REVOLUSI CASHLESS: DAMPAKNYA TERHADAP PERTUMBUHAN EKONOMI REGIONAL

CASHLESS REVOLUTION: THE IMPACT ON REGIONAL ECONOMIC GROWTH

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ABSTRACT

This study aims to examine the impact of non-cash payment systems on regional economic growth at the district and city levels in Indonesia. The variables analyzed include the transaction value of electronic money (e-money), ATM/debit cards, and credit cards. A quantitative approach was employed using secondary data from 984 districts and cities across Indonesia for the period 2020-2021, selected through purposive sampling. The data were evaluated using multiple linear regression analysis, which revealed that digital transactions particularly those using e-money and ATM/debit cards have a positive and significant influence on regional economic growth. In contrast, credit card usage was found to have no significant effect. These findings suggest that certain types of digital payment instruments can effectively stimulate local economic activity. Accordingly, local governments and regulators are encouraged to expand digital infrastructure and enhance financial literacy, with a particular focus on promoting inclusive and accessible non-cash payment tools such as e-money and debit cards. This research underscores the importance of adopting a region-based approach in designing economic digitalization policies and recommends that future studies explore the roles of social, cultural, and technological readiness factors in supporting the success of payment system transformation moving forward.

Keywords: Economic growth; Non-cash payment systems; Electronic money; ATM/Debit cards; Credit cards

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ABSTRAK

Penelitian ini bertujuan untuk mengkaji dampak sistem pembayaran nontunai terhadap pertumbuhan ekonomi regional di tingkat kabupaten dan kota di Indonesia. Variabel yang dianalisis meliputi nilai transaksi uang elektronik (e-money), kartu ATM/debit, dan kartu kredit. Pendekatan kuantitatif digunakan dengan menggunakan data sekunder dari 984 kabupaten dan kota di seluruh Indonesia untuk periode 2020-2021, yang dipilih secara purposive sampling. Data tersebut dievaluasi menggunakan analisis regresi linier berganda, yang mengungkapkan bahwa transaksi digital khususnya yang menggunakan e-money dan kartu ATM/debit memiliki pengaruh positif dan signifikan terhadap pertumbuhan ekonomi regional. Sebaliknya, penggunaan kartu kredit ditemukan tidak memiliki pengaruh yang signifikan. Temuan ini menunjukkan bahwa jenis instrumen pembayaran digital tertentu dapat secara efektif merangsang aktivitas ekonomi lokal. Oleh karena itu, pemerintah daerah dan regulator didorong untuk memperluas infrastruktur digital dan meningkatkan literasi keuangan, dengan fokus khusus pada promosi alat pembayaran nontunai yang inklusif dan mudah diakses seperti e-money dan kartu debit. Penelitian ini menggarisbawahi pentingnya mengadopsi pendekatan berbasis kawasan dalam merancang kebijakan digitalisasi ekonomi dan merekomendasikan agar studi masa depan mengeksplorasi peran faktor kesiapan sosial, budaya, dan teknologi dalam mendukung keberhasilan transformasi sistem pembayaran ke depannya.

Kata Kunci: Pertumbuhan ekonomi; Sistem pembayaran non-tunai; Uang elektronik; Kartu ATM/Debit; Kartu Kredit

1. INTRODUCTION

Digital transformation in the global financial sector has fundamentally reshaped how individuals conduct transactions, access capital, and participate in economic systems. With the advancement of technology during the Fourth Industrial Revolution, cashless payment systems have expanded rapidly across countries as part of broader digital economy initiatives. Countries such as Sweden, China, and Kenya have demonstrated that structured and inclusive digital payment adoption can improve economic efficiency, accelerate the circulation of money, and enhance financial inclusion (Demirgüç-Kunt *et al.*, 2022; Suri & Jack, 2016). In this global context, cashless payments have evolved beyond mere alternatives to physical cash into critical infrastructure for national economic resilience and fiscal stability.

However, international studies consistently highlight that the adoption of digital financial systems remains uneven, especially in developing economies. Cohen *et al.*, (2020) observed that disparities in infrastructure readiness and digital literacy are major barriers to widespread adoption in non-urban areas. Similarly, Malihah *et al.*, (2021) noted that top-down financial digitization policies often fail to engage rural populations due to the lack of localized strategies. Zins & Weill (2016) emphasized that limited access and low trust in digital systems are key constraints preventing rural communities from entering the formal financial system. These findings suggest that the digital divide is not merely technological it is institutional, structural, and social. Despite its importance, this

issue remains underexplored in empirical research, particularly in the context of countries like Indonesia where regional disparities are significant.

In Indonesia, the government's commitment to digitalizing the financial sector is evident through various strategic initiatives, including the National Non-Cash Movement (GNNT), the implementation of the Quick Response Code Indonesian Standard (QRIS), and the digitalization of regional financial systems.

Bank Indonesia reported a significant increase in electronic money transactions from IDR 6.02 trillion in 2020 to IDR 8.9 trillion in 2021, marking a growth of 49%. However, this growth has not been evenly distributed. Credit card transactions declined by 5% over the same period, indicating differing levels of adoption across population segments and types of payment instruments. These disparities become even more pronounced in non-urban areas, which often face constraints related to digital infrastructure, financial literacy, and strong cultural preferences for cash-based transactions (Bank Indonesia, 2020)

While numerous studies in Indonesia have focused on the macroeconomic benefits of cashless systems such as increased productivity, tax compliance, and financial inclusion most are concentrated in urban or national-level analyses (Mints *et al.*, 2022; Noman *et al.*, 2023; Qi *et al.*, 2016). There is still limited empirical investigation into how these systems function in non-urban or rural contexts, where infrastructure constraints, lower trust, and financial exclusion may lead to significantly different outcomes.

A study by Iriani *et al.*, (2024) found that the majority of micro, small, and medium enterprises (MSMEs) in Indonesia's rural regions still struggle to understand and access digital payment systems. This is largely due to a lack of information, limited internet connectivity, and entrenched habits of using cash. These findings align with global studies and reinforce the argument that the digital divide in the financial sector is not merely technological but also deeply rooted in social and structural factors. Despite this, there is still a lack of empirical research specifically examining how cashless payment systems contribute to local economic growth in non-urban areas of Indonesia, and how digital financial literacy may strengthen this relationship.

To address this gap, this study is grounded in two key theoretical frameworks: Economic Growth Theory and Financial Inclusion Theory. Economic Growth Theory, encompassing both classical and modern perspectives, explains how economic development is driven by mechanisms such as market efficiency, capital accumulation, and technological advancement. In this context, digital payment systems act as technological innovations that reduce transaction costs, increase the speed of economic circulation, and expand productive capacity, thereby supporting regional economic growth. Complementing this, Financial Inclusion Theory emphasizes the importance of expanding access to formal financial services, particularly in underserved areas. The use of digital payment instruments such as electronic money and debit cards enables broader participation in the financial system, enhances individual financial capability, and contributes to more inclusive and balanced regional development.

This research contributes theoretically by contextualizing Economic Growth Theory and Finansial Inclusion Theory within Indonesia's regional digital transformation. Empirically, it responds to a clear research gap by focusing on underexplored non-urban areas. Practically, the findings offer actionable insights for local governments, financial regulators, and banking institutions to build a more balanced and inclusive digital economy one that is not only efficient but also equitable and responsive to the socio-economic realities of diverse regions across Indonesia.

2. LITERATURE REVIEW

Economic Growth Theory

Economic growth as a quantitative indicator that compares economic growth in one year with the previous year according to Sukirno, (2021), Zargar *et al.*, (2023) states that economic growth reflects an increase in production capacity as measured by Gross Domestic Product (GDP) or Gross Regional Domestic Product (GRDP). Economic growth reflects an increase in real national income or real output, so a country is considered to be growing if real output increases. According to Keynes' theory, macroeconomic conditions affect individual behavior in a small economic scope.

In general, economic growth theories are divided into two: classical and modern. Letiche, (1960) in his publication related to Classical Theory as explained by Adam Smith and David Ricardo emphasizes the importance of free market mechanisms in driving economic growth. Meanwhile, the modern theory proposed by Harrod-Domar highlights the role of investment as a major factor. High investment boosts the economy because it has an impact on aggregate demand, aggregate supply, and production capacity. In the long term, investment also increases the capital stock, which is the key to sustainable economic growth (Yang *et al.*, 2021).

The theory of economic growth serves as the grand theory in this study, as it provides a comprehensive framework for understanding how macroeconomic factors such as production capacity, market dynamics, and investment contribute to the increase in regional economic output. This theoretical foundation guides the analysis of the relationships between payment systems and regional economic growth.

Financial Inclusion Theory

Financial Inclusion Theory, explains that broad access to formal financial services including digital payment systems plays a crucial role in increasing economic participation and promoting more inclusive economic growth. According to Demirgüç-Kunt *et al.*, (2022), financial inclusion enhances individuals' ability to save, transact, access credit, and invest efficiently.

In this context, the use of non-cash payment instruments such as electronic money and debit cards helps expand the reach of financial services, particularly in non-urban areas that have historically faced limitations in banking infrastructure. As people begin to access and utilize digital financial services, transaction efficiency improves, informal economic activities decrease, and consumption and investment become more traceable, all of which contribute to strengthening regional economic growth.

Non-Cash Payment System

Payment systems include the rules, institutions, and mechanisms for moving funds to meet obligations from economic activities. According to Fabris, (2019) and Chilukuri *et al.*, (2025)The payment system consists of legal provisions, standards, procedures, and technical mechanisms used for the exchange of monetary values, both within a country and internationally, through instruments recognized as means of payment. This system involves institutions such as banks, clearing houses, and central banks, and includes the process of designating, verifying, and settling financial obligations between parties. The payment system must guarantee efficient and secure money transfers, ensuring that individuals feel confident and comfortable engaging in economic transactions.

In the modern era, non-cash payment systems are supported by world central banks because they are safer, more effective, and more efficient. Non-cash transactions, which

are cheap and fast, support economic productivity. Card Payment Instruments (APMK), such as ATM/debit cards and credit cards, make transactions easier. Currently, payments with account-based APMK allow transactions to be made through methods determined by each bank according to its operational scale (Febriaty, 2019).

Electronic Money/E-money

According to a publication by the Bank for International Settlements (BIS), electronic money (e-money) is a stored-value or prepaid product owned by an individual, where a specified amount of money is stored in an electronic format. Electronic money is regulated under Bank Indonesia Regulation (PBI) No. 16/8/PBI/2014, which amends PBI No. 11/12/PBI/2009 regarding Electronic Money (Bank Indonesia, 2019). Furthermore, Bank Indonesia Regulation No. 20/6/PBI/2018 on electronic money outlines distinctions based on the scope of implementation, the medium for storing electronic money value, and the recording of user identity data.

ATM/Debit Card

Account Based Card (ATM Card and Debit Card) is one of a kind a payment instrument that using a card where the funds come from the customer's account. Initially, the most widely used payment instrument using a card was an ATM card. This is because the purpose of the ATM was initially only to substitute the function of a teller to increase operational efficiency and overhead costs, such as providing new branch offices and adding human resources.

According to Bank Indonesia Regulation No. 14/2/PBI/2012, a debit card is an APMK card that can be used to fulfill payment obligations, such as shopping transactions, where the payment is made directly from the cardholder's savings or deposits with the bank or authorized institution.

Credit Card

According to Lintangsari *et al.*, (2018), The banking industry needs to increase awareness of its products, including credit cards. A credit card is a payment tool that displays the cardholder's name and signature. It can be used to pay for purchases with funds lent by financial institutions at places that accept non-cash payments. Thus, credit cards are designed to provide convenience for customers when shopping.

Research Framework

This study examines the impact of various non-cash payment instruments on regional economic growth in Indonesia. Four hypotheses are proposed: H1 tests the overall effect of non-cash payment systems, while H2, H3, and H4 assess the individual impacts of electronic money, ATM/debit cards, and credit cards, respectively. The purpose of this model is to identify which instruments are most effective in driving regional economic growth and to provide a foundation for strengthening digital payment policy initiatives. The research framework is illustrated in the following diagram:

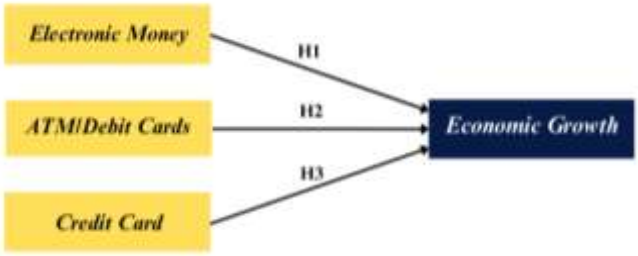

Figure 1. Research Framework

The research model is structured as follows:

1. Electronic Money (E-money):
   Directly influences regional economic growth by enhancing transaction speed, lowering cash-handling costs, and expanding access to formal financial systems, particularly in non-urban areas.
2. ATM/Debit Cards:
   Serves as a widespread non-cash payment instrument that supports financial inclusion and consumption-based growth, especially in regions with developing banking infrastructure.
3. Credit Card:
   Reflects consumer credit usage, yet its impact on regional economic activity may be limited due to low penetration in rural areas and a tendency toward consumptive, rather than productive, expenditure.
4. Regional Economic Growth (GRDP):
   Acts as the dependent variable representing the output of goods and services in each region, influenced by the adoption and volume of digital payment instruments.

The Impact of Electronic Money Usage on Economic Growth

Dianda *et al.*, 2025; Luo *et al.*, 2021; Zhang *et al.*, (2021) found that the use of electronic money has a significantly positive influence on long-term economic growth. Their studies highlight how digital financial innovations particularly electronic money promote transaction efficiency and broaden financial inclusion by reducing barriers to accessing formal financial services.

In line with Economic Growth Theory, technological adoption in financial systems enhances productivity and aggregate output by streamlining transaction processes and stimulating consumption and investment. Electronic money allows faster, low-cost transactions, especially in areas with limited physical banking infrastructure, enabling broader economic participation. Thus, regions with greater adoption of electronic money are more likely to experience improved economic performance. Additionally, from the lens of Financial Inclusion Theory, electronic money fosters broader economic participation, especially among previously unbanked populations, by integrating them into the formal financial ecosystem.

H_1: The use of electronic money has a significant positive impact on economic growth

The Effect of Using ATM/Debit Cards on Economic Development

ATM and debit cards are widely used instruments that facilitate secure and traceable financial transactions. Wong *et al.*, (2020) reported a strong positive relationship between debit card usage and economic growth in OECD countries. Similarly Islam *et al.*, (2019),

found that debit card transactions support formalization, increase consumption, and promote financial activity.

According to Economic Growth Theory, efficient financial instruments reduce transaction costs and boost spending, which contributes to overall output. In parallel, Financial Inclusion Theory views debit card usage as a way to expand access to financial services and strengthen participation in the economic system, especially at the local level
H_2: The use of ATM/Debit Cards has a significant positive impact on economic growth

The Effect of Credit Card Use on Economic Establishment

The role of credit cards in economic development is more complex. Yuan *et al.*, (2021) argue that credit card usage does not show a long-term positive effect and may even negatively impact short-term growth. However, other studies such as Akinwande *et al.*, 2024; Ismanda, 2019; Marginingsih & Sari, 2019; Puspitasari *et al.*, (2021) found that when used within a supportive financial environment, credit cards can positively contribute to national and regional economic activity.

In line with Economic Growth Theory, credit card use can increase household consumption and provide additional liquidity, stimulating economic activity. Increased purchasing power through credit facilities leads to increased demand for goods and services, which can stimulate production, investment, and ultimately regional economic growth. While the impact may vary depending on debt management capacity and financial system stability, within a healthy economic structure, credit cards can be a tool that supports economic expansion through consumption channels.
H_3: Credit Card Usage has a significant positive impact on economic growth

3. RESEARCH METHOD

Data

This study employs secondary data and a quantitative approach to examine the impact of non-cash payment systems on regional economic growth. The data were obtained from various official sources, including Statistic Indonesia (BPS) and Bank Indonesia (BI), with an initial total of 984 observations.. A purposive sampling method was applied in selecting the sample. This study applies multiple linear regression analysis using a panel data approach to examine the impact of non-cash payment systems on regional economic growth in Indonesia. The non-cash payment instruments analyzed include electronic money, ATM/debit card transactions, and credit card usage, with Gross Regional Domestic Product (GRDP) serving as the dependent variable. The data analysis was carried out through several stages. First, descriptive statistical analysis was conducted to observe the general characteristics of the data, such as mean, standard deviation, minimum, and maximum values. Second, a correlation analysis was performed to identify initial relationships among variables and to detect potential multicollinearity. Third, the Hausman test was used to determine the most appropriate model between fixed effects and random effects. Based on the test results, the random effect model was selected as the most suitable for this study. All data processing was performed using STATA version 14. In addition, the natural logarithm transformation was applied to all variables to stabilize variance and reduce the risk of heteroscedasticity. The significance levels were tested at 1%, 5%, and 10% to evaluate the strength of influence of each independent variable on the dependent variable.

The variables used in this research include the transaction values of non-cash payment instruments namely electronic money, ATM/debit cards, and credit cards

alongside the Gross Regional Domestic Product (GRDP) of districts and cities. Six administrative areas within the Special Capital Region (DKI Jakarta) were excluded from the sample, as they are reported collectively at the provincial level. Furthermore, of the remaining 508 districts and cities, 16 did not report any credit card transaction data. Due to the unavailability of complete data, these areas were omitted, resulting in a final sample of 492 districts/cities or approximately 95.72% of the total number of regions in Indonesia for a single year of observation. Since the study spans a two-year period (2020–2021), the total number of observations analyzed amounts to 984. The sample was further categorized into five regions: Sumatra, Java, Kalimantan, Sulampua (Sulawesi, Maluku, Papua), and Balinusra (Bali, Nusa Tenggara).

Table 1. Sample Selection Process

Criteria	Total
Total number of districts/cities in Indonesia	514
Reduction of samples based on criteria:	
a. Administrative areas in DKI Jakarta reported only at provincial level	(6)
b. Districts/cities without credit card transaction data	(16)
Total districts/cities included in the sample	492
Research Period	2 years (2020-2021)
Number of sample observations	984

Source: Processed data, (2022)

Empirical Model and Operational Variables

To address the research question and test the hypothesis, the empirical model used in this study is as follows:

$Y = \alpha + \beta1X1 + \beta2X2 + \beta3X3 + \varepsilon$

pdrb = α + β1nombelUE + β2nombelAtm/debet + β3nombelKK + ε……(1)

Where:

α = Constant

β = Regression Coefficient

ε = Standard Error

x = Independent Variable

y = Dependent Variable

For a summary of the operationalization of the variables and the data sources used in this study, refer to Table 2.

Table 2. Operationalization and Data Sources

Name	Operationalization of Variables	Data source
Pdrb	Economic growth is measured using the Gross Regional Domestic Product (GRDP) at Constant Prices (ADHK), which reflects the value added by goods and services based on the prices of a specific base year. This measurement is employed to assess real economic growth from year to year. In this study, the natural logarithm of GRDP ADHK for the year 2010 is used.	Central Statistics Agency (BPS)

Name	Operationalization of Variables	Data source
nombelUE	The value of electronic money is measured using the natural logarithm of the nominal value of electronic money transactions.	Bank of Indonesia (BI)
nombelATM/Debet	The value of ATM/Debit card transactions is measured using the natural logarithm of the nominal value of ATM/Debit card purchases.	Bank of Indonesia (BI)
nombelKK	The value of credit card transactions is measured using the natural logarithm of the nominal value of credit card purchases.	Bank of Indonesia (BI)

Source: Secondary data, Processed by Researchers (2022)

4. RESULTS AND DISCUSSION

Results

A complete description of the descriptive statistics of the variables in this study can be seen in Table 3 below:

Table 3. Descriptive Statistics of Variables

Variables	OBS	Mean	Std. Dev	Min	Max
*PDRBADHK	984	18.839.533	32.380.157	151.000	407.727.000
*NomBelUE	984	276.589	755.532	23	8.981.607
*NomBelATMD~t	984	258.221	1.048.977	259	27.602.949
*NomBelKK	984	147.850	704.844	0,16	11.997.897
Number of Observations = 984					
Explanation of operationalization of variables in table 1					

Source: Secondary Data, STATA-14 output (Processed, 2024)

Table 3 presents the descriptive statistics of all variables used in this study, based on 984 observations from Indonesian districts and cities during the 2020-2021 period. The results indicate significant disparities in both economic growth and the adoption of non-cash payment systems across regions. The Gross Regional Domestic Product at constant prices (PDRBADHK) has an average value of approximately 18.839.533, but with a very large standard deviation of 32.380.157, and a wide range from as low as 151.000 to over 407.727.000. This suggests a pronounced economic gap among regions, where some areas exhibit strong economic performance, while others remain economically underdeveloped. This observation reinforces the relevance of the study's objective, which seeks to examine how digital financial adoption influences local economic growth.

In terms of non-cash payment instruments, the average transaction value of electronic money (NomBelUE) is around 276.589, ATM/debit card transactions (NomBelATMD~t) at 258.221, and credit card transactions (NomBelKK) at 147.850. However, all three variables also show high standard deviations relative to their means. For instance, electronic money transactions reach a maximum of nearly 9 billion, while credit card transactions go up to 12 billion. This high degree of variability suggests that the adoption of cashless payments is highly uneven across districts and cities, indicating that while some regions are actively embracing digital payments, many others remain at a nascent stage.

Notably, credit card usage has the lowest average value but the highest maximum, reflecting its concentration in certain urban areas, likely those with higher income levels and better financial literacy. This finding aligns with the fourth hypothesis (H4), which anticipates that credit card usage may not have a significant impact on overall regional economic growth, particularly in non-urban or low-access areas.

Classical Assumption Test Results

Hausman Test

Table 4. Hausman Test Results

Variables	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
nombelue	0,0410503	0,0485735	-0,0075232	0,0004136
nombelatmd~t	0,0118161	0,0779964	-0,0661802	0,0033143
nombelkk	-0,008599	0,0039469	-0,012546	0,0006558

chi2(3)	=	502.05
Prob > chi2	=	0.0000

Source: Stata 14 output results (2022)

The Hausman test is used to determine which model is more appropriate for panel data analysis: the Fixed Effect Model (FEM) or the Random Effect Model (REM). This test aims to assess whether there are significant differences between the regression coefficients of the two models. If the differences are statistically significant, the Fixed Effect Model is preferred, as it assumes a correlation between the independent variables and individual-specific effects. Conversely, if the differences are not significant, the Random Effect Model is considered more efficient, assuming no such correlation exists.

Based on the results presented in Table 4, the chi-square (χ^2) value is 502,05 with a Prob > chi^2 = 0,0000, indicating a statistically significant difference between the fixed and random models. Therefore, the null hypothesis is rejected, implying that the Fixed Effect Model is more suitable for this study, as it accounts for the individual-specific effects of each region that may influence the relationship between the independent and dependent variables.

Multicollinearity Test

Table 5. Multicollinearity Test Results

Variables	VIF	1/VIF
NomBelUE	4,69	0,213180
NomBelatmD~t	4,66	0,214741
NomBelKK	4,43	0,225670
Mean VIF	4,59	

Source: Stata 14 output results (2022)

The multicollinearity test is used to assess whether a high linear correlation exists among the independent variables in the regression model. The Variance Inflation Factor (VIF) is used as the indicator, where a VIF value below 10 generally indicates no serious multicollinearity. As shown in Table 5, all independent variables have VIF values well below 10: NomBelUE at 4,69, NomBelATMD~t at 4,66, and NomBelKK at 4,43, with a mean VIF of 4,59. These results suggest that multicollinearity is not a concern in this

model. Each variable contributes sufficiently distinct information to the regression, and there is no significant overlap in explaining variations in GRDP.

Heteroscedasticity Test

Table 6. Heteroscedasticity Test Results

chi2(1)	=	0.91
Prob > chi2	=	0.3392

Source: Stata 14 output results (2022)

The heteroskedasticity test is conducted to determine whether the regression model exhibits non-constant variance of the error terms, which can affect the reliability of parameter estimates. In this study, the test result shows a $chi^2(1)$ value of 0.91 with a Prob > chi^2 = 0.3392. Since the p-value is greater than the 0.05 significance level, the null hypothesis is not rejected, indicating no evidence of heteroskedasticity in the model. Therefore, the regression model satisfies the assumption of homoskedasticity, allowing the estimated results to be interpreted with greater confidence.

Variable Correlation Analysis

Table 7. Variable Correlation Analysis Result Test

Variables	PDRBADHK	NomBelUE	NomBelATM/Debet	NomBelKK
PDRBADHK	1,0000			
NomBelUE	0,8421*** 0,0000	1,0000		
NomATM/Debet	0,7983*** 0,0000	0,8563*** 0,0000	1,0000	
NomBelKK	0,7552*** 0,0000	0,8484*** 0,0000	0,8472*** 0,0000	1,0000

Number of Observations = 984
Explanation of the operationalization of variables in table 1
*** = P-Value Significant 1%

Source: Secondary data, STATA-14 output (Processed, 2022)

Table 7 presents the results of the correlation analysis among the main variables used in the study. All relationships are positive and statistically significant at the 1% level, as indicated by the triple asterisks (***). These results offer initial evidence of a strong association between non-cash payment adoption and regional economic growth.

The dependent variable, PDRBADHK (Gross Regional Domestic Product at constant prices), shows the strongest correlation with electronic money transactions (NomBelUE), at 0,8421, followed by ATM/debit card transactions (0,7983) and credit card transactions (0,7552). This suggests that electronic money usage is more strongly associated with regional economic performance compared to other non-cash instruments. This finding supports Hypothesis 2 (H2), which proposes that electronic money has a significant influence on regional economic growth. Additionally, the high correlations among the non-cash payment instruments for example, between NomBelUE and NomBelKK (0,8484), and between NomBelATM/Debet and NomBelKK (0,8472) indicate that regions actively using one type of digital payment tend to also use others extensively. Despite these strong

associations, the earlier multicollinearity test confirms that the relationships do not pose a threat to the reliability of the regression estimates.

Overall, the correlation results reinforce the study's theoretical premise that the adoption of non-cash payment systems is closely linked to improvements in regional economic output. The particularly strong association between electronic money and GRDP aligns with previous descriptive findings and highlights the potential of electronic payments as a key driver of local economic growth. These insights further underscore the importance of targeted digital financial policies and infrastructure development to ensure inclusive and region-specific adoption of high-impact instruments.

Hypothesis Testing

Hypothesis testing in this study uses the Random Effect method with the STATA-14 software program. The test results can be seen in table 8 below:

Table 8. Hypothesis Testing Results

Variables	Expected sign	PDRBADHK
_CONS		28,74009 0,000
NomBelUE	+	0,04105*** 0,000
NomBelatmDebit	+	0,0118*** 0,070
NomBelKK	-	0,0085*** 0,374
Prob > F		0,0000
R-squared		0,7087***

Source: Secondary data, STATA-14 output (Processed, 2022)

The hypothesis testing in this study was conducted using the Fixed Effect Model, selected based on the Hausman test results. The analysis, processed using STATA version 14, aims to evaluate the effect of various non-cash payment instruments on regional economic growth (GRDP) across Indonesian districts and cities.

As shown in Table 8, electronic money transactions (NomBelUE) have a positive and statistically significant effect on GRDP, with a coefficient of 0.04105 and a p-value of 0.000. This strongly supports Hypothesis 2 (H2) and indicates that regions with higher adoption of electronic money tend to experience better economic performance. This result reinforces the role of electronic money in enhancing financial inclusion and transaction efficiency at the regional level.

ATM/debit card transactions (NomBelATM/Debet) also show a positive relationship, with a coefficient of 0.0118 and a p-value of 0.070. While this is only marginally significant at the 10% level, it still offers partial support for Hypothesis 3 (H3), suggesting that ATM/debit usage remains relevant in driving economic activity, especially in areas where it serves as the primary digital transaction tool.

In contrast, credit card transactions (NomBelKK) show a negative and statistically insignificant effect, with a coefficient of -0.0085 and a p-value of 0.374. This fails to support Hypothesis 4 (H4) and implies that credit card usage does not contribute significantly to regional economic growth. This outcome is consistent with earlier

descriptive findings, indicating that credit card adoption is limited and tends to be concentrated in a few urban centers.

The model achieves an R-squared value of 0.7087, indicating that approximately 70.87% of the variation in GRDP can be explained by the non-cash payment variables in the model. The Prob > F value of 0.0000 confirms that the regression model is statistically significant overall.

In summary, the results confirm that electronic money plays a significant and consistent role in supporting regional economic growth, while ATM/debit card usage has a modest but positive impact, and credit card transactions remain insignificant at the national scale. These findings suggest that policymakers should focus on promoting more accessible digital payment instruments like electronic money to support inclusive and regionally balanced economic development.

Summary of Hypothesis Testing Results

Table 9. Summary of Hypothesis Testing Results

Hypothesis	Statement	Coefficient	P-Value	Result	Conclusion
H1	**Electronic money** transactions positively affect regional economic growth	0,04105	0,00	**Accepted**	The use of electronic money has a significant positive impact on economic growth, Supported by Luo & Zhou, (2021); Dianda *et al.*, (2025) and (Zhang *et al.*, 2021).
H2	**ATM/debit card** transactions positively affect regional economic growth	0,0118	0,07	**Partially Accepted**	The use of ATM/Debit Cards has a significant positive impact on economic growth, Supported by Wong *et al.*, (2020) and (Islam *et al.*, 2019).
H3	**Credit card** transactions positively affect regional economic growth	-0,0085	0,374	**Rejected**	Credit Card Usage has a significant positive impact on economic growth, Supported by Yuan *et al.*, (2021); Madden *et al.*, (2017) and (Jung & Kang, 2021).

Source: Secondary data, STATA-14 output (Processed, 2022)

The hypothesis testing results indicate that among the three non-cash payment instruments examined, two electronic money and ATM/debit cards have a positive and statistically significant impact on regional economic growth. In contrast, credit card usage does not show a significant effect. These findings directly address the research objective, which aimed to assess the contribution of various digital payment tools to regional economic performance in Indonesia. Furthermore, they confirm most of the initial hypotheses and demonstrate that the effectiveness of digital payment instruments varies in practice, especially across different regional contexts.

First, the finding that electronic money usage has a significant positive effect on regional economic growth fully supports Hypothesis H1. This is consistent with previous studies by Dianda *et al.*, 2025; Luo *et al.*, 2021; Zhang *et al.*, (2021), which emphasize the role of e-money in promoting transaction efficiency and expanding financial access. Similarly, international studies such as Furqan *et al.*, 2023; Indriyani *et al.*, 2024; Wong *et al.*, (2020) also report similar positive relationships in OECD countries and developing economies. The result aligns with Economic Growth Theory, particularly the modern perspective, which highlights the role of innovation and efficiency in increasing output. Electronic money accelerates the circulation of money, reduces transaction costs, and facilitates financial access, especially in non-urban areas where traditional banking services are limited. This also supports the principles of Financial Inclusion Theory, demonstrating that digital financial tools can help integrate underserved populations into the formal economic system.

Second, the positive and significant effect of ATM/debit card usage on economic growth confirms Hypothesis H2 and is in line with the findings of (Islam *et al.*, 2019; Wong *et al.*, 2020). As widely used and institutionally supported instruments, ATM/debit cards play a central role in enabling secure and efficient transactions across Indonesia's diverse regions. This is in line with research by Fauzi *et al.*, 2023; Safitri & Ariza, (2021) states that debit cards are more inclusive because they do not require credit evaluation and are widely available among savings account users. From the perspective of Economic Growth Theory, such instruments support increased consumption and smoother financial flows, which stimulate local economic output. In line with Financial Inclusion Theory, ATM/debit cards are accessible to a broad population and thus contribute meaningfully to expanding participation in the formal economy.

Third, the finding that credit card usage does not significantly affect regional economic growth does not support Hypothesis H3. Although some studies such as those by Akinwande *et al.*, 2024; Ismanda, 2019; Marginingsih & Sari, 2019; Puspitasari *et al.*, (2021) suggest that credit card usage can positively impact economic activity, this study indicates otherwise in the Indonesian context. The results are more aligned with findings by Jung & Kang, 2021; Madden *et al.*, 2017; (Yuan *et al.*, 2021), which suggest that credit cards do not provide long-term benefits and may even have negative short-term effects, particularly in regions with low credit literacy or limited financial infrastructure. Theoretically, low credit card penetration in the regions is due to limited infrastructure, strict access requirements, and low credit literacy. While credit cards can theoretically boost consumption through additional liquidity, this effect is uneven and can increase household debt risk. On the other hand, more inclusive alternative instruments such as QRIS and e-wallets are now more widely used by the general public, replacing credit cards in driving digital economic activity

Overall, the findings directly respond to the research objective of evaluating how different non-cash payment instruments contribute to regional economic growth in Indonesia. They reinforce the theoretical framework by showing that digital financial tools, when appropriately adopted, can support both economic expansion and financial inclusion.

From a policy perspective, this study highlights the need for regionally tailored approaches to digital financial development. Local governments and financial regulators should prioritize the promotion of instruments that match the economic and social characteristics of each area, supported by digital infrastructure expansion and targeted financial literacy programs.

Ultimately, this study presents coherent evidence that not all digital payment systems deliver the same economic benefits. It provides theoretical support for applying Economic Growth Theory and Financial Inclusion Theory in understanding how digitalization shapes economic development at the regional level, and offers practical guidance for advancing more inclusive, balanced, and sustainable financial ecosystems in developing economies.

Additional Testing

This additional testing was conducted to analyze the influence of non-cash payment systems on regional economic growth in Indonesia by dividing it into 5 regions according to the division of Bank Indonesia's work areas, namely Sumatra, Java, Kalimantan, Balinusra and Sulampua.

The Sumatra region consists of 154 districts/cities in the Sumatra island region. Because the sample used was 2 years of observation, the total sample in the Sumatra region was 308 observations. Table 10 below presents the results of supplementary testing conducted in the Sumatra region.

Table 10. Sumatra Region Test Results

	Expected sign	PDRBADHK
_CONS		16,57344 0,000
NomBelUE	+	0,393*** 0,000
NomBelatmDebit	-	0,0944649 0,061
NomBelKK	-	0,056243 0,075
Prob > F		0,0000
R-squared		0,5329***
Obs		308
Variable Y = PDRBADHK *** = P Value Significant 1%		

Source: Secondary data, STATA-14 output (Processed, 2022)

The analysis conducted for the Sumatra region reveals that the non-cash payment system plays a significant role in driving regional economic growth, as reflected by an R-square value of 0,5329 at the 1% significance level. This indicates that increases in non-cash transaction values are associated with improved economic performance in the region. Moreover, Table 10 shows that 53,29% of the variation in economic growth in Sumatra can be attributed to the non-cash payment system. Among the observed variables, electronic money demonstrates a positive and statistically significant effect on economic growth at the 1% level. This suggests that higher consumer spending through electronic money transactions contributes to the region's economic expansion. Conversely, the ATM/debit card and credit card variables do not exhibit a significant influence on economic growth, indicating that these forms of payment do not substantially affect economic activity in the Sumatra region.

Next, testing for the Java region consisting of 113 regencies and cities in the Java island region. Because the sample used was 2 years of observation, the total sample in the

Java region was 226 observations. The results of additional testing in the Java region are presented in Table 11 below.

Table 11. Java Region Test Results

	Expected sign	PDRBADHK
_CONS		11,70851 0,000
NomBelUE	+	0,6529*** 0,000
NomBelatmDebit	-	0,088511 0,227
NomBelKK	-	-0,0263816 0,528
Prob > F		0,0000
R-squared		0,6230***
Obs		226

Variable Y = PDRBADHK
*** = P Value Significant 1%

Source: Secondary data, STATA-14 output (Processed, 2022)

The test results indicate that the non-cash payment system positively influences regional economic growth in the Java region, with an R-square value of 0,6230 at the 1% significance level. This suggests that an increase in non-cash transaction values contributes to stronger economic growth in Java. Additionally, as presented in Table 11, the model's R-square is 64,30%, meaning that around 64,30% of the variation in economic growth in the region can be explained by the non-cash payment system. Among the individual components, the electronic money variable has a significantly positive effect on economic growth at the 1% level. This finding implies that greater consumer spending through electronic money payments tends to promote economic growth in Java. On the other hand, ATM/debit card and credit card variables do not show a significant impact on economic growth in the region. These results are consistent with those observed in the Sumatra region, where economic growth is also not significantly affected by the use of ATM/debit cards or credit cards for transactions.

Next, testing for the Kalimantan region consisting of 55 regencies and cities in the Kalimantan island region. Because the sample used was 2 years of observation, the total sample in the Kalimantan region was 110 observations. The results of additional testing in the Kalimantan region can be seen below:

Table 12. Kalimantan Region Test Results

	Expected sign	PDRBADHK
_CONS		19,85163 0,000
NomBelUE	-	0,0169185 0,872
NomBelatmDebit	+	0,3316*** 0,002
NomBelKK	-	0,0667586 0,439
Prob > F		0,0000
R-squared		0,5504***
Obs		110

Source: Secondary data, STATA-14 output (Processed, 2022)

Based on the test results, the non-cash payment system has a positive effect on regional economic growth in the Kalimantan region, with an R-square value of 0,5504 at the 1% significance level. Among the variables, only the ATM/debit card shows a significant influence on economic growth. The transaction value of ATM/debit card payments has a positive and statistically significant effect on economic growth in Kalimantan at the 1% level. This suggests that higher household consumption using ATM/debit cards as a payment method contributes to increased economic growth in the region. In contrast, electronic money and credit card variables do not have a significant impact on economic growth in Kalimantan. Specifically, credit cards show no effect on economic growth in Kalimantan, consistent with findings in the other four regions.

Next, testing for the Sulampua region (Sulawesi, Maluku and Papua) consisting of 131 regencies and cities in the Sulampua region. Based on the research sample data used 2 years of observation, the total sample in the Sulampua region is 262 observations. "The findings from supplementary tests conducted in the Kalimantan region are presented in Table 13 as follows.

Table 13. Sulampua Area Test Results

	Expected sign	PDRBADHK
_CONS		17,53524 0,000
NomBelUE	+	,2846*** 0,000
NomBelatmDebit	+	,2067*** 0,000
NomBelKK	-	,0055949 0,454
Prob > F		0,0000
R-squared		0,6985***
Obs		262
Variable Y = PDRBADHK *** = P Value Significant 1%		

Source: Secondary data, STATA-14 output (Processed, 2022)

The test results show a positive influence of the non-cash payment system on regional economic growth in the Sulampua region, with an R-square value of 0,6985 at the 1% significance level. This indicates that 69,85% of the variation in economic growth in Sulampua can be explained by the use of non-cash payments. Specifically, both electronic money and ATM/debit card variables have a significant positive effect at the 1% level, suggesting that increased consumer spending using these payment methods contributes to higher economic growth in the region. In contrast, credit card usage has no impact on economic growth in Sulampua, consistent with the findings in the other four regions where credit cards do not influence regional economic performance.

Next, testing for the Balinusra region (Bali Nusa Tenggara) which consists of 39 regencies and cities in the Balinusra region. Based on the research sample data used 2 years of observation, the total sample in the Balinusra region is 78 observations. The additional test results for the Balinusra region are presented in Table 14 below.

Table 14. Balinusra Area Test Results

	Expected sign	PDRBADHK
_CONS		16,33311 0,000
NomBelUE	+	,4131*** 0,000
NomBelatmDebit	-	,0890597 0,198
NomBelKK	-	,0396308 0,329
Prob > F		0,0000
R-squared		0,8310***
Obs		78
Variable Y = PDRBADHK *** = P Value Significant 1%		

Source: Secondary data, STATA-14 output (Processed, 2022)

The test results indicate a positive impact of the non-cash payment system on regional economic growth in the Balinusra region, with an R-square value of 0,8310 at a 1% significance level. This suggests that an increase in non-cash transaction value contributes to higher economic growth in the region. As shown in Table 14, 83,10% of the variation in Balinusra's economic growth can be explained by non-cash payment usage. Among the variables, electronic money has a significant positive effect at the 1% level, indicating that greater use of e-money for consumption drives economic growth in the region. In contrast, ATM/debit cards and credit cards have no significant effect similar to the findings in the Sumatra and Java regions. Notably, across all five regions, credit card usage does not influence economic growth.

Based on the results of the additional tests, it can be concluded that economic growth in these five regions is predominantly influenced by the use of electronic money within the non-cash payment system. Specifically, economic growth in the regions of Sumatra, Java, Sulampua, and Balinusra is driven by electronic money usage, while in the Kalimantan region, it is influenced by the use of ATM/debit cards. Furthermore, only the Sulampua region shows economic growth influenced by more than one type of non-cash payment, namely electronic money and ATM/debit cards. The credit card variable shows no influence on economic growth in any of the five regions.

5. CONCLUSION

This study examined the impact of non-cash payment instruments on regional economic growth in Indonesia using panel data from 984 observations at the district and city levels for the period 2020-2021. The findings reveal that electronic money and ATM/debit card usage have a positive and significant effect on regional economic growth, while credit card usage does not show a significant impact. These results address an existing research gap by providing empirical evidence at the subnational level, an area often overlooked in previous studies that predominantly focused on national or urban contexts. The study also strengthens the theoretical relevance of Economic Growth Theory and Financial Inclusion Theory by demonstrating how digital financial systems contribute to local economic performance. Additional regional testing also highlights the heterogeneity of the impact of non-cash payment instruments. Electronic money usage

significantly boosted economic growth in Sumatra, Java, Sulawesi, and Balinusra, while ATM/debit cards proved more influential in Kalimantan. These findings highlight the importance of regionally tailored policy approaches.

By highlighting variation in the effectiveness of different digital payment instruments, this study shows that not all tools contribute equally to economic growth. Electronic money and debit cards appear to be more accessible and better aligned with the financial behaviors of populations in non-urban regions, making them more effective in stimulating inclusive and traceable economic activity.

Despite its contributions, this study has several limitations. First, the two-year observation period (2020-2021) restricts the analysis of long-term trends and structural changes in the adoption of digital payments. Second, the study only includes three types of non-cash instruments (electronic money, ATM/debit cards, and credit cards), excluding emerging platforms such as mobile wallets and QRIS-based systems. Additionally, the exclusion of several regions due to incomplete data may limit the generalizability of the findings across all of Indonesia's districts and cities.

Based on the findings, several practical recommendations are proposed. Local governments should focus on expanding digital infrastructure and ensuring affordable, reliable access to financial services, particularly in areas with low digital and financial literacy. Financial regulators, including Bank Indonesia, are encouraged to strengthen localized digital literacy campaigns and support broader adoption of inclusive instruments such as app-based e-money. The banking sector should also innovate in developing payment solutions tailored to regional economic characteristics, while prioritizing user education and system security.

At a broader policy level, this study emphasizes the importance of region-based strategies in designing financial digitalization policies. Theoretically, it extends the application of Economic Growth Theory and Financial Inclusion Theory in the context of digital transformation in emerging economies. Future research should explore how institutional readiness, cultural factors, and technological infrastructure shape the success of digital finance in promoting regional financial inclusion and balanced economic development.

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