

Cashless economy: opportunities and challenges in the digital age

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Abstract. A cashless economy is an economic system in which transactions are carried out using digital payment methods instead of physical money. The global shift toward a cashless economy represents a key transformation about the methods through which financial transactions are conducted, driven by the rapid advancement of digital technologies and evolving consumer behaviour. A cashless economy is characterized by the minimal use of physical cash for transactions, with a preference for digital payment systems such as credit and debit cards, mobile wallets, internet banking, and contactless payments. In a cashless economic system, digital payments become the main mode of transaction for consumers and firms, leading to a progressive decline in the circulation of physical currency. The paper is focused on the impact of the cashless transaction on the economy. Firstly, it analyses the advantages and disadvantages of a cashless economy and then analyses the digital payments for the Albanian sector. Usage of cashless systems offer lots of advantages for the economy. One of the primary benefits of a cashless economy is enhanced efficiency in financial transactions. Digital payments reduce the cost and time associated with handling physical cash, both for individuals and businesses. They enable faster processing, automated record-keeping, and easier integration with financial services. Cashless transactions improve transparency and traceability, as they are documented and can be traced at any moment. Also, the data and information transferred using online transactions are secured. Consumers benefit from not having to carry physical money, and advanced encryption and authentication technologies help prevent theft and fraud. While the adoption of cashless systems promises numerous advantages, it also introduces a range of issues that require careful management to guarantee an inclusive and resilient financial ecosystem. Usage of online payments makes the financial system vulnerable to cyberattacks, technical failures, and unauthorized access to data, that may result in widespread effects for both users and institutions. A cashless economy offers exclusion issues as some individuals may not know how to use smartphones or may not have internet connection. These problems affect older populations, rural communities, and low-income individuals. Privacy concerns are another critical issue. In a cashless system, every transaction can be tracked and stored, raising questions regarding data control, surveillance, and the inappropriate use of personal data. Using a multiple regression model, we examine the relationship between the number of online transactions, volume of transactions and numbers of digital point-of-sales. The model is focused on the Albanian economy and aims to analyse the total number of online transactions and the factors that indicate them. To perform this analysis, the data are collected by Albanian Association of Banks, Bank of Albania, and other national institutions and then are processed in EViews 10, a statistical software, used for general statistical analysis, time series estimation and econometric analyses. According to the model's findings, we have identified conclusions and prepared some recommendations on how to improve digital transactions in the Albanian economy. Analysis reveals a positive and significant correlation between the volume of digital transactions and the number of digital transactions, indicating that greater monetary activity in the digital space encourages transaction frequency. Moreover, the density of POS

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terminals emerges as a critical enabler, reinforcing the infrastructure's role in facilitating digital payments.

Keywords: *cashless economy, online banking, digital payments, volume of transactions, monetary activity*

JEL classification: *G21, E51, D73, E52, G12*

1. Introduction

In recent years, Albania has been gradually transitioning toward a cashless economy, driven by technological advancement, government initiatives, and the growing need for financial transparency. Although cash continues to dominate many day-to-day transactions, there is an increasing push from both public institutions and private sectors to promote digital payments and reduce reliance on physical currency. The Albanian government, along with the Bank of Albania, has undertaken several steps to encourage the adoption of electronic payments. Key initiatives include the digitalization of public services, tax incentives for card payments, and the implementation of a national financial education strategy.

This research is focused on analysing the effect of cashless transactions on the Albanian economy by combining both qualitative and quantitative approaches. Specifically, the paper aims to: identify the advantages and disadvantages of a cashless system as highlighted in institutional reports and expert studies, examine the determinants of digital transactions in Albania through an econometric model, and provide recommendations for strengthening the digital payments infrastructure. By clarifying these objectives, the paper not only contributes to the theoretical discussion on financial digitalization but also generates empirical evidence relevant for policymakers and banking practitioners of the country. Albania has recently made notable progress in transitioning to a cashless economy, with the banking sector serving as a key driver of this shift. As digital technologies reshape global finance, Albanian banks have begun adopting innovative solutions to provide faster, safer, and more convenient services to customers. From mobile banking apps and contactless payments to online transfers and digital wallets, the range of cashless options available to individuals and businesses has grown steadily. These developments reflect a broader shift toward financial modernization and are supported by government policies and the strategic vision of the Bank of Albania.

The transition to a cashless banking environment offers several benefits for the Albanian economy. It enhances transaction transparency, reduces the costs associated with cash handling, curbs the informal economy, and promotes greater financial inclusion. Moreover, digital banking strengthens the fight against tax evasion, money laundering, and other illegal activities by leaving clear electronic records of financial transactions. However, this transition is not without its challenges. A considerable number of residents, primarily in rural communities, still rely heavily on cash due to limited access to digital tools and financial education. Furthermore, trust in digital systems, concerns about cybersecurity, and resistance to change remain barriers to wider adoption. To overcome these hurdles, banks must invest in customer education, cybersecurity infrastructure, and user-friendly platforms that take into consideration the needs of all segments of society.

Despite these obstacles, moving toward a cashless economy presents numerous benefits for Albania. It can help reduce tax evasion, increase government revenues, combat corruption, and improve overall economic transparency. For consumers, it offers greater convenience, security, and access to modern financial tools. With the increasing use of mobile banking, contactless payments, and e-wallets, especially among younger generations, the foundation for a digital financial future is being laid. Also, the outlook for a cashless future in Albania is promising. Continued collaboration between banks, regulators, and technology providers is essential to ensure a secure, inclusive, and efficient digital financial ecosystem. As Albania continues its path toward EU integration, embracing a cashless economy will be a crucial step in aligning with European standards and unlocking new economic opportunities.

2. Literature review: digital payment economy

The concept of a digital payment economy describes a financial system in which most transactions are carried out electronically instead of using physical currency. This change is prompted by technological advancements, government policies, and changing consumer behaviours worldwide. Researchers have extensively examined the emergence, benefits, and challenges of moving towards cashless economies.

The literature on cashless economies has grown significantly, reflecting global interest in the digitalization of payments. Studies consistently emphasize efficiency gains, transparency, and reduced transaction costs as major benefits (Rogoff, 2016; World Bank, 2021). Conversely, challenges such as digital exclusion, cybersecurity risks, and privacy concerns remain critical (European Central Bank, 2020). Several empirical studies have examined the determinants of digital transaction activity. For instance, Hasan et al. (2013) used panel data across European countries to examine the relation between payment system evolution, POS terminals, and economic growth, finding a significant positive association. Similarly, Sharma (2019) employed a multiple regression model in the Indian context, showing that GDP growth and the spread of digital outlets strongly influenced the frequency of online transactions. A more recent study by Górká (2021) investigated Central and Eastern European economies and highlighted that transaction volume and infrastructure density (ATMs and POS) were critical drivers of cashless adoption.

The transition to cashless economies has been accelerated by innovations in payment methods such as credit/debit cards, mobile payment apps, contactless systems, and online banking platforms (Bátiz-Lazo & Efthymiou, 2017). Governments and central banks across the globe are actively promoting cashless systems to reduce the costs associated with printing and handling cash and to improve the efficiency of monetary transactions (Narula, 2020). Digital financial inclusion initiatives aim to expand access to electronic payments, especially in developing countries, to foster broader economic participation (Suri & Jack, 2016).

Researchers emphasize that cashless systems enhance transactional efficiency by speeding up payment processes and reducing friction in commerce (Kosse & Mattes, 2020). The reduction in physical cash handling cuts operational costs for businesses and banks, while also lowering risks such as theft and counterfeiting (Bhatnagar & Ghose, 2017). The digital nature of cashless transactions enables automated record-keeping, improving financial transparency and supporting better regulatory oversight (Ozili, 2018). This transparency also aids in combating financial crimes, such as laundering money and evading taxes (Levi & Reuter, 2006).

Consumer convenience is a significant driver behind cashless adoption, as users enjoy ease of payments, contactless options, and integration with digital wallets and apps (Donovan, 2012). Furthermore, during emergencies like the COVID-19 outbreak, cashless payments have been favoured to reduce physical contact and maintain social distancing protocols (Kumar et al., 2021).

Despite its advantages, the cashless economy presents several challenges. Cybersecurity risks are a major concern, with digital payments vulnerable to hacking, data breaches, and fraud (Nash et al., 2020). Technical failures and system outages can disrupt services, causing inconvenience and potential financial losses (Zhou & Piramuthu, 2019). Additionally, digital exclusion remains a pressing issue. Demographic groups like older adults and individuals with low income, and residents of rural areas may lack access to necessary technologies or financial literacy, leading to unequal benefits from cashless systems (Klapper et al., 2016).

Privacy issues also arise in cashless economies due to extensive data collection and transaction tracking. This generates worries regarding monitoring, improper use of personal data, and the potential loss of privacy for individuals. (Zuboff, 2019). Researchers argue that effective regulatory frameworks and consumer protections are essential to address these concerns (Arner et al., 2020).

The literature indicates that while a cashless economy offers substantial improvements in efficiency, security, and convenience, it also requires careful management of technological, social, and ethical challenges. Policymakers and stakeholders are urged to balance innovation with inclusivity, security, and privacy to ensure that the transition to cashless systems benefits all segments of society. Also, these empirical contributions mentioned above are directly relevant to the Albanian context, as the variables included in this paper's model such as transaction volume, POS density, gross domestic

product (GDP), and digital outlets, those tested internationally, enabling meaningful comparisons of outcomes.

3. Methodology

The data were obtained from reliable and authoritative sources in Albania, such as the Bank of Albania, INSTAT (Institute of Statistics) and Albanian Association of Banks. The data consists of monthly observations covering an eight-year period from 2016 to 2023. This study includes both quantitative and qualitative secondary data. Quantitative data, such as transaction volumes, number of POS terminals, GDP figures, and digital outlet counts, provide measurable and numerical insights essential for statistical analysis. Qualitative data, derived from institutional reports and publications, offer contextual understanding and background necessary for interpreting the quantitative findings and framing the analysis within Albania's economic and financial environment.

The core analytical methodology in this study involves multiple linear regression, specifically the Ordinary Least Squares (OLS) method - a fundamental econometric technique widely applied to estimate if the relationship between dependent and independent variables is linear. This approach estimates relationship between the dependent variable: Number of Digital Transactions (No.Trnx) and several independent variables: Volume of Digital Transactions (Trnx_Volume), Number of POS terminals (POS), Gross Domestic Product (GDP), and Number of Digital Outlets (Outlets).

The regression model is specified as follows:

$$\text{No.Trnx} = c + \beta_1 * \text{Trnx_Volume} + \beta_2 * \text{POS} + \beta_3 * \text{GDP} + \beta_4 * \text{Outlets} + \epsilon \quad (1)$$

where:

- No.Trnx - Number of Digital Transactions
- Trnx_Volume - Volume of Digital Transactions
- POS - Number of POS terminals
- GDP - Gross Domestic Product
- Outlets - Number of Digital Outlets
- ϵ - residual representing unexplained variation.

This regression model seeks to explain the number of digital transactions (No.Trnx) using four key factors: transaction volume, the number of POS terminals, GDP, and the number of digital outlets. A Point of Sale (POS) is the place and system where a customer completes a purchase transaction with a business (money is exchanged for goods or services). Meanwhile digital outlets are considered physical kiosks usually located in branches, equipped with advanced tech enabling self-service banking at any time: Deposits and withdrawals (including high-value for business clients), checking account, online banking transactions, access to help videos and remote support via a call button. Digital outlets are considered very helpful for beginners to understand how online banking works through videos and support, but also for high-value transactions for businesses.

POS is not the only way to make e-payments because transactions by mobile phones are becoming more important. According to the 2024 Annual Report of the Bank of Albania, both the number and the total value of internet and mobile transactions rose by 22.1% and 9%, respectively (Bank of Albania, 2024). The growth in online transfers can be attributed to several factors, including the Bank of Albania's measures to lower transaction fees, improvements in payment infrastructure, broader internet accessibility, and increasing familiarity of bank customers with these digital payment methods. Due to absence of monthly data for mobile transactions, these transactions are excluded from our model and identified as a limitation of the study.

Prior to conducting the regression, the study assumes that all variables are stationary time series, which is essential for ensuring the validity of inference in time series analysis. Furthermore, the residuals are considered to be normal distributed, satisfying one of key assumptions for applicability of least squares regression. The research follows a deductive approach, starting from established theories and existing knowledge about the factors influencing digital transactions and economic activity. Based on these theories, hypotheses are formulated regarding the relationship between the number of transactions and explanatory variables such as transaction volume, POS terminals, GDP, and digital

outlets. The deductive framework guides the empirical testing of these hypotheses through statistical analysis, allowing the study to confirm or not the predicted relationships within the Albanian context.

This methodological framework allows for quantifying the influence of economic and infrastructural factors on the volume of digital transactions in Albania, providing insights into the determinants of transaction behaviour over the analysed period.

To ensure the robustness and validity of the regression results, several diagnostic tests were conducted such as significance of the model, significance of the coefficients, multicollinearity, heteroscedasticity and autocorrelation.

The significance testing of the regression model and its coefficients is essential to determine whether the relationships observed in the sample data are likely to exist in the broader population. To assess overall fit and explanatory power of the model, an F-test is conducted. This test evaluates the null hypothesis that all regression coefficients, except intercept, have a value to zero, meaning that none of the independent variables have any explanatory power over the dependent variable. If $F_{\text{observed}} > F_{\text{critical}}$, then H_0 is rejected and the model is statistically important. A statistically significant F-test result indicates how independent variables collectively express variation in the number of digital transactions.

For individual coefficients, t-tests are performed to evaluate whether each independent variable significantly affects the dependent variable. Null hypothesis of each coefficient test that if coefficient equals zero, implying no effect. If the p-value associated with the t-test is below a predetermined significance $t_{\text{critical}} = 0.05$, null hypothesis is not accepted, meaning that variable has a significant impact on the number of digital transactions. This means the detected relationship is unlikely to have occurred by random chance, and the coefficient provides meaningful information about the direction and strength of the effect.

Multicollinearity testing is performed to identify whether there is a strong correlation among the predictor variables included in the regression model. This is an important step because high multicollinearity inflates the variances of the estimated coefficients, which makes it difficult to isolate the individual effect of each predictor on the outcome variable. To detect multicollinearity, variance Inflation Factor (VIF) is commonly used. Uncentered VIF values exceeding a threshold of 10 indicate problematic multicollinearity. When such high values are observed, it may be necessary to remove or combine variables to reduce redundancy and improve the reliability of coefficient estimates.

Heteroscedasticity testing examines whether residual's variance, or errors are constant across all levels of independent variables. This assumption of constant variance, known as homoscedasticity, is fundamental for the Ordinary Least Squares (OLS) method to produce efficient and unbiased estimates. If heteroscedasticity is present, it violates this assumption, leading to inefficient coefficient estimates and biased standard errors, which undermine the validity of hypothesis testing. To detect heteroscedasticity, the White testing is performed. A significant result from these tests signals the presence of heteroscedasticity, in which case corrective measures, such as using robust standard errors or alternative estimation techniques, should be applied to ensure valid inference.

Autocorrelation testing is crucial for time series data to determine whether residuals of a regression model are correlated during the time. This violates the OLS assumption that the errors are independent, and can result in underestimated standard errors and inflated statistical significance, potentially leading to misleading conclusions. Autocorrelation is detected by Durbin-Watson statistic. A Durbin-Watson value near 2 indicates the absence of autocorrelation, whereas values substantially lower or higher suggest positive or negative autocorrelation, respectively. Detecting autocorrelation often necessitates adjustments to the model or error structure to obtain valid and reliable parameter estimates.

The testing explained above ensures that the conclusions drawn from the regression analysis are statistically justified and reliable for interpreting the determinants of digital transaction activity.

Opportunities and challenges of cashless economy

The rise of digital technology has led many countries to explore and adopt a cashless economy, where transactions are conducted electronically through mobile payments, bank transfers, cards, and digital wallets instead of using physical cash. This transformation is not just a matter of convenience, it brings a wide range of practical benefits for consumers, businesses, and governments alike. A cashless economy promotes greater efficiency in transactions, reduces the cost and time associated with handling

cash and enables faster processing with automated record-keeping. It also supports transparency and traceability of financial activities, enhances security through modern encryption and authentication, and improves consumer convenience by offering flexible and accessible payment options. Together, these advantages make a strong case for transitioning toward a more digital and cash-free financial system.

The opportunities provided by cashless economy are mentioned below:

Enhanced efficiency in transactions. A cashless economy significantly enhances the efficiency of financial transactions. Digital payment systems such as mobile wallets, debit/credit cards, and online banking allow individuals and businesses to conduct transactions quickly and smoothly. Unlike cash payments, which can be slowed down by manual handling and the need for exact change, cashless transactions are processed electronically and often in real time. This reduces wait times, improves service delivery, and increases productivity across various sectors.

Additionally, enhanced transaction efficiency benefits the broader economy by facilitating quicker circulation of money. Businesses can reinvest revenue more rapidly, and consumers can make payments anytime and anywhere, even outside traditional banking hours. This continuous flow of funds supports more dynamic economic activity and can improve cash flow management for enterprises of all sizes.

Reduced cost and time of handling cash. Handling physical cash involves considerable expenses for both businesses and governments. For businesses, cash management includes costs related to security, counting, transporting cash to banks, and dealing with counterfeit currency. This process requires extensive work and time, requiring staff to dedicate hours to tasks that do not directly generate revenue. Governments also face significant costs in printing, distributing, and safeguarding physical currency. Transitioning to cashless payments reduces or eliminates many of these costs. Electronic transactions are processed automatically and securely, saving businesses time and resources. With less cash handling, risks related to theft and loss are also minimized. For financial institutions and government agencies, cashless systems streamline currency management and lower operational expenses, freeing up funds for other critical services.

Faster processing and automated record-keeping. Cashless payments benefit from digital platforms that automatically record every transaction. This automation leads to much faster processing times compared to manual cash handling and bookkeeping. For businesses, automated record-keeping simplifies accounting, inventory management, and financial reporting, reducing errors and increasing accuracy. The immediate availability of transaction data also aids in real-time decision-making and cash flow monitoring. Consumers benefit as well, with easy access to detailed digital records of their spending history through banking apps or payment platforms. This transparency allows individuals to better manage their budgets, track expenses, and plan finances effectively. Furthermore, automated records facilitate smoother tax reporting and auditing processes for both individuals and businesses, improving compliance and reducing administrative burdens.

Improved transparency and traceability. A key advantage of cashless transactions is the inherent transparency and traceability of electronic payments. Every digital transaction leaves a verifiable record that can be tracked and audited. This level of visibility is particularly valuable in combating financial crimes such as money laundering, tax evasion, and corruption. With a clear audit trail, authorities can more easily monitor the flow of funds and enforce regulations.

In addition to regulatory benefits, transparency fosters trust among consumers and businesses. Customers gain confidence knowing that their payments are secure and verifiable, while merchants benefit from reduced fraud and disputes. Enhanced traceability also supports fairer economic practices and can help governments ensure that subsidies, social welfare payments, or public funds reach their intended recipients.

Advanced security through encryption and authentication. Cashless payment systems incorporate sophisticated security technologies that protect users from fraud and unauthorized access. Encryption scrambles transaction data to prevent interception by malicious actors, while authentication mechanisms such as passwords, biometrics, and two-factor verification add extra layers of protection. These security measures reduce the risk of identity theft and financial fraud compared to carrying physical cash, which can be lost or stolen with little chance of recovery.

Moreover, payment platforms continuously update and improve their security protocols to respond to emerging threats. The integration of cutting-edge technologies such as tokenization and

behavioural analytics further enhances protection by detecting suspicious activities in real time. This evolving security landscape helps maintain user trust and promotes wider adoption of cashless payment options.

Consumer convenience is one of the most visible and immediate benefits of a cashless economy. Digital payment systems enable transactions to be completed anytime and anywhere, without relying on cash. Whether shopping in-store, ordering online, or paying bills, consumers enjoy a seamless experience that saves time and effort. Features such as contactless payments, mobile wallets, and recurring billing add to this convenience. Beyond ease of payment, cashless systems often integrate with other financial tools, such as budgeting apps, loyalty programs, and digital receipts, offering consumers greater control over their finances. For travellers, cashless payments reduce the need for currency exchange and increase security. Overall, the convenience of cashless payments enhances customer satisfaction and encourages broader economic participation.

A cashless economy, while offering convenience and efficiency, also presents several challenges. It can exclude individuals without access to digital infrastructure, such as smartphones, bank accounts, or the internet, thereby widening the financial divide. Privacy concerns arise as every transaction becomes traceable, potentially exposing individuals to data misuse or surveillance. Some of the challenges of cashless economy are listed as below:

Cybersecurity risks (attacks, data breaches). A major disadvantage of a cashless economy is the increased exposure to cybersecurity threats. As financial transactions shift from physical cash to digital platforms, they become vulnerable to various types of cyberattacks such as hacking, phishing, ransomware, and identity theft. Cybercriminals continuously develop sophisticated methods to exploit weaknesses in payment systems, which may result in considerable financial damage for individuals as well as organizations. Unauthorized data access can expose personal and financial information, causing harm not only through monetary theft but also through compromised privacy and damaged reputations. Moreover, the growing reliance on interconnected digital networks means that a successful cyberattack could have far-reaching consequences. It could disrupt entire payment ecosystems, erode consumer trust, and undermine confidence in financial institutions. Addressing these risks requires substantial investment in cybersecurity infrastructure and continuous vigilance. However, no system is entirely immune, and the evolving nature of cyber threats presents a persistent challenge in maintaining secure cashless transactions.

Technical failures in payment infrastructure. Cashless economies depend heavily on the seamless operation of technology and digital infrastructure. This reliance exposes the system to risks associated with technical failures, including software bugs, hardware malfunctions, and network outages. When payment infrastructure fails—whether due to server downtime, power outages, or connectivity issues—transactions may be delayed or completely blocked. Such interruptions can cause frustration for consumers and businesses alike, leading to lost sales, reduced productivity, and diminished confidence in cashless systems. Furthermore, technical failures can have a disproportionate impact during critical times, such as during emergencies or peak shopping seasons, when timely transactions are essential. For small businesses or vendors who rely solely on electronic payments, even a brief disruption could result in significant financial damage. Thus, building resilient, redundant, and well-maintained infrastructure is crucial, but it requires ongoing investment and skilled management to minimize the risk of failures.

Digital exclusion (elderly, rural, low-income groups). Despite the convenience of cashless payments, not everyone can benefit equally from this shift. Digital exclusion remains a serious challenge, particularly for elderly populations, rural communities, and low-income individuals. Many in these groups may lack access to smartphones, bank accounts, or reliable internet connections, making it difficult or impossible to participate fully in a cashless economy. For instance, older adults may face difficulties adapting to new technologies, while rural areas might suffer from poor network coverage and limited digital infrastructure. This exclusion risks deepening existing social and economic inequalities, as those without access to digital payment methods may be forced to rely on cash or informal systems that are less secure and less efficient. Additionally, without proper support and education, marginalized groups may be vulnerable to fraud or exploitation. To ensure that the gains of a cashless economy reach everyone, targeted inclusion-focused policies are essential, affordable technology access, and targeted financial literacy programs.

Privacy concerns (data tracking, surveillance). The digital nature of cashless payments creates extensive data trails that can be used to monitor consumer behaviour and financial activities. While such data can improve service quality and aid in fraud detection, it also raises serious privacy concerns. Consumers may worry about who has access to their transaction data, how it is stored, and whether it could be misused by companies, governments, or third parties. This level of data tracking can feel invasive and may lead to a loss of trust in digital payment platforms. Additionally, the potential for surveillance, whether for commercial purposes or by state agencies poses ethical and legal questions about the right to privacy. In some cases, aggregated transaction data can reveal sensitive personal information, habits, or locations, which could be exploited or shared without consent. Addressing these privacy concerns requires robust data protection laws, transparent policies, and empowering consumers with control over their personal information to ensure their rights are respected in a cashless society.

4. Research results and discussion

The study also relies on qualitative analysis to capture the theoretical and institutional perspectives regarding the advantages and disadvantages of a cashless economy in Albania. These sources provide important insights that contextualize the quantitative results and allow for a more holistic understanding of Albania's transition toward digital payments.

As Bank of Albania (2022a) emphasizes, the adoption of cashless transactions leads to multiple macroeconomic benefits, including improved efficiency in financial intermediation, reduced operational costs for banks, and stronger monitoring of financial flows. Digital payment systems such as digital wallets, bank cards, and internet-based banking services allow individuals and businesses to conduct transactions quickly and smoothly. Unlike cash payments, which can be slowed down by manual handling and the need for exact change, cashless transactions are processed electronically and often in real time. This reduces wait times, improves service delivery, and increases productivity across various sectors. The Bank of Albania (2023) highlights the development of an instant payment system, modeled on the Eurosystem's TIPS, enabling safe, prompt electronic settlements at any time of day, thereby enhancing efficiency. Enhanced transaction efficiency also benefits the broader economy, facilitating quicker circulation of money. Businesses can reinvest revenue more rapidly, and consumers can make payments anytime and anywhere, even outside traditional banking hours. According to the Bank of Albania (2023), electronic payments grew by 25.5% in 2023, surpassing the strategic objective of 10 per-capita transactions set in the National Retail Payment Strategy, demonstrating improved transparency and financial monitoring.

Moreover, the Bank of Albania (2022b) reports that cashless systems are generally more secure than traditional cash handling. Advanced encryption methods, two-factor authentication, and fraud-detection mechanisms reduce the risk of physical theft and counterfeit money. Consumers benefit from not needing to carry large amounts of cash, and merchants are less exposed to cash-related robberies. For businesses, cash management includes costs related to security, counting, transporting cash to banks, and dealing with counterfeit currency. This process is labour-intensive and time-consuming. Electronic transactions are processed automatically and securely, saving businesses time and resources.

The Albanian Association of Banks (2021) highlights that digital payment systems support transparency and accountability, while also contributing to reduced tax evasion through traceable transactions. Every digital transaction leaves a verifiable record that can be tracked and audited. This level of visibility is particularly valuable in combating financial crimes such as money laundering, tax evasion, and corruption. With a clear audit trail, authorities can more easily monitor the flow of funds and enforce regulations. Transparency also fosters trust among consumers and businesses. Customers gain confidence knowing that their payments are secure and verifiable, while merchants benefit from reduced fraud and disputes. Enhanced traceability supports fairer economic practices and can help governments ensure that subsidies, social welfare payments, or public funds reach their intended recipients.

International studies (such as European Central Bank, 2020) underline that cashless systems enhance consumer convenience and enable broader financial services through innovations like digital banking and contactless systems. Digital payments enable users to make payments anytime and anywhere and no cash is required. Consumers also gain easy access to detailed digital records of their

spending history, allowing them to better manage budgets, track expenses, and plan finances. Financial inclusion in Albania has expanded significantly: 78% of Albanians had a payment account in 2025, compared to only 40% in 2015, while digital payments per capita increased from 2 to 23, demonstrating improved accessibility and convenience (European Payments Council, 2025).

On the other hand, national institutions have drawn attention to disadvantages and risks. The Bank of Albania (2022b) warns that a strong dependence on electronic infrastructure increases exposure to cybersecurity risks, technical disruptions, and data breaches. A major system failure could paralyze economic activity, while successful cyberattacks may undermine consumer trust. Addressing these risks requires substantial investment in cybersecurity infrastructure. The European Central Bank (2020) and the Albanian Association of Banks (2021) note that digital exclusion remains a significant issue. Older populations, rural communities, and low-income groups may lack digital literacy, access to smartphones, or stable internet connections, making it difficult or impossible to participate fully in a cashless economy. This exclusion risks deepening social and economic inequalities if adequate support and education are not provided.

Privacy concerns are another disadvantage. The Bank of Albania (2022a) stresses that in a fully cashless system, all transactions are traceable, which raises questions about data protection, ownership, and potential misuse by third parties. While transaction traceability helps combat financial crime, it also heightens the risk of surveillance and erosion of privacy. Consumers may worry about who has access to their transaction data, how it is stored, and whether it could be misused by companies, governments, or third parties. This level of data tracking can feel invasive and may lead to a loss of trust in digital payment platforms. Additionally, the potential for surveillance, whether for commercial purposes or by state agencies poses ethical and legal questions about the right to privacy. In some cases, aggregated transaction data can reveal sensitive personal information, habits, or locations, which could be exploited or shared without consent. Addressing these privacy concerns requires robust data protection laws, transparent policies, and empowering consumers with control over their personal information to ensure their rights are respected in a cashless society.

Regression model

The data is collected from trusted sources in Albania such as: Bank of Albania, INSTAT (Institute of Statistics) and Albanian Association of Banks. All data used in this study are on a monthly basis for the period 2016-2023, so we have analysed an eight years' time period. To examine the relationships between variables, we applied the least squares method, a widely used technique in econometric modeling. Regression analysis estimates the relation between the dependent variable and one or more independent variables. For the purposes of this study, we assume that all variables, both dependent and independent—are stationary time series and the error terms (residuals) are normally distributed.

The model equation is:

$$Y = \beta_0 + \beta_1 * x_1 + \beta_2 * x_2 + \dots + \beta_n * x_n + \varepsilon \quad (2)$$

The model has its constant term c and the standard error ε .

Below is the full equation of the regression model that has been used in the study.

$$\text{No.Trnx} = c + \beta_1 * \text{Trnx_Volume} + \beta_2 * \text{POS} + \beta_3 * \text{GDP} + \beta_4 * \text{Outlets} + \varepsilon \quad (3)$$

Variables consist in:

- dependent variable: Number of digital transactions
- independent variables: Value of digital transactions, POS, gross domestic product (GDP), digital outlets

To estimate this equation, we have utilized EViews 10, a statistical software used for general statistical analysis, time series estimation and econometric analyses. The model aims to find the relation and the effect of these variables on the Albanian market

Significance test

The significance of the model is evaluated by testing the following hypothesis:

$H_0: \beta_1 = \beta_2 = \beta_3 = 0$ (The model is not statistically important);

$H_a: \exists \beta_i \neq 0$ (The model is statistically important);

If $F_{\text{observed}} > F_{\text{critical}}$, then H_0 is rejected and the model is statistically important. After processing the data in EViews, the result is shown below:

Table 1. Estimation for significance test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1180827.	450484.6	-2.621237	0.0108
TRNX_VOLUME	4.073654	0.061711	66.01156	0.0000
POS	42.85321	13.42419	3.192239	0.0021
GDP	-0.702922	0.357034	-1.968780	0.0530
OUTLETS	2286.575	744.9550	3.069414	0.0031
R-squared	0.985636	Mean dependent var		341259.8
Adjusted R-squared	0.984803	S.D. dependent var		489725.5
S.E. of regression	60371.36	Akaike info criterion		24.91959
Sum squared resid	2.51E+11	Schwarz criterion		25.07527
Log likelihood	-917.0250	Hannan-Quinn criter.		24.98170
F-statistic	1183.649	Durbin-Watson stat		1.678185
Prob(F-statistic)	0.000000			

Source: EViews 10, processed by authors.

As far as the $F_{\text{observed}} = 1183 > F_{\text{critical}} = 5$ ($\alpha=0.05$), we conclude that H_0 is not true and the model is important.

The value of R^2 indicates that the model is well built and it shows that the model has a great significance. Our model has a $R^2=98.5\%$ that means that 98.5% of transactions are determined by independent indicators of this study.

Variables significance test

When we estimate a regression model, we often check whether each estimated coefficient is significant. This involves testing the null hypothesis that the coefficient has no effect, meaning it is equal to zero. The following hypothesis are assumed:

$H_0: \beta_i = 0$, the coefficient is not important;

$H_a: \beta_i \neq 0$, the coefficient is important;

These hypotheses can be tested by student statistics (t-statistics) or by probabilities. H_0 is rejected, if the $t_{\text{observed}} > t_{\text{critical}}$ (value of $t_{\text{critical}} = 1.96$) or if probability of the variable is lower than $P < 0.05$.

The regression indicates that each one-unit rise in transaction value corresponds to an increase of 4.07 in the number of transactions. Each unit increase in POS leads to 43 more transactions and every unit increase in these digital outlets corresponds to 2,287 more transactions while holding other variables constant. GDP shows a negative effect on the dependent variable, which for each increase by 1 unit, transaction count slightly decreases. This variable has a borderline significance.

Based on Table 1, all predictors included in the model are statistically significant, because probabilities of variables result lower than 0.05, except GDP which is borderline and we have excluded from the model.

The equation after the adjustments is as below:

$$\text{TRNX_NO} = \beta_0 + \beta_1 \cdot \text{TRNX_VOLUME} + \beta_2 \cdot \text{POS} + \beta_3 \cdot \text{OUTLETS} + \epsilon \quad (4)$$

Table 2. Estimation for coefficient testing

Dependent Variable: TRNX_NO
 Method: Least Squares
 Sample (adjusted): 2016M01 2023 M02
 Included observations: 86 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1237962.	458691.2	-2.698900	0.0087
TRNX_VOLUME	4.066537	0.062858	64.69392	0.0000
POS	30.37706	12.07500	2.515699	0.0142
OUTLETS	2032.443	748.6074	2.714965	0.0083
R-squared	0.984829	Mean dependent var		341259.8
Adjusted R-squared	0.984179	S.D. dependent var		489725.5
S.E. of regression	61599.12	Akaike info criterion		24.94722
Sum squared resid	2.66E+11	Schwarz criterion		25.07177
Log likelihood	-919.0472	Hannan-Quinn criter.		24.99690
F-statistic	1514.673	Durbin-Watson stat		1.581807
Prob(F-statistic)	0.000000			

Source: EViews 10, processed by authors.

Multicollinearity test

Multicollinearity refers to a situation where the independent variables are highly correlated with one another. In other words, the variables move closely together instead of varying independently [$cov(x_i:x_j)=0; i \neq j$]. This condition represents a problem within the dataset because it weakens the ability of the model to isolate the individual effect of each variable. When this issue exists, the statistical conclusions drawn from the analysis may become unstable or unreliable.

H₀: Independent variables do not correlate to each other.

H_a: Independent variables correlate to each other.

If uncentered VIF < 10, then the variable has multicollinearity.

Table 3. Multicollinearity test

Variance Inflation Factors
 Date: 06/19/25 Time: 04:57
 Sample: 2016M01 2023M12
 Included observations: 74

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	2.10E+11	4103.208	NA
TRNX_VOLUME	0.003951	1.668747	1.098419
POS	145.8056	270.1898	15.09852
OUTLETS	560413.0	2361.334	15.29209

Source: EViews 10, processed by authors.

Based on the table above, we conclude that all our model suffers from multicollinearity, this means that among the independent variables exists the phenomenon of correlation, because all the uncentered VIF are higher than 10. Multicollinearity inflates standard errors, making it harder to determine which variables are statistically significant. Although model fit is excellent and coefficients are significant, multicollinearity may still pose problems for interpretation and prediction stability.

Autocorrelation test

Autocorrelation is displayed when the assumption of least squares method is not complete. (The assume of least squares method: residues are uncorrelated with each other [$\text{cov}(e_i:e_j)=0; i \neq j$]).

Hypothesis for autocorrelation test are:

H_0 : the model has no autocorrelation

H_a : the model has autocorrelation

H_0 is rejected if Prob.Chi-Square (2) < 0.05, but autocorrelation can also be examined using the Durbin–Watson statistic. A value of this statistic that is approximately equal to 2 generally indicates the absence of autocorrelation. If the value deviates substantially from 2, it may suggest the presence of positive or negative autocorrelation in the residuals.

Durbin-Watson = 1.68 < DW =2, this may suggest some mild positive autocorrelation, worth checking with residual plots or tests like Breusch-Godfrey.

Table 4. Autocorrelation test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.106225	Prob. F(2,68)	0.1296
Obs*R-squared	4.316725	Prob. Chi-Square(2)	0.1155

Source: EViews 10, processed by authors

The Breusch-Godfrey (BG) test checks for serial correlation in residuals of the model specifically, whether the error terms from your regression correlate across time. This is especially important in time series data.

As far as Prob.Chi-Square (2) = 0.1155 > 0.05, the model does not suffer from autocorrelation.

There is no indication of serial correlation in the model's residuals at the first and second lags. This is a good sign, indicating that your model does not violate the assumption of uncorrelated errors, which supports the reliability of your regression results.

Heteroscedasticity testing

An important assumption of regression analysis is that the error terms have constant variance across all observations. When this condition holds, the errors are described as homoscedastic. To evaluate this assumption, researchers commonly examine plots of the residuals. If the variance of the errors is not constant—meaning heteroscedasticity is present—the usual estimation techniques may become inefficient and the reliability of statistical inference can be affected. Hypothesis are as below:

H_0 : the model has no heteroscedasticity

H_a : the model has heteroscedasticity

The H_0 is rejected and the model suffers from heteroscedasticity, if F-statistic is lower than 0.05.

Table 5. Heteroscedasticity

Heteroskedasticity Test: White

F-statistic	228.5820	Prob. F(9,64)	0.0000
Obs*R-squared	71.76734	Prob. Chi-Square(9)	0.0000
Scaled explained SS	757.3543	Prob. Chi-Square(9)	0.0000

Source: EViews 10, processed by authors

Based on the values, we conclude that our regression model suffers from heteroskedasticity, because Pstatistic is lower than 0.05 To eliminate the heteroskedasticity we have performed as below:

Table 6. Testing after adjustment

Dependent Variable: TRNX_NO
 Method: Least Squares
 Sample (adjusted): 2016M01 2023 M02
 Included observations: 86 after adjustments
 White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1237962.	412000.4	-3.004758	0.0037
TRNX_VOLUME	4.066537	0.158163	25.71111	0.0000
POS	30.37706	8.809959	3.448036	0.0010
OUTLETS	2032.443	711.4826	2.856630	0.0056
R-squared	0.984829	Mean dependent var		341259.8
Adjusted R-squared	0.984179	S.D. dependent var		489725.5
S.E. of regression	61599.12	Akaike info criterion		24.94722
Sum squared resid	2.66E+11	Schwarz criterion		25.07177
Log likelihood	-919.0472	Hannan-Quinn criter.		24.99690
F-statistic	1514.673	Durbin-Watson stat		1.581807
Prob(F-statistic)	0.000000	Wald F-statistic		634.9724
Prob(Wald F-statistic)	0.000000			

Source: EViews 10, processed by authors.

Based on the above results, all independent variables are statistically significant at conventional levels ($p < 0.01$). Transaction volume has a strong positive effect on the number of transactions with a very high t-value and tiny p-value. POS and digital outlets also positively influence the dependent variable.

Final model

The final adjusted model that has resulted after performing all relevant tests is:

$$TRNX_NO = \beta_0 + \beta_1 \cdot TRNX_VOLUME + \beta_2 \cdot POS + \beta_3 \cdot OUTLETS + \epsilon$$

This model is also significant as the previous model, because $F_{observed} > F_{critic}$ and all the variables are significant too. The regression explains roughly 98.48% of the fluctuations in the number of digital transactions. This means the model fits the data very well.

Adjusted R-squared: 0.9842 for the number of predictors is still very high, confirming good explanatory power. All independent variables are statistically significant predictors of the number of digital transactions.

5. Conclusion

The transformation toward digital payment systems is a key driver of economic change in increasing transparency in financial transactions. Digital payment systems create detailed electronic records, which facilitate monitoring and auditing, thereby reducing opportunities for financial fraud and enhancing regulatory oversight.

By reducing reliance on physical cash, cashless systems help curb the circulation of black money and counterfeit currency. The traceability of electronic transactions makes it more difficult to engage in illicit activities, contributing to a cleaner and more accountable financial environment. Moreover, cashless economies promote financial inclusion by expanding access to formal financial services. Digital platforms enable underserved populations, including those in remote or rural areas, to participate in the economy, encouraging formalization and contributing to overall economic growth and development. The adoption of cashless payment methods in Albania significantly has improved the efficiency and speed of transactions. Electronic payments have minimized processing times and reduced

operational costs for businesses and financial institutions, fostering smoother and more convenient commercial activities.

The regression analysis reveals a strong and significant relationship across the number of digital transactions and key explanatory variables, underscoring important insights about the drivers of cashless payment adoption in Albania. Notably, the volume of online transactions exhibits a highly positive correlation with transaction frequency, as evidenced by the coefficient of 4.07, which remains significant at the 1 percent significance level. This demonstrates that as growth in online transaction value increases, the number of transactions rises substantially, highlighting the critical role of transaction volume in stimulating payment activity. Furthermore, the density of Point of Sale (POS) terminals shows a significant positive association on frequency of digital payments. The coefficient for POS terminals is 30.38, also statistically significant, confirming that expanding POS infrastructure encourages more frequent use of digital payment methods. Similarly, the number of outlets shows a positive and significant impact, suggesting that greater physical availability of retail points correlates with increased transaction counts. As digital outlets are digital kiosks equipped with advanced tech enabling self-service banking at any time, these are considered a new way of technology that help businesses get used with online banking. These are at a very low number, but they represent the way to measure digital transactions in the absence of mobile phones data, as mentioned in the limitations of the research (below). This is the reason why the number of online transactions is highly explained by this variable, more than POS. The model demonstrates excellent explanatory power, with an adjusted R-squared of approximately 0.98, indicating that explanatory variables collectively describe 98% of the fluctuation in digital transaction numbers. Overall significance of the model is strongly confirmed by F-statistic and corresponding p-value, validating the robustness of the findings.

These findings highlight the wider advantages of a cashless economy, improving transaction efficiency and fostering transparency via digital records. However, should also be considered critical challenges related to financial inclusion, cybersecurity, and data privacy ensure that benefits of electronic payments are accessible and secure for all segments of society. This study suggests that continued investment in digital payment infrastructure and policies supporting cashless adoption can act as significant catalysts on promoting a financial system that is more efficient, transparent, and inclusive.

Recommendations

While the shift to digital payments offers considerable advantages, it simultaneously presents challenges that must be addressed to ensure adoption that is equitable, safe, and effective. Issues such as limited digital infrastructure, low financial literacy, cybersecurity threats, and privacy concerns can hinder progress and exclude vulnerable populations. To overcome these obstacles, a coordinated effort involving governments, financial institutions, technology providers, and communities is essential. The following recommendations outline key strategies that can help build a robust foundation for a cashless society—one that is accessible, secure, and respects consumer privacy.

Enhance digital infrastructure (more POS terminals). To support a smooth transition to a cashless economy, it is crucial to invest in and expand the digital infrastructure. This includes increasing the availability of Point-of-Sale (POS) terminals across urban and rural areas, making digital payment options widely accessible. By deploying more POS terminals in small shops, markets, public transportation, and remote locations, businesses and consumers can benefit from convenient and reliable payment methods. This infrastructure upgrade reduces dependence on cash and helps bridge the gap between different geographic and socioeconomic groups.

Moreover, enhancing digital infrastructure also involves improving internet connectivity and mobile network coverage, especially in underserved rural and remote areas. Reliable internet access is foundational for the efficient functioning of cashless payment systems. Governments and private sectors should collaborate to ensure that connectivity is affordable and stable, enabling even marginalized communities to participate in the digital economy.

Improve financial literacy and digital inclusion. One of the biggest barriers to cashless adoption is the absence of financial education and digital skills within targeted populations, such as the older individuals, low-income groups, and rural residents. Targeted education programs are essential to teach people how to use digital payment tools safely and confidently. These programs can include community

workshops, online tutorials, and collaboration with local organizations to reach diverse audiences. Financial literacy also involves educating consumers about managing budgets, understanding digital transactions, and recognizing potential scams. Digital inclusion programs must aim to provide equitable access to technology while keeping costs manageable for all users. This can mean subsidizing smartphones or data plans, developing user-friendly payment applications, and providing multilingual support to cater to various linguistic groups. By empowering people with knowledge and access, financial institutions and governments can reduce the digital divide and promote equitable participation in a cashless economy.

Expand the variables and assess economic impact. Authorities and researchers should track additional indicators, such as mobile phone and computer ownership, as well as transactions conducted via mobile banking apps and online platforms. This broader dataset can inform more inclusive strategies and help target underserved populations. Additionally, examining the broader economic impact of digital payments - for example, analysing GDP as a dependent variable with transaction volume and number of transactions as explanatory variables, would provide insights into how digital payment adoption influences overall economic growth.

Plan for long-term monitoring and assessment. Extending analysis to cover periods of at least ten years will capture long-term trends, technological developments, regulatory changes, and market maturation. Continuous monitoring will support evidence-based policymaking and ensure that interventions remain effective as Albania's digital economy evolves.

Strengthen cybersecurity and privacy measures. As cyber threats become increasingly sophisticated, strengthening cybersecurity is vital to protect users and maintain trust in digital payment systems. Governments and financial institutions should invest in implementing sophisticated security technologies, including encryption and multi-factor authentication, biometric verification, and continuous monitoring for suspicious activities. Developing a robust cybersecurity infrastructure helps prevent fraud, data breaches, and unauthorized transactions. Additionally, there should be clear regulations and standards for cybersecurity that all payment providers must follow. Control over personal data should rest with individuals, allowing them to access, adjust, or delete information as appropriate. Public awareness campaigns about privacy rights and responsible data sharing can help build consumer confidence and encourage wider adoption of digital payments.

Limitations

It is important to acknowledge certain limitations of this study. Primarily, the regression model relies on secondary data, which may contain measurement errors or inconsistencies that could affect the accuracy of the results. Second, the model includes only a limited set of explanatory variables—transaction volume, POS terminals, GDP, and digital outlets—while other important factors such as banking apps on mobile phones, consumer behaviour, or technological innovation were not captured. POS terminals are not the only channel through which electronic payments can be conducted, meaning that the model may underestimate the broader scope of digital transactions. Ownership of mobile phones and computers is a crucial driver of e-payments, yet there are no reliable estimates of transactions made by individuals using these devices; therefore, are excluded from the analysis. Third, the study covers the period from 2016 to 2023, during which many digital payment technologies were only recently implemented in Albania. As a result, the findings may not entirely reflect long-term adoption patterns or the effects of more mature digital infrastructures.

Regarding the regression the study assumes that all variables are stationary time series, which is essential for ensuring the validity of inference in time series analysis. Furthermore, the residuals are presumed to exhibit a normal distribution, satisfying one of key assumptions for applicability of least squares regression. Finally, the findings are context-specific and may not be directly generalizable to other regions or time periods without further validation.

Future research

Future studies could explore alternative modeling approaches to better understand the relationship between economic growth and digital transactions. For instance, GDP could be used as the dependent variable, with transaction volume and the number of digital transactions as independent variables. This approach would help evaluate the effect of online payment on overall economic activity.

The model could be expanded by incorporating additional indicators such as mobile phone and computer ownership, as these devices are essential for facilitating e-payments beyond POS terminals. Collecting reliable data on transactions made through mobile banking applications and online platforms would provide a more comprehensive understanding of digital payment adoption. Furthermore, extending the analysis to cover a period of more than ten years would allow researchers to assess long-term patterns and the effects of advancements in technology, regulatory shifts and market maturation as Albania's digital payment ecosystem evolves.

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