Stablecoin Remittances, FX Realisation and Digital Dollarisation in Pakistan

A Settlement-Based Framework for a Remittance-Dependent Emerging Economy

Abstract

This paper develops a settlement-based framework for assessing stablecoin-mediated remittances to Pakistan. It distinguishes the speed with which recipients obtain Pakistani rupees from the point at which the corresponding foreign exchange is verified as realized through authorized institutions. The framework separately measures beneficiary payout, verified FX realization, resident-held stablecoin exposure, bank-funding leakage, and the remittance channel displaced. It distinguishes transfers that replace conventional formal remittances from those that replace informal or unrecorded transfers and from additional remittances. The paper applies the framework to Pakistan's remittance market, existing digital payment infrastructure through Raast, and the emerging regulatory setting for virtual assets. Public data indicate substantial remittance and stablecoin-related activity, but they do not identify stablecoin remittance flows, beneficial ownership, or the settlement point of the foreign-exchange leg. The paper therefore proposes a transaction-level research design linking sender instructions, token movements, authorized FX settlement, and PKR payout records. The resulting framework provides a way to evaluate payment costs, settlement, resident dollar-linked exposure, and bank-funding effects without treating any single measure as a proxy for the others.

Keywords: stablecoins, Pakistan, remittances, foreign exchange settlement, digital dollarisation, Raast, virtual assets

JEL codes: E42, E44, F24, F31, G21, G28

Introduction

Dollar-stablecoin rails in the context of remittances can reduce payment frictions, enable transfers at hours that are more convenient to senders and receivers, and may also spur competition in the provision of remittance services. Moreover, widespread access to a digital token that is pegged to the US$ raises additional macro-financial considerations. This includes how and whether FX exposure and FX realization materialize, where FX exposure resides, and implications for bank funding.

For instance, consider a stablecoin remittance to Pakistan. Upon receipt, the resident receives PKR and can make purchases immediately. How, however, did the recipient's intermediary acquire PKR and dispose of US$ stablecoins? If they are an Authorized Dealer (AD) that can settle in US$ by selling US$ to the open market and buying PKR in return, the intermediary's US$ receipts from non-residents offset its PKR payouts to residents. In this case, FX realization does occur.

If, however, the recipient's intermediary sells US$-denominated tokens to another resident in exchange for PKR, FX realization has not, at least not verifiably, occurred. In this case, however, the recipient's household does immediately have PKR with which to make consumption and investment choices. Nevertheless, US$ exposure has not exited Pakistan's economy, it has simply transferred to another resident. Therefore, in considering dollar-stablecoins in the context of remittances, it is helpful to consider FX realization, FX exposure, and the identity of the final token holder.

Motivation

Pakistan's workers' remittances amounted to US$ 30.3 billion in FY2023-24 (SBP, 2025), rising to US$ 38.3 billion in FY2024-25 (SBP, 2025), and, reportedly, to US$ 41.6 billion in

FY2025-26 (Government of Pakistan, 2026a). In addition, Pakistan was reported by the International Monetary Fund as a top-EM, in terms of inflows relative to GDP, recipient of stablecoins (IMF, 2026). While these are based on web-traffic data and transactional data at crypto-currency exchanges that do not shed light on the ultimate usage of stablecoins in Pakistan, it is nevertheless clear that stablecoin activity in Pakistan is large enough to merit closer scrutiny.

This paper therefore provides an accounting treatment for remittances received via dollar-pegged stablecoins. It identifies verifiable FX realization in this context, distinguishes displacement of the formal remittance channel, displacement of the informal remittance channel, and additionality in this context, and highlights dollarization and bank funding implications when US$-pegged stablecoins are held by residents. It also highlights where public information on the Raast system's footprint, stablecoins' macroeconomics significance, and remittance costs can be helpful in calibrating a fuller-fledged assessment of dollar-stablecoins' role in remittances into Pakistan, even as public information does not offer insight into stablecoins' share of remittances into Pakistan. Moreover, it sketches out the design of a potential empirical exercise including data needs, falsification strategies, and stopping/scaling rules. It does not offer guidance about a welfare-optimal share of remittances arriving as stablecoins nor a threshold that might be considered safe. Faster payments, cheaper payments, a high share of remittances as stablecoins, high stablecoin transactional velocity, stablecoin-driven FX realization, and household savings are all different and none is a proxy for another.

Literature and Research Gap

Stablecoins as Cross-Border Payment and FX Instruments

Building on this, Auer et al. (2025) investigate bilateral flows of stablecoins and crypto-assets across countries. They document that bilateral volumes of stablecoin transfers are associated

with bilateral needs for payments in daily transactions as well as with the costs of conventional remittances between a heterogeneous set of countries. Schär et al. (2026) look at Ethereum transactions involving transfers of stablecoins at a more granular transaction-level and find that on-chain transfers cannot straightforwardly be interpreted as payments as nearly 60% of the 593 million stablecoin transfers studied take place as part of multi-step crypto-native financial transactions, such as trading, lending, arbitrage, liquidity provision, and settlement. Similarly, Reuter (2025) finds that inferring the country of origin of stablecoin transactions is non-trivial since this information is not available in blockchain data. Instead, econometric attribution methods need to be implemented to measure cross-border stablecoin transfers. Aldasoro et al. (2026) find that stablecoin usage has substantial linkages with the conventional money market: Studying four USD-pegged stablecoins and 27 fiat currencies they document deviations from fiat-stablecoin parity for acquiring US dollars as well as provide evidence for a causal effect of stablecoin demand on fiat-exchange rates and the synthetic dollar-funding market. Together, these studies indicate that stablecoins are a growing and important component of international payment flows that are well-integrated with the rest of the macro-finance system.

The April 2026 Global Financial Stability Report by the IMF (2026) provides further evidence that cross-border stablecoin transactions are increasing across emerging market and developing economies. The report documents that stablecoin flows are associated with macro-financial (high) instability, institutional (good) fundamentals, international trade as well as remittances and highlights Pakistan's high (gross) inflows relative to GDP in 2024. At the same time, the report underscores several data and attribution challenges, for example, by distinguishing between inflows through CEXs or self-custody wallets, relying on web-traffic-based estimation methods for some countries and mentioning that transaction-level analysis is needed to determine

the ultimate use of stablecoin inflows as remittances or otherwise. These challenges also reflect in our setting. Identifying crypto-asset transfers that pertain to (family) remittance flows and determining at which leg of the settlement process a fiat-exchange occurs are crucially important micro-institutional aspects that we explore in the context of remittances to Pakistan. Relatedly, we can shed light on who bears crypto-exposure along the settlement process.

From Conventional Dollarisation to Token Dollarisation

Ize and Levy Yeyati (2003) emphasize that the currency denomination of financial intermediation reflects household and firm decisions about financial portfolios, with agents seeking to manage uncertainty about inflation and the real exchange rate. Reinhart et al. (2003) highlight that foreign-currency use extends beyond bank deposits, including foreign-currency notes and coins and financial assets held abroad. Measuring broader dollarization is therefore more difficult.

Hofmann et al. (2026) find that conventional and stablecoin dollarization respond to similar macroeconomic factors using data from more than 130 economies, although dollarization measures do not always move one-for-one. Aldasoro et al. (2026) highlight that using a USD-pegged stablecoin can reinforce the international hierarchy of currencies and increase monetary-sovereignty concerns, especially in emerging-market economies. Overall, the macroeconomic effect depends on whether adoption increases aggregate dollar-linked claims or changes their composition.

The Financial Stability Board (2024), Adrian et al. (2025), and the Bank for International Settlements (BIS, 2026) point to potential gains from digital access alongside macro-financial risks, including faster transmission of global shocks, capital-flow volatility, and possible circumvention of regulation and other policy objectives.

Hofmann et al. (2026) model bank-funding channels and find that stronger stablecoin demand can raise deposit funding costs and reduce loan supply. Cerutti et al. (2026) find that banks that suffer larger deposit outflows in response to positive shocks in stablecoin demand do not charge a premium to lend to firms, suggesting no evidence of a stablecoin/bank-disintermediation risk premium among US banks.

Anadu et al. (2024) show that stablecoins may be highly sensitive to sentiment, citing instances of rapid redemptions back into bank deposits during financial-stress episodes; their findings highlight liquidity-management considerations. These studies suggest that financial-stability effects are context-specific and should be investigated in our setting.

H_t measures stablecoins originating from remittances and beneficially owned by Pakistanis rather than total dollarization. Pakistani foreign-currency financial assets also include FE-25 deposits, foreign-currency cash, foreign-currency financial assets held abroad, and other USD-linked assets. According to the April 2026 edition of the SBP's monthly Monetary Policy Information Compendium, resident FE-25 deposits stood at US$5.879 billion as of end-March 2026 (SBP, 2026d).

Directly adding H_t to bank-deposit totals would be problematic; residency, valuation, ownership, and overlap need to be treated consistently. Self-custody also complicates inference about the size and use of foreign-currency assets, particularly stablecoin holdings, as discussed next.

Behaviour, Channel Choice and Cost Elasticity

Evidence on stablecoins as a foreign-currency saving vehicle is promising but incomplete. Murakami and Viswanath-Natraj (2025) show that households in small, open economies may hold USD-denominated stablecoins to hedge against economic fluctuations and smooth consumption.

Le et al. (2025) show that households' direct digital access to foreign-currency assets can strengthen currency-substitution dynamics and weaken banks' economic role in transmitting monetary-policy actions following macroeconomic shocks. Thus, recipient-side retention may not always be welfare-improving, supporting direct estimation of remittance-linked stablecoin holdings rather than assuming a uniformly positive or negative effect.

Survey-based evidence is important because it captures sender and recipient-side factors that transaction data may not fully reveal. Kosse and Vermeulen (2014) find that migrants' choice of transfer channel responds to fees and service charges, financial-sector development in recipients' economies, financial-accessibility concerns, and educational attainment.

Nakasone et al. (2024) use a lab-in-the field experiment to show that providing detailed information on traditional and mobile-money providers leads to heterogeneous changes in channel selection, pointing to the importance of financial literacy, habits, and trust. Ahmed and Martinez-Zarzoso (2021) find that lower remittance costs are associated with higher levels of remittances recorded as formal transfers; this result speaks to price elasticity of demand for remittances, though it is important to disentangle additionality and formalization.

Remittance Cost Measurement

The literature offers mixed evidence on stablecoins' potential to reduce the price of international transfers. Katz (2026) finds that the cost of sending a remittance through a stablecoin can be lower than the RPW average cost of sending a remittance but also finds considerable cross-corridor variability owing to different on-and off-ramp fees and stablecoin premium/discount. However, RPW cost is a point-in-time estimate that includes transfer charges and exchange-rate spreads.

A stablecoin transfer's total end-user cost should include sending-amount acquisition costs; network, stablecoin premium/discount, and off-ramp costs; foreign-exchange spreads; receiving-side withdrawal costs; and expected failed-transfer costs.

Total resource cost would add providers' compliance, blockchain-monitoring, correspondent-banking, prefunding, foreign-exchange-hedging, working-capital, customer-support, and other operating costs, as well as fraud losses. End-user cost should not be added to providers' resource cost unless measuring total resource cost; the latter may be appropriate for a social-cost calculation but not for measuring the price that households face.

The potential for cost reductions and efficiency gains may influence incumbent firms' strategies, investment, and market values. Copestake et al. (2026) provide evidence on market-reaction effects, finding that firms involved in the cross-border payments industry experienced a decline in stock and bond valuations around a positive, US-specific policy shock related to the US government's pro-stablecoin stance.

Finally, the World Bank's RPW database reports the cost to end-users. This cost can be compared with the cost of stablecoin-based transfers. The extent to which lower-cost options raise welfare depends on demand-side factors including trust, financial-literacy, and habits, and supply-side factors including competition and regulatory conditions. The next section describes the data used in our study.

Research Questions and Testable Implications

RQ1. What would be the counterfactual remittance channel if stablecoins were not available, and what share would have been sent through formal, informal, or additional channels?

RQ2. Under what conditions does stablecoin use generate verified foreign-exchange realization relative to the counterfactual remittance channels?

RQ3. Does rapid payout into Pakistani rupees correspond to verified foreign-exchange realization?

RQ4. How does stablecoin use affect resident-held dollar-linked exposures, including stablecoin holdings and possible crowding out of other dollar-linked assets?

RQ5. How does the total cost of stablecoin-based remittances compare with the cost of existing remittance channels?

RQ1 is important because it helps determine how much of the stablecoin transfers would be recorded in the absence of stablecoins . This question is relevant for understanding whether stablecoins facilitate FX realization through formalization of previously informal transfers. The fraction, m, routed formally in the counterfactual is an estimand that would need to be estimated and is not an exogenously determined parameter of resident behavior.

RQ2 helps understand the conditions under which stablecoin transfers can lead to better FX realization compared to the counterfactual transfers.

RQ3 highlights that payout can be a misleading indicator of FX realization. We show below that high rates of quick payout into PKR need not equate to high FX realization.

RQ4 is important for understanding dollar-linked exposures of residents of the country of remittance origin. We show below that controlling for payout, an increase in FX realization will reduce the fraction of tokens held by residents, but the implications for net changes in dollar-linked exposures are not straightforward and could lead to crowding out existing dollar-linked assets, or contribute to higher dollarization in the economy. These two cases have different macro-financial implications.

RQ5 highlights that blockchain fees need not correspond to the costs faced by providers of remittance services and/or prices faced by their customers. We discuss below conditions under

which stablecoins can help lower total cost of sending remittances relative to existing options, which will depend on remittance corridors and market access considerations among other factors.

Contribution Relative to Existing Work

This section outlines how we suggest crypto-enabled remittances can be measured. The goal is to provide a framework that enables providers and supervisors to match their understanding of remittance flows to variables they can observe and reconcile. Previous work has noted difficulties in estimating flows, including attribution of transactions by geography (Reuter, 2025), and counting transfer events as payments (Schär et al., 2026). Our approach tracks transfers as they happen to capture the full remittance flow, which would enable supervisors to avoid counting local payouts for immediate rupee use as foreign-currency settlements.

Three Settlement Arrangements

Consider an individual who wants to send a payment worth the equivalent of 200 dollars to their family in Pakistan. We focus on three possible arrangements for this to happen. In the first, the sender instructs an authorised financial institution that is permitted to make payments in PKR and is subject to regulation, including settlement and reporting requirements. In the second, the sender instructs a provider that is authorised to receive tokens. In this example, an authorised financial institution makes foreign-exchange transactions where this is permitted and reconciles settlement from abroad with a payout in PKR to the beneficiary. In the third, the recipient of the transfer sells the token for PKR to someone else who is happy to buy tokens within Pakistan.

The first two examples are analogous to formal transfers today. The third is an example of peer-to-peer settlement using stablecoins. From the perspective of the beneficiary, they would be able to access purchasing power in Pakistan. From the perspective of Pakistan's financial system, the token may remain within Pakistan, in the hands of a resident. As such, an authorised financial institution does not record a credit in foreign-currency settlement. Residents might choose to buy

tokens rather than other types of formal FX, reducing demand in the future. Whether this happens, and to what extent, needs to be estimated, but would not in itself constitute a settlement.

Table 1

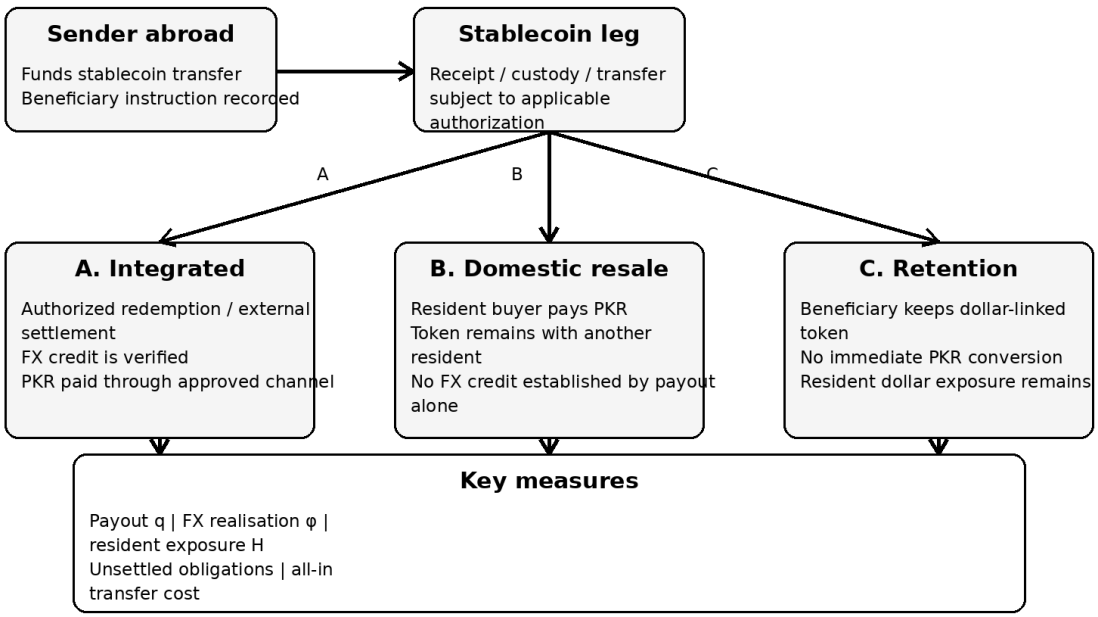
Economic distinctions across settlement arrangements

Arrangement	Beneficiary receives PKR	Verified formal FX realisation	Location of token exposure
Conventional formal transfer	Yes, after payout	Observed through settlement records	No token required
Integrated stablecoin transfer	Yes, after payout	Only if redemption / external settlement is verified	Temporary provider exposure or nonresident holder
Domestic token resale	Yes, after sale	Not established by the PKR payment	May move to another Pakistani resident
Beneficiary retains token	Not immediately	Not established by receipt alone	Beneficiary retains dollar-linked exposure

Note. q denotes prompt beneficiary payout; φ denotes verified FX realisation conditional on payout; m denotes the share of stablecoin flow that displaces a conventional formal route. Source: author's construction.

Figure 1

Settlement paths for a dollar-stablecoin remittance to Pakistan



Note. The figure is conceptual. Legal permissions for each function depend on the specific provider, licence, banking arrangement, foreign-exchange treatment, and payment channel.

Bank Deposits, FX Realisation and Official Reserves Are Different Outcomes

First, as discussed earlier, PKR transfers between resident bank accounts, such as from a buyer's account to the beneficiary's account, do not, at the aggregate level, necessarily lead to fall in bank deposits, as they just switch deposits between banks and depositors. Whether banking system will see any fall in aggregate net deposit levels depends on other factors like withdrawals for cash or foreign currency, whether remittance service provider will keep those PKR deposits with commercial banks or use it for other settlements, how much of remitter deposits are recycled domestically and so on. However, concentration of deposits in few banks' balance sheets, such as banks acting as stablecoin service providers, or few depositors' bank accounts, such as client money accounts of stablecoin service providers, may also affect the stability of funding for banking sector. While, Hofmann et al. (2026) use a structural model to show a potential contractionary impact of stablecoins through bank funding channel, Cerutti et al. (2026) show no bank-disintermediation that can be priced using stock prices of US banks against demand shocks for stablecoins. Therefore, it remains an empirical question whether stablecoin adoption for receiving international remittances would be contractionary through the bank funding channel in the case of Pakistan.

Secondly, it is important to differentiate between FX realisation and building of official reserves. While authorised banks/companies may be allowed to keep foreign currency to facilitate permitted transactions or even in the form of assets on their own balance sheets, official reserves only move when central bank conducts a transaction. Thus, not all foreign exchange that is realised through current account items in Pakistan will add to reserves. Therefore, receiving tokens for a

stablecoin or paying PKR to the remittance beneficiary, does not lead to a similar amount of increase in SBP's official reserves.

What Stablecoin Adoption Replaces

The key question that needs to be understood is whether use of stablecoins for international remittances: i) simply substitutes existing transfers done via formal routes such as banks and exchange companies, reducing transaction costs but not changing total remittances for family support and therefore gross foreign exchange offered to formal sector; ii) substitutes remittances that were being sent through informal or even unrecorded channels, potentially adding to the foreign exchange visible to be settled; iii) leads to additionality that is, an increase in family support via remittances altogether? To begin with a conservative assumption, this discussion assumes that total underlying international remittances for family support remain same and only their transmission channels change. Additionality effects are kept aside so as not to double-count potential fall in transaction costs that leads to foreign exchange additionality.

Informal Remittance Channels in Pakistan

Transfers of foreign currency using informal networks (hawala/hundi) are illegal in Pakistan. However, it has been a competitive force against formal remittance channels due to convenience and wider reach especially to less literate and remote areas, a point made by the SBP Governor in a 2019 speech (SBP, 2019) discussing potential of blockchain-based remittances. In our simple example above, 1 - m was assumed to be the share of the stablecoin remittances flow that would not otherwise have used a conventional formal remittance route. This share may include transfers through unrecorded or informal channels, however, care needs to be taken to not necessarily tag it with hawala only. The rise of stablecoin remittances and their economic importance will be dependent upon whether they can be considered as FX inflows settled through

authorised means and subsequently, traceably converted and paid-out to the ultimate beneficiary. It may include additions to overall remittances too. Hence, if m is not uniquely identified, FX additionality should be assessed for the whole spectrum of values of m.

A Settlement-Adjusted Analytical Framework

Flows, Stocks and Residence

Let R denote annual underlying family transfers (US-dollar equivalents), with $R > 0$. If a fraction $s \in [0, 1]$ is executed through the stablecoin pathway, the relevant annual stablecoin remittance flow is

$$X = sR, \text{ and } X > 0.$$

Write $q \in [0, 1]$ for the share of X converted and paid out to residents in local currency (PKR), and $\varphi \in [0, 1]$ for the share of X for which foreign exchange is verified as realised through authorised institutions. At settlement horizon h, define q_h and φ_h analogously; the payout-before-FX gap is

$$G_h = q_h(1 - \varphi_h)X.$$

For a fixed horizon such as $h \in \{1, 7, 30\}$, report $(G_h)/X$ alongside q_h and φ_h; the main FX-realisation statistic remains φ. Supervisory use favours reporting full curves q_h and φ_h across several horizons, not a single-timestamp classification: for example, $q_1 \approx 1$ while φ_7 converges.

Interpret φ as the share of stablecoin-mediated transfers whose foreign-exchange value is treated as realised rather than merely promised, after reversals and net of documented charges. Gross verified FX settlement at horizon h is $F_h = q_h \varphi_h X$; dropping h at the supervisory reference horizon gives

$$F = q \varphi X.$$

Net additionality requires a counterfactual split of X: share m displacing comparable conventional formal transfers, share i displacing comparable informal transfers, and additional share a. Then m + i + a = 1 with each share in [0, 1], so a = 1 - m - i. If comparable conventional and informal channels realise FX fractions φ_T and φ_I respectively, incremental verified FX is

$$ ΔF = X[q φ - m φ_T] $$

under the maintained informal-sector assumption φ_I = 0. More generally,

$$ ΔF = X[q φ - m φ_T - i φ_I]. $$

The term involving a drops out of these net FX-settlement identities because a enters through X alone; use a (and inputs such as cost-response ΔR/R ≈ ε_cΔc/c_0, with sensitivity inputs) when translating into output or other macro effects.

For resident-held stablecoin exposure arising from remittances, define U = uX as new resident-held stablecoin value originating from these transfers. Write θ ∈ [0, 1] for the share of value that is paid out in PKR but whose FX is not yet realised that nevertheless remains resident-beneficially-owned (for example, domestic resale). Then

$$ U = uX = X[(1 - q) + θq(1 - φ)], 0 ≤ θ ≤ 1. $$

Two boundary readings: (i) even full payout q = 1 can imply u = 1 - φ if tokens are resold domestically (θ = 1); (ii) if q = 0, φ is unidentified and qφ is recorded as zero, and U is reconciled separately between (1-q)X, provider-side stablecoin inventory, and recipient-side holdings. Exclude token purchases not funded by these remittances; report any such component as a distinct data item.

If remittance-origin resident-held value exits Pakistani-resident holdings at annualised rate δ ∈ (0, 1], through sale, redemption, or leaving residence, the stock H_t obeys

$$ H_t = (1 - δ)H_(t-1) + u_t X_t, 0 < δ <= 1, $$

where H_t measures resident-held stablecoin value originating from family remittances. Under constant u, X, δ, H* = uX/δ. Report the realised-φ curve φ_h and the gap (q_h - φ_h); classify FX-realisation timing only after tracing settlement, not from a single-timestamp rule.

A Minimal Bank-Funding Accounting Extension

Let D be the level of resident deposits or the supervised deposit base used for stability assessment, D > 0. At horizon h, suppose a share ω_h of newly created resident-held stablecoin value U_h = u_h X leaves the domestic banking system via cash or transfers abroad/into non-banked channels, while a further share r_h of that outflow returns to domestic banking as beneficiary or provider-side client-money/deposit balances. The net funding displacement is

$$ B_h = ω_h(1 - r_h)u_hX, $$

and the normalised deposit-base pressure indicator is

$$ b_h = B_h/D. $$

Report b_h with a sign convention where positive indicates contractionary pressure on the monitored deposit base at horizon h. Aggregate-level identities do not identify concentration or maturity channels; deposit stability may deteriorate through concentration even when net B is small.

Boundary reading: If domestic token sales are purely resident-to-resident banked transactions with no cash/external leakage, then on impact ω ≈ 0 and B ≈ 0 even though provider-side deposit concentration may rise; identify that channel separately.

$$ B_h = ω_h(1 - r_h)u_hX; \quad b_h = B_h/D \qquad (4a) $$

Table 2

Parameter-to-measurement mapping for the settlement framework

Variable	Meaning	Empirical counterpart	Caveat
q, φ, G_h, u	q: share of eligible cohort value promptly paid in PKR. φ: share of paid-out value later matched to authorised external FX settlement, net of charges. G_h: PKR already paid but FX not yet verified at horizon h. u: share of cohort value ultimately added to resident access (assuming consistent definitions, $u=(1-q)+\theta q(1-\varphi)$ if residual unrealised resident-held value redeems domestically).	Provider payout ledgers and authorised-institution settlement/credit data joined at transaction or batch level, valued consistently. Promptness evaluated at chosen horizons h, such as 1, 7, or 30 days.	Stablecoin payout does not equal formal FX settlement; φ needs reconciliation and is undefined if q=0. G_h should be reported with an ageing distribution, not just one total.
m, i, a, εc, φT	m: share that would have been sent through conventional formal channels absent the corridor. i: share that would have used informal channels. a: share representing new transfers induced by the corridor. εc: elasticity of remitted value to corridor cost. φT: FX-realisation share for the relevant comparator formal transfers.	Quasi-experiments/phased access where possible; sender/beneficiary history and route-choice surveys; displacement of formal/informal flows; overall transfer-response measures for a. φT from authorised-institution data using the same horizon/valuation rules.	True counterfactuals unobserved, so report assumptions/sensitivities, such as 0-1, rather than assuming equivalence. εc alone does not identify a. On-chain geography alone cannot identify i.
θ, δ, Ht	θ: share of cohort tokens still unrealised that are beneficially owned by residents. δ: rate at which prior-period remittance-corridor token stocks exit resident beneficial ownership during the period. Ht: value of remittance-corridor-origin tokens held by residents at end of period.	Provider exchange-held balances with beneficial-ownership/residency classification plus best-available estimates of self-custody; longitudinal token-inventory data to compute exits/additions: Ht.	Classification rules affect results. Self-custody/offshore wallets are hard to observe, biasing θ. Ht is a corridor-origin resident stock, not total dollarisation or all exchange holdings.
ωh, rh, Bh	ωh: share of eligible cohort value entering resident access that leaks from domestic-bank deposits during horizon h via cash or external transfers. rh: share of that leakage redeposited in domestic beneficiary/provider/client-money accounts. Bh: net bank-funding displacement: $Bh=\omega h(1-rh)uhX$.	Provider payout accounts (beneficiary/client-money), bank deposit movements, cash-withdrawal and external-transfer data. Classify counterparties as resident/non-resident and domestic-bank vs cash vs external-transfer destinations.	Gross flows can recycle; report net measure. Define horizons and counterparties clearly; resident-to-resident bank transfers excluded. Bh is an accounting measure, credit effects require additional modelling.

Note. All value ratios should use a common valuation basis and cohort horizon. Unknown purpose, residency, or ownership should remain unclassified rather than being imputed.

Core Propositions

Proposition 1 (settlement condition). Verified formal FX realisation increases relative to displaced rails if and only if

$$q\,\varphi > m\,\varphi_T$$

when $X > 0$; it is unchanged if equality holds and decreases otherwise.

Proposition 2 : payout is not a dollarisation proxy. Better verified realisation (higher φ) weakly reduces resident token additions from remittances whenever $\theta q > 0$. In particular, when $\theta = 1$ and $\varphi = 0$,

$$\partial u/\partial q = -1 + \theta(1 - \varphi) = 0,$$

that is, payout merely shifts the same token between residents.

Proposition 3, the counterfactual matters. Incremental formal FX realisation is lower when the displaced formal share m is larger (for X, q, φ, φ_T fixed and $X(1 - q) \neq 0$). Hence a stablecoin rail can be efficient while reducing verified FX realisation if it displaces an already-formal channel.

These propositions are accounting identities. They define what can and cannot be learned from transaction-level evidence about FX settlement and dollarisation, and specify the data needed to estimate the relevant aggregates. They deliberately stop short of welfare conclusions: utility gains require assumptions about risk premia and the social use of dollars, which are addressed below.

Behavioural and Welfare Limits

Conditional on households holding dollar-linked stablecoins, Proposition 2 implies that additions to resident-held stocks rise with the attractiveness of retaining such tokens relative to PKR deposits, net of risks, convenience, and conversion costs. Higher expected PKR depreciation raises the value of private hedges but does not, by itself, identify welfare effects. Observed co-

movement between stablecoin retention and depreciation can arise because both respond to the same information rather than because retention causes depreciation. In a state-dependent setting, shocks that lower expected redemption, for example confidence or regulatory shocks, can reduce payout, lower verified realisation, increase retention, slow exits from holdings, and amplify bank-funding leakage. Thus, widespread adoption could support private hedging while weakening monetary-policy transmission domestically.

A related identification problem concerns welfare. Lower observed transfer costs may reflect cross-subsidies across flows or times of day, risk-bearing by intermediaries, or liquidity premia not visible in average fees. Without stress-period pricing and balance-sheet data, fee comparisons identify cost incidence rather than verified welfare gains. Accordingly, FX-settlement effects, dollarisation effects, cost incidence, and bank-funding effects are kept as separate, directly interpretable quantities rather than aggregating them into an index relying on ad hoc welfare weights.

Pakistan: Institutional and Regulatory Application

Pakistan received US$41.6 billion in total remittances in FY2025-26. Even a modest 5% routing share therefore corresponds to a material scale, approximately US$2.08 billion per annum. The IMF has also highlighted Pakistan’s importance in crypto markets by placing it among the top ten emerging market economies by gross stablecoin inflows as a share of GDP in 2024. However, those metrics rely on geographic inference from web-traffic sources and destination countries and count each step of complex transactions. While informative about global attention, they can overstate actual use for direct payments and do not establish Pakistan’s share in global stablecoin remittances. Estimating that share requires ownership and purpose-of-transfer data at the inflow stage.

The application focuses on stablecoins used to receive international remittances in a jurisdiction that permits crypto-asset-related services for resident households under regulation and offers an existing domestic digital PKR payment system. The baseline assumes that recipients receive funds in a dollar-linked stablecoin cross-border and then payout in PKR through the domestic digital rail, making the relevant counterfactual the conventional cross-border rail for the same final payout system. This isolates the incremental effects of the stablecoin leg without conflating them with the benefits of digital PKR transfer infrastructure. In Pakistan, the State Bank of Pakistan (SBP) operates Raast. Under SBP's EPD Circular Letter No. 02 of 2026, exchange companies with prior EPD approval may provide digital remittance disbursement using Raast to facilitate crediting remittances into bank accounts, electronic money institution accounts, and microfinance banks' current accounts.

Remittance Scale and Public Stablecoin Evidence

A 5% routing share of Pakistan's US$41.6 billion annual remittance inflows implies roughly US$2.08 billion routed through an alternative channel. The IMF has separately reported that Pakistan is among the top ten emerging markets for gross stablecoin inflows as a share of GDP in 2024 (IMF, 2026). However, these are gross transaction-based measures inferred from sources and destinations of crypto-asset transactions. They provide evidence of global attention and activity involving Pakistan, but overstate actual use for direct payments due to transaction complexity. Consequently, they do not provide a direct estimate of Pakistan's share in global stablecoin remittances, which would require ownership and purpose-of-transfer information.

Existing Digital Remittance Comparator: Raast

Under the baseline assumption, households are able to use Raast for the domestic payout of remittances received through a stablecoin, as permitted by the EPD Circular Letter No. 02 of

2026. The counterfactual for measuring incremental effects of a stablecoin is therefore not the absence of digital rails, but the current conventional cross-border remittance rail for remittances that are credited into Raast-enabled accounts. The focus is thus on the potential for stablecoins to serve as an additional cross-border rail alongside Raast for the domestic leg.

Pakistan's Raast rail offers a ready-made domestic PKR payment system into which stablecoin remittance inflows can be disbursed, reducing implementation frictions relative to jurisdictions without an equivalent system. The rules require real-time settlement: a transfer initiated via Raast for P2P must be credited to the beneficiary within 20 seconds of Raast credit advice (SBP, 2022). Settlement is final and irrevocable, and end-customer fees are prohibited (SBP, 2022). During calendar year 2025, 1.973 billion Raast transactions totalling about PKR 50 trillion were processed through the system (SBP, 2026e). During the first quarter of 2026, 742 million Raast transactions totalling PKR 23.27 trillion were processed through the system. Of the total, 664 million were P2P transactions totalling PKR 18.88 trillion. While these are aggregate usage data, not remittancespecific data, they demonstrate the scale of Pakistan's existing domestic digital payment rail. However, they do not directly report the key parameters of interest, namely, remittance transfer cost or processing times specifically for Raast-based remittance payouts, which are instead discussed next.

Virtual-Asset Regulation and Banking Interface

This article will not discuss the requirements for licensing of virtual-asset service providers, financial crime compliance, and operational and consumer-protection requirements for entities offering virtual-asset-related services in Pakistan. The Virtual Assets Act, 2026 has created PVARA as a federal authority for licensing and supervising entities providing virtual-asset-related services. It has been operationalized recently, and it notified two Regulations on August 21, 2026,

namely S.R.O. 1419(I)/2026 and S.R.O. 1420(I)/2026, which outline requirements for licensing, supervision, customer due diligence, transaction monitoring, record-keeping, sanctions screening, etc. The authority has also issued one advisory (Advisory number PVARA/ADV/001/2026 dated April 26, 2026). Stablecoin-related matters, including any pilots and partnerships with other regulators or entities for using stablecoins in cross-border payments (including remittances) will be within the purview of PVARA. Any partnership or pilot will need approval of the Authority if it involves provision of any service that can be offered by a regulated entity under its framework. Access to blockchain rails of a remittance entity, or an MoU with it does not mean regulatory approval for offering any services.

Regarding the interface of banks with VASPs, SBP through its BPRD Circular Letter No. 10 of 2026 has allowed banks to open accounts for VASPs subject to certain conditions. This includes maintaining segregated client money accounts in PKR and ensuring there is no commingling of funds. Banks will also not allow cash deposit or cash withdrawals from these accounts. Banks will have to comply with existing AML/CFT and FX-related circulars, policies, etc., applicable to them. Banks or other entities under the supervision of SBP are not permitted to deal or invest in virtual assets using their own funds or client's funds. The circular does not allow banks to provide any facilitation to VASPs other than maintaining bank accounts, so banks cannot assume that allowing accounts means they can offer services including custody, redemption, stablecoin models for foreign exchange, etc.

The 2025 Financial Stability Board (FSB) thematic review has also noted significant variation in implementation of international standards for crypto-assets and stablecoins globally. Gaps continue to be seen in monitoring and reporting and international cooperation among regulators.

Table 3

Regulatory allocation of functions in a candidate Pakistan stablecoin-remittance model

Function	Primary regulatory question	Evidence required for a pilot
Stablecoin issuance / transfer / custody / exchange	Is the activity within a PVARA licence or authorised pilot?	PVARA licence, sandbox/NOC/other applicable authorisation and activity scope
PKR client money banking	Does the bank arrangement comply with SBP BPRD instructions?	Segregated account structure, CDD, monitoring and permitted transaction design
Foreign-exchange realisation	Which authorised institution receives and records the external FX proceeds?	Matched FX credit, value date, amount, charges and reversal record
Beneficiary payout	Which approved bank / MFB / EMI / EC channel delivers PKR?	Payout transaction ID, beneficiary account/wallet/cash record and finality
AML/CFT and sanctions	How are originator, beneficiary, purpose and blockchain risk controlled?	KYC, sanctions/PEP screening, transaction monitoring, travel-rule/data controls where applicable

Note. The table is an analytical allocation of functions, not legal advice or a statement that any particular business model is currently authorised. Specific permissions must be confirmed with the relevant regulators.

A Settlement Design for Evaluation

Regulatory Incentives and the Sandbox

The PVARA sandbox, NOC, and licensing tracks lower testing costs, provide regulatory clarity and give the PVARA insight into the scope and limits of activities, governance, consumer protection, safeguarding, record-keeping, reporting, and exit conditions of each participant, that is, entity receiving, holding, transferring, or otherwise dealing with a token on behalf of others . At the same time, token linkage with domestic client money and its realization through authorised foreign-exchange (FX) institutions fall under SBP regulations for banks and other licensed payout institutions.

Ambiguity about who will approve what across legs of the journey and reporting requirements that do not mesh would likely induce providers to prefer other routes with fewer checks. The goal should be to design regulations as a set of incentives that modify providers' payoffs so that transparent routes offer better payoffs than opaque ones. A pilot is a perfect

occasion to learn whether these goals are achievable, and to calibrate scaling criteria based on reconciliation of all legs, consumer outcomes, liquidity, and data that provide evidence on the values of the key parameters, specifically m, i, a. Poor quality of data would mean scaling down rather than up.

A critical element of a credible architecture is the disaggregation of a single remittance transaction into four: (i) the instruction(s) by the sender, (ii) any dealing with the tokens, such as receiving, holding, transferring, disposing, (iii) the realization of the transaction in real-world foreign-currency at an authorised FX institution, and (iv) the corresponding disbursement(s) in PKR to the intended recipient. The four should be identifiable as one transaction using a transaction ID, and be able to capture failures/reversals as well. This will require protocols for data access, storage, and privacy.

Possession of token(s) would not necessarily be indicative of receipt of the PKR amount, just as completion of the journey of funds within Pakistan would not close the international leg. Where payouts are made before realization in foreign-currency at authorised FX institutions, the difference would need to be disclosed. It will be important to keep tabs on the quantum and age of such unmatched liabilities, quantum of prefunded liabilities against which payouts have been made, token balances vis-à-vis redemption requests, ability of banks to meet redemption requests, and liquidity of banks in both PKR and foreign-currency during normal operations as well as in a stress environment.

Dimensionless Sensitivity Analysis

Where relevant, we report sensitivities of key ratios without providing baseline values that could be mistaken as evidence.

The ratio of verified-settlement to stablecoin supply is $f = F/X = q\ \varphi$. The increment in verified-settlement per dollar of stablecoin supply is $\Delta f = \Delta F/X = q\ \varphi - m\ \varphi_T$.

The ratio of stablecoin proceeds used by residents to add to aggregate assets and liabilities denominated in foreign-currency is u.

The ratio of value of Pakistani rupees disbursed against liabilities in foreign-currency that have yet to be settled to stablecoin supply is $g_h = G_h/X = q_h(1-\varphi_h)$.

The reduction in bank funding per dollar of stablecoin supply is $B_h/X = \omega_h(1-r_h)u_h$.

Where we apply these to Pakistan's current situation, it will be necessary either to make assumptions about the values of these parameters or seek evidence on their values.

Table 4

Dimensionless mechanism scenarios (purely algebraic)

Scenario	q	φ	m φ_T	f=q φ	Δf	u (θ=1)	g=q(1-φ)
High realisation	0.90	0.95	0.80	0.855	+0.055	0.145	0.045
Same payout, weak realisation	0.90	0.20	0.80	0.180	-0.620	0.820	0.720
Lower payout, high realisation	0.40	0.95	0.80	0.380	-0.420	0.620	0.020
All displaced route fully formal	0.90	0.95	1.00	0.855	-0.145	0.145	0.045

Note. These values are logical examples inside the unit interval, not Pakistan estimates or calibrated bounds. The table reports outcomes per dollar routed through the stablecoin rail. A dollar translation using the reported remittance total is retained only in Appendix A.

Table 5

Full sensitivity of incremental verified settlement per stablecoin dollar

q φ \ m φ_T	0.20	0.40	0.60	0.80	1.00
0.20	+0.00	-0.20	-0.40	-0.60	-0.80
0.40	+0.20	+0.00	-0.20	-0.40	-0.60
0.60	+0.40	+0.20	+0.00	-0.20	-0.40
0.80	+0.60	+0.40	+0.20	+0.00	-0.20

q φ \ m φ_T	0.20	0.40	0.60	0.80	1.00
1.00	+0.80	+0.60	+0.40	+0.20	+0.00

Empirical Strategy: From Public Evidence to Transaction-Level Tests

Public Descriptive Evidence

Public evidence shows large remittance inflows into Pakistan: workers' remittances were US$38.3bn in FY2024-25 and US$41.6bn in FY2025-26. Inbound remittance costs are modest relative to global and regional benchmarks. Using World Bank Remittance Prices Worldwide data, average costs to send into Pakistan in Q3 2025 were about 1.2-2.4% from the United Kingdom, 1.5-2.2% from the United Arab Emirates, 2.8% from Saudi Arabia, and 2.9-3.8% from the United States. These are below the Q3 2025 global average of 6.36% and below the Middle East, North Africa, Afghanistan & Pakistan regional average of 5.11%. The symmetric outbound corridor is not observed in RPW because the dataset has not collected information about remittance services from Pakistan for multiple quarters. We treat this as a data limitation, not as evidence that outbound and inbound prices are similar.

IMF data also point to sizeable gross stablecoin inflows in 2024 in Pakistan relative to GDP. We interpret these series as suggestive of Pakistan's position in the sample; however, these data are broad capital flow measures that are not limited to remittances and can also reflect trading and treasury flows.

Domestically, SBP data show that the existing domestic rail has considerable scale. In Q3 FY26, Raast recorded 742 million transactions totaling PKR 23.27 trillion, including 664 million peer-to-peer transactions totaling PKR 18.88 trillion.

Taken together, the evidence indicates that (i) there is a large and growing population of Pakistan-based recipients of inbound remittances, (ii) existing formal corridors are competitive on cost, (iii) domestic rail capacity is large, and (iv) the effect of stablecoin remittances on Pakistan's

net F/X realization cannot be determined using public information alone, especially given that IMF data do not separate remittance flows. We therefore use these data to set the descriptive context and provide an aggregated country-level evidence set including workers' remittances FY2025-26, Raast transactions/value in Q3 FY26, and PVARA licensees in Appendix D. Identification requires transaction-level comparisons that hold provider, amount, funding source, payout method, and timing constant. In particular, blockchain transaction fees cannot be compared to RPW remittance costs.

where $\Delta F/X = q\ \varphi - m\ \varphi_T$ denotes the change in net F/X realized by Pakistan from adopting stablecoin remittances, positive values indicate higher F/X realization relative to the formal channels displaced, and q, φ, m, θ are the scenario inputs described above, and are not estimates of these parameters in Pakistan.

Table 6

Public empirical facts that constrain the Pakistan application

Observed public fact	Latest/period used	Implication for the paper
Workers remittances: US$38.3bn; government-reported US$41.6bn	FY2024-25; FY2025-26	Scale is material, but neither total identifies stablecoin use.
Raast: 742m transactions, PKR23.27tn; P2P: 664m, PKR18.88tn	Q3 FY26	Domestic payout rail already operates at scale; cross-border leg should be isolated.
Pakistan among EMEs with relatively large gross stablecoin inflows/GDP	2024 flows reported in IMF 2026 analysis	Establishes relevance, not remittance purpose or beneficial residence.
Pakistan-bound corridor prices show material provider/method dispersion	World Bank RPW Q3 2025	Requires matched-quote cost comparison rather than a single assumed saving.

Source: SBP (2025, 2026c), Government of Pakistan (2026a), IMF (2026), and World For the Pakistan stablecoin remittance pilot, the major corridors are the United Arab Emirates and Saudi Arabia. The major corridors are the United Kingdom and the US. For each of these corridors:

Stage 1: Public Corridor Cost Benchmark

Using the World Bank's Remittance Prices Worldwide database or direct observation of representative providers, compute the full cost of sending a benchmark amount via conventional routes. Decompose the cost into the explicit fee and FX margin. Report both.

Using the same data sources or direct observation of stablecoin routes, compute the full end-user cost of a benchmark remittance via stablecoin (C_SC^user). Where feasible, decompose C_SC^user into stablecoin acquisition fee, network fee, stablecoin premium or discount relative to local-currency parity, redemption fee, FX margin, cash-out fee, and, where possible, a measure of failure costs that fall on the user. Where possible, also compute the full cost to the remittance provider (C_SC^prov)—compliance costs, banking costs, liquidity/prefunding costs, FX-hedging costs, float/working-capital costs, customer-support costs, expected losses, etc.—and identify any portion of user-facing costs that is subsidized. Compute the observed consumer-level price difference

$$\Delta\tau_user = (C_TR^{user} - C_SC^{user})/\text{transfer value}$$

holding constant—as closely as data permit—corridor, timing, funding mode, payout mode, transfer size, and other determinants of fees. Report both gross and subsidy-adjusted differences. Report the price gap by corridor, transfer size, payout mode, and, where possible, by user segment. Repeat at different points in time. Do not interpret $\Delta\tau$_user as a welfare effect; a positive $\Delta\tau$_user indicates a lower observed price for stablecoin transfers, not necessarily a net benefit.

Stage 2: Transaction-Level Settlement Reconciliation

Using the pilot's transaction-level data, build a dataset in which each family of related transactions is linked: the original payment by the sender, the transfer of stablecoins, any reversals

or corrections, the payout to the recipient, any associated fees, and—critically—any associated external-currency settlement by the operator. For each cohort of receipts, tabulate realized outcomes as of multiple horizons, such as 1, 7, and 30 days. Compute two core measures: q, the share of eligible receipt value actually paid out by the chosen horizon, and φ, the value of external-currency assets acquired or liabilities extinguished, matched to those receipts, divided by the value of local-currency funds paid out. Do not substitute exchange-traded stablecoin turnover or stablecoin off-ramp activity for φ. The same tokens can be traded multiple times and net currency flows are likely to be quite small relative to activity.

Estimate how much of observed stablecoin remittance use displaced existing channels and how much reflected additional transfers. Decompose observed stablecoin value as:

where m is the share that replaces existing formal (recorded) remittances, i the share replacing informal (unrecorded) remittances, and a the share of additional transfers, with m + i + a = 1. Ideally, these shares would be identified using randomized access to the service, or, as a second-best alternative, phased rollouts with eligible-but-not-yet-treated comparison groups. Alternative strategies include sender-level difference-in-differences estimation, using senders who used stablecoins as treatment groups, with their own pre-adoption transactions as controls, or DiD leveraging the phased introduction of stablecoins to different corridors. Survey evidence about why users adopted the system can provide suggestive evidence about m and i, but transaction-level evidence is essential. If none of these strategies is feasible, do not report a point estimate of incremental external-currency receipts, instead using Equation 2 to report outcomes for each $m \in [0,1]$. The estimated cost elasticity, $\varepsilon_c = d \ln R / d \ln c$, may be used to bound the likely response, with $\Delta R/R$ approximately $\varepsilon_c \Delta c/c$, but does not identify additionality vs formalisation. Ahmed

and Martinez-Zarzoso (2021) find sizeable negative cost elasticities for formal, that is recorded, remittances.

Table 7

Measurement and data-access requirements

Object	Preferred measurement	Access and principal limitation
All-in cost advantage	Same-time sender outlay and net PKR received for matched amounts	Public quotes plus provider records; timing and access must be comparable
Prompt payout q	Beneficiary payment linked to receipt cohort and horizon	Provider payout data; failed and reversed transactions retained
Verified realisation φ	Matched authorised FX credit net of reversals and documented charges	Authorised institution reconciliation; promises or wallet transfers excluded
Resident holdings H	Residency / beneficial ownership plus provider inventory reconciliation	Permissioned data; self-custody coverage remains incomplete
Bank-funding effect	Gross withdrawals/external transfers, domestic recycling, provider client-money balances, cash payout and deposit concentration	Matched bank/provider data required; resident-to-resident deposit transfers must not be counted as aggregate funding loss
Macro outcomes	PKR volatility, dealer spreads, deposits and liquidity indicators	Official/market series; causal claims require an identified shock

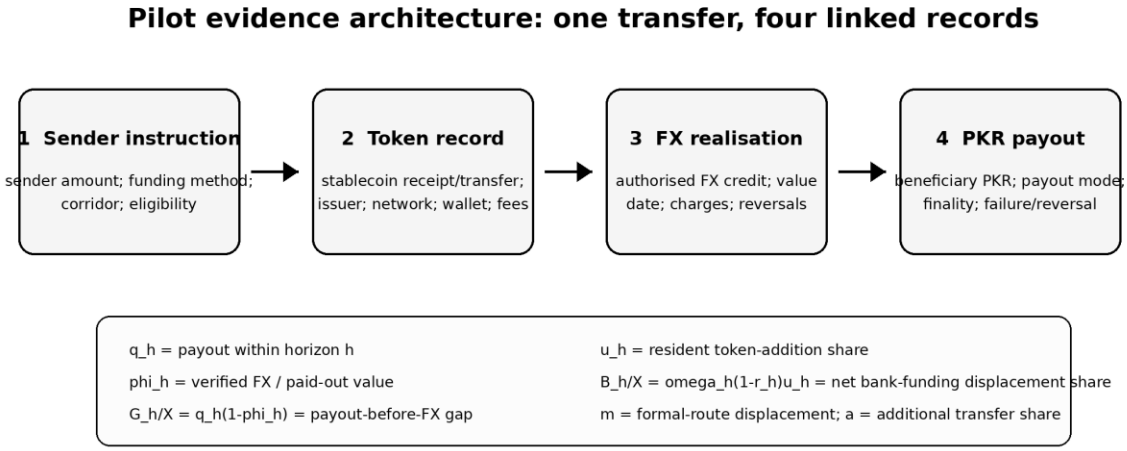
Note. Unknown purpose, residency, or ownership should remain unclassified rather than being mechanically assigned to remittances.

Stage 3: Phased Provider Evaluation

Testing needs to get permission from PVARA as well as SBP to start. Best option would be a technical dry-run and a 90 days live but controlled pilot. Initially, the pilot should be conducted only for one high-volume corridor with one payout option, similar to the control. Expansion to a second corridor/cash payout can be considered if the pilot clears the first evaluation gate. Where possible and legal, randomize the availability of the service among eligible transfers. Otherwise, roll out to different corridors/providers gradually, which can also be considered as the control. Define eligible counterparties and transfers, MDE, primary outcome and target, timing of settlement, randomization procedure , data management procedure and decision criteria for pilot success/failure prior to starting to process transfers in the pilot.

Figure 2

Pilot evidence architecture: one transfer, four linked records



Using a shared reference that connects sender, token, authorised FX and PKR payout records, we match transfers from the pilot and calculate the following outcomes, holding the settlement horizon constant across transfers to preserve timing differences: the mean all-in user cost of transfers calculated as a share of sender outlay, completion times, failure/reversals, FX received per eligible dollar sent (verified transfers only), and exposure to unmatched residents per eligible dollar sent. We estimate the following outcomes using separate, rather than pooled, specifications. We aggregate transfers at the provider (j), sender corridor (c) and week (t) level, including transfers that were attempted but rejected or failed where applicable for the outcome of interest.

$$ Y_jct = α_jc + γ_ct + βA_jct + ε_jct (5) $$

Y jct is the outcome of interest. A jct =1 if the pilot's authorised stablecoin remittance service is available to eligible users in provider-corridor-week jct and 0 otherwise. We include provider-by-corridor (α jc) and corridor-by-week fixed effects (γ ct) to account for observed and unobserved heterogeneity of providers and potential common shocks impacting corridors in a

given week. We interpret β as the intentionto-treat effect of availability of the authorised stablecoin service on our outcome of interest. Identification comes from comparing outcomes where the pilot's authorised stablecoin remittance service is available versus not available within corridor-weeks and/or across corridors depending on the staggered nature of the rollout and the availability of a never/late-treated comparison group. Where feasible, we will also estimate event-study specifications of equation (5), where β is allowed to vary with leads and lags of treatment. Leads can be used to check for differential pre-trends while lags provide insights into treatment effects over time. Inference should reflect the level of randomization/assignment of the rollout. Randomization-inference approaches may be appropriate and/or clustered standard errors at the level of randomization with corrections for few clusters where there are a small number of providers.

Table 8

Proposed phased pilot and review gates

Phase	Scope	Primary evidence	Decision
Dry run (no live customer funds)	End-to-end ledger linking; simulated reversals, downtime, depeg and failed settlement	100% record linkage; reconciliation logic; access controls; incident playbook	Proceed only after regulators and participating institutions sign off data and control readiness.
Stage 1 (first 30 live days)	One corridor; capped exposure; matched conventional payout comparator	q_1/q_7; φ_1/φ_7; G_h; cost; failures; complaints; liquidity; issuer/bank concentration	Hold scale if material reconciliation or consumer-protection issues emerge.
Stage 2 (days 31-90)	Second corridor or broader payout mode after Stage 1 gate	Same metrics plus m, i, a and B_h/D; heterogeneity by amount/payout/customer	Scale, redesign, or stop according to pre-specified evidence rather than transaction volume alone.

It is important to highlight that the 90-day period is a suggestion and is meant as a design of the research, and does not have any legislative backing. However, Pakistan's Virtual Assets Act, 2026 does allow for a sandboxed approach with limits on the type of transactions, number of customer accounts, and limits on amounts involved (Government of Pakistan, 2026b; PVARA, 2026a). PVARA has the mandate to decide on these parameters in a binding fashion.

Mechanism Tests, Falsification and Robustness

Notably, pVARA does not publish an open list of entities that hold NOCs and licenses. This makes it difficult to verify VA businesses that can be considered legal. Therefore, to carry out a stage 2 or 3 of the pilot, one would have to approach PVARA or the VA firms directly (see Appendix D.4).

Pilot Reporting Template and Illustrative Intervention Triggers

The suggested pilot is designed to require a succinct daily operational report as well as a weekly supervisory report. The template and trigger for intervention are illustrative and can be modified by regulators after dry runs. The goal is to seek clarity on risk appetites before allowing for more transactional scale rather than impose rules based on arbitrary and untested limits.

Table 9

Minimum pilot return and illustrative triggers

Metric	Daily/weekly field	Illustrative trigger for review or pause
Settlement linkage	% of transfers with all four records matched	Any unexplained break after T+1; systematic breaks pause new scaling.
Verified FX	φ_1, φ_7 and unmatched amount by age	φ_7 below 95% for two consecutive cohorts or >1% of value unmatched beyond 7 days: supervisory review.
Payout-before-FX gap	G_1, G_7; oldest prefunded payout	Any balance beyond agreed SLA or liquidity coverage below 1.0 of due obligations: pause affected route.
Consumer outcome	Failure/reversal rate; complaints; net PKR received	Failure/reversal rate > comparator by 2 percentage points for two weeks: remediation before scale.
Price claim	Matched all-in user cost vs conventional comparator	No sustained price advantage: remove cost-saving claim; continue only if another pre-specified benefit is supported.
Market/issuer risk	Stablecoin premium/depeg; redemption status; issuer concentration	>1% depeg lasting one hour, redemption suspension, or loss of required banking access: immediate pause.
Bank funding	ω_h, r_h, B_h/D; deposit concentration	Breach of pre-agreed bank liquidity/funding limit or material concentration deterioration: cap or redesign.

Macroeconomic Extension and Identification Limits

Conditional on credible classification of flows, supplementary analysis can use cross-country panels or state-dependent local projections around shocks. These extensions do not replace the primary settlement-funding-payout evidence. Remittances should be measured relative to lagged GDP; resident unmatched funding should be measured relative to deposits. Interpretation should acknowledge endogeneity to exchange-rate expectations, political risk, global funding conditions, and crypto-market shocks. Broad common shocks may be controlled with time and country effects, but their effects are heterogeneous and may be informative when interacted with predetermined country-level crypto-exposure variables. Sender-country crypto regulations and network-level gas-fee shocks may be considered only after assessing whether they also shape migration-linked income, remittance demand, wallet access, speculative trading, or other international transactions.

Policy Implications for Pakistan

Governance thresholds adopted before a pilot should be treated as decision-relevant triggers for containment or termination, not ex post evidence that the observed range was safe at the national level. The main inferential tests are as follows. If cohorts with similar recipient-side payout speed q but sharply different verified settlement φ lead to materially different deposit, lending, and FX outcomes, payout should not be treated as a sufficient proxy for settlement. If resident unmatched funding rises without matching increases in resident transfers to bank accounts and bank-recognized exchange-company VASP client-money accounts, and is followed by deposit contraction conditional on those transfers, token purchases appear deposit-financed; a simple negative deposit correlation without transfer conditioning is not decisive. Reconciled token, FX,

and payout balances, including fees, failures, reversals, and timing differences, provide the reference for subsequent inference.

Efficiency claims fail if the assessed stablecoin service does not dominate alternatives on total effective price for the relevant sample and corridors. Remittance-specificity claims fail if inference disappears after excluding transfers involving wallets, exchanges, speculation, or trading. Robustness should include alternative horizons, inclusion/exclusion of failed transactions, cash versus wallet/account payout, issuer- and network-level splits, and quantification of unverifiable residual activity.

Distributional Incidence and Welfare Accounting

The appropriate outcome is a vector of incidence measures: lower verified transfer charges for senders; faster and more reliable payouts, with possible dollar-hedging benefits, for recipients; issuer, redemption, and liquidity risks for resident token buyers; deposit changes for banks; prefunding, technology, customer-protection, AML/KYC, taxation, and data-obligation costs for exchange companies and VASPs; and effects on formalisation, FX realisation, illicit-flow controls, payment-system resilience, financial inclusion, market structure, and central-bank operational space for the public sector. Consequently, welfare evaluation must move beyond an aggregate measure such as the stablecoin remittance price. Although a lower verified price is necessary, it is not sufficient when benefits and operational risks differ across stakeholders.

Table 10

Distributional incidence to report before any welfare conclusion

Group	Potential gain	Potential cost/risk	Measurable pilot outcome
Sender	Lower all-in price; more availability	On-ramp friction; fraud; failed transfer	All-in cost, completion, failure, complaint outcome
Beneficiary	Faster PKR or optional dollar hedge	Depeg/redemption risk; digital exclusion	Net PKR, payout time, retention choice, complaint outcome

Group	Potential gain	Potential cost/risk	Measurable pilot outcome
Resident token buyer/holder	Dollar access and liquidity services	Issuer, cyber, liquidity and policy risk	Holding duration, premium, redemption access
Banks / ECs / payout institutions	New fee income and digital volume	Funding leakage, concentration, prefunding and compliance cost	B_h/D, client-money balances, liquidity, unit economics
VASP / issuer	Volume and network effects	Capital, safeguarding, compliance and redemption obligations	Unit cost, reserve/redemption data, incidents
Public sector / economy	Competition, formalisation, traceability	Dollarisation, FX leakage, integrity and crisis-management burden	ΔF, H_t, concentration, incidents, tax/regulatory costs

More important than the welfare measure is the distributional analysis. Reporting requirements should make it possible to link all legs of the transaction. Ideally, this would involve matching sender-initiated remittance transactions and instructions with a common reference number that appears in (i) the remittance transaction initiated by the sender; (ii) the token's transaction records; (iii) the foreign-currency account credited; and (iv) the remittance transaction resulting in a PKR payout. Only after all four can be reconciled should expansion be considered.

It would also be useful for supervisory returns to report the variables q_h, φ_h, G_h, u_h, and B_h/D, ageing of transactions that cannot be matched, concentration of transactions by stablecoin issuer or banking partner, the number of failed transactions, and complaints from remittance recipients. Beneficiary information that cannot be verified should continue to be reported but classified as unknown or self-custody, as appropriate.

A dashboard to monitor dollarisation

Holdings of resident-verified, Pakistan-relevant stablecoins, H_t, should be included in dollarisation monitoring. This could be reported separately from traditional dollarisation measures such as foreign-currency deposits, official-sector estimates of residents' foreign-currency accounts abroad, and estimates of currency abroad, so that policymakers can more easily analyse the contribution of stablecoins to the dollarisation process.

Efforts to consolidate dollarisation metrics should avoid double-counting stablecoin balances with dollarisation measures such as residents' foreign-currency accounts abroad. It will be important to understand whether residents are moving dollars they already hold into stablecoins or whether net resident foreign-currency holdings are increasing.

Requirements for a stablecoin pilot in family remittances

If stablecoin-based family remittances are allowed, SBP and PVARA should consider whether to require VASPs to operate in a pilot and adhere to requirements before wider participation is allowed. The goal should be to allow a subset of transactions to flow through new rails without disrupting the rest of the system.

Pilot programs could also clarify the rights and responsibilities of each actor. For instance, if the stablecoin depegs, who bears the losses? How much prefunding of the final, domestic, PKR leg is needed to ensure payouts can be made? How will payouts be made in the event of an outage? It will be important to ensure the terms of service, user agreements, and contracts between banking partners and stablecoin issuers make these responsibilities clear.

Pilots should also help policymakers and researchers better understand stablecoins and their uses. For instance, are token premiums widening? Have stablecoin issuers blocked redemptions? These types of events could trigger predetermined responses to minimise confusion about the appropriate response.

Widening the pilot should be contingent on agreeing ex ante on review gates across the above areas of focus, including dollarisation and the parameters m, i, and a, and agreeing ex ante on the conditions that must be met, for example, in reconciliation rates, liquidity, concentration, before expanding the pilot.

The stablecoin rail could be compared with similar transfers made with existing, SBP-approved digital payment rails used for home-remittance payouts, such as Raast-enabled remittances that meet similar demographic and amount profiles, keeping constant the last mile, domestic-leg of the transfer.

Comparisons of the cross-border leg could analyse the amount of PKR the recipient receives net of fees, sender's all-in costs, time taken, frequency of transaction failures or reversals, dispute resolution, and unit economics for remittance service providers.

Caveats

PVARA has an important role in licensing and overseeing virtual-asset-related activity. However, VASP accounts at commercial banks, execution of authorised foreign-exchange transactions, and the mechanism used for PKR payouts to remittance recipients will be subject to SBP approval and oversight. Clear roles and responsibilities could be agreed upon to minimise gaps or duplication.

To minimise duplication and identify missing legs, PVARA could work with relevant agencies to agree on a common data dictionary and identifiers. There is not currently publicly-available data that follows Pakistan's family remittances from sender instruction through the crypto-asset rail to authorised foreign-exchange transactions to recipient's PKR payouts.

Our analysis is partial equilibrium, not general equilibrium, and cannot provide a treatment-effect estimate of allowing stablecoin transfers relative to status quo transfers. Nor can it provide a one-size-fits-all measure of what constitutes safe-and-sound levels of stablecoin activity for any given country. Crypto-asset transactions do not reveal whether transactors are residents, whether the underlying motive is sending a family remittance, or whether authorised foreign-exchange transactions have taken place.

Stablecoin transfers in Pakistan's family-remittance system could be used by residents to obtain rapid, local-currency payouts but could be fully or partially insulated from Pakistan's foreign-currency reserves. This would be analogous to some of the use-cases identified by international studies discussing stablecoins in other countries' payments systems (Aldasoro, Beltran, & Grinberg, 2026; Aldasoro, Frost, & Ito, 2026; Hofmann, Mehrotra, & Paulick, 2026; Schär et al., 2026).

Stablecoin-related policy discussions often position stablecoins and digital assets as being at odds with the financial system: adopt them for innovation or reject them to protect financial stability. But there is a lot of grey-area between these poles. A range of requirements and approaches could be used to ensure stablecoins do not threaten financial stability while allowing Pakistan's remittance system to be tested before considering allowing stablecoin rails more widely.

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Appendix A

Reproducible Scenario Calculations

For Table 4, use $R = 41.6$ and $X = 0.10 \times R = 4.16$, both in US-dollar billions. For each row calculate $F = Xq\varphi$; displaced formal realisation = $Xm\varphi_T$; $\Delta F = F - Xm\varphi_T$; and resident additions $U = X[(1 - q) + \theta q(1 - \varphi)]$. Set $\varphi_T = \theta = 1$. Retain full precision until rounding to three decimals. These are algebraic scenario calculations, not calibrated predictions.

As an optional dollar-scale illustration of the Stage 1 customer-price comparison, for an assumed adoption share s and measured advantage $\Delta\tau_user$, $X = R \times s$ and gross customer-price savings in US-dollar millions equal $1000 \times X \times \Delta\tau_user$; $s = 0.01$, 0.05, and 0.10 combined with $\Delta\tau_user = 0.005$, 0.01, and 0.02 span a wide illustrative range and are not Pakistan estimates. No growth assumption is applied. For the persistence illustration use $H = uX/\delta$ only under constant flows and parameters; use equation 4 for transitional stocks.

Appendix B

Field Instruments for Primary Data Collection

A primary-data extension should combine transaction records with short sender/recipient surveys and semi-structured provider interviews. The survey should be administered to treatment and comparator users at the same point in the transfer journey. Core sender items are: previous remittance channel; total amount sent; explicit fee; exchange rate shown; funding method; expected delivery time; reason for channel choice; prior crypto/stablecoin use; trust and perceived risk; whether the transfer would have been sent without the service; and whether the amount changed because of price or convenience. Recipient items are: payout mode; actual receipt time and amount; whether any token was retained or resold; reason for retention/resale; access to bank/wallet/cash; and complaint or failure experience.

Provider interviews should document the operational chain rather than solicit broad opinions. Questions should cover token acquisition/redemption, settlement counterparties, banking arrangements, prefunding, FX realisation, reconciliation, liquidity buffers, hedging, compliance cost, incident history, failed/reversed transactions, complaint handling, and the provider's interpretation of the displaced channel. Interview claims should be triangulated against ledger and bank records wherever possible.

Appendix C

Table C1

Illustrative Weekly Pilot Return

Field	Definition
Eligible transfers / value	Count and value of all eligible transfers, including failed attempts
Stablecoin-routed transfers / value	Treatment count and X
q_1, q_7, q_30	PKR payout shares by cohort horizon
φ_1, φ_7, φ_30	Verified authorised FX realisation conditional on payout
G_h and ageing	Payout-before-FX gap and age buckets: <1d, 1-3d, 4-7d, >7d
m, i, a with uncertainty	Formal displacement, informal/other displacement, additional transfers
u_h, H_t	New resident token additions and closing remittance-origin resident stock where observable
ω_h, r_h, B_h/D	Gross bank leakage, recycling, and net funding displacement relative to deposits
Cost and provider economics	Matched user price, compliance, banking, liquidity, hedging, float and support costs
Consumer outcomes	Failure, reversal, complaints, resolution time, net PKR received
Risk concentrations	Issuer, banking partner, network, wallet/provider and top-counterparty concentration
Incidents	Depeg, redemption delay, cyber/operational outage, sanctions/AML event, data breach

Appendix D

Public Data Compilation: Mined Dataset and Sources

This appendix compiles, from publicly available official and international sources, the descriptive benchmarks used or referenced in the main text (Sections on Pakistan's institutional application and the Stage 1 cost benchmark). Every figure below is drawn from a named public source, current as of the access date shown; none is estimated, modeled, or inferred by the author. Two genuine data gaps are also documented explicitly, since their absence is itself informative for the paper's argument.

D.1 Workers' Remittances to Pakistan by Source Country, FY2025–26

The State Bank of Pakistan (SBP) reported total workers' remittances of US$41.6 billion for FY2025–26 (1 July 2025 – 30 June 2026), up 8.6 percent from US$38.3 billion in FY2024–25. The country breakdown below is drawn from SBP data as reported in contemporaneous press coverage of the release; SBP's own country-level annual tables (EasyData portal, home remittances series) provide the primary source and should be consulted directly for a fully reconciled corridor-by-corridor series.

Table D1

Workers' Remittances to Pakistan by Source Country/Region, FY2025–26

Source country/region	FY2025–26 (US$ billion)	Share of total
Saudi Arabia	9.78	23.5%
United Arab Emirates	8.81	21.2%
United Kingdom	6.33	15.2%
European Union (aggregate)	5.23	12.6%
United States	n.a. (monthly only; June 2026: 0.297)	—
All other countries (residual)	≈ 11.4	≈ 27.5%
Total (FY2025–26)	41.6	100%

Note. The residual row is the author's arithmetic difference between the reported total and the four named lines; it is not itself an SBP-published figure and should not be read as a precise "other" total. Figures for the United States and other individual

corridors are reported by SBP on a monthly rather than always a consolidated annual basis in public coverage; the annual, fully reconciled SBP country table (EasyData, Home Remittances series) is the authoritative source and should be used in place of this row for any further work. Source: State Bank of Pakistan, as reported 9 July 2026 (see Gulf News, 2026; Business Recorder, 2026; The Nation, 2026 in the reference list).

D.2 World Bank Remittance Prices Worldwide: Regional and Global Cost Benchmarks

The Remittance Prices Worldwide (RPW) database is the most direct public source for the Stage 1 cost comparator discussed in the main text. Two facts from the Q3 2025 RPW report are directly relevant and are reported here exactly as published, not adjusted or reweighted by the author.

Table D2

World Bank RPW Cost Benchmarks Relevant to Pakistan, Q3 2025

Benchmark	Value (% of amount sent, $200 basis)	Trend from Q1 2025
Global average total cost	6.36%	down from 6.49%
Middle East, North Africa, Afghanistan & Pakistan (MENAAP) region average	5.11%	region now the lowest-cost of the six RPW regions
South Asia region average	5.30%	up from 4.80%
Global digital remittances index	4.59%	down from 4.85%
Global SmaRT average (three cheapest qualifying services per corridor)	3.29%	unchanged
Pakistan outbound corridors (all)	Not available	RPW reports a continuing data-collection gap

Note. Pakistan is grouped by RPW within the MENAAP region for receiving-side statistics, but RPW's own Q3 2025 report states explicitly that it “continued to experience difficulties in collecting data on all outbound services from Pakistan,” so no Pakistan-specific outbound corridor average is published; Pakistan-to-Afghanistan is separately flagged as having no SmaRT-qualifying services at all. This gap is itself relevant to the paper's argument: even the most established public cross-border price benchmark cannot currently price a stablecoin-vs-formal-channel comparison for a Pakistan corridor directly, reinforcing the case in the main text for provider-level Stage 1 data collection rather than reliance on RPW alone. Source: World Bank, Remittance Prices Worldwide, Issue 54 (September 2025 release, covering Q3 2025 data).

D.3 SBP Digital Payments Infrastructure: Raast Volumes

Raast, SBP's instant payment system and the domestic digital-payout comparator discussed in the main text, has published volume figures that bound the scale of the existing digital rail against which any stablecoin payout service should be compared.

Table D3

Raast Transaction Volumes, Selected Periods

Period	Transactions	Value
Cumulative, launch (Jan 2021) to Jun 2025	1.9 billion	PKR 44.3 trillion
Q3 FY2026 (Jan–Mar 2026) alone	742 million	PKR 23.27 trillion
Digital channels, share of all retail payments by volume, Q3 FY2026	92%	3.4 of 3.7 billion transactions

Note. These are aggregate figures across all Raast use cases (P2P, P2M, bulk disbursement) and are not specific to remittance payout; SBP does not publish a separately disaggregated remittance-payout-via-Raast volume in these reports, which is itself a measurement gap relevant to the paper's Stage 1 comparator. Source: State Bank of Pakistan, Payment Systems Quarterly Review, Q3 FY2026, and Annual Payment Systems Review FY2024–25.

D.4 PVARA Licensing Status

As of the access date below, PVARA's regulatory framework (the Pakistan Virtual Asset Services Regulations, 2026 and the Activity-Specific Regulations, 2026) was notified on 21 August 2026, establishing ten license categories. PVARA accepts No Objection Certificate (NOC) applications and, per public secondary reporting, does not maintain a public list of NOC holders; no public VASP license register was located as of the access date. This absence of a public registry is a direct constraint on the empirical design proposed in the main text, since it means that even identifying which entities are currently operating under an NOC requires either a direct PVARA data request or reliance on individual firms' own public disclosures.

D.5 Data Gaps Documented in This Appendix

Three gaps recur across the sources compiled above and are worth stating plainly rather than papering over: (1) World Bank RPW cannot currently price any Pakistan outbound corridor, so the paper's Stage 1 cost comparator must rely on directly collected provider quotes rather than an RPW corridor figure for Pakistan specifically; (2) SBP's published Raast statistics are not disaggregated by use case, so no public figure isolates remittance payout volume from P2P, P2M, and bulk-disbursement traffic; (3) PVARA maintains no public NOC or license register, so the population of authorised virtual-asset entities operating in Pakistan is not independently verifiable from public sources alone. These three gaps collectively motivate the paper's Stage 2 and Stage 3 empirical design, which does not assume public data can substitute for direct provider-level access.

D.6 Additional Sources Compiled in This Appendix

The press and secondary sources used to compile Sections D.1–D.4 (Business Recorder, 2026; Gulf News, 2026; The Nation, 2026; The News International, 2026; The Express Tribune, 2026; Arab News Pakistan, 2026; CoinConnect, 2026; Cryptoverse Lawyers, 2026) and the underlying World Bank Remittance Prices Worldwide print report (World Bank, 2025, September) are listed in the main References list above rather than repeated here.