Five Facts About Stablecoins *

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Abstract

We document five facts about payment stablecoins using granular blockchain data from 2020 to 2025. First, stablecoin circulation and transaction volume are growing rapidly, with a growing share of wallets that transact only in stablecoins. Second, we develop a novel Bayesian attribution method that uses transaction-timing data to help geolocate individual wallets. This approach shows that stablecoin activity is distributed broadly across the Americas, Europe, and Asia, but that standard methods substantially overstate the cross-regional share of flows. Third, we estimate a structural model of cash management on stablecoin transaction data to show that inferred costs of transacting in stablecoins currently exceed those for cash but have been declining over time. Fourth, onchain credit markets are expanding substantially. Finally, stablecoins are powering agentic commerce, with AI agents transacting autonomously. Our findings suggest that stablecoins are transitioning from primarily speculative instruments toward broader use in payments and financial services.

JEL classification: E41, E42, G23, O33.

Keywords: Stablecoins, digital payments, cash management, money demand, decentralized finance, blockchain, agentic commerce

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1 Introduction

Stablecoins are digital currencies recorded on blockchains that maintain a stable value relative to a unit of account, typically fiat currencies such as the U.S. dollar. Unlike volatile cryptocurrencies such as Bitcoin and Ether, stablecoins are designed to serve as a store of value and a medium of exchange on public blockchains, effectively functioning as tokenized money. Their programmability—enabling integration with smart contracts and other blockchain-based applications—also gives them a central role in the growing decentralized finance (DeFi) ecosystem.

Fiat currency-backed stablecoins are backed by reserves of safe, liquid assets denominated in major fiat currencies. Other varieties include algorithmic stablecoins, whose supply adjusts algorithmically to maintain their peg, and commodity-backed stablecoins backed by assets such as gold and bitcoin. Because fiat-backed stablecoins do not pay interest and maintain their value at par relative to fiat currency, they are often used for payments. Our focus in this paper is on fiat-backed stablecoins, which have gained significant traction in recent years. As of December 2025, the two largest such stablecoins—USDT (issued by Tether) and USDC (issued by Circle)—had a combined market value exceeding US$260 billion.

This paper represents the first comprehensive analysis of stablecoin usage patterns using granular blockchain data over the period 2020–2025. The richness of this dataset allows us to classify transactions by size and function—distinguishing consumer payments from large-value transfers and purely financial transactions—and to compare stablecoin performance against traditional payment methods on dimensions such as speed, cost, and turnover.

A central question in the public discourse is whether stablecoins serve a legitimate economic purpose beyond cryptocurrency speculation. Prior work has documented a decline in the specula-

tive use of stablecoins and an increase in their use as general-purpose tokenized money (G. Liao, Hadeed, and Z. Zeng 2023). We extend this analysis by documenting new facts about the growth in use cases, geographic reach, and financial infrastructure emerging around stablecoins.

We document five facts about the stablecoin market:

1. **Rapid growth in payment-oriented wallets.** Stablecoin circulation grew approximately 50% over the past year to $307.7 billion as of December 2025, while monthly onchain transaction volume grew even faster—reaching $6.3 trillion in December 2025, an increase of 126% year-over-year. Crucially, the number of wallets holding primarily stablecoins—with little other cryptocurrency holdings—has risen sharply, and wallet segmentation analysis shows a growing share of payment-oriented wallets relative to exchange and trading wallets. These patterns are consistent with the shift away from speculative use.

2. **Global reach.** Stablecoin transaction volume is distributed across the Americas, Europe, and Asia, with each major region accounting for roughly a third of wallet-to-wallet flows. Using a Bayesian refinement of the standard visitor-share geographic attribution methodology—incorporating circadian transaction timing patterns—we show that the industry-standard approach overstates the cross-regional share of flows by 15–22 percentage points due to an ecological inference problem. The corrected estimates indicate that the majority of volume flows within regions, consistent with domestic payments and savings use cases.

3. **Cash-like usage patterns.** Stablecoin wallet behavior closely resembles traditional cash management: owners hold balances to meet liquidity needs, periodically deposit funds when balances run low, and maintain precautionary reserves. Estimating the structural cash management model of Alvarez and Lippi 2009, we find that transaction costs for accessing stable-

coins remain higher than for traditional cash but have declined over time as infrastructure has improved.

4. **Expanding onchain credit.** Both secured and unsecured credit markets operating entirely onchain have grown substantially, with stablecoins serving as the primary unit of account. Outstanding loans on secured lending protocols have quadrupled to $37.8 billion, while unsecured credit has expanded 459% since April 2025, signaling the emergence of broader onchain financial intermediation.

5. **Agentic commerce.** Stablecoins are enabling a new form of machine-to-machine commerce through protocols such as x402, which allow AI agents to transact autonomously using stablecoins. Since its launch in May 2025, x402 has grown to 22.9 million monthly transactions, with usage shifting from micropayments toward automated API access and agentic payments.

These findings have implications for the ongoing debate over whether stablecoins serve a legitimate purpose in improving payment efficiency. Our results speak to concerns raised by regulatory agencies about the nature of stablecoin transaction volume, and they inform the design of regulatory frameworks that balance innovation with financial stability and consumer protection.

1.1 Related Literature

A growing literature examines cryptocurrencies and digital assets, though much of it focuses on volatile cryptocurrencies as an asset class. Rogoff 2017 offers a critical perspective on the long-term viability of cryptocurrencies given their inherent volatility and the lack of a stable monetary anchor. Makarov and Schoar 2022 examine the extent to which cryptocurrencies facilitate cross-border capital movements and the associated regulatory implications.

Research on stablecoin design and peg stability has advanced rapidly. Lyons and Viswanath-Natraj 2023 study the mechanisms that maintain Tether's price stability, finding that migration to Ethereum and decentralization of issuance enhanced arbitrage efficiency and reduced peg deviations. Gorton and J. Y. Zhang 2023 draw parallels between stablecoins and nineteenth-century bank notes, arguing that stablecoins face similar challenges and proposing regulatory options to mitigate stability risks. Gorton, C. P. Ross, and S. Y. Ross 2022 develop a framework for understanding how privately issued instruments acquire "moneyness," demonstrating that most stablecoins remain distant from true no-questions-asked status due to redemption frictions and issuer risk. Liu, Makarov, and Schoar 2023 provide a detailed account of the Terra-Luna collapse, showing how the failure of an algorithmic stablecoin resembled a traditional bank run. Ante et al. 2023 provide a systematic review of empirical research on stablecoins, identifying key themes including peg stability, safe-haven characteristics, and interconnections with other crypto assets.

Several papers examine the financial stability implications of stablecoins. Anadu et al. 2023 show that stablecoins, like money market funds, are prone to runs and flight-to-safety behavior, with investors selling riskier stablecoins and moving into those backed by safer assets during periods of crypto market stress. Ma, Y. Zeng, and A. L. Zhang 2025 find that stablecoins rely on a centralized arbitrage structure and demonstrate a trade-off: expanding the set of arbitrageurs improves price stability but makes panics more likely. Aldasoro et al. 2025 explore how stablecoins respond to shocks from both cryptocurrency markets and monetary policy, finding that stablecoin market capitalization shrinks when monetary policy tightens. An important insight from this literature is that stablecoin stability depends critically on reserve composition and the functioning of the primary issuance and redemption market, rather than solely on secondary market trading dynamics.

Our analysis of the geographic distribution of stablecoin activity relates to research on cross-border crypto flows. Graf von Luckner, Reinhart, and Rogoff 2023 use peer-to-peer Bitcoin trading data to study the geographic determinants of crypto vehicle transactions, finding that local financial market conditions—including the structure of cross-border payment systems—are associated with adoption patterns. Reuter 2025 traces the geography of stablecoin transactions, finding strong use for remittances and dollar access in Latin America and Africa, with North America showing consistent net outflows. Murakami and Viswanath-Natraj 2025 model the macroeconomic implications of stablecoin adoption in emerging market economies, finding welfare effects that depend on local monetary conditions and the degree of currency substitution.

The impact of stablecoins on traditional finance has also received attention. G. Y. Liao and Caramichael 2022 analyze how stablecoin adoption could affect the banking system, considering scenarios ranging from a two-tiered system that supports stablecoin issuance to a narrow banking model. They find that a two-tiered approach can maintain credit intermediation, while the replacement of physical cash with tokenized cash stablecoins could crowd in deposits to the banking system. Cong 2025 extends this analysis by examining how regulated stablecoins under frameworks like the GENIUS Act may complement rather than disrupt banking, finding that deposit erosion risks depend critically on underlying economic frictions such as deposit-rate stickiness and search costs. G. Liao, Hadeed, and Z. Zeng 2023 present evidence that stablecoin usage has shifted decisively away from speculative activities: the speculative trading ratio of payment stablecoins like USDC is substantially lower than that of fiat currencies used in traditional asset trading. Kosse et al. 2023 analyze the stablecoin market's evolution and find that while fiat-backed stablecoins have been less volatile, temporary deviations from par can occur during periods of secondary market stress.

Finally, because stablecoins can be viewed as a tokenized form of cash, our analysis connects to

the classical literature on money demand (Tobin 1956; Baumol 1952; Baumol and Tobin 1989) and more recent work estimating cash demand in the context of technological innovation (Alvarez and Lippi 2009; Alvarez and Lippi 2014).

2 Institutional Background

This section describes the key institutional features of the stablecoin market before turning to the data used in our analysis.

Stablecoins facilitate real-time domestic and cross-border payments between consumers, businesses, and financial institutions. They serve both traditional finance applications and decentralized finance (DeFi), where blockchain technology enables transactions without traditional financial intermediaries. Stablecoins also act as a bridge between these two domains, allowing users to move seamlessly between conventional banking and onchain activity.

To maintain their peg, stablecoin issuers hold reserves that enable redemptions at par. The composition of these reserves varies substantially across issuers, a distinction that has important implications for stability and run risk (G. Y. Liao and Caramichael 2022). USDC reserves are held in two components: approximately 80 percent in short-dated US Treasuries and Treasury reverse repos, managed through the Circle Reserve Fund (an SEC-regulated government money market fund), and approximately 20 percent in cash deposits at globally systemically important banks and settlement banks.[1] This reserve structure is described in detail by (G. Liao, Hadeed, and Z. Zeng 2023). Tether's reserves are more diversified: as of September 2025, approximately 77 percent is held in cash and cash equivalents (primarily US Treasury bills), with the remainder allocated to

[1] See https://www.circle.com/en/transparency. USDC reserves do not contain any other assets of different risk profiles.

precious metals (7 percent), secured loans (8 percent), Bitcoin (5 percent), and other investments.[2] US dollar-linked stablecoins remain dominant, although stablecoins pegged to other currencies such as euros, Mexican pesos, and Australian dollars are also in circulation.

The stability of a stablecoin's peg depends on both the soundness of its reserves and the functioning of its primary market—the direct issuance and redemption channel between the issuer and authorized participants. In the secondary market, where stablecoins are traded on exchanges, temporary price deviations from par can occur, particularly during periods when the primary market is non-operational (e.g., outside banking hours). However, these deviations tend to be small and short-lived when the issuer's reserves are composed of highly liquid assets and the primary market functions efficiently (G. Liao, Hadeed, and Z. Zeng 2023).

Similar to traditional payment networks, transaction consts on blockchain networks are not free. Transaction costs on blockchain networks take the form of "gas" fees, which are per-transaction charges that fluctuate with network congestion. These fees vary substantially across blockchains: on Ethereum, gas fees can range from a few cents to several dollars per transaction, while Layer 2 networks and alternative blockchains such as Solana and Base offer fees that are typically fractions of a cent. The level of gas fees relative to transaction size shapes the distribution of stablecoin activity across networks, with smaller-value payments gravitating toward lower-cost chains.

3 Data

Our primary dataset comprises all transactions for all wallets on the Ethereum blockchain between January 2020 and December 2025. The data are obtained directly from the Ethereum blockchain and

[2]See https://tether.to/en/transparency. Tether's reserve composition has shifted substantially toward US Treasuries in recent years.

enriched through publicly sourced address labels and wallet classification. For each transaction, we observe the participating wallet addresses, the transaction amount, the time of settlement, and the gas fee paid. We aggregate these data to a daily frequency. Although the pseudonymous nature of the blockchain does not allow us to identify the precise end users of each wallet, we are able to classify wallets based on their onchain behavior and known address labels.

Although the pseudonymous nature of blockchain addresses does not allow us to identify end users directly, we classify wallets into three broad types based on their onchain characteristics and publicly available address labels. *Externally owned accounts* (EOAs) are addresses controlled by a private cryptographic key, typically representing individuals or businesses. *Smart contract addresses* are identified from the Ethereum contract registry and include DeFi protocols, multisignature wallets, and other programmable addresses. *Exchange-affiliated addresses* are identified by combining curated address labels—compiled from public blockchain analytics platforms, exchange disclosures, and community-maintained databases—with exchange deposit address mappings that trace the flow of funds from individual deposit addresses to known exchange hot wallets. Our structural cash management analysis in Fact 3 focuses on EOA wallets, which best capture the behavior of individual and business users.

Our analysis focuses on holdings and transactions of the two dominant dollar stablecoins: USDC and USDT. Together, these two stablecoins account for approximately 85 percent of total dollar stablecoin circulation and over 99 percent of onchain stablecoin transaction volume as of December 2025. We observe transactions in other stablecoins, such as DAI, but exclude them from our primary analysis given their much smaller scale and different reserve structures.

For the wallet-level analyses, we restrict attention to a cohort of active stablecoin wallets. Cohort membership requires that a wallet maintain a peak stablecoin balance of at least $1,000, execute at

least five stablecoin transactions during the year, and be active from the beginning of the calendar year. We further exclude transitory addresses (pass-through wallets that never hold an overnight balance) and ephemeral wallets (those whose outgoing transaction history spans fewer than three days). These filters isolate wallets engaged in sustained economic activity rather than mechanical routing or one-off transactions. The cohort construction and all sample filters are described in detail in Appendix 5.

4 Five Facts About Stablecoins

We now present five facts that characterize the stablecoin market. We begin with a broad overview of the rapid growth of stablecoin transactions and then turn to specific use cases, including geographic distribution, cash management behavior, onchain credit, and agentic commerce.

Fact 1: Stablecoin Only Wallets and Transactions are Growing

The stablecoin market has experienced rapid growth in recent years. Figure 1 shows that US dollar stablecoin circulation grew approximately 50% over the past year, adding $102.5 billion to reach $307.7 billion as of December 31, 2025.[3] USDT and USDC account for approximately 85 percent of total stablecoin circulation.

Transaction volume growth has outpaced circulation growth. Figure 2 shows that monthly onchain USDT and USDC transaction volume grew 126% over the past year, reaching $6.3 trillion in December 2025. The concentration of transaction volume in USDT and USDC is even more pronounced than for circulation: together, these two stablecoins comprise over 99 percent of onchain

[3] Data from DeFiLlama, which aggregates the outstanding amounts of each stablecoin across blockchains using mint and burn data.

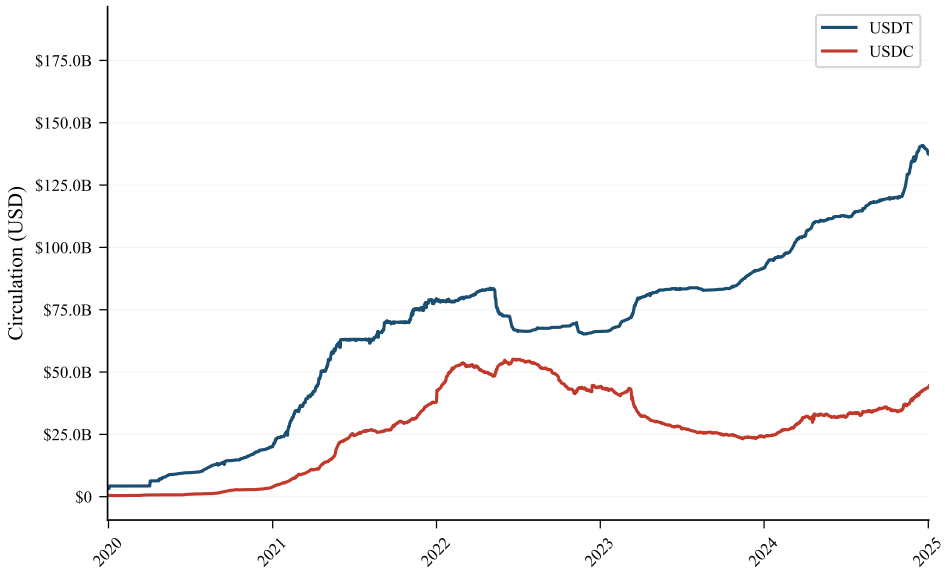


Figure 1: **Stablecoin Circulation.** This figure presents the total circulation of US dollar stablecoins over time.

stablecoin transaction volume. Notably, USDC onchain transaction volume exceeds that of USDT despite USDT's larger circulation. USDC volume accelerated further following the passage of the GENIUS Act in July 2025, which established the first comprehensive federal regulatory framework for payment stablecoins.

The ratio of exchange trading volume to circulation has also evolved over time. Figure 3 shows that both major dollar stablecoins have seen their trading turnover decrease in recent years. This pattern is consistent with these stablecoins being used increasingly for non-speculative purposes.

A key indicator of whether stablecoins are being used for payments—as opposed to serving as a peripheral component of speculative crypto trading—is the prevalence of wallets that hold primarily stablecoins and little other digital assets. Figure 4 shows that both the number and share of stablecoin-dominant wallets have risen steadily. This pattern is consistent with a growing population of wallet owners who use stablecoins purely for payment and store-of-value purposes—as tokenized cash—rather than in support of cryptocurrency trading.

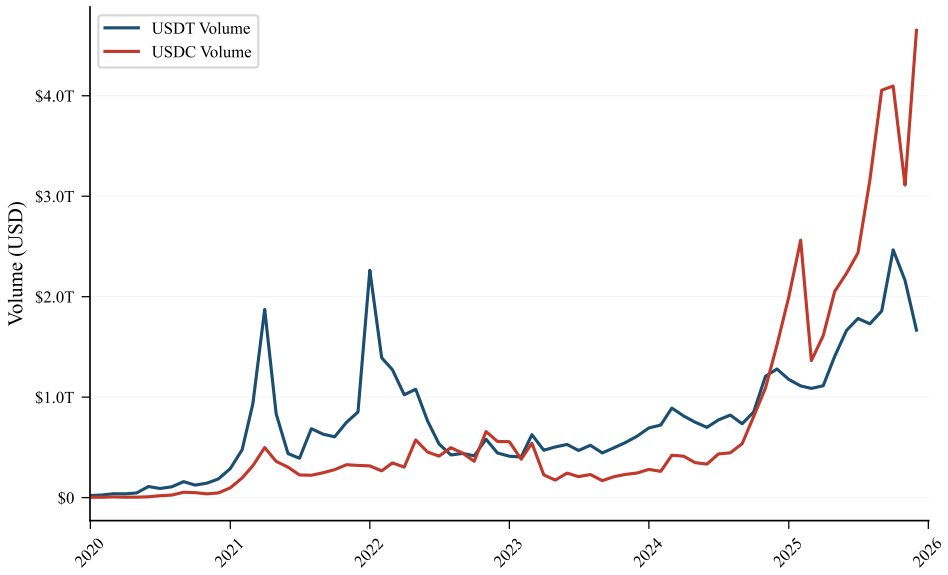


Figure 2: **Stablecoin Transaction Volume.** This figure presents the monthly transaction volume of USDT and USDC over time.

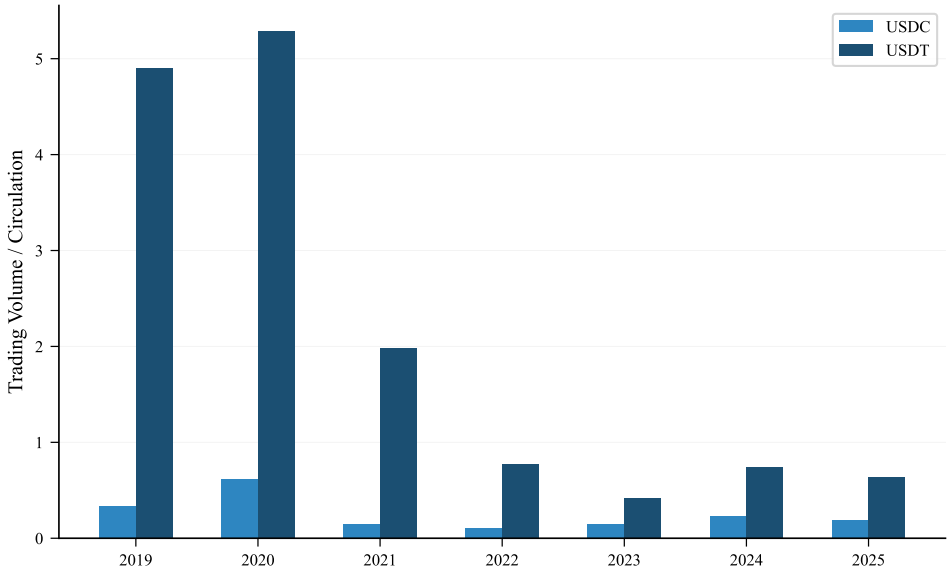


Figure 3: **Trading Volume to Circulation Ratio.** This figure presents the ratio of trading volume to circulation for USDC and USDT over time, a measure of stablecoin velocity.

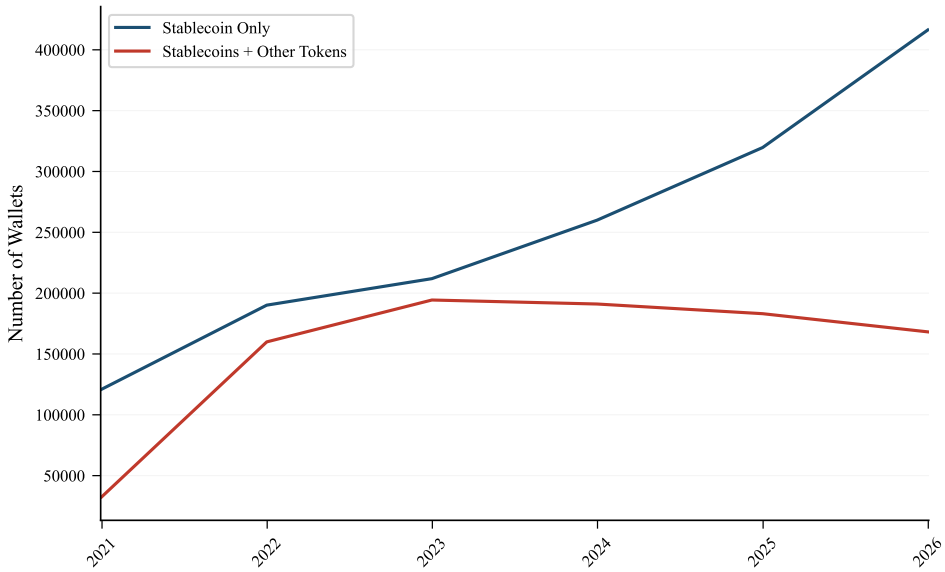


Figure 4: **Stablecoin-Dominant Wallets.** This figure presents the number of stablecoin-dominant wallets.

Further evidence comes from wallet segmentation analysis. Figure 5 classifies active stablecoin wallets (excluding temporary wallets with a total transaction lifespan of three days or fewer) into three categories based on their non-stablecoin activity: *exchange wallets* affiliated with known cryptocurrency exchanges, *payment wallets* that hold stablecoins with minimal non-stablecoin activity (non-stablecoin transaction turnover ratio of 5 percent or less), and *trading wallets* with substantial non-stablecoin transactions. The share of payment-oriented wallets has grown steadily from 2021 to 2025, while the share of exchange-affiliated wallets has declined. This compositional shift shows that stablecoins are increasingly used for payments and settlement rather than speculation.

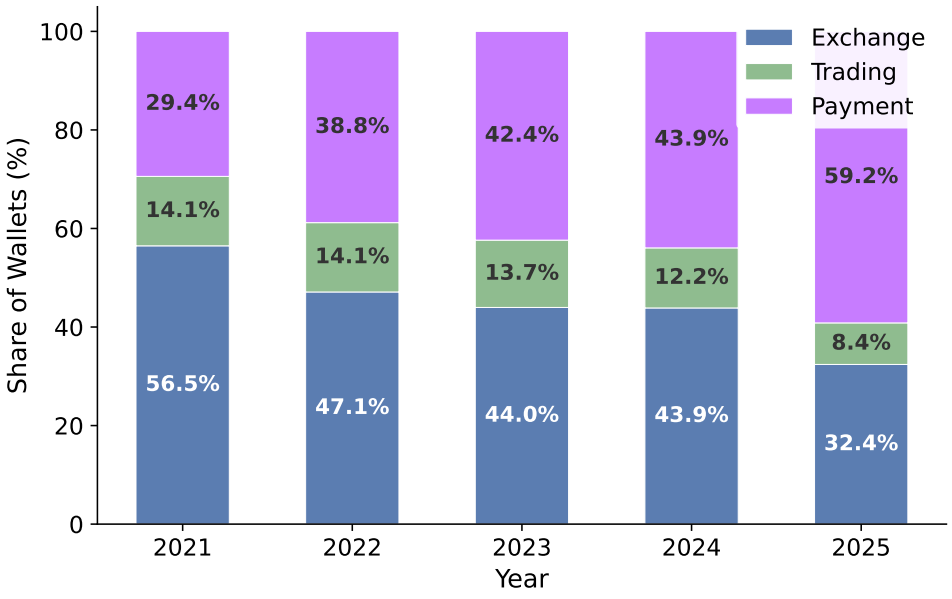


Figure 5: **Wallet Segmentation (Excluding Ephemeral).** This figure presents the share of active stablecoin wallets classified as exchange, payment, or trading wallets, excluding ephemeral wallets, from 2021 to 2025.

Having established the rapid growth of stablecoin circulation, volume, and adoption, we next examine where this activity is taking place.

Fact 2: Geographic Distribution of Stablecoin Activity

Geolocating cryptocurrency wallets is inherently difficult. In jurisdictions such as the United States and Europe, cryptocurrency exchanges must comply with know-your-customer (KYC) and anti-money laundering (AML) regulations, which require exchanges to verify the identities of their clients. However, this information is not publicly available. Moreover, many wallets operate outside well-regulated jurisdictions and are not attached to any identifying information.

Industry-Standard Approach

The standard methodology for estimating the geographic distribution of cryptocurrency activity allocates onchain transaction volume proportionally based on the geographic distribution of web traffic to identified counterparty services.[4] For each wallet-to-wallet stablecoin transfer, we trace the flow of funds through a chain of up to ten intermediate transactions to identify a counterparty with known geographic characteristics, typically a cryptocurrency exchange or payment processor. The transfer volume is then allocated across regions in proportion to that counterparty's IP traffic distribution.

As an example, consider a 100 USDC transfer from a wallet traced to an exchange whose web traffic originates 60 percent from the Americas and 40 percent from Europe. The standard approach attributes 60 USDC to the Americas and 40 USDC to Europe.

This standard approach infers geography from aggregate service-level traffic distributions. A

[4]For example, this method is used by Chainalysis in their annual Geography of Cryptocurrency Report (Chainalysis 2024) and widely adopted in the industry.

wallet traced to a global exchange with users in 100+ countries has its volume fractionally attributed across all those countries, even though the wallet owner transacts from a single location. As a result, the standard approach systematically overstates the cross-regional share of flows. In our sample, the standard methodology attributes approximately 63 percent of wallet-to-wallet volume as cross-regional across all years (Figure 7).

Bayesian Refinement Using Transaction Timing

We extend the standard approach by incorporating a Bayesian update from transaction timing. The key insight is that each wallet's transactions occur at specific UTC hours, and the distribution of transaction activity across hours differs systematically by region due to circadian patterns. Wallets in the Americas transact disproportionately during American business hours, and similarly for EMEA and APAC.

Let $\rho \in \{\text{Americas}, \text{EMEA}, \text{APAC}\}$ denote a region, and let $h \in \{0, 1, \ldots, 23\}$ denote the UTC hour at which a transaction occurs. For each region ρ, we construct an empirical hourly likelihood $P(h \mid \rho)$—the probability of observing a transaction at hour h given that the wallet is located in region ρ—from exchange-level transaction data, calibrated separately for each year to account for shifts in the global activity distribution. Each wallet's visitor-share allocation from the industry-standard approach serves as the prior $P(\rho)$, representing the probability that the wallet belongs to region ρ before observing any transaction timing. For a wallet with n observed transactions occurring at hours $h_1, \ldots, h_n$, we combine the prior with the product of hourly likelihoods via Bayes' rule to obtain the posterior probability that the wallet is in region ρ:

$$P(\rho \mid h_1, \ldots, h_n) \propto P(\rho) \times \prod_{i=1}^{n} P(h_i \mid \rho).$$

Both the sender and receiver of each transfer are attributed independently via separate posteriors. As an alternative specification (Model B), we calibrate the hourly likelihood distributions using BIS Triennial Survey data on foreign exchange turnover by time zone, which provides an independent anchor for the circadian activity pattern.

Exchange-operated wallets are excluded from the Bayesian analysis because their transaction timing reflects operational batch schedules rather than user geography. These wallets constitute only 1.5 percent of wallet-to-wallet addresses but carry 57–65 percent of wallet-to-wallet volume; their extreme transaction counts (100,000+ per month) produce degenerate posteriors that can introduce spurious regime shifts in the regional time series. Excluding exchange infrastructure while retaining user-initiated deposits to exchanges preserves the geographic signal while removing a source of noise. Full methodological details are in Appendix B.6.

Results

Figure 6 presents the regional distribution of wallet-to-wallet stablecoin volume under the Bayesian attribution. The Americas account for 36–44 percent of sender volume, EMEA for 27–34 percent, and APAC for 29–35 percent over the 2022–2025 sample period. A notable feature of the data is that the Americas share is robust across model specifications: both Model A and Model B assign approximately 38–39 percent of flows to the Americas on average, with a cross-model monthly correlation of 0.59. The key axis of model uncertainty is the EMEA–APAC split. Model A attributes roughly 30 percent to each, while Model B attributes approximately 41 percent to EMEA and 21 percent to APAC. This divergence arises because the FX-calibrated likelihood concentrates more probability mass in European trading hours, while the empirical likelihood that is calibrated from observed crypto exchange activity picks up more APAC-hours activity than traditional foreign

exchange markets would predict.

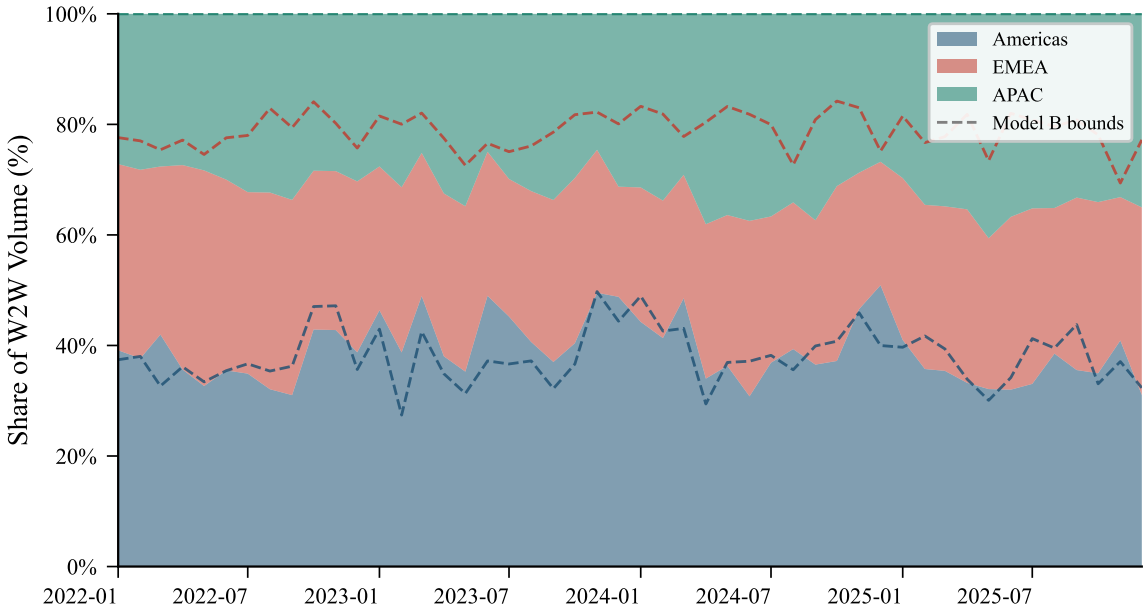


Figure 6: **Regional Distribution of Stablecoin Volume (Bayesian Attribution).** Monthly sender-region shares of wallet-to-wallet stablecoin volume on Ethereum, 2022–2025. Solid areas show the exchange-calibrated Bayesian model (Model A); dashed lines show cumulative boundaries under the FX-calibrated alternative (Model B).

Figure 7 compares the cross-regional share of volume under the prior-only allocation and the two Bayesian specifications. The prior-only approach attributes a stable 63 percent of volume as cross-regional throughout the sample. The exchange-calibrated Bayesian model (Model A) reduces this number significantly to 48 percent in 2022 and 42 percent in 2025 percentage points. The FX-calibrated model (Model B) produces an even lower bound of 8–13 percent for cross-regional flows, reflecting the stronger concentration of posteriors when the likelihood is anchored to foreign exchange market timing. We interpret the Model A and Model B estimates as plausible bounds on the true cross-regional share.

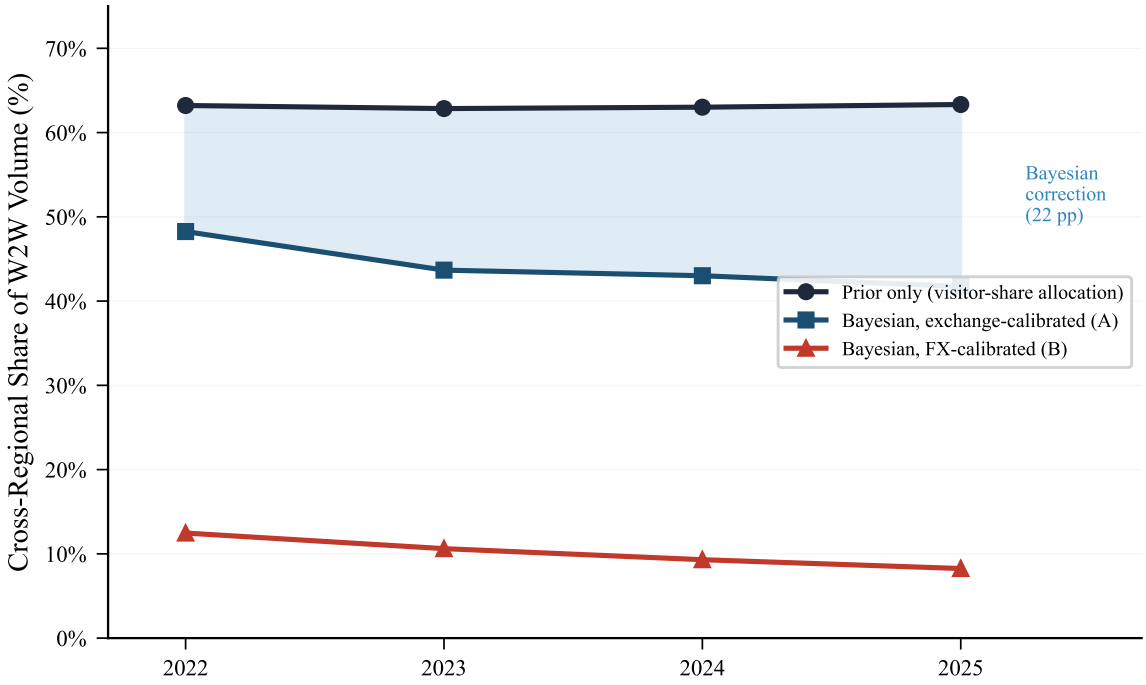


Figure 7: **Cross-Regional Share: Prior-Only vs. Bayesian Attribution.** The prior-only visitor-share approach (gray) attributes roughly 63% of wallet-to-wallet volume as cross-regional. Bayesian updating with circadian timing evidence reduces this to 42–48% (exchange-calibrated, Model A) or 8–13% (FX-calibrated, Model B). The shaded area highlights the correction from the exchange-calibrated Bayesian model.

Net Bilateral Flows and Balance Geography

The corridor-level data reveal a persistent directional pattern in net bilateral flows. Over the full 48-month sample, the Americas is a net sender of stablecoins to both EMEA and APAC under both model specifications. Under Model A, cumulative net outflows from the Americas total $31.7 billion to EMEA and $29.6 billion to APAC; the Americas–EMEA corridor is directionally robust under Model B as well ($27.9 billion). EMEA, in turn, is a net sender to APAC ($11.0 billion under Model A). This hub-and-spoke pattern in which stablecoins flow outward from the Americas is consistent with minting activity concentrated among U.S.-connected issuers and subsequent redistribution through onchain intermediation. Net outflows from the Americas to EMEA accelerated during 2024, with monthly flows rising from a typical $100–300 million range in 2022–2023 to peaks exceeding $3 billion in late 2024.

The geographic distribution of stablecoin *balances* exhibits an even more pronounced shift than the flow data. Under Model A, APAC's share of end-of-month stablecoin balances rose from 15.5 percent in 2022 to 41.7 percent in 2025, while the Americas' share declined from 57.6 percent to 31.4 percent over the same period. Model B produces a directionally consistent pattern: APAC balances rose from 11.2 to 30.4 percent, while Americas balances fell from 67.5 to 27.5 percent. The fact that balance shares shift more rapidly than flow shares implies that APAC-attributed wallets have lower stablecoin turnover than Americas-attributed wallets—they receive stablecoins and hold them longer, rather than passing them through quickly.

Event-Driven Geographic Reallocation

The 48-month panel spans several major market events, and the geographic attribution data reveal systematic patterns of event-driven reallocation. Events with a clear U.S. nexus such as the FTX

collapse (November 2022), the SVB-induced USDC secondary market dislocation (March 2023), and the U.S. presidential election (November 2024) are each associated with a 6–10 percentage point spike in the Americas' sender share, consistent with U.S.-domiciled wallets reacting to domestic catalysts more rapidly and intensely than wallets in other regions. By contrast, the Luna/UST collapse (May 2022)—a global event originating in Asia—produced a 6 percentage point *decline* in the Americas' share, as activity surged simultaneously across all regions. In each case, the Americas share reverts toward its pre-event level within two to three months, suggesting that these event responses reflect temporary liquidity and positioning adjustments rather than permanent geographic shifts.

Discussion

The broad geographic distribution of stablecoin volume with substantial activity across all three major regions is consistent with broad international demand for dollar-denominated digital payment instruments, a pattern studied in a model by Murakami and Viswanath-Natraj 2025. At the same time, the Bayesian correction indicates that the majority of wallet-to-wallet volume flows within regions rather than across them, which is consistent with stablecoins serving domestic payments and savings use cases alongside cross-border transfers.

The net bilateral flow pattern and the balance migration toward APAC together suggest a dynamic in which dollar stablecoins are minted primarily through Americas-based infrastructure and subsequently accumulate in wallets attributed to other regions. This pattern is structurally analogous to the distribution mechanics observed in international dollar funding markets, where dollar-denominated instruments are originated domestically and subsequently intermediated to meet demand abroad. The event-window results further demonstrate that onchain stablecoin flow data contain extractable geographic signal: regional shares respond systematically to macrofinancial

events in a manner consistent with wallet owners' proximity to the event's epicenter.

The remaining three facts take a deeper look at specific functions of stablecoin wallets. We begin by examining whether stablecoin usage patterns resemble traditional cash management, then turn to the expansion of onchain credit markets, and conclude with the emergence of agentic commerce.

Fact 3: Stablecoin Wallet Usage Resembles Traditional Cash Management

The growing prevalence of stablecoin-only wallets documented in Fact 1 suggests that stablecoins are increasingly functioning as tokenized cash—a digital form of money used primarily for payments and liquidity management. In this subsection, we analyze stablecoin holdings and transactions through the lens of a structural cash management model, with the goal of comparing stablecoin wallet behavior to that of traditional cash wallets.

In canonical models of money demand, individuals withdraw cash periodically to meet a stream of expenditures, replenishing their balances when holdings run low. This logic underlies the models of Baumol 1952, Tobin 1956, and Alvarez and Lippi 2009. We provide evidence that the quantitative features of stablecoin usage are strikingly similar to those of traditional cash.

Throughout this section, we focus on externally owned account (EOA) wallets, which best capture the behavior of individuals and businesses rather than exchanges.

Table 1 provides an overview of wallet-level summary statistics by balance size. We classify wallets into three groups based on their average stablecoin balance: small (below $500), medium ($500 to $50,000), and large (above $50,000). Larger wallets transact more frequently and move substantially larger amounts, but even the median small wallet maintains a balance of around $100 and sends approximately $35 per day. Deposit frequency—the fraction of days on which a wallet receives an inflow—is low across all groups, consistent with the periodic replenishment behavior

predicted by inventory-theoretic models of money demand.

Table 1: Summary Statistics by Wallet Size

		<$500	$500–$50K	>$50K	All
Wallets		34,610	37,817	5,741	78,168
Balance ($)	p50	106.36	2,942	128,556	732.65
	p75	239.89	9,276	296,417	5,226
	p90	374.94	22,335	833,696	31,191
Daily Outflow ($)	p50	34.99	154.89	1,848	84.97
	p75	100.84	563.75	7,398	370.82
	p90	292.41	2,092	28,172	1,783
Txn Frequency	p50	0.022	0.033	0.038	0.027
	p75	0.041	0.066	0.090	0.055
	p90	0.068	0.129	0.211	0.107
Deposit Frequency	p50	0.014	0.016	0.016	0.016
	p75	0.027	0.038	0.049	0.033
	p90	0.052	0.082	0.139	0.070

Notes: This table reports the cross-sectional distribution of wallet-level summary statistics by average balance bucket, pooled across 2020–2025. The sample includes externally owned accounts (EOAs) on Ethereum (1/16 random sample). Balance is the time-series mean of daily total stablecoin balance. Daily outflow is average daily stablecoin sent. Transaction frequency is the fraction of observed days with any send or receive activity. Deposit frequency is the fraction of observed days with a positive stablecoin inflow. Rows report the 50th, 75th, and 90th percentiles within each bucket.

Theoretical Framework

We now describe our theoretical framework, which builds off of Alvarez and Lippi 2009. For ease of exposition, we assume each wallet is managed by a wallet owner. Owners manage their stablecoin wallets to minimize the opportunity costs associated with holding stablecoins rather than investing them in more productive assets. The key feature of the model is that owners have a precautionary motive for holding stablecoins, but this motive decreases with improvements in technologies that make it easier to gain access to stablecoins. Thus, this model and its estimation will allow us to evaluate improvements in access to stablecoins over time.

Time is continuous. We assume that owners face a constant liquidity demand c that must be

met using stablecoins. Let $m \geq 0$ denote the non-negative stablecoin balance of the owner, which decreases continuously due to this liquidity demand:

$$\frac{dm(t)}{dt} = -c. \tag{1}$$

Owners can deposit into their stablecoin wallet at any time from a separate account, such as a high-yield savings account at a traditional bank. We assume this separate account earns a nominal interest rate r.

There is one source of randomness in the environment. Owners are exposed to a "free adjustment opportunity," which is described by a Poisson process with intensity p. We assume that a fixed cost b is paid for each deposit into the stablecoin wallet from the interest-bearing account, unless the deposit occurs exactly at the time of a free adjustment opportunity.

We can write the problem of the owner as:

$$G(m) = \min_{m(t),\tau_j} \mathbb{E}\left\{\sum_{j=0}^{\infty} e^{-r\tau_j}\left[I_{\tau_j} b + \left(m(\tau_j^+) - m(\tau_j^-)\right)\right]\right\} \tag{2}$$

subject to (1) and $m(t) \geq 0$, where τ_j denotes the stopping times at which an owner makes a deposit from the traditional finance account into the stablecoin wallet. The indicator I_{τ_j} is zero if the deposit takes place at a time of a free adjustment opportunity; otherwise, it equals one. The parameters that define this problem are r, p, b, and c.

Model Solution and Key Moments

The solution to equation (2) shows that there is an upper target level $\overline{m}$ such that whenever balances reach the lower trigger level $\underline{m}$, the owner will make a deposit to restore stablecoin balances to the

upper target. For notational convenience, we define $\alpha \equiv b/c$, which represents the transaction cost relative to liquidity demand. Following Alvarez and Lippi 2009, the target level is:

$$\frac{\overline{m}}{c} = \left(\frac{2\alpha}{r}\left(1 + \frac{p}{r}\right)\right)^{1/2} \tag{3}$$

and the trigger level is:

$$\frac{\underline{m}}{c} = \left(\frac{2\alpha}{r}\left(\frac{p}{r}\right)\right)^{1/2}. \tag{4}$$

The solution to the owner's problem yields closed-form expressions for three key moments that we can compute in the data and use to identify the structural parameters of the model:

1. **Average Stablecoin Holdings over Liquidity Demand (M/c).** The first moment is average stablecoin balances relative to liquidity demand per unit of time:

$$\frac{M}{c} = \frac{1}{p}\left(\frac{p\left(\frac{2\alpha}{r}\left(1 + \frac{p}{r}\right)\right)^{1/2}}{1 - \exp\left(-p\left(\frac{2\alpha}{r}\left(1 + \frac{p}{r}\right)\right)^{1/2}\right)} - 1\right). \tag{5}$$

2. **Number of Deposits (n).** The second moment is the expected number of deposits into the stablecoin wallet per unit of time:

$$n = \frac{p}{1 - \exp\left(-p\left(\frac{2\alpha}{r}\left(1 + \frac{p}{r}\right)\right)^{1/2}\right)}. \tag{6}$$

3. **Level of Precautionary Savings ($\underline{m}/M$).** The third moment is the ratio of the trigger level to

average holdings, which measures the level of precautionary savings:

$$\frac{\underline{m}}{M} = \frac{2\sqrt{p/r}}{\sqrt{1+p/r}+\sqrt{p/r}-\frac{1-e^{-p\sqrt{2\alpha/r}(\sqrt{1+p/r}-\sqrt{p/r})}}{p\sqrt{2\alpha/r}(\sqrt{1+p/r}-\sqrt{p/r})}(\sqrt{1+p/r}-\sqrt{p/r})}. \tag{7}$$

Empirical Moments in the Data

We now present estimates of these three moments using our stablecoin wallet data, computing the empirical counterparts for each wallet in our sample.

Average Holdings over Liquidity Demand (M/c). Table 2 presents the ratio of average holdings relative to daily liquidity demand. Across all wallets within our sample, the average wallet holdings rose from slightly above daily liquidity demand to almost three times daily liquidity demand over the past six years. Given the high degree of skewness in the size of stablecoin wallets, we also compute our sample statistics separately for wallets with an average balance of less than 500 dollars, between 500 to 50,000 dollars, and greater than 50,000 dollars. Looking down the columns in Table 2 shows that larger wallets tend to hold more stablecoins relative to liquidity demand than smaller wallets.

Table 2: **Average Wallet Holdings Relative to Consumption.**

	2020	2021	2022	2023	2024	2025
Full Sample	1.16	1.16	2.34	2.58	2.39	2.93
<500 Wallets	0.26	0.17	0.25	0.30	0.25	0.39
500-50K Wallets	1.67	1.30	2.28	2.66	2.45	3.10
>50K Wallets	3.75	3.76	5.10	6.34	7.07	7.29

Average stablecoin holdings relative to liquidity demand remain much smaller than for traditional cash. In the sample of Italian households studied by Alvarez and Lippi 2009, average cash

holdings range from 10 to 19 times daily liquidity demand. This comparison suggests that stablecoin wallet owners turn over their balances far more frequently than traditional cash users.

Precautionary Savings ($\underline{m}/M$). The second moment of interest in our framework is how low stablecoin wallets drop before the owner deposits more stablecoins. If owners tend to keep a high wallet balance prior to depositing more stablecoins, then our framework suggests that the technology for acquiring stablecoins is costly. On the other hand, allowing for lower levels of precautionary holdings implies that the technology for acquiring stablecoins is readily accessible.

Table 3 shows that wallet balances drop to around 60 to 70 percent of average balances before owners deposit more stablecoins. Overall, the level of precautionary savings has tended to decline over the past five years, with the largest declines following 2021. This pattern is consistent across small, medium, and large wallets.

Table 3: **Balance at Time of Replenishment Normalized by Average Balance.**

	2020	2021	2022	2023	2024	2025
Full Sample	0.84	0.93	0.63	0.70	0.60	0.68
<500 Wallets	0.77	1.02	0.50	0.59	0.50	0.56
500-50K Wallets	0.90	0.91	0.64	0.74	0.63	0.71
>50K Wallets	0.89	0.71	0.72	0.74	0.71	0.79

Nevertheless, precautionary savings in stablecoin wallets remain much higher than in traditional cash wallets, where Alvarez and Lippi 2009 found ratios of 0.30 to 0.47. The fact that stablecoin wallet owners maintain higher precautionary balances suggests that accessing stablecoins remains costly relative to withdrawing cash from an ATM.

Number of Deposits (n). Table 4 presents the annual frequency of deposits. From 2022 to 2025, the number of annual deposits has been increasing steadily on average and across each of the wallet

segments. In 2025, the average wallet owner engaged in around 6 deposits.[5] Stablecoin wallets also experienced more deposit activity during the pandemic years, but settled down shortly after.

Table 4: **Number of Annual Replenishments.**

	2020	2021	2022	2023	2024	2025
Full Sample	10.59	7.51	5.18	5.22	5.65	5.87
<500 Wallets	8.03	3.90	3.31	4.02	4.44	4.39
500-50K Wallets	12.05	8.81	5.36	5.62	5.96	6.19
>50K Wallets	18.08	12.62	6.80	5.55	6.95	7.40

For comparison, Alvarez and Lippi 2009 report that the number of annual cash withdrawals ranges from 16 to 23 for households far from ATMs to 50–64 for households near ATMs. Thus, wallet owners deposit very infreuently when compared to traditional cash management. The relatively low deposit frequency for stablecoin wallets suggests there exist non-trivial transaction costs.

Parameter Estimation

We estimate the structural parameters p and α in two stages, exploiting the fact that each wallet's deposit frequency n_i is directly observable. Since equation (6) defines n as a function of α, p, and r, we can substitute out α and express the remaining theoretical moments as functions of p and n alone. This reparameterization reduces the first-stage estimation to a single parameter, p.

In the first stage, we estimate p by matching the balance-to-consumption ratio M/c and the precautionary savings ratio $\underline{m}/M$ to their theoretical counterparts evaluated at the sample mean deposit frequency $\bar{n}$. We minimize the criterion function:

$$Q_N(p) = \bar{g}_N(p)' \, W_N \, \bar{g}_N(p), \tag{8}$$

[5]Some wallet owners deposit multiple times over a short time period. We consolidate consecutive deposits occurring within five days of each other into a single deposit event, provided the wallet balance does not decline between them.

where $\bar{g}_N(p)$ is the vector of deviations between the cross-wallet sample means of M/c and $\underline{m}/M$ and their model-implied values, and W_N is a diagonal weighting matrix. We implement an iterative procedure: in the initial step, W_N is the identity matrix; in subsequent iterations, we update the diagonal of W_N using the inverse of the estimated cross-wallet variance of each moment's residuals and re-estimate p. We iterate until convergence.

In the second stage, given the estimated $\hat{p}$ and each wallet's observed deposit frequency n_i, we recover the wallet-specific normalized transaction cost α_i analytically. Using the structural relationship implied by equation (6), we compute the implied target balance $\overline{m}_i/c$ for each wallet and then solve for α_i from the target-level equation. We calibrate the interest rate r to the average three-month US Treasury yield for each year. To limit the influence of outliers, we report the median value of α across wallets.

Parameter Estimates and Discussion

Using the moment conditions described above, we estimate the structural parameters of the Alvarez-Lippi model. Table 5 presents the parameter estimates by year.

Table 5: **Alvarez-Lippi Model Parameter Estimates.** This table presents estimates of the free adjustment opportunity rate p and the normalized transaction cost α.

Segment	2020	2021	2022	2023	2024	2025
Parameter: p						
Full	8.84	6.64	3.23	3.66	3.39	4.01
<500	5.19	1.62	1.46	1.86	2.05	2.38
500-50K	10.77	7.73	3.42	4.15	3.74	4.42
>50K	16.12	8.95	4.89	4.11	4.94	5.84
Parameter: α (%, median)						
Full	0.00	0.00	0.05	0.13	0.12	0.08
<500	0.00	0.01	0.27	0.97	0.20	0.19
500-50K	0.00	0.00	0.03	0.07	0.09	0.06
>50K	0.00	0.00	0.02	0.07	0.03	0.03

The parameter p represents the average number of free adjustment opportunities per year, which can be interpreted as the frequency with which owners can costlessly access their stablecoin wallets. Since 2022, this parameter has been increasing steadily for all wallet segments, which indicates that wallet owners are finding it easier to access their stablecoin wallets to make deposits.

The parameter α represents the normalized transaction cost of depositing stablecoins relative to liquidity demand. Together, these parameters allow us to characterize the costs associated with stablecoin transactions. Overall, these parameter values have not moved much since 2022. At an aggregate level, our estimate of the normalized transaction cost increased from 0.05 percent of annual liquidity demand in 2022 to 0.13 in 2023, before falling to 0.08 in 2025.

When compared to the results from Alvarez and Lippi 2009, the average number of free adjustment opportunities, p, was marginally higher for Italian households, indicating that the technology to access cash in the early 2000's was more convenient than the technology for accessing stablecoin wallets today. Estimates of the normalized transaction cost α for traditional cash wallets in Alvarez and Lippi 2009 were higher than our estimates. However, this level difference is less interpretable and could reflect differences in liquidity demand as well as transaction costs.

As a whole, the evidence suggests that accessing stablecoins remains costly relative to traditional cash in recent years. However, costs appear to be declining over time: wallets are being accessed more frequently, and owners are willing to hold less in reserve. These patterns are consistent with improving infrastructure and declining transaction costs in the stablecoin ecosystem.

Beyond their use as a medium of exchange, stablecoins have also become the foundation for a growing onchain financial system. We turn next to the expansion of credit markets built on stablecoin infrastructure.

Fact 4: On-chain Credit Markets Are Expanding

Stablecoins serve not only as a medium of exchange but also as the unit of account and settlement currency for a growing onchain credit market. Decentralized finance protocols have enabled the development of both secured and unsecured lending entirely onchain, with stablecoins as the primary currency for borrowing and lending. The expansion of these markets represents a deepening of stablecoin use beyond simple payments into broader financial intermediation.

Secured credit protocols, such as Aave, allow users to borrow stablecoins against crypto-collateral deposited onchain. Figure 8 shows that total outstanding loans on secured DeFi protocols have expanded from $9.26 billion to $37.8 billion over the past two years, representing a fourfold increase.

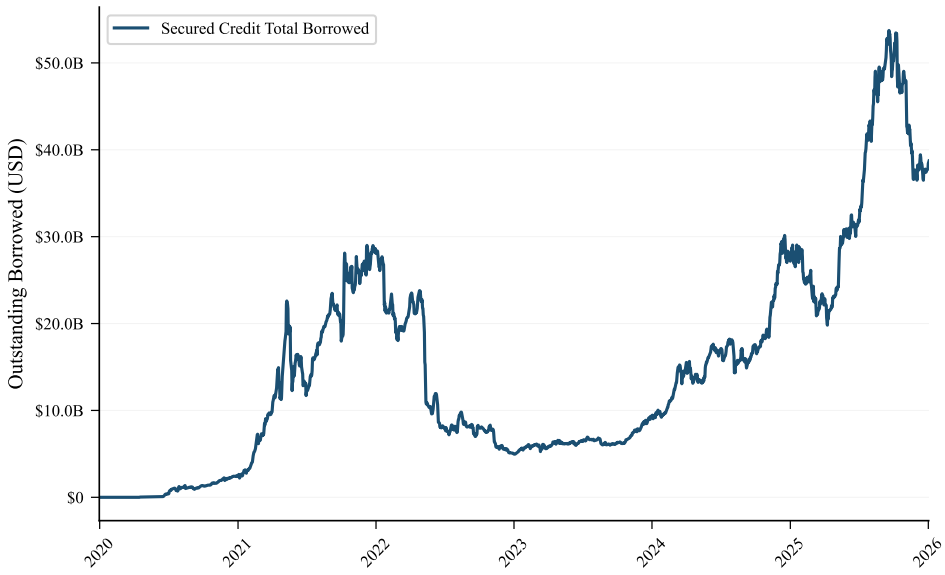


Figure 8: **Secured Credit Outstanding Loans.** This figure presents the total value of outstanding loans on secured credit DeFi protocols (e.g., Aave) over time.

Unsecured credit protocols, such as Maple Finance, facilitate lending without requiring onchain collateral, instead relying on off-chain credit assessments and institutional borrowers. Although smaller in scale, this market has grown even faster: Figure 9 shows that outstanding unsecured loans have expanded 459% since April 2025, rising from $0.38 billion to $2.15 billion. The rapid growth

of unsecured lending suggests increasing trust in onchain credit infrastructure and the emergence of reputation-based lending in decentralized markets.

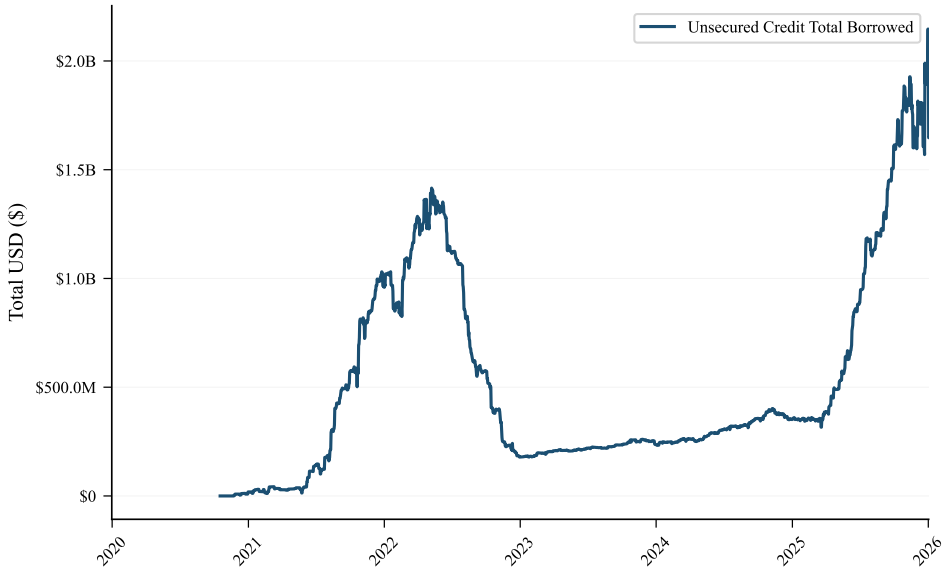


Figure 9: **Unsecured Credit Outstanding Loans.** This figure presents the total value of outstanding loans on unsecured credit DeFi protocols (e.g., Maple) over time.

While onchain credit extends the role of stablecoins deeper into financial intermediation, our final fact documents a stablecoin use case that goes beyond human-initiated transactions entirely.

Fact 5: Stablecoins Power Agentic Commerce

A novel application of stablecoins has emerged in the form of agentic commerce—transactions initiated and executed autonomously by AI agents. This development is facilitated by protocols like x402, which enable a new paradigm for internet-native payments.

x402 is an open internet payment protocol, named after the previously unused HTTP status code *402 (Payment Required)*. The protocol enables internet-native payments between clients and servers using stablecoins, without relying on traditional third-party payment rails such as credit cards or payment processors. Payment verification and settlement are coordinated by facilitators—services

that manage blockchain interaction and validation.

The protocol supports several use cases. First, x402 enables API monetization, paywalls, and pay-as-you-go services, allowing content and service providers to charge for access in real time. Second, the protocol supports micropayments—transactions as small as fractions of a cent—which makes long-tail and usage-based business models economically viable by allowing users to pay only for the exact services they consume. Third, because payments can be made programmatically and without identity-linked accounts, x402 enables agentic payments, where AI agents transact autonomously across the internet without human intervention.

x402 is an application-layer protocol and does not correspond to a unique smart contract or token standard. As such, transactions cannot be identified directly from onchain metadata. Instead, x402 activity is identified by cross-referencing sender addresses against a table of intermediary services ("facilitators") that handle payment verification and interface with blockchains on behalf of the protocol. These facilitators provide a reliable means of identifying transactions associated with x402.

Because all currently identified facilitators are EVM-native, we restrict our sample to transactions occurring on EVM-compatible blockchains. We infer the economic use case of each transaction based on the project affiliation of its facilitating intermediary. This classification is informed by observable transaction characteristics — including transfer size distributions, transaction frequency and timing patterns, and the network structure of payments — as well as publicly available information regarding the services provided by each facilitator:

- **API:** Polygon, Heurist, AurraCloud, Open X402
- **Agentic:** Questflow, Virtuals Protocol, PayAI, xEcho

- **Developer:** B402, X402rs, CodeNut, 402104, thirdweb
- **Content:** DayDreams, Ultravioleta DAO, Pieverse, Treasure
- **Exchanges:** Coinbase
- **Other:** Corbits, Mogami

We classify transfers with a value below $0.01 as micropayments. All reported statistics on micropayments are based on transactions occurring between November 2025 and January 2026, a period of higher activity following the protocol's launch in May 2025.

Figure 10 shows that x402 activity has increased dramatically since its launch. The number of monthly x402 transactions has grown from 725 in May 2025 to 22.9 million in December 2025, and monthly volume has grown from $114 to $1.9 million over the same period. USDC dominates x402 activity, accounting for 99.9% of total transactions and 98.7% of total volume (Figure 11).

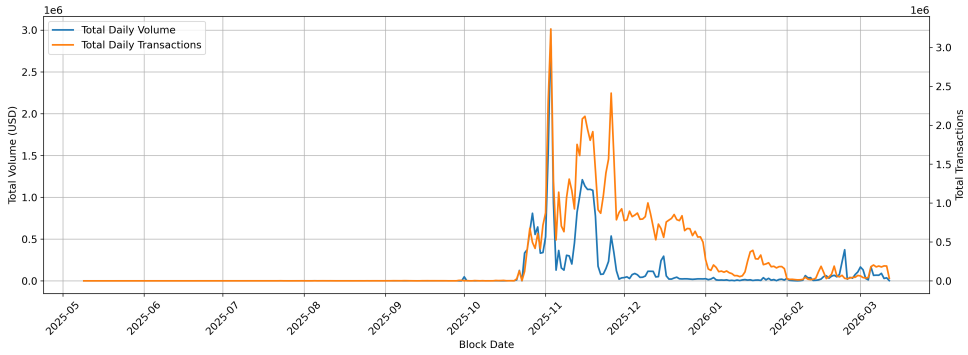


Figure 10: **x402 Activity Growth.** This figure shows the growth in x402 transactions and volume since the protocol's launch in May 2025.

The composition of x402 transactions has evolved as the protocol has matured. Micropayments—one-time services valued at less than $0.01—initially made up the majority of x402 activity. Although their overall share has fluctuated, they continue to account for a significant fraction of transactions (Figure 12), with the vast majority valued at less than $0.001. Meanwhile, the share of transactions

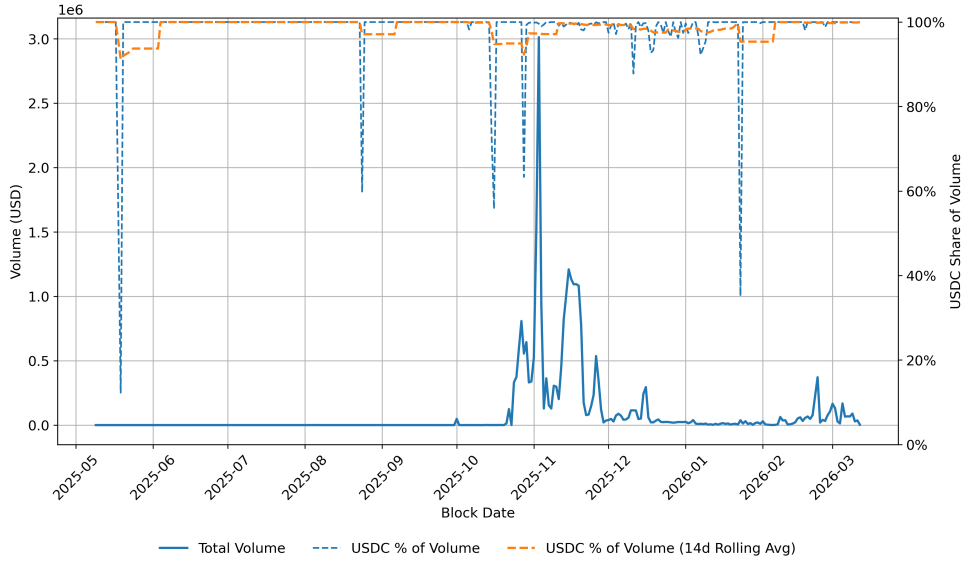


Figure 11: **USDC Dominance in x402.** This figure shows that USDC accounts for the vast majority of x402 activity.

associated with pay-per-use APIs and agentic payments has risen rapidly since October 2025, accounting for a majority of all transactions by early 2026. This compositional shift suggests that x402 is increasingly being used for automated machine-to-machine commerce rather than small one-time human-initiated payments.

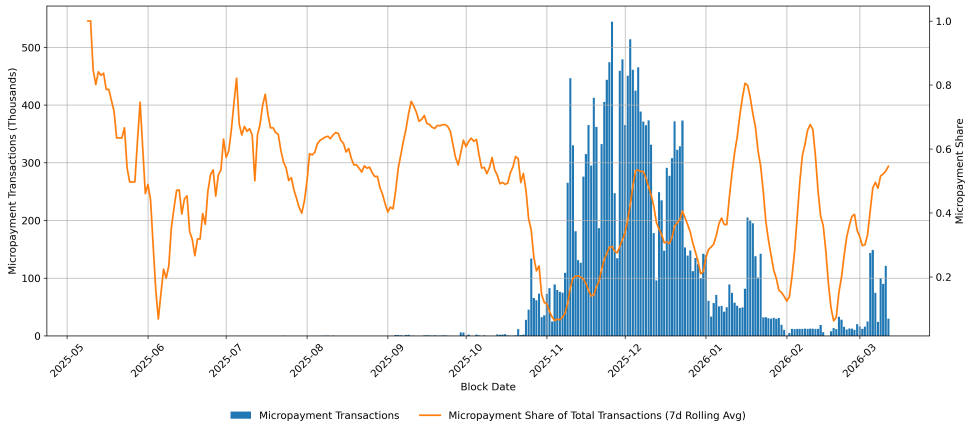


Figure 12: **x402 Micropayments.** This figure shows the share of x402 transactions that qualify as micropayments (less than $0.01) over time.

5 Conclusion

This paper has documented five facts that characterize the rapidly evolving stablecoin market. Stablecoin circulation and transaction volume are growing at a remarkable pace, with an increasing share of wallets devoted exclusively to stablecoin activity—consistent with the shift from speculative use toward payment and settlement. This growth is geographically broad, with transaction volume distributed roughly evenly across the Americas, Europe, and Asia, suggesting that stablecoins facilitate cross-border and domestic transactions across a broad geographic footprint. At the wallet level, stablecoin usage patterns closely resemble traditional cash management, though our structural estimates indicate that transaction costs remain higher than for conventional cash—albeit declining over time as blockchain infrastructure matures. Beyond payments, stablecoins have become the foundation of expanding onchain credit markets in both secured and unsecured lending. Finally, the emergence of agentic commerce through protocols like x402 points toward a future in which stablecoins facilitate not only human-initiated payments but also autonomous machine-to-machine transactions.

These findings have important implications for the design of stablecoin regulation. The passage of the GENIUS Act in July 2025 established the first federal regulatory framework for payment stablecoins, requiring full reserve backing, regular audits, and consumer disclosures. Our evidence that stablecoins are increasingly used as tokenized cash—with usage patterns resembling traditional money demand—is consistent with the payment infrastructure classification adopted in recent regulatory frameworks such as the GENIUS Act, and may inform ongoing policy design in other jurisdictions. At the same time, the diversity of stablecoin use cases—from everyday payments and cash management to credit intermediation and AI-driven commerce—underscores the importance

of regulatory approaches that can accommodate the evolving nature of this technology while safeguarding financial stability.

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Appendices for

Five Facts About Stablecoins

Lin William Cong Gordon Liao Eswar Prasad Tony Zhang

Appendix A: Alvarez-Lippi Model

This appendix provides additional detail on the structural cash management model used in Fact 3. The model follows Alvarez and Lippi 2009, which extends the classical inventory-theoretic framework of Baumol 1952 and Tobin 1956 by introducing stochastic free adjustment opportunities.

Environment. Time is continuous. A representative wallet owner faces a constant liquidity demand $c > 0$ that must be financed using stablecoins, so that stablecoin balances $m(t)$ evolve according to $dm/dt = -c$. The owner can replenish balances at any time by transferring funds from an interest-bearing account (earning nominal rate $r > 0$), but each such transfer incurs a fixed cost $b > 0$. In addition, free adjustment opportunities—moments at which the owner can deposit without incurring the fixed cost—arrive according to a Poisson process with intensity $p \geq 0$.

The owner's problem is to choose stopping times $\{\tau_j\}$ and post-deposit balances $\{m(\tau_j^+)\}$ to minimize the expected present value of transaction costs plus the opportunity cost of holding stablecoins, subject to the constraint $m(t) \geq 0$. The key economic trade-off is between the opportunity cost of holding non-interest-bearing stablecoins (which increases with r) and the fixed cost of replenishing them (which increases with b). The free adjustment parameter p captures the ease of accessing the stablecoin ecosystem: a higher p implies more frequent costless adjustment opportunities, reducing the need for precautionary balances.

Optimal policy. The solution takes the form of a two-sided (s, S) rule. Define the normalized transaction cost $\alpha \equiv b/c$. The owner maintains balances within the interval $[\underline{m}, \overline{m}]$, where:

$$\frac{\overline{m}}{c} = \left(\frac{2\alpha}{r}\left(1 + \frac{p}{r}\right)\right)^{1/2}, \tag{9}$$

$$\frac{\underline{m}}{c} = \left(\frac{2\alpha}{r} \cdot \frac{p}{r}\right)^{1/2}. \tag{10}$$

When balances reach the lower trigger $\underline{m}$, the owner deposits enough stablecoins to restore the balance to the upper target $\overline{m}$. Additionally, whenever a free adjustment opportunity arrives, the owner resets balances to $\overline{m}$ regardless of the current level.

The model nests several classical cases. When $p = 0$ (no free adjustment opportunities), the trigger level $\underline{m}$ equals zero and the model reduces to the standard Baumol-Tobin framework, in which the owner depletes balances entirely before incurring the fixed cost to replenish. When $p > 0$, the trigger level is strictly positive, reflecting a precautionary motive: the owner maintains a buffer stock of stablecoins because free adjustment opportunities may arrive before balances are fully depleted.

Mapping to the data. The model generates closed-form expressions for three observable moments—equations (5), (6), and (7) in the main text—as functions of the two structural parameters (α, p) and the interest rate r, which we calibrate externally. We compute the empirical counterparts of these moments for each wallet in our sample:

- M/c: Average daily stablecoin balance divided by average daily outflows (liquidity demand).
- n: Number of deposit events per year, where a deposit is defined as a net inflow that increases the wallet balance.
- $\underline{m}/M$: Minimum balance observed prior to each deposit event, divided by average holdings.

Identification and estimation. Because the deposit frequency n_i is directly observed for each wallet, we can express the remaining model moments as functions of p and n alone, reducing the first-stage estimation to a single parameter. We estimate p by iterative minimum distance using two moments—M/c and $\underline{m}/M$—with the diagonal weighting matrix updated at each iteration using the inverse of the cross-wallet residual variance for each moment until convergence. Given $\hat{p}$, we recover wallet-specific values of α_i analytically from the structural equations, using the three-month US Treasury yield as the interest rate r. All wallet-level moments are winsorized at the 2.5th and 97.5th percentiles prior to estimation to limit the influence of extreme observations.

Interpretation. The estimated parameter $\alpha = b/c$ represents the transaction cost of depositing stablecoins, normalized by liquidity demand. A declining α over time indicates that the cost of accessing stablecoins is falling relative to usage, consistent with improvements in onramp infrastructure, lower gas fees on Layer 2 networks, and broader exchange integration. The parameter p governs the frequency of free adjustment opportunities. A rising p implies that wallet owners face more frequent opportunities to costlessly adjust their stablecoin holdings—for example, through incidental transfers, yield harvesting, or automated portfolio rebalancing—reducing the precautionary motive for holding large stablecoin buffers.

Appendix B: Data Construction

This appendix describes the construction of the datasets used throughout the paper. Our analysis draws on three primary data sources: (i) Ethereum blockchain records accessed via Google BigQuery's public and indexed blockchain datasets, (ii) aggregated market data from DeFiLlama and similar public dashboards, and (iii) Dune Analytics for x402 protocol transactions. We describe each in turn.

B.1 Blockchain transaction data. Our core dataset consists of the complete history of ERC-20 token transfers on the Ethereum blockchain from January 2020 through December 2025. These data are extracted from indexed blockchain tables that parse the raw Ethereum transaction logs into structured records of token transfers. For each transfer, we observe the sender address, recipient address, token identifier, transfer amount, block timestamp, and associated gas fee. We focus on transfers of USDC and USDT, the two dominant dollar-denominated stablecoins, which together account for approximately 85 percent of total stablecoin circulation and over 99 percent of onchain stablecoin transaction volume as of December 2025.

We complement the transfer-level data with a daily balance panel that records, for each wallet–token–day triple, the end-of-day stablecoin balance, the number of transactions, and the volume of sends and receives. This panel is constructed from the cumulative transfer history and enables us to track wallet-level holdings dynamics at a daily frequency without requiring real-time node queries.

B.2 Wallet classification. We classify all Ethereum addresses into three mutually exclusive categories based on their onchain characteristics.

Externally owned accounts (EOAs) are addresses controlled by a private cryptographic key, typically representing an individual, a business, or an institutional user. EOAs are the residual category after excluding contract and exchange addresses.

Smart contract addresses are identified from the Ethereum contract registry, which records all

addresses that contain deployed bytecode. These include DeFi protocol contracts, multisignature wallets, and other programmable addresses. We exclude smart contracts from the wallet-level analyses, as their transaction patterns reflect automated protocol logic rather than individual or business cash management behavior.

Exchange-affiliated addresses are identified by combining two complementary sources. The first is a set of curated address labels that tag addresses belonging to known cryptocurrency exchanges (e.g., Coinbase, Binance, Kraken). These labels cover exchange hot wallets, cold storage addresses, and operational wallets, and are compiled from publicly available blockchain analytics, exchange disclosures, and community-maintained databases.[6] The second source is a table of exchange deposit addresses, which maps individual user deposit addresses to their parent exchange omnibus wallets by tracing the flow of funds from deposit addresses to known exchange hot wallets. The union of these two sources provides comprehensive coverage of exchange-affiliated activity.

B.3 Active wallet cohort. For the wallet-level analyses, we restrict attention to a cohort of active stablecoin wallets. Cohort membership requires meeting three criteria within a given calendar year: (i) a maximum combined stablecoin balance (across USDC, USDT, and DAI) of at least $1,000 at any point during the year; (ii) at least five stablecoin transactions during the year; and (iii) the wallet must be active from the beginning of the year (i.e., it appears in the balance panel on January 1).

We further exclude two categories of wallets that are unlikely to represent sustained economic activity. *Transitory wallets* are those for which total sends approximately equal total receives and for which the overnight balance never exceeds zero—these are pass-through addresses that briefly hold stablecoins in transit. *Ephemeral wallets* are those whose outgoing transaction history spans fewer than three calendar days, indicating short-lived activity inconsistent with ongoing payment or savings behavior.

These filters are designed to isolate wallets engaged in meaningful, sustained stablecoin usage.

[6] Public sources of exchange address labels include Etherscan labels, Dune Analytics community tables, and exchange self-disclosures in proof-of-reserves reports.

The balance threshold excludes dust accounts and abandoned wallets; the transaction threshold excludes wallets with negligible activity; and the ephemeral and transitory filters remove addresses that serve a purely mechanical routing function.

B.4 Stablecoin-dominant wallet classification. To measure the prevalence of wallets that use stablecoins primarily for payment rather than in support of cryptocurrency trading, we classify each wallet in the active cohort based on its non-stablecoin token transfer activity. Specifically, we query the full ERC-20 token transfer history for each cohort wallet and flag wallets that sent at least one non-stablecoin token during the year. Wallets with no outgoing non-stablecoin transfers are classified as *stablecoin-dominant*: their onchain activity consists entirely of stablecoin sends, consistent with using stablecoins as a standalone payment instrument rather than as a complement to broader cryptocurrency trading.

This classification is intentionally conservative in that it examines only outgoing transfers. A wallet that passively receives non-stablecoin tokens (e.g., airdrops) but never actively sends them is still classified as stablecoin-dominant, as its revealed behavior is exclusively oriented toward stablecoin transactions.

B.5 Wallet segmentation. In addition to the stablecoin-dominant classification, we implement a finer-grained segmentation of active stablecoin wallets that categorizes each wallet into one of four segments based on its onchain behavior during a calendar year. This segmentation is applied to all non-contract wallets that have received at least one USDC or USDT transfer during the year and maintain a positive holding-day average stablecoin balance above $10 (where the holding-day average is computed over days on which the balance is strictly positive).

The segmentation algorithm proceeds hierarchically:

1. *Exchange wallets.* An address is classified as an exchange wallet if it appears in either the curated exchange address label set or the exchange deposit address table. This category captures hot

wallets, cold wallets, and deposit addresses operated by centralized cryptocurrency exchanges.

2. *Ephemeral wallets.* Among the remaining (non-exchange) addresses, those whose entire transaction history within the year spans three calendar days or fewer are classified as ephemeral. These wallets are typically used for a single transaction sequence and then abandoned.

3. *Trading wallets.* Among non-exchange, non-ephemeral wallets, we compute a turnover ratio defined as the average daily non-stablecoin transaction volume divided by the average daily stablecoin balance (both averaged over the same annual window). Wallets with a turnover ratio exceeding 5 percent are classified as trading wallets, indicating substantial engagement with non-stablecoin digital assets relative to their stablecoin holdings.

4. *Payment wallets.* The residual category consists of wallets with a turnover ratio of 5 percent or below. These wallets hold stablecoins with minimal non-stablecoin trading activity, consistent with using stablecoins primarily for payments, savings, or settlement.

The non-stablecoin volume used in the turnover ratio is computed from the full ERC-20 token transfer history (excluding USDC and USDT), with each token transfer valued at its daily spot price from decentralized exchange (DEX) price feeds. The stablecoin balance denominator uses the holding-day average rather than the calendar-day average, which avoids diluting the ratio for wallets that are intermittently active.

For reporting purposes, we present two variants: the full four-way segmentation (including ephemeral wallets) and an ex-ephemeral segmentation that redistributes attention to the three economically substantive categories. Balances are reported using a year-end snapshot (December 31) rather than an annual average, as the snapshot more closely corresponds to reported aggregate circulation figures.

B.6 Geographic attribution. The geographic distribution of stablecoin activity presented in Fact 2 is estimated using wallet-to-wallet transfer volumes on Ethereum, with geographic attri-

bution proceeding in two stages: a prior based on counterparty visitor shares and a Bayesian update based on transaction timing.

Prior construction. For each stablecoin transfer, we trace the flow of funds through a chain of up to ten intermediate transactions to identify a counterparty wallet or service with known geographic characteristics—predominantly cryptocurrency exchanges, payment processors, and regulated on-ramp/offramp services with measurable web traffic patterns. Once a counterparty is identified, we allocate the transaction volume proportionally across regions based on the counterparty's observed IP traffic distribution. This visitor-share allocation serves as the prior $P(\rho \mid \text{wallet})$ over three broad regions: the Americas, Europe–Middle East–Africa (EMEA), and Asia–Pacific (APAC). Transfers that cannot be linked to a service with known geographic traffic within ten hops are excluded.

Bayesian updating. We refine the prior using the timing of each wallet's transactions. Because circadian activity patterns differ across regions, the distribution of transaction hours (in UTC) carries geographic information. We construct empirical hourly likelihood distributions $P(h \mid \rho)$ from exchange-level transaction data, using exchanges with known regional concentration to identify region-specific timing patterns. The likelihoods are calibrated separately for each calendar year to account for shifts in global activity distributions. For a wallet with n observed transactions at UTC hours $h_1, \ldots, h_n$, the posterior region probability is

$$P(\rho \mid h_1, \ldots, h_n) \propto P(\rho) \times \prod_{i=1}^{n} P(h_i \mid \rho).$$

Both the sender and receiver of each transfer are attributed independently via separate Bayesian posteriors. This dual-sided attribution means that a transfer's sender and receiver may be assigned to different regions with different confidence levels.

Exchange wallet exclusion. Exchange-operated wallets (hot wallets and cold storage addresses, identified via address-label databases) are excluded from the Bayesian attribution. These wallets constitute approximately 1.5 percent of wallet-to-wallet addresses but carry 57–65 percent of wallet-

to-wallet volume. Their extreme transaction frequencies (100,000+ transactions per month) cause the posterior to converge to whatever region has slightly higher likelihood density, producing degenerate attributions that can introduce spurious regime breaks in the time series. The exclusion filter operates on the transaction signer (the externally owned account that signed the Ethereum transaction), which preserves user-initiated deposits to exchanges while excluding exchange-initiated withdrawals and rebalancing flows.

Robustness. As an alternative specification (Model B), we calibrate the hourly likelihood using data from the BIS Triennial Central Bank Survey of foreign exchange turnover by time zone, which provides an independent anchor for regional activity patterns. The exchange-calibrated model (Model A) and FX-calibrated model (Model B) produce bounds on the cross-regional share of flows: 42–48 percent (Model A) and 8–13 percent (Model B), compared with 63 percent under the prior-only allocation.

Limitations. The prior-based step assumes that transaction sizes are distributed similarly across regions for a given counterparty and may be distorted by VPN usage. The Bayesian update assumes that circadian timing patterns are stable within each calendar year and that the exchange-level training sample is representative of the broader wallet population. Transactions that do not pass through identifiable services are excluded, which may introduce selection bias.

B.7 Onchain credit data. Data on secured and unsecured onchain credit (Fact 4) are sourced from public DeFi protocol dashboards and data aggregators. Secured credit outstanding is measured as the total value of stablecoin loans on overcollateralized lending protocols (principally Aave, Compound, and MakerDAO), where borrowers post cryptocurrency collateral that exceeds the loan value. Unsecured credit outstanding is measured from institutional lending protocols (principally Maple Finance and Clearpool) that extend stablecoin loans based on off-chain credit assessments rather than onchain collateral. Both series are reported at monthly frequency.

B.8 x402 protocol data. Transaction data for the x402 protocol (Fact 5) are sourced from Dune Analytics. Because x402 is an application-layer protocol rather than a distinct smart contract standard, x402 transactions cannot be identified directly from onchain metadata such as contract addresses or event logs. Instead, we identify x402 activity by cross-referencing the sender address of each token transfer against a curated table of x402 *facilitators*—intermediary services that handle payment verification and blockchain settlement on behalf of the protocol. This facilitator table is maintained as a community-curated Dune Analytics query and is updated as new facilitators join the protocol.

For each identified x402 transfer, we observe the block date, token symbol, transfer amount in USD, and the project affiliation of the facilitating intermediary. We classify transactions into economic use cases based on the facilitator's project affiliation: *API* (pay-per-use API access), *Agentic* (autonomous AI agent transactions), *Developer* (developer tools and SDKs), *Content* (digital content and media), *Exchanges* (exchange-integrated payments), and *Other*. Transfers with a USD value below $0.01 are classified as micropayments.

Because all currently identified x402 facilitators operate on EVM-compatible blockchains, our x402 sample is restricted to these networks (principally Base, Polygon, and Ethereum). The sample covers the period from the protocol's launch in May 2025 through January 2026.

B.9 Aggregate market data. Aggregate stablecoin circulation (Fact 1) is sourced from DeFiLlama, which tracks the outstanding supply of each stablecoin across all blockchains using mint and burn data. Monthly onchain transaction volume and centralized exchange trading volume are sourced from public market data providers. The velocity measure (trading volume to circulation ratio) is computed by dividing annualized monthly trading volume on centralized exchanges by the average stablecoin supply for the corresponding month.

[FIXME: Additional results to be added.]



Figure 13: **Stablecoin Corridor Flows, 2025 (Bayesian Attribution).** Each cell shows the gross volume (in billions of USD) and percentage of total wallet-to-wallet volume flowing from the sender region (row) to the receiver region (column). Based on the exchange-calibrated Bayesian model (Model A) applied to Ethereum USDC and USDT transfers.

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