observed exchange rates against contemporaneous Bloomberg reference rates. When intraday timestamps are not available, we use Bloomberg daily BGN rates at the New York close. When intraday timestamps are available, we benchmark customer-facing exchange rates against Bloomberg BFIX executable quotes sampled at 30-minute intervals.

Throughout the paper, we define the exchange rate $E_{i,j,t}$ as the number of units of receiving currency j per unit of paying currency i at time t. A higher value of $E_{i,j,t}$ implies a cheaper transfer, as the recipient receives a larger amount of the destination currency for

a given amount of the paying currency.

For each observation, the FX cost is defined as the difference between the Bloomberg benchmark exchange rate $E^{\text{bbg}}_{i,j,t}$ and the effective exchange rate applied to the customer $E^{\text{c}}_{i,j,t}$. We measure the FX markup using the log difference, expressed in basis points:

$$\text{FX Cost}_{i,j,t} = 10{,}000 \times \left(\ln E^{\text{bbg}}_{i,j,t} - \ln E^{\text{c}}_{i,j,t} \right).$$

This measure captures implicit pricing embedded in the exchange rate and does not incorporate any explicit fees charged on the transaction.

4.2 Explicit Fees

Explicit fees include any fixed or proportional charges disclosed to the customer at the time of the transaction, such as wire fees, service fees, transfer fees, or platform commissions. Fixed fees are converted into basis points by dividing the fee amount by the transaction value and multiplying by 10,000. When multiple fee components apply, we aggregate them into a single explicit fee measure expressed in basis points.

4.3 All-in Cost

The harmonized all-in cost of a cross-border payment is defined as the sum of the FX markup and explicit fees:

$$\text{All-in Cost}_{i,j,t} = \text{FX Cost}_{i,j,t} + \text{Explicit Fees}_{i,j,t}.$$

This definition ensures comparability across providers and payment rails, regardless of whether costs are levied primarily through exchange-rate markups or explicit charges.

4.4 Classification of Currency Tiers

Table 1 provides a snapshot of global foreign exchange market activity using data from the 2025 BIS Triennial FX Turnover Survey, together with bid–ask spreads in spot FX markets for USD-linked pairs. FX trading volumes are extraordinarily large. Average daily global FX turnover reached approximately $9.5 trillion in April 2025, with transactions involving the U.S. dollar accounting for nearly $8.5 trillion. Spot FX markets for actively traded currencies are highly liquid, with bid–ask spreads measured in only a few basis points.

The large turnover and tight bid-ask spreads imply that, for major currencies, FX conversion costs in wholesale markets are economically negligible relative to the costs observed in retail and payment-oriented settings. For example, the EUR, JPY, and GBP trade against the U.S. dollar with average bid–ask spreads between 6 and 9 basis points, while several emerging markets currencies have bid-ask spreads below 10 basis points. As a result, large deviations from benchmark FX rates observed in bank wires, fintech transfers, or stablecoin-based payments cannot be attributed to underlying FX market illiquidity, but instead reflect frictions specific to payment rails, balance sheet usage, regulatory constraints, or pricing power.

To organize the analysis and capture systematic heterogeneity across currencies, we classify currencies into four tiers based on their role and liquidity in global FX markets, as measured by BIS turnover. Tier 1 consists of the global G4 currencies, USD, EUR, JPY, and GBP, which account for the highest levels of global FX turnover. Tier 2 includes the remaining traditionally defined G10 currencies, CHF, AUD, CAD, SEK, NZD, NOK, and DKK, together with HKD and SGD, reflecting their importance as global FX trading centers. Tier 3 comprises the ten most actively traded emerging market currencies according to the BIS survey, CNY, INR, KRW, MXN, TWD, BRL, ZAR, PLN, IDR, and TRY. All remain-

ing currencies are classified as Tier 4. The breakdown of the currency tier is summarized as follows:

Tier 1: USD, EUR, JPY, GBP,

Tier 2: CHF, AUD, CAD, HKD, SGD, SEK, NZD, NOK, DKK,

Tier 3: CNY, INR, KRW, MXN, TWD, BRL, ZAR, PLN, IDR, TRY,

Tier 4: All remaining currencies.

5 Cross-Border Payments through Banks and Fintechs

In this section, we first present the key summary statistics and discuss key drivers for different payment rails, and then we compare the costs across different payment rails for different types of payment corridors.

5.1 Major Non-Bank Money Transfer Operators (MTOs)

We first discuss the costs of conducting cross-border transfers through large MTOs. Figure 1 and Table 2 summarize the all-in costs of cross-border payments through three MTOs for U.S.-outbound corridors, covering transfer amounts of $200, $500, $10,000, and $50,000 and a wide range of recipient currencies.

Figure 1 shows a signficant decline in median costs as transfer size increases. For small-value payments of $200, median all-in costs range from roughly 170 basis points for Tier 1 currencies to nearly 300 basis points for Tier 4 currencies. As transfer values rise to $10,000, costs fall sharply across all tiers, converging to approximately 40–60 basis points for Tier 1 and Tier 2 currencies and around 80–130 basis points for Tier 3 and Tier 4 currencies. Beyond $10,000, additional scale economies are limited, with costs flattening or declining only modestly at $50,000. This pattern reflects the importance of fixed fees in MTO pricing

schedules, which loom large for small transactions but become negligible at higher values.

Despite these scale economies, costs remain systematically higher for less liquid currencies. Even at $50,000, median costs for Tier 4 currencies remain roughly three times those for Tier 1 currencies. This persistent tier gradient highlight frictions in emerging and frontier market corridors, even when transfer sizes are large.

Table 2 provides a more granular view of this heterogeneity across individual currencies. Among Tier 1 recipients, EUR corridors are the cheapest, with median costs of approximately 95 basis points at $200 falling to about 38 basis points $10,000–$50,000. GBP transfers are somewhat more expensive at small sizes but converge to similar levels at higher amounts. JPY stands out as substantially costlier than other Tier 1 currencies, with median costs exceeding 260 basis points at $200 and remaining above 100 basis points even at $10,000–$50,000. Within Tier 2 currencies, costs are generally higher and more dispersed. Transfers to CAD, AUD, and SGD resemble Tier 1 outcomes at large sizes, while CHF and HKD remain persistently expensive, with median costs exceeding 120–150 basis points even at $10,000.

Tier 3 and Tier 4 currencies exhibit the greatest heterogeneity. Some corridors, such as INR and IDR, display relatively low costs at large transfer sizes, falling below 30–70 basis points at $10,000–$50,000. Others, including PLN, PHP, and several Latin American currencies, remain above 150–250 basis points even for large transactions. In a few cases, such as NGN and ARS, median costs are negative, likely reflecting the parallel exchange rates induced by capital controls. As domestic residents in countries with significant capital controls are willing to pay a premium to move funds overseas, money transfer operators can obtain favorable FX rates when sending funds into these countries.

Overall, Figure 1 and Table 2 show that the costs of cross-border payments via MTOs

vary substantially across corridors and decline sharply with transfer size. For transfers above $10,000, payment costs are modest, around 40–60 basis points for transfers from the United States to developed markets and average below 150 basis points for transfers to emerging markets.

5.2 B2B Payment via Fintech Platform

We next compare the pricing of retail-oriented money transfer operators discussed in Section 5.1 with cross-border payments executed through a B2B fintech platform. Table 3 reports FX costs for U.S.-outbound FX wire transfers conducted by a community bank and an educational institution using the same fintech provider. The platform charges a fixed wire fee of $8, which is negligible relative to typical corporate transfer sizes. We therefore abstract from the fixed fee and treat the FX markup as approximately equal to the total cost of the transfer.

For Tier 1 currencies (USD to GBP, EUR, and JPY), FX wires through the B2B fintech platform cost on average about 83 basis points. Relative to MTO transfers with values above $10,000, these costs are higher for GBP and EUR but lower for JPY. For Tier 2 currencies, average FX costs rise modestly to around 96 basis points. As in the MTO data, transfers to Hong Kong and Singapore stand out as relatively expensive within Tier 2, with average markups of approximately 145 basis points. Even so, these costs are broadly comparable to MTO pricing for large transfers to developed markets.

For Tier 3 and Tier 4 currencies, FX costs on the B2B fintech platform exceed 300 basis points on average and exhibit substantial cross-currency heterogeneity. In many cases, these costs are higher than those charged by retail MTOs even for small-value transfers. Overall, relative to large-value transfers executed through MTOs, the B2B fintech platform is system-

atically more expensive, particularly along emerging-market corridors. Unlike retail MTOs, which can exploit customer flow imbalances and corridor-specific FX segmentation to offer relatively low prices for certain emerging-market currencies, especially at large transfer sizes, the B2B fintech platform appears to price FX risk in emerging markets more conservatively and less competitively.

5.3 Retail FX Bank Wires through SWIFT

Systematic transaction-level data on retail FX wire transfers executed through the SWIFT correspondent banking system are not publicly available. To provide direct evidence on pricing in this segment, we assemble a small set of FX wire transfers based on personal transactions conducted through large international banks. The implied FX costs for these transactions are reported Table 4.

Even within this limited sample, FX costs are substantial for transfers involving highly liquid currencies. For Tier 1 currency pairs such as EUR–USD and USD–EUR, implied FX costs range from approximately 230 to 470 basis points. Transfers involving other actively traded Tier 2 currencies, including CHF and SGD against the USD, exhibit FX costs of similar magnitude, typically exceeding 300 basis points. These costs are large relative to observed FX spreads in wholesale markets for the same currency pairs.

Furthermore, the FX costs reported in Table 4 capture only the implicit markup embedded in the exchange rate applied to the wire transfer. They do not include explicit wire fees commonly associated with international bank wires. As a result, the figures in Table 3 should be interpreted as a lower bound on the total cost borne by customers executing FX wire transfers through banks.

These results stand in contrast to the evidence in Sections 5.1 and 5.2. For large-value

transfers, non-bank money transmitters charge median all-in costs of approximately 40–60 basis points for Tier 1 currencies. FX wire transfers executed through a B2B fintech platform exhibit average FX markups of roughly 80–100 basis points for Tier 1 and Tier 2 currencies. Relative to these alternatives, retail FX bank wires invovling the largest global banks appear to involve FX costs often exceeding 300 basis points even among the most liquid FX currency pairs.

The magnitude of the FX costs observed in retail bank wire transfers is particularly significant given the characteristics of the sending institutions. The banks involved are large international banks with routine access to wholesale FX markets, where trading in the relevant currency pairs typically occurs close to mid-market rates. Moreover, these banks maintain extensive correspondent banking networks and sizable nostro and vostro account balances, which allow them to internalize a significant portion of cross-border settlement and liquidity management costs. Therefore, it is unlikely that FX market access or unusually high correspondent banking costs fully account for the FX markups observed in Table 3. Rather, the evidence is suggestive of significant pricing power in retail FX services by large global banks.

6 Cross-Border Payments via Stablecoin Rails

6.1 Single-Layer Stablecoin Sandwich

Instant, costless cross-border payments are often cited as the primary use case for stablecoins. In practice, however, the process is more complex. In this section, we decompose the mechanics and costs of a typical stablecoin-based FX transfer, implemented through what is commonly referred to as a "stablecoin sandwich."

The total cost of executing a cross-border payment via the stablecoin sandwich consists of four components: (i) the FX cost embedded in converting between fiat currencies and stablecoins, (ii) trading costs imposed by exchanges, (iii) blockchain transaction (gas) fees incurred when transferring stablecoins on-chain, and (vi) fees associated with fiat on- and off-ramps, such as exchange commissions and withdrawal charges.

6.1.1 FX Costs

We begin by examining the FX component of the all-in costs associated with stablecoin transfers. Conversion between USD-linked stablecoins and local fiat currencies can occur across several venues, including CEXs, fintech platforms and banks that facilitate off-ramping, and peer-to-peer markets. Among these, CEXs provide systematically quoted and publicly observable FX prices, offering greater transparency. As a result, we rely on stablecoin–local fiat FX rates from CEXs as reported by CoinDesk.

Table 5 shows that for Tier 1 and Tier 2 currencies, FX costs implied by stablecoin–fiat trading are close to zero on average, indicating that stablecoin-implied exchange rates closely track Bloomberg BFIX benchmark rates. For major currencies such as EUR, GBP, CHF, and SGD, average deviations are small relative to costs observed in bank and fintech payment rails. This suggests that, when liquidity is available, the FX leg of the stablecoin sandwich can be executed at prices comparable to wholesale FX markets.

For Tier 3 and Tier 4 emerging market currencies, the interpretation of stablecoin-implied FX costs differs from that for advanced-economy currencies. In many cases, average FX costs are negative, indicating that the stablecoin–fiat exchange rate is more favorable than the Bloomberg benchmark for outbound payments from the United States into these markets. This pattern reflects a stablecoin access premium in countries with capital controls, where

local users are willing to pay a premium to obtain stablecoins or dollar exposure. As a result, stablecoin-based rails can, at times, offer more favorable FX pricing than traditional payment channels for devleoped to emerging market transfers.

Using historical remittance costs collected by the World Bank RPW and the CEX FX data for the same period between 2022Q1 and 2025Q1, Table 6 shows that in high-cost USD-outbound emerging-market corridors, RPW all-in remittance costs often range between 300 and 600 basis points, whereas stablecoin-implied FX costs for the same corridors are close to zero or negative on average. Table 7 demonstrates that this pattern generalizes beyond USD sources. When developed-market currencies such as EUR, GBP, or JPY are the source currency, stablecoin-implied FX costs remain largely negative relative to RPW spreads.

Although stablecoin–local fiat trading pairs exhibit favorable average pricing outcomes, these come with important limitations. Trading volume remains very small for the vast majority of currencies, constraining the scale at which such pricing can be accessed. The euro has the highest turnover against USD stablecoins on centralized exchanges, with average daily trading volume of $186 million over 2021–2025, compared with $2.7 trillion in daily FX turnover for EUR-linked instruments in 2025. Beyond the euro, only five currencies (KRW, TRY, BRL, GBP, and THB) have average daily trading volume exceeding $10 million. Moreover, FX costs for these currencies are highly volatile, exhibiting large time-series standard deviations. As a result, the availability and reliability of advantageous FX pricing can be uncertain and may vary substantially over time and across transaction sizes.

6.1.2 Other Fees

Blockchain transaction fees represent the second component of the stablecoin sandwich. Table 8 reports average gas fees across major blockchains over the 2023–2026 period. Even

on relatively expensive Layer 1 networks such as Ethereum, average transaction fees are well below one dollar, while fees on Layer 2 networks and alternative chains are typically only a few cents or less. Relative to the size of typical cross-border transfers, these gas fees are economically negligible and contribute only a trivial amount to the total cost of the transaction.

The third cost we consider is the exchange trading fee, which is charged as a percentage of the transaction size in spot trading. As shown in Table 9, trading fees on leading CEXs range from as low as 0 to as high as 60 basis points for low-volume traders on five of the six exchanges in our sample. In most cases, makers (who provide liquidity) pay fees at the lower end of the schedule, while takers (who remove liquidity) face the higher end. Kraken stands out as the most expensive platform, charging a fixed transaction fee of 100 basis points for traders with less than $10,000 in monthly volume. These fees can accumulate into substantial explicit trading costs.

The final relevant costs are the deposit and withdrawal fees charged by centralized exchanges. Tables 10 and 11 report the fees collected from exchange websites. Fees are denominated in the currency indicated in each column heading. Deposit and withdrawal fees vary across exchanges, across individual fiat and cryptocurrencies, by deposit or withdrawal method, and in some cases by transaction size. In general, deposits are free or inexpensive for both fiat and cryptocurrencies, whereas withdrawals often involve substantial fixed fees. These moderately sized fixed withdrawal fees (e.g., €1) imply that large transactions are relatively more cost-efficient than small-value transactions.

6.1.3 An Example: USD-USDC-EUR Coinbase-Kraken Stablecoin Sandwich

Figure 2 provides a concrete illustration of a USD–USDC–EUR stablecoin sandwich using Coinbase for on-ramping and Kraken for off-ramping. A U.S. sender deposits USD into Coinbase (at zero ACH cost), converts the funds into 100 USDC, and transfers the tokens on Ethereum to Kraken, incurring a modest gas fee (about \$0.19). On Kraken, the USDC is exchanged into EUR at a rate equal to the Bloomberg benchmark exchange rate adjusted by a spread ϕ, and is subject to a 1 percent trading fee. Finally, the EUR proceeds are withdrawn via SEPA to the recipient's euro bank account, with a fixed €1 withdrawal fee.

The figure highlights that while the on-chain transfer cost is economically negligible, explicit exchange trading fees and fixed fiat withdrawal charges materially affect the all-in cost, especially for small-value transactions. Thus, although the FX leg itself can be executed close to Bloomberg mid rates, the stablecoin sandwich remains sensitive to exchange fee schedules and fixed off-ramping costs. Moreover, this stylized example omits additional charges such as token withdrawal fees and potential bridge fees required to move assets across blockchains, which implies that total costs can accumulate further in practice.

Overall, the stablecoin sandwich is far from intermediary-less or frictionless: centralized crypto exchanges effectively play a role analogous to correspondent banks, creating additional "hops" for fiat on- and off-ramping and reintroducing layers of intermediation into what is often described as a disintermediated payment rail. Even when centralized exchanges are not used, other intermediaries, such as peer-to-peer trading venues, fintech platforms, or crypto-focused banks, typically perform similar functions for USD on-ramping, blockchain transfers, and FX off-ramping. As a result, the stablecoin architecture often substitutes one set of intermediaries for another rather than eliminating intermediation altogether.

6.2 Double-decker Stablecoin Sandwich (DeFi-Based FX)

We now turn to the "double-decker" stablecoin sandwich, where two stablecoins are involved. We focus on the case that the USD stablecoin and non-USD stablecoin are traded on-chain through a decentralized exchange (DEX), such as Uniswap or PancakeSwap. Relative to the single-layer sandwich described in Section 6.1, this structure replaces the off-chain FX conversion on a centralized exchanged with an on-chain swap between two fiat-denominated stablecoins, for example USDC (USD-pegged) and EURC (EUR-pegged). The transaction can be summarized as:

$$\text{Fiat}_{USD} \rightarrow \text{USDC} \rightarrow \text{EURC} \rightarrow \text{Fiat}_{EUR}.$$

The total cost of executing a cross-border payment via the double-decker stablecoin sandwich consists of four components: (i) the FX cost embedded in the stablecoin-to-stablecoin exchange rate on the DEX, (ii) protocol trading fees charged by the DEX, (iii) blockchain gas fees associated with token transfers and on-chain swaps, and (iv) fiat on- and off-ramping fees at the two ends of the transaction, since decentralized exchanges do not directly support fiat deposits or withdrawals.

6.2.1 FX Costs on Decentralized Exchanges

We begin by examining the FX component of the double-decker sandwich. On decentralized exchanges, exchange rates are determined by automated market makers (AMMs). For example, in a constant-product AMM with reserves x_{USDC} and y_{EURC}, the implied EUR/USD price is given by $y_{\text{EURC}}/x_{\text{USDC}}$. Arbitrageurs ensure that on-chain exchange rates track traditional FX benchmarks, subject to liquidity depth and gas cost.

Table 12 reports FX costs implied by USDT/USDC–local currency trading on decentralized exchanges.[3] Among Tier 1 and Tier 2 currencies, EUR, GBP, CHF, and SGD, on average are very close to the Bloomberg mid rate. For certain Tier 3 currencies, such as KRW and BRL, implied FX costs are negative on average. As in Section 6.1, local users may pay a premium to obtain USD-denominated stablecoins. In these cases, on-chain FX pricing can appear more favorable than Bloomberg benchmarks for USD-outbound transfers.

However, FX liquidity on DEXs is extremely limited. Only the USD–EUR stablecoin pair exhibits meaningful trading activity, averaging approximately $15 million per day. Most non-USD stablecoin pairs have negligible trading volume on DEXs, limiting their practical relevance for cross-currency transfers at present.

6.2.2 Other Fees

In addition to the FX cost, decentralized exchanges charge protocol-level trading fees. As shown in Table 9, these fees vary by protocol and pool, typically ranging from 1 to 30 basis points for major liquidity pools, although fee tiers can be higher for less liquid pairs. These fees are automatically deducted from the traded amount and accrue to liquidity providers.

Gas fees represent a second explicit cost. Executing a double-decker sandwich requires multiple on-chain actions: transferring stablecoins to a self-custody wallet, performing the stablecoin-to-stablecoin swap, and transferring tokens to an exchange or intermediary for fiat off-ramping. Each step incurs a blockchain transaction fee. As reported in Table 8, average gas costs on major blockchains are generally well below $1 per transaction. While economically negligible for large transfers, gas fees can meaningfully increase the percentage

[3]For the selection of non-USD stablecoins, we start from those included in Circle's recent StableFX initiative, which is being developed on its own Layer-1 blockchain, Arc. We also include a few other stablecoins for these currencies that are traded in DEX.

cost of very small-value payments.

Although the FX transaction itself is decentralized, fiat conversion at the beginning and end of the sandwich typically requires centralized intermediaries. Because DEX protocols do not conduct AML/KYC screening and do not maintain banking relationships, users must rely on centralized exchanges, crypto-focused banks, or third-party providers (e.g., MoonPay, Transak, Banxa) to convert fiat into stablecoins and redeem foreign-currency stablecoins into fiat.

As a result, the double-decker sandwich inherits many of the same deposit and withdrawal fees discussed in Section 6.1, including fixed fiat withdrawal charges and, in some cases, crypto withdrawal fees. These fixed fees introduce scale economies similar to those observed for centralized exchanges and MTOs: large transfers are relatively more cost-efficient than small transactions.

6.2.3 An Example: USD–USDC–EURC–EUR via Uniswap

Figure 3 provides a concrete illustration of a USD–USDC–EURC–EUR double-decker sandwich. A U.S. sender first converts USD into USDC via a centralized exchange. The USDC is transferred to a self-custody wallet, incurring a gas fee and possibly a crypto withdrawal fee. The sender then conducts an on-chain swap from USDC into EURC on Uniswap, paying a protocol trading fee and additional gas. Finally, the EURC is transferred to a centralized venue that supports EUR withdrawals and redeemed into fiat euros, subject to fiat withdrawal fees.

Even when the implied FX rate on Uniswap is close to the Bloomberg mid rate, the accumulation of protocol fees, multiple gas payments, and fixed fiat withdrawal charges can generate a nontrivial all-in spread. In the example shown in Figure 3, three gas fees (around

$0.6 if all transferred on Ethereum), a Uniswap protocal fee equal to 0.05% of the transfer value, and an additional €1 withdrawal fee needs to be paid at the minimum.

Overall, while the double-decker stablecoin sandwich decentralizes the FX price discovery mechanism, it does not eliminate intermediation. Centralized entities, such as CEXs, remain essential for fiat currency access.

7 Comparison between Traditional Rails with Stablecoins

Table 13 provides a systematic comparison of traditional correspondent banking, fintech MTOs, and stablecoin-based payment rails along several dimensions, including payment infrastructure, speed, costs, liquidity, regulation, and user experience.

7.1 Payment Infrastructure

Traditional bank wires rely on multi-hop correspondent banking relationships supported by SWIFT messaging and the maintenance of nostro and vostro balances. Payments are settled by adjusting prefunded interbank accounts, often across multiple intermediaries. Each intermediary performs compliance screening and liquidity management, embedding operational and regulatory costs directly into the payment chain.

Fintech MTOs maintain prefunded local accounts and internally net customer flows, using wholesale FX markets and correspondent banking only for residual imbalances. The result is a partial bypass of multi-hop settlement, particularly in high-volume corridors, but continued reliance on the banking system for liquidity and FX management.

Stablecoin rails adopt a different payment infrastructure: a fiat–stablecoin(s)–fiat "sandwich" in which value is transferred on-chain and FX conversion occurs on centralized or decentralized crypto exchanges. Settlement is achieved through blockchain consensus rather

than through correspondent accounts, but fiat access remains dependent on exchange-based on- and off-ramps. Stablecoin rails do not require correspondent prefunding within the banking system; instead, liquidity provision migrates to stablecoin issuers, centralized exchanges, and automated market makers. Instead of banks and Fintech MTOs, a new class of payment intermediaries in the crypto ecosystem are necessary to facilitate cross-border payments using the stablecoin rails.

7.2 Speed

These differences in payment infrastructure translate directly into differences in settlement speed. Traditional correspondent banking is often described as settling on a T+1 to T+3 basis. However, data from SWIFT (2024) indicate that approximately 90% of cross-border payments transmitted over the SWIFT network reach the destination bank within one hour. This evidence suggests that the purely cross-border segment of the transaction, sometimes referred to as the "flight time", is typically short. Instead, the bulk of end-to-end delays arises in the "last mile," of the journey, that is, between the beneficiary bank and the final crediting of the end-customer account within the domestic payment system, arising from compliance requirements and batch processing in banks' back-office IT system.

Fintech MTOs frequently achieve minutes-to-same-day delivery in major corridors by paying out from prefunded local balances. The speed experienced by end customers arises because the underlying funds do not need to move cross-border at the time of the transaction; instead, settlement occurs through prior liquidity positioning and internal netting.

Stablecoin token transfers settle on-chain within minutes. However, end-to-end speed depends critically on the efficiency of fiat on- and off-ramping at both ends of the transaction. Customers often need to incur additional fees to obtain immediate fiat liquidity. For

example, Circle charges an expedited "burn" fee for same-day (T+0) USDC redemptions into U.S. dollars, whereas standard redemptions settle on a T+1 basis without such charges. Thus, even when on-chain settlement is near-instantaneous, rapid conversion back into bank deposits may require paying an explicit liquidity premium, reflecting the cost of immediate liquidity access in the traditional financial market infrastructure.

7.3 All-In Costs and Liquidity

There are salient cost differentials across different payment rails. Traditional bank SWIFT rails involve high FX markups, often 200 to 400 basis points in retail settings, together with explicit wire fees. These spreads are enormous relative to wholesale FX bid–ask spreads, which are typically only a few basis points for major currencies. The gap cannot plausibly be attributed to underlying FX illiquidity. Instead, it reflects the costs of correspondent liquidity, capital usage, compliance, and banks' significant pricing power in transactional FX and retail banking services.

Fintech MTOs exert substantial price discipline and compress cross-border payment costs relative to traditional bank wires. In developed-market corridors, all-in costs typically range from approximately 40 to 150 basis points, with pronounced scale economies as transfer size increases. Their pricing advantage reflects internal flow netting, corridor specialization, prefunded liquidity management, and transparent fee structures.

Community banks, which may lack the scale or infrastructure to establish and manage their own correspondent banking networks, can access similar pricing by routing transactions through B2B fintech platforms. In our sample, the community bank passes through the FX wire pricing offered by the fintech platform to its retail customer, which results in signficantly cheaper outbound FX wiring costs for U.S. customers than the largest U.S. banks.

Stablecoin rails display a different cost structure. For major currencies, the FX component of the stablecoin sandwich is typically priced close to benchmark rates, but explicit exchange trading fees, blockchain gas fees, and fiat withdrawal charges become the primary cost drivers. Unlike traditional bank wires, where most costs are embedded implicitly in exchange-rate markups, stablecoin costs are often transparent and fee-based. Fixed withdrawal fees imply scale economies similar to those observed for MTOs, rendering small-value transfers relatively expensive in percentage terms. In emerging-market corridors characterized by capital controls or FX segmentation, stablecoin-implied exchange rates can be more favorable than official benchmarks, generating apparent cost advantages that reflect captial control distortions rather than technological efficiency.

However, despite the cost advantage in some major remittance corridors, stablecoin rails face more binding liquidity constraints. Outside major currency pairs, stablecoin–fiat and stablecoin–stablecoin trading volumes remain small, implying potential price volatility and slippage for larger transactions. As a result, while stablecoins may be competitive for retail-sized payments, their ability to displace traditional rails in high-value institutional transfers is currently limited.

7.4 Trust and Regulation

Traditional bank rails operate within a mature legal and regulatory framework, with well-established recourse mechanisms and deposit insurance protections. Customers therefore tend to place a high degree of trust in conducting cross-border payments through banks, particularly for large-value transactions. Fintech MTOs, while typically regulated as payment institutions, depend on banking partners for settlement and safeguarding of customer funds. The substantial growth in MTO payment volumes over the past decade suggests

that customer trust in these institutions has increased, reflecting improved transparency, reliability, and regulatory oversight.

By contrast, stablecoin rails depend on the solvency of stablecoin issuers, the operational integrity of centralized exchanges, and an evolving regulatory regime. High-profile events, such as the collapse of the crypto exchange FTX, the temporary de-pegging of USDC during the failure of Silicon Valley Bank, and persistent concerns regarding the transparency of reserve backing for widely used USDT, have underscored the counterparty risks embedded in this ecosystem. Recent legislative initiatives, such as the proposed Guiding and Establishing National Innovation for U.S. Stablecoins (GENIUS) Act in the United States, seek to address these concerns by establishing clearer prudential standards for stablecoin issuers, including reserve requirements, disclosure obligations, supervisory oversight, and restrictions on permissible activities.

7.5 User Experience

Finally, user experience plays an important role in the choice of cross-border payment method. Although traditional bank wires are generally perceived as the safest option, sending an international FX wire often requires an in-person branch visit, and there is typically no mechanism to track the payment once funds have been debited from the sender's account. By contrast, fintech MTOs offer a significantly improved user experience, with fully digital mobile interfaces, transparent upfront pricing, and real-time payment tracking.

Stablecoin-based rails currently impose the greatest operational complexity on retail users. To execute either a single-layer or double-decker stablecoin sandwich, customers must maintain exchange accounts, manage self-custody wallets, and hold native crypto tokens to pay network gas fees and defi protocal fees. Users must also understand token standards,

wallet compatibility, and, in some cases, bridging protocols to ensure that transfers are correctly routed and received.

Because blockchain transactions are generally irreversible, operational errors, such as sending tokens to an incompatible address or across the wrong network, can result in permanent loss of funds. These frictions stand in contrast to the relatively streamlined and consumer-protected interfaces offered by traditional banks and fintech MTOs, and they represent a meaningful barrier to broad direct retail adoption of stablecoin-based cross-border payment rails.

Fintech payment companies can build on stablecoin rails while abstracting away much of the underlying operational complexity for retail users. A notable example is Felix Pago, a remittance provider that enables U.S. residents to send funds conveniently to recipients in Latin America through a WhatsApp interface. In the U.S.–Mexico corridor, Felix Pago relies on a USD–MXN–USDC stablecoin sandwich in the backend, while presenting customers with a simple, app-based user experience.

7.6 Other Initiatives

Besides banks, fintech MTOs, and stablecoin rails, several other ongoing initiatives could meaningfully reshape the architecture of cross-border payments if scaled successfully.

First, banks can issue digital money in the form of tokenized deposits. A distinct private-sector initiative is JPMorgan's tokenized deposit platform, now operating under Kinexys (OliverWyman and Kinexys (2023)), which issues blockchain-based representations of commercial bank deposits rather than fully reserved stablecoins. On a permissioned blockchain, these deposits can be transferred 24/7 among institutional clients of JPMorgan and can embed programmable features such as conditional payments and atomic delivery-versus-

payment settlement.

Second, Project Nexus is a BIS Innovation Hub initiative designed to link national fast payment systems through a single multilateral gateway, allowing instant cross-border retail payments without creating a new settlement asset. Singapore has been a leading jurisdiction in this effort. Singapore has already established several bilateral real-time payment linkages, including PayNow–PromptPay with Thailand (2021), PayNow–DuitNow with Malaysia (2023), PayNow–UPI with India (2023), and cross-border QR payment interoperability with Indonesia (2023). These live connections allow near-instant, low-cost retail transfers using mobile numbers or QR codes and serve as practical building blocks for the multilateral Nexus model.

Third, another notable initiative in wholesale cross-border payment is Fnality, which issues tokenized representations of central bank reserves held in omnibus accounts at participating central banks. Designed primarily for wholesale financial market settlement, Fnality aims to enable 24/7 atomic settlement of tokenized securities and cross-border FX transactions in central bank money equivalents. Unlike stablecoins, these tokens are fully backed by central bank reserves and operate within a tightly regulated institutional environment.

Fourth, Project mBridge, led by the BIS Innovation Hub in collaboration with several central banks (including the People's Bank of China, Hong Kong Monetary Authority, Bank of Thailand, and the Central Bank of the United Arab Emirates), explores cross-border settlement using wholesale central bank digital currencies (CBDCs) on a shared distributed ledger. In this model, participating central banks issue digital claims directly on the platform, enabling banks in different jurisdictions to transact in multiple CBDCs with atomic payment-versus-payment settlement.

8 Conclusion

Cross-border payments have evolved meaningfully over the past decade, but cost differentials across payment rails remain substantial. Fintech MTOs have achieved significant progress in compressing remittance costs by internalizing flow netting, digitizing compliance, and managing prefunded local liquidity. In contrast, traditional bank wires routed through SWIFT and correspondent banking remain persistently expensive for retail customers, even in the most liquid currency pairs.

Stablecoin-based payment rails offer a different architecture, but the economics extend well beyond near-instant blockchain transfers. The stablecoin(s) "sandwich" requires fiat on- and off-ramps, exchange-based trading, and in some cases, decentralized liquidity pools. Each of these components involve distinct intermediaries and explicit fees. While the FX leg from the centralized and decentralized crypto exchanges can be priced close to wholesale FX market and may offer an advantage in certain emerging-market corridors, the overall process of cross-border transfer is neither intermediary-free nor costless. Stablecoin rails therefore introduce a new set of intermediaries, and their competitiveness ultimately depend on markets' trust towards these new intermediaries rather than on atomic blockchain settlement alone. The future cross-border payments will therefore depend as much on governance and regulation as on technological innovation.

References

Adams, A., M.-C. Lader, G. Liao, D. Puth, and X. Wan. 2023. On-chain foreign exchange and cross-border payments. *Available at SSRN 4328948* .

Cerutti, E., M. Firat, and M. Hengge. 2025. Global cross-border payments: A $1 quadrillion evolving market? *IMF Working Paper* .

Cipriani, M., L. S. Goldberg, and G. La Spada. 2023. Financial sanctions, swift, and the architecture of the international payment system. *Journal of Economic Perspectives* 37:31–52.

Circle. 2026. Felix uses USDC as a SWIFT alternative. *Case Studies* .

Financial Stability Board. 2025. G20 roadmap for enhancing cross-border payments: Consolidated progress report for 2025. *Basel, Switzerland* .

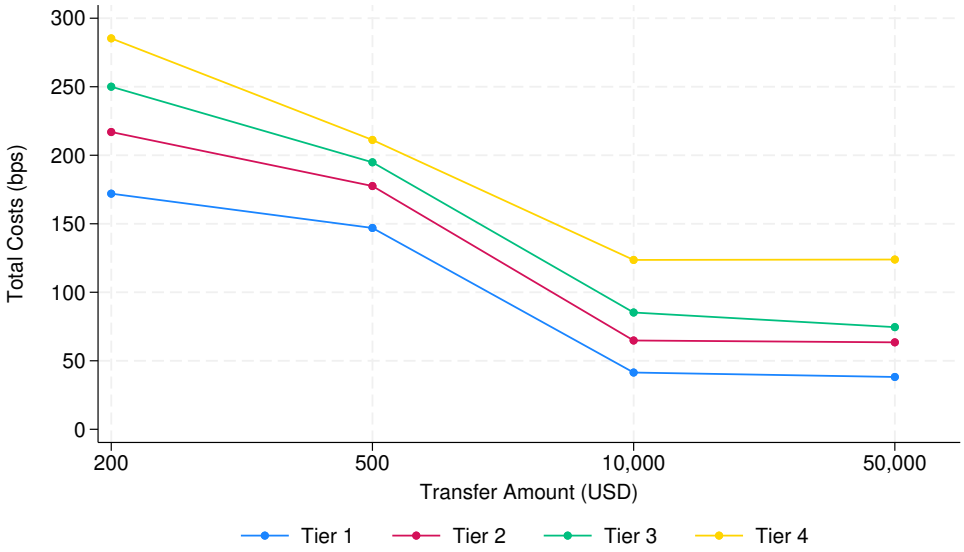
OliverWyman, and Kinexys. 2023. Deposit tokens: A foundation for stable digital money .

SWIFT. 2024. Spotlight on speed: Where to focus for faster international payments .

von Luckner, C. G., C. M. Reinhart, and K. Rogoff. 2023. Decrypting new age international capital flows. *Journal of Monetary Economics* 138:104–22.

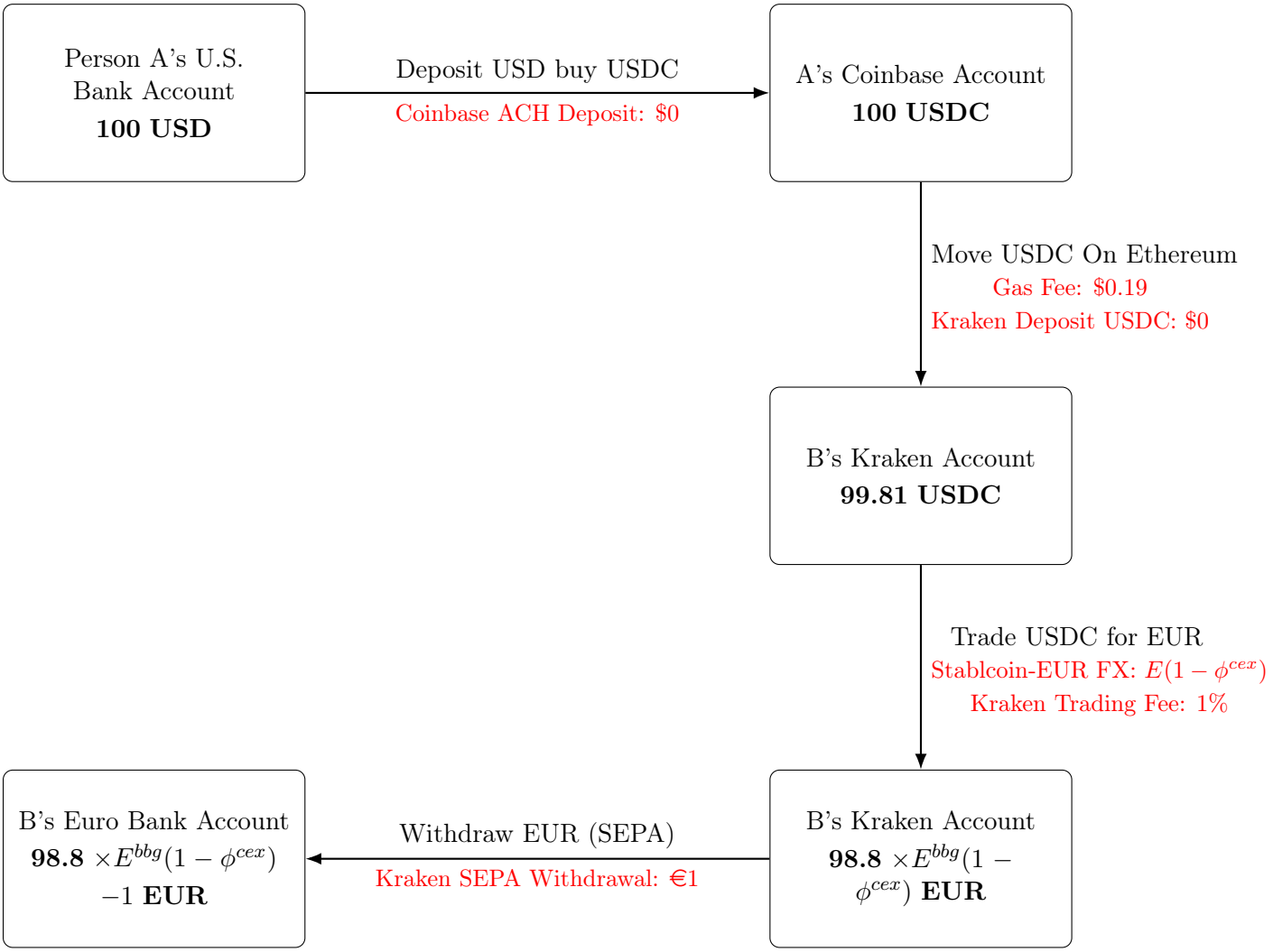
von Luckner, C. M. G., M. R. Koepke, and M. S. Sgherri. 2024. *Crypto as a marketplace for capital flight*. International Monetary Fund.

Figure 1: Median Costs by Fintech MTOs in USD-corridors



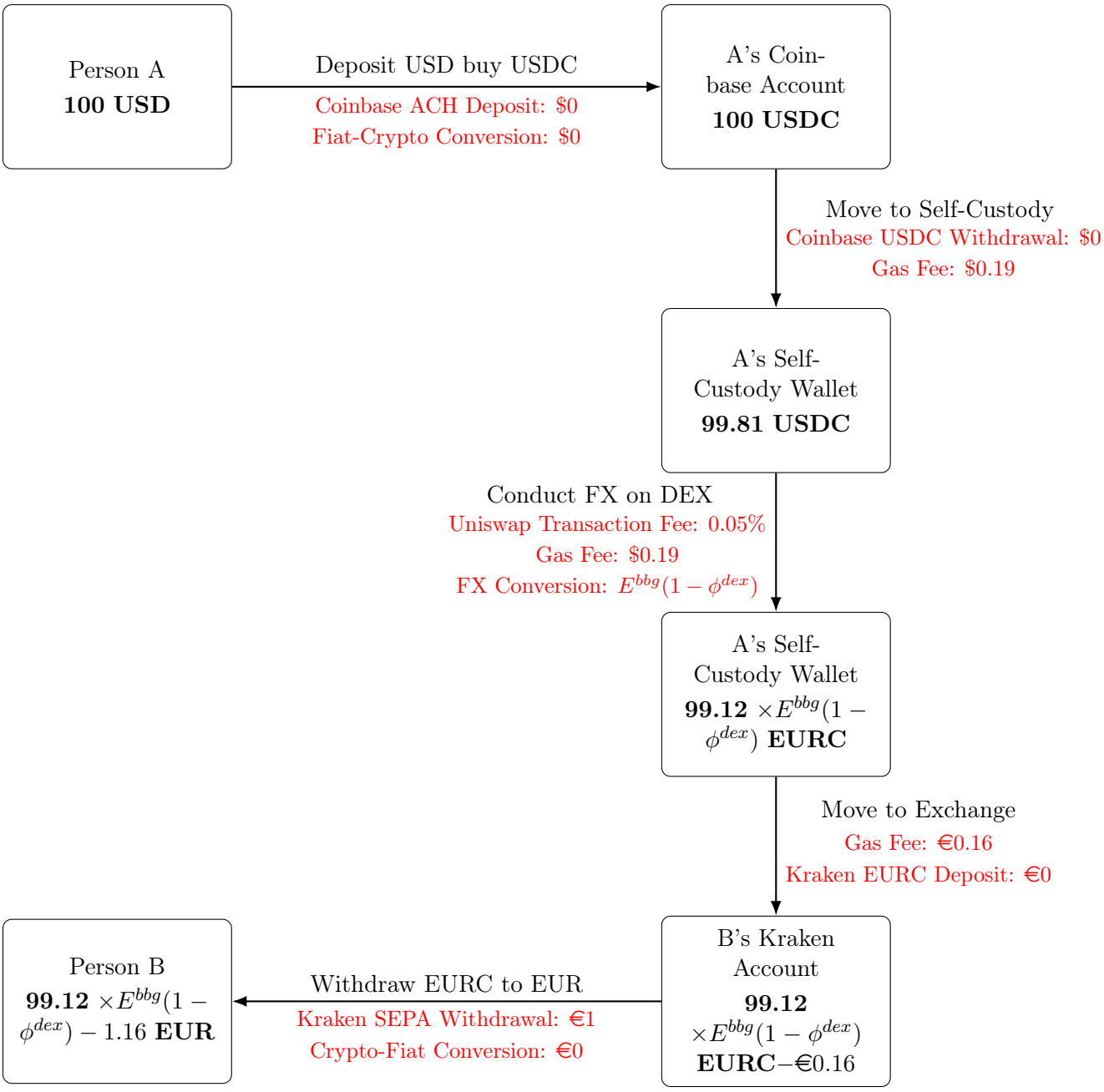
Notes: This figure plots the median cost of cross-border payments of $200, $500, $10,000, and $50,000 from the United States to different tiers of recipient currencies, as quoted by three major non-bank fintech money transmitters. The data are collected from the providers' websites at 30-minute intraday intervals during the week of January 23–30, 2026. The pay-in and pay-out method combinations that yields the lowest all-in costs are chosen for each provider and corridor. Currency tier definitions are given in Section 4.4.

Figure 2: USD-USDC-EUR Stablecoin sandwich using Coinbase and Kraken



Notes: This figure displays the flow of funds for a USD-USDC-EUR stablecoin sandwich. USD is converted into USDC on Coinbase, transferred on-chain to Kraken, exchanged into EUR at an FX rate $E^{bbg}(1-\phi^{cex})$ and withdrawn to a euro bank account. The total spread arises from exchange trading fees, potential FX mark-ups relative to the Bloomberg mid FX rate, ϕ^{cex}), blockchain transaction costs, and fixed withdrawal fees.

Figure 3: USD-USDC-EURC-EUR Double-decker Stablecoin Sandwich



Notes: This figure illustrates a "double-decker stablecoin sandwich" transaction that converts USD into EUR through a sequence of centralized and decentralized platforms. Person A deposits USD into Coinbase and converts it into USDC at par, transfers USDC to a self-custody wallet, and conducts FX conversion from USDC to EURC on a decentralized exchange at rate $E^{bbg}(1-\phi^{dex})$, where ϕ^{dex} captures the DEX-implied FX spread relative to the Bloomberg benchmark rate E^{bbg}. The EURC is then transferred to Kraken and redeemed into EUR for Person B via SEPA withdrawal. The diagram reports intermediary balances and associated fees at each stage, including network gas fees, DEX trading fees, exchange withdrawal fees, and fiat transfer charges.

Table 1: FX Turnover and Bid-Ask Spreads of Highest-Turnover Currencies

(1) Currency	(2) Rank	(3) Tier	(4) Vol ($B)	(5) Share (%)	(6) Bid-Ask (Bps)
USD	1	1	8,471.5	89.1	–
EUR	2	1	2,714.1	28.5	5.8
JPY	3	1	1,608.3	16.9	7.1
GBP	4	1	966.6	10.2	9.0
CNY	5	3	817.5	8.6	3.7
CHF	6	2	601.0	6.3	13.8
AUD	7	2	582.4	6.1	10.5
CAD	8	2	547.5	5.8	7.3
HKD	9	2	366.7	3.9	2.1
SGD	10	2	232.3	2.4	13.0
INR	11	3	185.1	1.9	1.4
KRW	12	3	170.9	1.8	3.9
SEK	13	2	157.8	1.7	28.8
NZD	15	2	147.5	1.6	15.8
MXN	14	3	146.8	1.5	17.4
NOK	16	2	126.7	1.3	33.8
TWD	17	3	116.2	1.2	8.7
BRL	18	3	89.9	0.9	4.9
ZAR	19	3	81.8	0.9	32.6
PLN	20	3	76.3	0.8	29.3
DKK	21	2	68.6	0.7	7.7
IDR	22	3	63.8	0.7	11.0
TRY	23	3	54.6	0.6	35.4

Notes: This table reports the highest-turnover currencies based on average daily trading volume from the 2025 BIS Triennial Over-the-Counter Derivatives Survey. Column 1 lists the currency ticker. Column 2 reports the turnover rank. Column 3 indicates the tier classification used in the paper. Column 4 shows average daily turnover in billions of U.S. dollars. Column 5 reports the currency's share of global FX turnover (the world total sums to 200% because each FX trade involves two currencies). Column 6 reports the average bid–ask spread of USD exchange rate against the currency in basis points, computed from daily New York 5 p.m. closing quotes from Bloomberg over the period 2020–2025.

Table 2: Median Costs by Fintech MTOs in USD-Corridors by Recipient Currency

Currency	Tier	$200	$500	$10,000	$50,000
EUR	1	95.3	66.3	37.8	38.2
GBP	1	172.0	146.9	41.4	38.1
JPY	1	264.8	228.6	105.7	115.8
SEK	2	201.2	168.1	64.8	70.4
AUD	2	205.5	172.6	44.5	56.5
HKD	2	213.3	177.6	122.6	121.7
CAD	2	217.0	176.4	38.3	34.5
NZD	2	217.3	177.8	65.8	63.5
SGD	2	229.8	183.1	45.9	47.1
CHF	2	244.1	193.7	154.2	151.5
IDR	3	118.6	112.6	72.6	69.6
CNY	3	200.4	166.2	97.2	99.3
INR	3	224.2	118.8	26.1	29.1
PLN	3	242.2	205.8	169.0	169.8
TRY	3	250.0	192.3	96.1	100.5
BRL	3	259.2	232.7	100.3	91.6
KRW	3	270.4	204.3	64.0	58.0
MXN	3	345.4	194.9	85.2	74.6
ZAR	3	373.2	209.5	67.5	65.0
NGN	4	-254.6	-276.1	-340.9	-347.2
KES	4	190.3	160.8	136.9	141.2
CZK	4	197.3	169.1	55.5	56.5
MYR	4	213.9	185.6	123.6	120.0
PHP	4	227.3	198.0	169.6	169.6
AED	4	248.7	171.2	132.0	131.2
VND	4	267.0	211.2	91.9	78.8
ARS	4	285.3	51.3	-62.1	-52.0
THB	4	290.0	222.9	99.8	123.9
GTQ	4	296.6	221.5	122.2	120.6
DOP	4	306.7	274.9	234.9	236.4
ILS	4	319.8	232.2	178.6	193.0
CLP	4	380.0	293.4	103.6	91.6
PEN	4	428.6	339.9	255.1	253.5
COP	4	446.4	321.4	191.3	188.7

Notes: This table summarizes the median cost of cross-border payments of $200, $500, $10,000, and $50,000 from the United States to different recipient currency, as quoted by three major non-bank fintech money transmitters. The data are collected from the providers' websites at 30-minute intraday intervals during the week of January 23–30, 2026. The pay-in and pay-out method combinations that yields the lowest all-in costs are chosen for each provider and corridor. Currency tier definitions are given in Section 4.4.

Table 3: Summary of FX Markups of U.S. Outbound FX Wires via a B2B FinTech Plaform

Panel A: Tier 1 currencies			
Currency	Mean	SD	Count
GBP	82.6	36.2	643
EUR	82.6	27.9	1,412
JPY	83.6	29.5	118
Average	83.0	31.2	2,173

Panel B: Tier 2 currencies			
Currency	Mean	SD	Count
DKK	69.6	53.2	21
NZD	75.8	35.2	9
NOK	82.6	19.8	16
AUD	84.8	33.5	45
SEK	85.6	53.1	40
CAD	85.9	20.9	70
CHF	92.3	15.1	74
SGD	144.0	4.1	17
HKD	145.5	1.8	18
Average	96.2	26.9	310

Panel C: Tier 3 currencies			
Currency	Mean	SD	Count
MXN	148.7	34.1	32
ZAR	148.8	23.9	74
PLN	177.0	62.9	4
INR	257.4	47.6	107
KRW	400.3	13.8	18
CNY	452.6	33.6	24
TRY	456.2	15.9	4
TWD	457.5	78.9	4
BRL	608.4	140.7	29
Average	345.2	50.2	296

Panel D: Tier 4 currencies			
Currency	Mean	SD	Count
AED	135.5	61.6	33
ILS	139.1	97.6	38
THB	154.3	14.0	7
XOF	246.0	35.3	8
VND	253.5	3.4	9
PHP	268.6	13.6	5
MAD	274.1	9.2	4
KES	278.6	12.7	8
CLP	281.4	15.8	6
MYR	286.3	4.6	5
PEN	339.5	2.2	4
TZS	365.3	10.8	4
KZT	425.6	2.9	7
ETB	452.7	65.0	6
COP	488.1	21.4	30
NGN	758.9	43.7	14
Average	321.7	26.3	188

Notes: This table shows summary statistics of the mean and standard deviation of FX markups associated with U.S.-outbound FX wire transfers provided to us by a community bank and an educational institution. Both institutions executed their FX wires through the same B2B payment providers.

Table 4: Individual Bank FX Wire Transactions and Implied FX Costs

Date	Send	Receive	Sending Bank	Receiving Bank	FX Cost
11/18/24	EUR	USD	Large German Bank	Large U.S. Bank	365.5
6/26/25	USD	EUR	Large U.S. Bank	Regional French Bank	230.2
7/22/25	EUR	SEK	Large U.S. Bank	Large Scandavanian Bank	198.6
8/1/25	EUR	USD	Large French Bank	Large U.S. Bank	457.8
8/1/25	EUR	USD	Large French Bank	Large U.S. Bank	467.8
11/28/25	CHF	USD	Large Swiss Bank	Large U.S. Bank	309.2
1/6/26	USD	EUR	Large U.S. Bank	Regional German Bank	299.5
1/16/26	SGD	USD	Large Singaporean Bank	Large U.S. Bank	313.7

Notes: This table reports individual bank wire transfers based on personal transactions. The FX cost is defined as the log difference between the Bloomberg 5:00 p.m. New York closing spot rate and the exchange rate applied to the wire transfer, expressed in basis points.

Table 5: FX Costs Implied from USDT/USDC–Local Currency Fiat Trading

Currency	Tier	Mean FX Cost	SD FX Cost	Daily Vol. ($M)
EUR	1	-8.2	35.8	185.7
GBP	1	-2.2	87.3	17.4
JPY	1	1.2	162.2	0.2
AUD	2	-9.9	79.7	4.0
SGD	2	-8.0	29.2	0.7
CHF	2	-6.7	41.5	3.2
HKD	2	-2.0	23.8	3.5
CAD	2	5.1	52.2	1.7
NZD	2	6.4	48.3	0.3
INR	3	-473.6	381.6	0.8
KRW	3	-210.9	1067.1	143.5
ZAR	3	-193.6	177.0	3.6
PLN	3	-171.8	533.2	1.7
TRY	3	-80.4	134.1	83.2
BRL	3	-59.5	80.7	20.9
TWD	3	-42.6	42.9	7.7
IDR	3	-24.5	41.8	5.2
MXN	3	-1.9	45.1	7.4
ARS	4	-4393.2	2885.5	2.0
NGN	4	-1616.2	2035.2	0.1
UAH	4	-428.7	532.2	2.3
CZK	4	-82.4	139.4	0.4
BGN	4	-81.7	163.3	0.3
ILS	4	-72.0	908.4	0.5
KES	4	-56.1	1695.3	0.1
KZT	4	-51.7	303.4	0.4
THB	4	-27.1	103.9	16.5
RON	4	-22.6	77.1	0.3
PEN	4	-18.7	842.2	0.2
PHP	4	-14.3	32.3	3.5
CLP	4	-10.7	67.5	0.5
AED	4	-3.8	14.3	1.8
COP	4	143.7	184.8	1.1

Notes: This table reports summary statistics for FX trading costs associated with USDT/USDC–local currency fiat pairs. For each currency, the table shows the mean and standard deviation of FX costs, as well as the average daily trading volume. The sample period spans 2021–2025.

Table 6: Median Historical FX Cost Comparison for USD-Outbound Remittance Corridors

	Stablecoin FX Cost	RPW All-in Cost
USD-BRL	-54.5	484.0
	(76.0)	(50.7)
USD-COP	119.7	453.0
	(184.8)	(49.6)
USD-IDR	-23.8	528.0
	(41.8)	(27.8)
USD-INR	-472.0	282.5
	(318.9)	(16.9)
USD-KES	-54.6	419.0
	(1695.3)	(40.5)
USD-MXN	2.2	367.0
	(45.1)	(27.2)
USD-NGN	-813.6	250.0
	(2035.2)	(83.4)
USD-PEN	-16.2	342.0
	(842.2)	(41.6)
USD-PHP	-14.2	337.5
	(32.3)	(29.8)
USD-THB	-1.1	558.0
	(104.5)	(94.4)
USD-UAH	-412.5	323.0
	(509.8)	(43.3)
USD-ZAR	-164.7	599.0
	(148.5)	(75.7)
Average	-158.8	411.9
	(502.9)	(48.4)

Notes: This table report volume weighted median FX costs associated with USD-stablecoin and local fiat currency FX rate traded on centralized crypto exchanges, and the all-in costs of cross-border transfers from the World Bank's Remittance Prices Worldwide (RPW) database. Standard deviations across time are in parentheses. All costs are measured in basis points. The sample period is 2022Q1-2025Q1.

Table 7: Average Costs of Remittance Payments from Developed Markets as Source Country

Source Currency	Stablecoin FX Cost		RPW All-In Cost	
	Median	SD	Median	SD
Tier 1				
EUR	-91.4	222.4	388.0	67.8
GBP	-89.5	217.9	348.8	51.7
JPY	-117.1	274.6	640.8	111.6
USD	-158.8	502.9	411.9	48.4
Tier 2				
AUD	-117.4	120.4	336.9	53.2
CAD	-148.4	393.5	453.8	50.8
CHF	2.7	31.9	633.0	150.2
NZD	-220.0	200.4	401.5	44.3
SGD	-87.6	205.0	233.8	38.0

Notes: This table reports summary statistics of average FX costs for transfers from the listed source currencies to developing-market destinations. The first two columns present FX costs implied by USD stablecoin–local fiat trading on centralized crypto exchanges. The last two columns report the all-in costs of sending cross-border payments for the same remittance corridors based on historical data from the World Bank's Remittance Prices Worldwide (RPW) database. All costs are measured in basis points. The sample period is 2022Q1-2025Q1.

Table 8: Three-year average transaction fee as of January 2026.

Blockchain	Average Gas	Type
Avalanche C-Chain	\$0.0014	Layer 1
BNB Smart Chain	\$0.0823	Layer 1
Ethereum	\$0.19	Layer 1
Tron	\$0.5344	Layer 1
Arbitrum	\$0.0124	Ethereum Layer 2
Base	\$0.0146	Ethereum Layer 2
Celo	\$0.0003	Ethereum Layer 2
Optimism	\$0.001	Ethereum Layer 2
Gnosis	\$0.0011	Ethereum Sidechain
Polygon	\$0.0128	Ethereum Sidechain

Notes: This table shows the average gas fee per transaction along different blockchains as of January 2026 from Token Terminal.

Table 9: Transaction Fees on Centralized and Decentralized Exchanges

Type	Exchange	Trading Fees
Centralized	Coinbase	0.40-0.60%
	Kraken	1%
	Binance US	0-0.6%
	Gemini	0.20-0.40%
	Crypto.com	0.25-0.50%
	Blockchain.com	0.40-0.45%
Decentralized	Uniswap V2	0.3%
	Uniswap V3	0.01-1%
	Uniswap V4	0-100%
	Pancakeswap V2	0.25%
	Pancakeswap V3	0.01-1%
	Pancakeswap V4	0-100%

Notes: Fee information collected from exchange websites as of February 2026.

Table 10: Deposit Fees on Centralized Exchanges

Exchange	USD					USDC	USDT
	ACH	Wire	Debit	SWIFT	PayPal		
Coinbase	\$0	\$10		\$25	2.5%	0 USDC	0 USDT
Kraken	\$0	\$0	\$0.25 +3.75%	\$0-3	Variable	0 USDC	0 USDT
Binance US	\$0					0 USDC	0 USDT
Gemini	\$0	\$0	3.49%		2.5%	0 USDC	0 USDT
Crypto.com		\$0		\$0		0 USDC	0 USDT
Blockchain.com	\$0	\$0				0 USDC	0 USDT
	EUR					EURC	
	SEPA	Debit	SWIFT	PayPal			
Coinbase	€0					0 EURC	
Kraken	€0	€0.25 +3.75%	€3	Variable		0 EURC	
Binance US						0 EURC	
Gemini	€0	3.49%		2.5%		0 EURC	
Crypto.com	€0					0 EURC	
Blockchain.com	€0					0 EURC	

Notes: Fee information collected from exchange websites as of February 2026.

Table 11: Withdrawal Fees on Centralized Exchanges

Exchange	USD				USDC	USDT
	ACH	Wire	Debit	SWIFT		
Coinbase	$0	$25		$25	0 USDC	0.01%
Kraken	$0	$4		$13	0.1-2 USDC	0-4 USDT
Binance US	$0				Dynamic	
Gemini	$0	$25			Dynamic	
Crypto.com	$0	$15		$45	0.008-10 USDC	0.011-10 USDT
Blockchain.com	$0	$16			Dynamic	
	EUR				EURC	
	SEPA	Debit	SWIFT	PayPal		
Coinbase	€0				0 EURC	
Kraken	€1		€5		0.42 EURC	
Binance US					Dynamic	
Gemini	€0				Dynamic	
Crypto.com	€1					
Blockchain.com	€0.50				Dynamic	

Notes: Fee information collected from exchange websites as of February 2026.

Table 12: FX Costs Implied USD- and Non-USD-Linked Stablecoin Trading on Decentralized Exchanges

Currency	Tier	Mean FX Cost	SD FX Cost	Transaction Fee	Gas Fee USD	Daily Vol. ($M)
EUR	1	-2.0	153.7	3.8	0.079	15.440
GBP	1	8.3	68.2	0.0	0.015	0.051
JPY	1	-146.7	1184.5	18.3	0.027	0.061
AUD	2	-26.9	223.9	14.9	0.054	0.189
SGD	2	3.7	807.8	5.2	0.058	1.509
CHF	2	-2.8	218.8	2.0	0.160	0.144
BRL	3	-62.5	766.3	9.5	0.017	0.384
IDR	3	-8.9	706.6	5.4	0.053	0.028
KRW	3	-142.2	187.9	3.6	0.082	0.093
MXN	3	-0.5	325.8	28.3	0.010	0.138
NGN	4	-50.1	102.5	8.4	0.036	0.003

Notes: This table reports summary statistics for FX trading costs associated with USDT/USDC-local currency stablecoins on decentralized exchanges. For each currency, the table shows the mean and standard deviation of FX costs, as well as the average transaction fees in basis points, average gas fees in USD, and average daily trading volume in 2025. The local currency stablecoins are EURC, EUROC, and EURT for EUR, VGBP for GBP, GYEN, JPYC and JPYT for JPY, AUDD and AUDF for AUD, XSGD for SGD, ZCHF for CHF, BRL1, BRLA and BRZ for BRL, IDRT and IDRX for IDR, KRW1 and KRWO for KRW, MXNB and MXNe for MXN, and cNGN for NGN.

Table 13: Comparison of Cross-Border Payment Rails

	Banks (SWIFT / Correspondent)	**MTO / Fintech**	**Stablecoin Rails**
Architecture	Multi-hop correspondent banking; SWIFT messaging; nostro/vostro balances	Local prefunding; internal netting; residual settlement via banks	Fiat–stablecoin–fiat "sandwich"; on-chain transfer; CEX/DEX for FX
Balance Sheet Usage	Requires correspondent liquidity and regulatory capital usage	Requires prefunded local balances and FX hedging	No correspondent prefunding; liquidity provision shifts to exchanges and AMMs
Intermediation	Multiple regulated banking intermediaries	Fintech intermediary + partner banks	Crypto exchanges, stablecoin issuers, and on-chain liquidity providers
Speed	Typically T+1 to T+3; compliance and intermediary delays	Minutes to same-day in major corridors; corridor-dependent	Minutes on-chain; overall speed depends on fiat on/off-ramp
All-in Cost	High FX markups (often 200–400+ bps retail; lower for large clients) + explicit wire fees	40–150 bps in developed corridors; higher in EM corridors; strong scale economies	FX near benchmark in major currencies; explicit trading, gas, and withdrawal fees; fixed fees matter for small transfers
Liquidity	Deep wholesale FX markets; scalable for large-value transfers	Dependent on corridor flow netting and prefunded liquidity	Limited stablecoin–fiat and stablecoin–stablecoin depth outside major pairs; price impact for large trades
Trust / Regulation	Mature regulatory framework; legal recourse; deposit insurance	Regulated payment institutions; reliant on banking partners	Dependent on stablecoin issuer, exchange solvency, and evolving regulatory regime
User Experience	Often opaque FX pricing; high friction for retail (e.g. in-person branch visits)	Digital interface; transparent pricing; app-based	Requires exchange accounts or wallets; operational complexity for retails users