

**DIGITAL PAYMENTS TRANSFORMATION IN UZBEKISTAN: FROM
PHYSICAL PAYMENT INFRASTRUCTURE TO TRANSACTION INTENSITY**

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Abstract: *Payment-system development can occur through expansion of installed acceptance infrastructure or greater transaction activity relative to that infrastructure. This study examines how these margins shaped real terminal-turnover growth in Uzbekistan during 2018-2025. Using annual Central Bank payment statistics, nominal turnover is converted to constant 2018 prices and analysed through an exact logarithmic accounting decomposition separating changes associated with the installed POS-terminal stock, cards per POS terminal, and real turnover per issued card. The decomposition is descriptive rather than causal. In 2018-2021, real turnover grew by **0.197 log points**, while the POS-stock component was **+0.571**, indicating that infrastructure expanded faster than real turnover. In 2021-2025, real turnover grew by **1.042 log points**, while the POS-stock component was nearly zero (**-0.006**) and the combined utilisation-related component was **+1.048**. Within the latter, cards per POS accounted for **+0.930** and real turnover per issued card for **+0.118**. The findings demonstrate the importance of monitoring payment-infrastructure utilisation alongside infrastructure stocks.*

Keywords: *digital payments; payment infrastructure; transaction intensity; point-of-sale terminals; accounting decomposition.*

1. INTRODUCTION

Payment-system development can occur through two distinct margins: expansion of installed acceptance infrastructure and greater transaction activity relative to existing infrastructure. The distinction matters because infrastructure and utilisation need not grow together. As a payment system develops, transaction activity may continue to increase even when the stock of acceptance infrastructure stabilises. Infrastructure counts alone may therefore provide an incomplete picture of payment-system development.

This distinction is consistent with the economics of two-sided payment markets. The value of card networks depends on participation by both cardholders and merchants (Rochet and Tirole, 2003), while empirical research documents interactions between card use and merchant acceptance (Rysman, 2007; Bounie et al., 2017; Higgins, 2024; Crouzet et al., 2023). Consequently, the card base, acceptance infrastructure and transaction activity need not expand proportionally.

Uzbekistan provides a useful setting for examining this relationship. Between 2018 and 2025, cards issued into circulation increased from about 17.7 million to 68.3 million and installed payment terminals from 244,913 to 430,762, while nominal terminal turnover rose from approximately UZS 63.7 trillion to UZS 460.3 trillion. Most terminal expansion

occurred before 2021, whereas cards and transaction value continued to grow thereafter. Despite substantial international research on payment adoption and merchant acceptance, peer-reviewed evidence specifically examining payment-infrastructure utilisation in Uzbekistan remains limited.

This study therefore asks whether growth in real terminal turnover during 2018-2025 came mainly from expansion of installed acceptance infrastructure (the extensive margin) or from greater transaction activity relative to that infrastructure (the intensive margin), and whether this composition changed over time. Using annual Central Bank payment statistics, nominal turnover is converted to constant 2018 prices and analysed through an exact logarithmic accounting decomposition. The method separates the POS-stock component from utilisation-related components and is descriptive rather than causal.

The results reveal a marked difference between two descriptive sub-periods. In 2018-2021, real turnover grew by **0.197 log points**, compared with a **+0.571** POS-stock component, indicating that infrastructure expanded faster than real turnover. In 2021-2025, real turnover increased by **1.042 log points** while the POS-stock component was approximately zero (**-0.006**); the combined utilisation-related component was **+1.048**. The 2021 division reflects the observed infrastructure pattern rather than a statistically identified structural break.

The paper contributes by distinguishing infrastructure expansion from utilisation in Uzbekistan's payment system and applying an exact accounting decomposition to quantify their respective roles in real-turnover growth. This approach also demonstrates why infrastructure-stock measures can usefully be complemented by utilisation indicators as payment systems develop. Section 2 positions this approach within the literature on two-sided payment markets, infrastructure utilisation and the coexistence of electronic and cash-based payment channels. Section 3 then presents the data and methodology, followed by the empirical results, discussion and conclusion.

Section 7 concludes.

2. Literature Review

2.1 Payment systems as two-sided markets

Card payment systems operate as two-sided platforms linking cardholders and merchants, with participation on each side affecting the value of participation on the other (Rochet and Tirole, 2003). This interdependence means that card issuance, merchant acceptance and payment activity need not develop independently or proportionally.

Empirical evidence supports this relationship. Rysman (2007) finds a positive association between card-network usage and merchant acceptance in the United States and shows that consumers may hold several cards while concentrating spending on one network. This distinction is important when issued-card stocks are used as a measure of payment-system development. Bounie et al. (2017) similarly find that consumer payment preferences influence merchant card acceptance in France. Evidence from Mexico and India further shows that changes affecting one side of a payment market can induce wider adoption through network complementarities (Higgins, 2024; Crouzet et al., 2023). These findings support

analysing payment infrastructure and its utilisation jointly rather than treating either as a sufficient measure of development.

2.2 From infrastructure expansion to payment utilisation

Payment-system development involves both expanding infrastructure and increasing its utilisation. These dimensions can diverge when transaction activity continues to rise after terminal expansion slows. This distinction is economically relevant because the benefits of electronic-payment infrastructure ultimately depend on transactions processed rather than equipment stocks alone (Humphrey et al., 1996).

International measurement frameworks partly recognise this distinction. The IMF Financial Access Survey separates financial-service outreach from use, although it does not collect POS-terminal data (IMF, 2019). Similarly, CPMI–World Bank guidance distinguishes access to transaction accounts from their frequent use (CPMI and World Bank Group, 2016, 2020). CPMI statistics report terminal density and card transactions, and Bech et al. (2018) document increases in both across participating jurisdictions. These indicators, however, generally present stocks and transaction flows separately rather than decomposing turnover growth between infrastructure expansion and utilisation. Micro-level evidence also indicates that digital-payment use depends on factors beyond infrastructure availability, including education, employment, internet access and urban residence (Aurazo and Vega, 2021).

2.3 Electronic payments and the persistence of cash infrastructure

Growth in electronic payments does not necessarily imply the disappearance of cash-related infrastructure. European evidence indicates substitution from cash towards card payments, but the extent differs across transaction types and currency denominations (Snellman et al., 2001; Amromin and Chakravorti, 2009). Markose and Loke (2003) likewise model electronic POS and ATM networks as coexisting components of the payment system. Bech et al. (2018) find that card payments and terminal density increased alongside continued demand for cash across CPMI economies. Consequently, simultaneous growth in card acceptance and self-service infrastructure should not automatically be interpreted as contradictory, particularly where ATMs and other self-service devices perform different functions.

2.4 Research gap and the Uzbekistan setting

Existing research therefore establishes three points relevant to this study: payment markets exhibit interdependence between users and acceptance infrastructure; access and utilisation are distinct dimensions; and electronic and cash-related infrastructure may coexist. Less attention has been given to how transaction growth is distributed between infrastructure expansion and greater utilisation once an acceptance network begins to stabilise. Peer-reviewed evidence specifically examining this issue in Uzbekistan remains limited.

Uzbekistan's annual payment statistics allow these dimensions to be examined over 2018–2025. The Central Bank reports cards issued into circulation, installed payment terminals, terminal turnover, and a combined series for ATMs and self-service kiosks. Interpretation nevertheless requires caution: issued cards are not necessarily active cards, terminal turnover is not defined as exclusively physical POS activity, and ATMs and kiosks

cannot be separated. Within these limits, the following analysis decomposes real terminal-turnover growth into infrastructure and utilisation-related components to examine how their relative importance changed over time.

3. Data and Methodology

3.1 Data

The analysis uses annual system-level payment statistics for Uzbekistan covering 2018–2025. The main source is the Central Bank of Uzbekistan, which publishes a regular statistical release on cards, terminals and self-service devices, together with turnover through payment terminals. Four payment-system variables are drawn from this release:

- the number of bank cards issued into circulation;
- the number of installed payment terminals;
- turnover through payment terminals, reported in million UZS;
- the number of installed ATMs and self-service kiosks, which the Central Bank publishes as a single combined series.

The Central Bank's series of installed payment terminals (published in English as 'POS-terminals') is referred to below as installed POS terminals. Card, terminal and device counts are stock variables recorded at the start of the following year, that is, at the end of each reporting year. Terminal turnover is a flow accumulated over the January–December period.

Observations are taken from the compiled Central Bank payment-system series assembled for this study (Central Bank of the Republic of Uzbekistan, n.d.). During source verification, the 2019 observations were checked against the Central Bank release dated 1 January 2020 (Central Bank of the Republic of Uzbekistan, 2020) and corrected accordingly. The corrected values are:

- terminal turnover: 71,020,181 million UZS;
- cards issued into circulation: 20,547,366;
- installed payment terminals: 392,361;
- installed ATMs and self-service kiosks: 9,203.

Several observations in the compiled historical series could not be independently matched to retrievable primary releases during verification. These observations are used as they appear in the compiled series. In particular, the 2021 issued-card observation used in the calculations could not be independently verified against the corresponding year-end Central Bank release. This is taken into account when interpreting the results.

Nominal turnover is converted to real terms using annual-average consumer price inflation. Because terminal turnover accumulates over the whole year, the appropriate deflator is the average price level for that year rather than the change in prices between December of consecutive years. The latter measures price movement at a single point in time and would misalign the timing of prices and transactions. Annual-average inflation rates are:

- 2018–2020: 17.52, 14.53 and 12.87 per cent, from the World Bank's World Development Indicators (World Bank, 2026);

• 2021–2025: 10.8, 11.4, 10.0, 9.6 and 8.8 per cent, from the Statistics Agency's annual CPI series (Statistics Agency under the President of the Republic of Uzbekistan, 2026), which compares each year with the corresponding period of the previous year.

3.2 Variable construction

Price index and real turnover. Let π_t denote annual-average CPI inflation in year t , expressed as a decimal. A chained price index with 2018 as the base year is defined as

$$P_{2018} = 100, \quad P_t = P_{t-1} \times (1 + \pi_t) \text{ for } t = 2019, \dots, 2025. \quad (1)$$

Under this convention, the 2018 inflation rate describes the change from 2017 to 2018 and is not used in the index, since 2018 is the reference year. Real terminal turnover in constant 2018 prices is then

$$RT_t = NT_t \times (100 / P_t), \quad (2)$$

where NT_t is nominal turnover in million UZS. Real turnover therefore equals nominal turnover in 2018, and each later year is deflated by the cumulative price change since the base year.

Average stocks for flow-to-stock ratios. Turnover is a flow generated over the year, whereas cards and terminals are counted at year-end. When a flow is related to a stock, the stock measure should match the period over which the flow accrues. Flow-to-stock utilisation ratios are therefore computed on the average annual stock:

$$\bar{S}_t = (S_{t-1} + S_t) / 2, \quad (3)$$

where S denotes either installed terminals or issued cards. Because no 2017 observation is used, $\bar{S}_{2018}$ cannot be formed. Flow-to-stock ratios based on average stocks are reported for 2019–2025, and the 2018 value is either shown on a year-end basis and marked as such or left out of comparisons that rely on average stocks.

Indicators. On this basis, the study constructs the following indicators:

- **Real turnover per average installed terminal:** $RT_t / \text{POS}_{\bar{S}_t}$.
- **Real turnover per average issued card:** $RT_t / \text{Card}_{\bar{S}_t}$.
- **Issued cards per installed terminal:** $\text{Cards}_t / \text{POS}_t$. This is a ratio of two year-end stocks, so no averaging is needed.
- **Installed ATMs and self-service kiosks per 1,000 issued cards:** $1,000 \times \text{ATM}_t / \text{Cards}_t$, also computed from year-end stocks.
- **Installed POS terminals per 1,000 issued cards:** $1,000 \times \text{POS}_t / \text{Cards}_t$, also computed from year-end stocks.

Year-on-year growth is $g_t = X_t / X_{t-1} - 1$. The compound annual growth rate between years a and b is

$$\text{CAGR}_{a,b} = (X_b / X_a)^{1/(b-a)} - 1. \quad (4)$$

Indexed trajectories are computed as $I_t = 100 \times X_t / X_{2018}$. Card, terminal and device stocks, as well as real turnover, can then be compared on a common scale.

3.3 Accounting decomposition

The central tool of the study is an exact decomposition of growth in real terminal turnover. Real turnover can be written as the product

$$RT_t = \text{POS}_t \times (\text{Cards}_t / \text{POS}_t) \times (RT_t / \text{Cards}_t). \quad (5)$$

Taking logarithms and first differences gives

$$\Delta \ln RT_t = \Delta \ln POS_t + \Delta \ln(Cards_t / POS_t) + \Delta \ln(RT_t / Cards_t). (6)$$

The terms on the right-hand side sum exactly to the change on the left, with no residual. The first term, $\Delta \ln POS$, is the infrastructure or extensive component: the component of observed log growth associated with changes in the installed terminal stock. The second, $\Delta \ln(Cards/POS)$, is the component associated with changes in card density relative to installed acceptance infrastructure. The third, $\Delta \ln(RT/Cards)$, is the component associated with changes in real turnover per issued card. For accounting purposes, the second and third terms are treated together as utilisation-related, or intensive, components.

Because the second and third terms of equation (6) share the issued-card stock, their sum simplifies to a single ratio:

$$\Delta \ln(Cards_t / POS_t) + \Delta \ln(RT_t / Cards_t) = \Delta \ln(RT_t / POS_t). \quad (7)$$

The principal comparison between extensive and utilisation-related growth can therefore be expressed as the POS-stock component, $\Delta \ln POS$, against the combined utilisation-related component, $\Delta \ln(RT/POS)$. The combined component depends only on real turnover and the installed terminal stock. It does not depend on how the issued-card stock divides utilisation-related growth between card density and turnover per issued card. It therefore serves as the primary basis for the extensive-versus-utilisation interpretation. The two separate components are reported as secondary descriptive results.

The decomposition uses year-end stocks throughout. This differs from the average-stock convention applied to the flow-to-stock ratios in Section 3.2. The reason is that the identity in equation (6) requires all three components to be defined at the same observation dates. Using year-end values for POS and Cards in every term keeps the components consistent with one another and preserves the exact identity for each annual change from 2019 to 2025.

For sub-periods, annual log changes are summed. The total for each component then equals the log change in that component between the first and last year of the sub-period. Each component is reported in log points and also as a share of the total change in real turnover. Shares are only interpreted when the total change is clearly different from zero, because otherwise small movements produce misleadingly large percentages.

Equation (6) is an identity. It is not an econometric model and has no stochastic structure, estimated parameters or behavioural interpretation. It shows how observed log growth in turnover is distributed across accounting components, but it does not show why turnover grew. A rise in turnover per card, for example, may reflect more frequent card use, higher average transaction values, changes in how many issued cards are actually active, or a shift of transactions from other channels into those recorded as terminal turnover. The decomposition cannot tell these explanations apart. With eight annual observations, however, an accounting approach is more appropriate than regression analysis. Regression inference on a short and strongly trending time series would have very few degrees of freedom and would be highly sensitive to spurious correlation. The decomposition, by contrast, is transparent and exact, and anyone with the underlying series can reproduce it.

Results are compared across two sub-periods, 2018–2021 and 2021–2025. The split is descriptive and follows the pattern visible in the infrastructure series. 2021 is not treated as an estimated structural break, and no formal test is applied.

3.4 Limitations

Several limitations follow from the data and design:

- **Short series.** The sample has eight annual observations, which limits statistical inference and makes the results sensitive to individual years.

- **Cards and terminals are not necessarily active.** The Central Bank series count cards issued into circulation and installed terminals. They do not show how many of these are in use, so per-card and per-terminal ratios describe issued and installed stocks rather than active users or active devices.

- **Scope of terminal turnover.** Central Bank terminology does not establish that terminal turnover covers physical point-of-sale transactions only.

- **Combined ATM and kiosk series.** ATMs and self-service kiosks are published together, so their functions cannot be separated.

- **Other payment channels.** App-based, QR-code and other digital payments may be only partly reflected in terminal turnover, if at all.

- **Incomplete source verification.** Several historical observations could not be checked against the original year-end releases.

- **Card-based components.** The separate card-density and turnover-per-issued-card components depend on the issued-card observations in the compiled series, including the unverified 2021 observation. Their combined utilisation-related component does not.

- **No causal inference.** The analysis is descriptive and cannot establish what caused the patterns observed.

4. Evolution of Payment Infrastructure in Uzbekistan, 2018–2025

Uzbekistan's payment infrastructure expanded along all measured dimensions between 2018 and 2025, but the components grew at very different rates. According to the Central Bank's payment-system statistics (Central Bank of the Republic of Uzbekistan, n.d.), the number of cards issued into circulation rose from about 17.7 million to 68.3 million. That is a compound annual growth rate of 21.3 per cent. Installed payment terminals rose from 244,913 to 430,762, which corresponds to 8.4 per cent a year. Installed ATMs and self-service kiosks grew fastest of the three stock series, from 6,859 to 40,090 units, or 28.7 per cent a year. Over the same period, nominal turnover through payment terminals increased from about UZS 63.7 trillion to UZS 460.3 trillion, a compound rate of 32.6 per cent.

These growth rates show that the payment system did not expand in proportion across its components. Issued cards grew roughly two and a half times as fast as the terminal network on an annual basis. As a result, the balance between the card base and the acceptance network changed over the period. This point is taken up in Section 5. The terminal network also grew unevenly. Over 2018–2021, the installed POS stock grew by about 0.57 log points, slightly more than its net expansion over 2018–2025 as a whole, since the stock was marginally lower in 2025 than in 2021. Between 2021 and 2025 it stayed broadly unchanged, ending the period

marginally below its 2021 level. The full-period annual rate of 8.4 per cent therefore averages over an early phase of rapid expansion and a later phase with essentially no net change. It does not describe a steady trend.

ATMs and self-service kiosks followed a different path. The combined series grew faster than both issued cards and installed terminals, so the self-service device network expanded relative to the card base rather than falling behind it. The data do not show what functions this growth served. The Central Bank reports ATMs and self-service kiosks as a single category. Kiosks may be used for bill payments, top-ups and other services that do not involve dispensing cash. The combined series therefore cannot be read as a measure of cash-access infrastructure alone. What it does show is that self-service devices and POS terminals developed on clearly different trajectories, especially after 2021, when the device series kept growing while the POS stock levelled off.

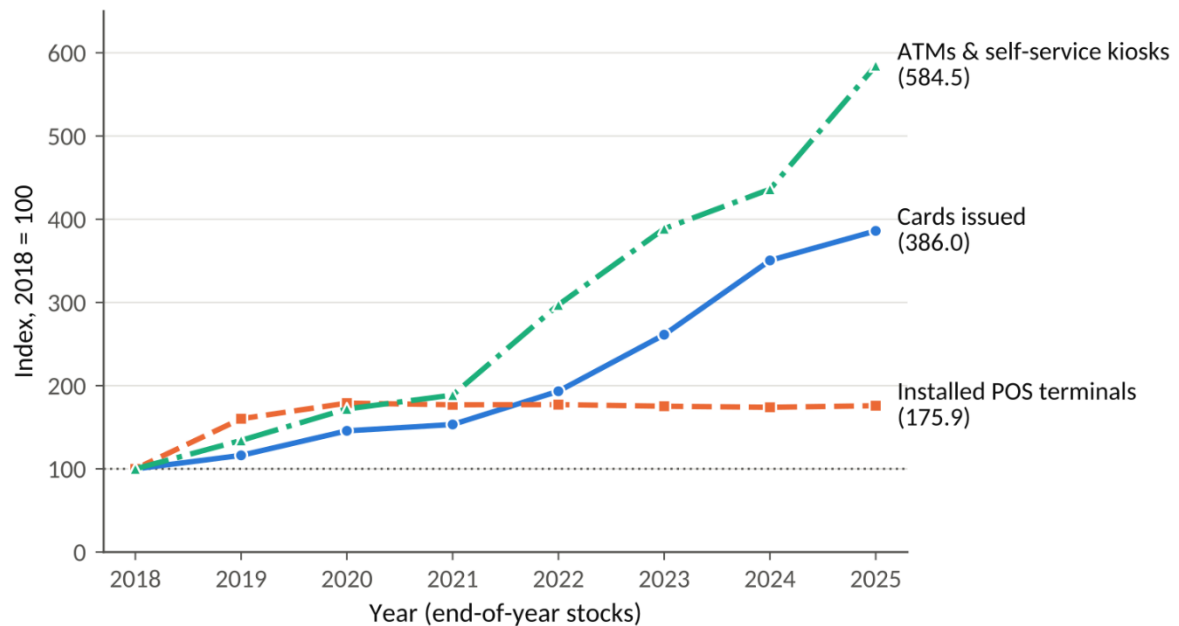
Converting turnover into constant 2018 prices shows how much of the nominal growth reflects rising prices. Using the chained annual-average CPI index described in Section 3, real terminal turnover increased from about UZS 63.7 trillion to UZS 219.9 trillion. That is roughly 3.45 times the 2018 level, compared with about 7.2 times in nominal terms. The real compound growth rate of 19.4 per cent is about 13 percentage points below the nominal rate. The gap reflects the relatively high inflation of the period, particularly in 2019-2020, and confirms that nominal turnover series overstate the expansion of transaction activity. Measured in real terms, turnover still grew more than twice as fast as the terminal stock over the full period. Real turnover grew slightly more slowly than the number of issued cards, however (19.4 versus 21.3 per cent a year). Over the full period, therefore, real turnover per issued card did not increase. This point matters when the two utilisation components are interpreted separately in Section 5.

Figure 1 places the three infrastructure stocks on a common index with 2018 = 100. Its purpose is to show the divergence between the terminal network and the other two series, rather than the size of any single indicator. The expected visual pattern is threefold:

- Cards and ATMs/self-service kiosks rise steadily across the whole period.
- The POS series rises steeply until 2020 and is broadly flat thereafter.
- After 2021 the cards index overtakes the POS index and both the cards and the ATM/self-service kiosk indices move progressively further above it.

This widening gap is the starting point for the utilisation analysis that follows.

Figure 1. Indexed Development of Payment Infrastructure in Uzbekistan, 2018–2025 (2018 = 100)



Source: Author's calculations based on Central Bank of the Republic of Uzbekistan payment-system statistics.

5. Transaction Intensity and Accounting Decomposition

5.1 Card density and the acceptance network

The simplest way to relate the card base to the acceptance network is the ratio of issued cards to installed POS terminals. This ratio rose from about 72 cards per terminal in 2018 to about 159 in 2025, so the ratio more than doubled. Put the other way, the number of installed terminals per 1,000 issued cards fell from about 13.85 to 6.31. Both measures record the same change: the stock of issued cards grew much faster than the stock of installed terminals.

These ratios should be read as describing the relationship between two stocks, not as a direct measure of demand. The numerator counts cards issued into circulation, not active cards or individual cardholders. As Rysman (2007) shows, consumers often hold several cards but concentrate their spending on one. The denominator counts installed terminals, some of which may be inactive. A rising ratio is therefore consistent with more active users per acceptance point. It is equally consistent with more cards per person, a larger stock of dormant cards, or a combination of the two. What the ratio does establish is that the growth of the card base was not matched by proportional growth in installed acceptance infrastructure, especially after the POS stock stopped expanding.

5.2 Real turnover and installed terminal capacity

The utilisation question becomes more concrete when real turnover is compared directly with the terminal network. Before 2021, the two series moved in the same direction but at very different speeds. The installed POS stock grew by about 0.57 log points, while real turnover grew by only about 0.20 log points. After 2021 the relationship reversed. Real turnover grew by about 1.04 log points while the terminal stock changed by less than 0.01. Between 2021 and 2025, the two utilisation-related components together amount to about

1.05 log points, equivalent to the change in real turnover per installed year-end terminal. This is the sum of the two utilisation-related components reported below.

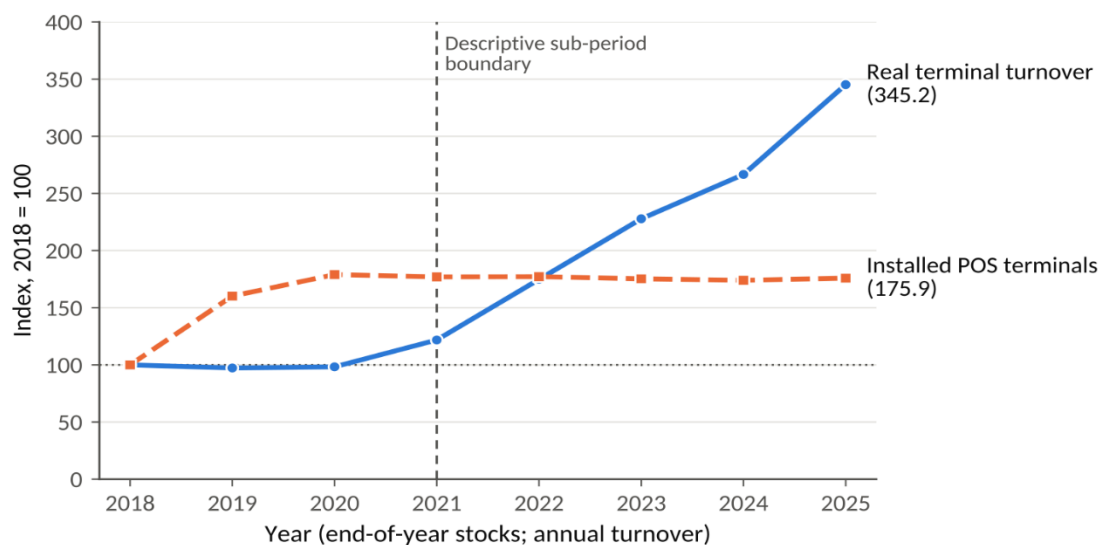
Higher turnover per terminal should not be read as higher technological or operational efficiency. The ratio rises when the same installed network records more transaction value, but several different processes can produce that outcome:

- more transactions per active terminal;
- higher average transaction values;
- a larger share of installed terminals in active use;
- changes in which transactions are recorded as terminal turnover.

As noted in Section 3, Central Bank terminology does not establish that this turnover is limited to physical point-of-sale transactions. Nor does the series capture all digital payments. App-based, QR-code and other channels may be only partly reflected in it.

Figure 2 plots real terminal turnover against the installed POS stock, both indexed to 2018 = 100. It is designed to make the post-2021 divergence visible. In the early years, terminal capacity grows faster than real turnover. From 2021 onwards, the terminal line is essentially flat while real turnover continues to rise.

Figure 2. Real Terminal Turnover and Installed POS-Terminal Capacity in Uzbekistan, 2018–2025



Source: Author's calculations based on Central Bank of the Republic of Uzbekistan payment-system statistics; annual-average CPI from the World Bank (2018–2020) and Statistics Agency of Uzbekistan (2021–2025).

5.3 Accounting decomposition by sub-period

The decomposition in equation (6) formalises these patterns by assigning observed log growth in real turnover to three accounting components. The results differ sharply between the two sub-periods. Following Section 3.3, the principal comparison is between the POS-stock component and the combined utilisation-related component. The separate card-density and turnover-per-issued-card components are reported as secondary descriptive detail.

Over 2018–2021, real terminal turnover grew by 0.197 log points. The accounting component associated with the installed POS stock was +0.571 log points, almost three times the total. The combined utilisation-related component, $\Delta \ln(RT/POS)$, was -0.374 log points.

Within this combined component, the card-density component was -0.144 and the turnover-per-issued-card component -0.230. In accounting terms, the terminal network expanded faster than real turnover over this sub-period. Real turnover grew, but by less than the growth of the installed POS stock alone would have implied had turnover per installed terminal remained constant. This result describes the composition of observed growth. It does not imply that the expansion of the terminal network weakened utilisation, and the decomposition cannot show why turnover did not keep pace.

Over 2021–2025, the picture is reversed. Real turnover grew by 1.042 log points. The POS-stock component was -0.006 log points, consistent with a terminal network that was broadly unchanged and ended the period marginally smaller. The combined utilisation-related component, $\Delta \ln(RT/POS)$, was +1.048 log points, so the observed growth appears almost entirely in utilisation relative to the installed terminal stock. Within this combined component, the card-density component was +0.930 log points and the component associated with real turnover per issued card was +0.118 log points. Allowing for rounding, the components sum to the observed total.

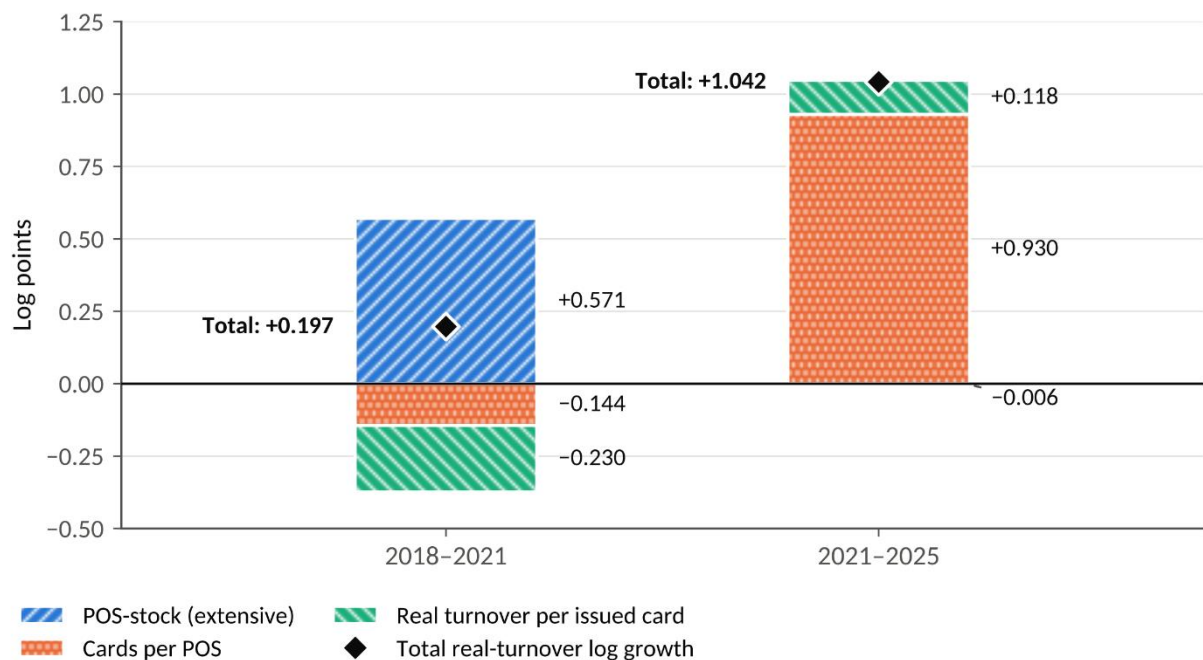
In share terms, the combined utilisation-related component accounts for slightly more than 100 per cent of observed real-turnover log growth over 2021–2025. This follows arithmetically from the small negative value of the extensive component, which offsets part of the positive intensive components so that the total is slightly smaller than their sum. The share should be read only as a statement about how the accounting identity is composed. It is not an efficiency score, and it does not imply that utilisation "over-performed" in any economic sense.

As a secondary descriptive result, the two separate components within the combined utilisation-related component differ considerably in size. Most of the post-2021 intensive growth is associated with card density, that is, with the continued rise in issued cards relative to an unchanged terminal stock. The per-card component is positive but much smaller. Real turnover grew somewhat faster than the stock of issued cards over 2021–2025, but most of the growth in real turnover per terminal is accounted for by the card-density component. The card-density component inherits the measurement limits of the issued-card series. It is consistent with more active cards per acceptance point, but it may also partly reflect cards held in parallel or dormant cards.

The central empirical finding is that the accounting composition of real-turnover growth shifted between the two sub-periods. Before 2021, expansion of the installed terminal network was the dominant accounting component. After 2021, real terminal turnover expanded substantially while the installed POS stock stayed broadly stable. Almost all of the observed growth is attributable, in accounting terms, to the combined utilisation-related component. The division at 2021 is descriptive. It matches the visible change in the terminal series but is not a statistically identified structural break. The boundary values for 2018 and 2021 also include observations that could not be re-verified against the original year-end releases (Section 3.4). The shift in composition is clear in the data. Whether it reflects a lasting change in how the payment system develops cannot be established from eight annual observations.

Figure 3 presents the decomposition graphically. For each sub-period, it separates observed log growth in real turnover into the POS-stock (extensive) component, the cards-per-POS component and the real-turnover-per-card component. Positive and negative components are shown on either side of zero, so that the offsetting component in each sub-period is visible directly.

Figure 3. Accounting Decomposition of Real Terminal-Turnover Growth



Source: Author's calculations based on Central Bank of the Republic of Uzbekistan payment-system statistics; annual-average CPI from the World Bank (2018–2020) and Statistics Agency of Uzbekistan (2021–2025).

6. Discussion and Policy Implications

6.1 Interpretation in relation to the literature

The main result of Sections 4 and 5 is a change in the accounting composition of real terminal-turnover growth. Over 2018–2021, the payment system expanded chiefly through its installed acceptance infrastructure. The POS-stock component (+0.571 log points) was almost three times the observed growth in real turnover (+0.197), and both utilisation-related components were negative. Over 2021–2025, real turnover rose by 1.042 log points while the POS-stock component was close to zero (-0.006). The combined utilisation-related component was +1.048 log points, so almost all observed growth appears, in accounting terms, in utilisation relative to the installed terminal stock. The comparison is descriptive, and the sub-period boundary is not a statistically identified break. It nonetheless shows that infrastructure expansion and infrastructure utilisation followed different timetables over this period, and that they should be treated as distinct dimensions of payment-system development rather than as a single process measured by the size of the terminal network.

Two-sided market theory explains why the two dimensions need not move together. In the framework of Rochet and Tirole (2003), a payment platform creates value only when both cardholders and merchants participate, and the growth of each side depends on the other.

Nothing in this framework requires the card base and the acceptance network to grow in step. The Uzbekistan data show that they did not. Cards per installed POS terminal rose from about 72 to 159 over the period, and terminals per 1,000 issued cards fell from about 13.85 to 6.31. Most of this change occurred after the terminal stock stopped expanding. The earlier phase can be read as the construction of acceptance capacity. The later phase is one in which the card side kept growing against a broadly fixed network of acceptance points.

The micro-level literature suggests why transaction activity on an existing network can keep rising after the network stops expanding, although our aggregate data cannot confirm any of these mechanisms for Uzbekistan. Bounie et al. (2017) find that merchant acceptance responds to consumers' payment preferences. Rysman (2007) documents a positive association between consumer usage and merchant acceptance across regions. Higgins (2024) shows that a card-issuance shock in Mexico was followed by terminal adoption among small retailers and further card adoption among other consumers. Crouzet et al. (2023) show that complementarities between users can make electronic-payment adoption persistent once it passes a certain point. Taken together, these studies describe feedback between the two sides that can raise activity on an existing network without a proportional increase in devices. The post-2021 pattern in Uzbekistan is consistent with such dynamics. Consistency is not identification, however, and the decomposition cannot tell which mechanism, if any, lies behind the aggregate figures.

The composition of the post-2021 utilisation components calls for particular care. In the secondary decomposition of the combined utilisation-related component, the card-density component (+0.930 log points) accounts for most of that growth. It measures the rise in issued cards relative to installed terminals. It does not measure how actively cards were used. Rysman (2007) shows that consumers often hold several cards while concentrating their spending on one. A rising stock of issued cards may therefore reflect cards held in parallel, dormant cards, or new cardholders, and the series cannot tell these apart. The second element of that secondary decomposition, real turnover per issued card, which comes closest to usage, was much smaller (+0.118 log points). It is also calculated per issued card, not per active card. This asymmetry argues against a strong reading of the post-2021 period. The data show that much more real transaction value passed through an essentially unchanged terminal network. They do not show that each card, or each cardholder, came to transact substantially more.

The different trajectory of ATMs and self-service kiosks adds to this picture without settling it. The combined device series grew faster than both cards and terminals. Because the Central Bank reports ATMs and self-service kiosks together, this growth cannot be read as an expansion of cash-access infrastructure specifically. The literature reviewed in Section 2 cautions against expecting card growth to be mirrored by a contraction of other infrastructure. Markose and Loke (2003) model card and ATM networks as coexisting, and Bech et al. (2018) find that electronic payments and cash use grew together across CPMI economies. The Uzbekistan data are consistent with that coexistence, but the combined device category prevents any firmer conclusion.

6.2 Policy implications for payment-system monitoring

The main implication concerns measurement. In the early development of a payment system, the number of cards and terminals is a reasonable guide to progress, because expanding access points is itself the constraint. Once the installed terminal stock stabilises, as it did in Uzbekistan after 2021, stock indicators capture a smaller part of what is changing. The dynamics observed in this study show up mainly in the ratios between infrastructure and transactions, not in the infrastructure counts. International frameworks already recognise the distinction between availability and use. The IMF Financial Access Survey separates geographical outreach from the use of financial services (IMF, 2019). The CPMI–World Bank guidance treats frequent use of transaction accounts as a distinct objective (CPMI and World Bank Group, 2016, 2020). Applying the same distinction to acceptance infrastructure would complement the payment-system statistics the Central Bank already publishes.

Several utilisation indicators could serve this purpose. Real transaction value per installed acceptance point can be computed from the current data, as this study has done. Other indicators would require data that are not currently available:

- transaction value and transaction frequency per active acceptance point;
- transaction value and transaction frequency per active card;
- the share of issued cards that are active;
- the share of installed terminals that are active;
- merchant acceptance coverage;
- the regional distribution and utilisation of acceptance infrastructure;
- transaction indicators by payment channel.

These are proposals for future monitoring, not indicators that can be derived from the present dataset.

This argument should not be read as a case for ending infrastructure expansion. National aggregates cannot show whether acceptance points are adequate in particular regions, between rural and urban areas, in specific sectors, or among small merchants. A flat national terminal stock is compatible with areas of unmet acceptance alongside areas of low use. The number of terminals may therefore become a less informative *headline* measure as the stock stabilises. It does not become irrelevant. The policy shift implied by the findings is towards more detailed monitoring that combines infrastructure counts with utilisation measures, so that expansion can be targeted where acceptance gaps are identified.

6.3 Data and measurement priorities

The limitations described in Section 3.4 point to specific measurement priorities. The first is to distinguish issued cards from active cards, and installed terminals from active terminals. Without these distinctions, per-card and per-terminal ratios combine changes in how actively devices are used with changes in how many are active at all. The second is to publish ATMs and self-service kiosks as separate series, which would make it possible to interpret the growth of self-service devices in relation to cash access and other services. The third, where technically possible, is to separate physical point-of-sale transactions from other transactions recorded as terminal turnover, and to report card-based payments alongside other digital channels. This would clarify what the turnover series covers.

Transaction counts deserve particular attention. The current series records only the value of transactions. An increase in real value per terminal can come from more transactions or from larger average transactions, and these two sources have different economic meanings. Transaction counts would separate the frequency of use from the size of payments. They would also allow the per-card component to be read as a change in how often cards are used, which the value data alone cannot support. Merchant and location coverage would, in the same way, show where acceptance exists, which aggregate terminal counts cannot. Regional breakdowns would allow future research to test whether the national shift towards greater utilisation is widespread or concentrated in a limited number of areas.

Taken together, these findings describe a payment system in which the scale of infrastructure and its utilisation should increasingly be monitored together. The eight-year aggregate dataset used here can document this change in composition. It cannot identify the behavioural mechanisms behind it, which remain a question for research using more detailed and more frequent data.

7. Conclusion

This paper examined whether growth in real terminal turnover in Uzbekistan during 2018–2025 was associated primarily with expansion of installed acceptance infrastructure or with greater transaction activity relative to that infrastructure. The results show a clear change in the accounting composition of growth across the two descriptive sub-periods.

During 2018–2021, installed POS infrastructure expanded considerably faster than real terminal turnover: the POS-stock component was **+0.571 log points**, compared with real-turnover growth of **+0.197**. In 2021–2025, the pattern reversed. Real turnover increased by **1.042 log points** while the POS-stock component was approximately zero (**-0.006**), leaving a combined utilisation-related component of **+1.048 log points**. Most of this component was associated with the increase in issued cards relative to installed POS terminals (**+0.930**), while real turnover per issued card contributed **+0.118**. These are accounting components rather than causal effects, and issued-card density should not be interpreted as consumer demand or card activity.

The analysis contributes by separating infrastructure expansion from utilisation and applying an exact accounting decomposition to Uzbekistan's system-level payment data. The findings indicate that infrastructure-stock indicators become less informative when considered alone as an acceptance network stabilises. Payment-system monitoring could therefore complement infrastructure counts with measures such as active cards and terminals, transaction frequency, transaction value per active acceptance point, merchant coverage, and regional utilisation. Infrastructure monitoring nevertheless remains important where regional or merchant-level acceptance gaps persist.

Several limitations qualify the results. The analysis uses only eight annual observations; issued cards and installed terminals do not necessarily represent active instruments; terminal turnover does not capture all digital-payment channels; and ATMs and self-service kiosks are reported jointly. National aggregates also cannot identify regional patterns or the behavioural mechanisms underlying the observed changes. Future research using regional, merchant-

level, transaction-level or higher-frequency data could examine these dimensions more directly.

Overall, the evidence shows that Uzbekistan's payment-system development cannot be assessed solely by how much infrastructure has been installed. As the acceptance network has stabilised, understanding how intensively that infrastructure is used has become increasingly important.

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