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The Use of Digital Payment Instruments in The Context of Financial Digitalization for Indonesia's Economic Growth in 2021-2024

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Abstract

The utilization of electronic money instruments as a means of payment has shown a significant upward trend in recent years. Nevertheless, this increase has not been accompanied by corresponding growth in Indonesia's economy, which has remained relatively stagnant and sluggish. This study aims to examine the effect of electronic payment transaction values on Indonesia's economic growth during the period 2021–2024. The analysis employs panel data regression using the Fixed Effect Model (FEM), processed through EViews 12 software. The variables used in this study include Gross Regional Domestic Product (GRDP) per capita as the dependent variable, while the independent variables consist of the transaction values of electronic money, ATM (debit) cards, and credit cards. The findings indicate that the transaction values of electronic money and credit cards have a positive and statistically significant effect on GRDP per capita. In contrast, the transaction value of ATM (debit) cards and Consumer Price Index shows a negative but statistically insignificant effect. Collectively, the transaction values of electronic money, ATM (debit) cards, and credit cards exert a positive and significant influence on GRDP per capita.

***Keyword**: ATM (debit) cards, Consumer Price Index, Credit cards, Economic growth, Electronic money, Panel data*

INTRODUCTION

Over the past decade, advancements in information technology have fundamentally transformed payment sustems across the globe, including in Indonesia. This transformation is marked by a gradual shift in public preference from cash and paper-based payment instruments toward digital payment instruments such as electronic money, debit cards, and credit cards. The advantages of speed, convenience, and security offered by these instruments have significantly driven their widespread adoption. In line with this transformation, Bank Indonesia has implemented the *Quick Response Code Indonesian Standart*(QRIS) and the *Blueprint for the Indonesian Payment System* (BSPI) 2025, both of which aim to accelerate the integration of the digital financial ecosystem to support national economic growth.

Empirical evidence from 2021 to 2024 indicates a substantial increase in the value of digital payment transactions. The value of digital payment instruments transactions grew by 96,85%. This phenomenon reflects not only the expansion of financial inclusion but also the deep penetration of digital payment technologies into various segments of the economy, encompassing both household consumption and business activites.

Nevertheless, the rapid acceleration of digital payment adoption has not been matched by proportional improvements in economic growth. Indonesia's regional gross domestic product (GRDP) per capita grew at a relatively stable rate of around 5% annually during the same period, with only limited variation across provinces. This discrepancy raises a fundamental question regarding the extent to which the expansion of digital payment systems contributes to regional economic performance.

Previous studies examining the relationship between digital payment instruments and economic growth have produced mixed results. Some have reported significant positive effects of electronic money and credit card transactions on economic growth, while others have found negative or statistically insignificant effects for certain instruments, such as debit cards. These divergent findings can be attributed to differences in research periods, data aggregation levels (national versus regional), and analytical methodologies. Moreover, variables such as the Consumer Price Index (CPI) and the technological distinction between chip-based and

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server-based electronic money have rarely been examined simultaneously within a unified analytical framework.

This study seeks to address these research gaps by analyzing the influence of electronic money transaction values, debit card transaction values, credit card transaction values, CPI, and chip-based electronic money usage on regional economic growth in Indonesia during the 2021–2024 period. The analysis employs panel data covering 33 provinces and applies the *Fixed Effect Model* (FEM) to capture regional heterogeneity and provide robust estimates. The findings of this research are expected to contribute in two ways. Theoretically, they enrich the literature on the nexus between financial digitalization and economic growth by incorporating the most recent regional-level data. Practically, they offer evidence-based recommendations for policymakers, financial institutions, and digital payment service providers to design strategies that optimize the role of digital payment systems in fostering inclusive and sustainable economic growth.

LITERATURE REVIEW

Money Quantity Theory by Irving Fisher

The relationship between money, payment systems, and economic growth has long been recognized in economic theory. A key theoretical foundation for this study is the Quantity Theory of Money, as formulated by (Fisher, 1911) in *The Purchasing Power of Money*. Fisher's framework establishes a direct relationship between the quantity of money in circulation and the aggregate output of the economy, mediated by the velocity of money. According to his exchange equation, $M \times V = P \times T$, where M denotes the money supply, V the velocity of circulation, P the general price level, and T the volume of transactions. Under the assumption of a constant velocity in the short run, changes in the money supply are expected to be proportional to changes in nominal output. In this context, digital payment transactions can be viewed as part of the demand for money in its electronic form, influencing aggregate output through their impact on transaction efficiency and velocity.

Long Growth Economic

Economic growth, particularly in the long run, is closely linked to sustained improvements in productivity and per capita output. As highlighted by Case et al. (2020), increases in output per worker are central to long-term growth, and indicators such as real gross domestic product (GDP) or gross regional domestic product (GRDP) per capita provide a meaningful measure of changes in living standards. In the context of digital finance, the modernization of payment systems is argued to contribute to growth by reducing transaction costs, expanding financial inclusion, and facilitating greater market participation.

Previous Research

Empirical evidence on the impact of digital payments on economic growth has been mixed. Some studies, such as HastinaFebrianty (2021) and Zulfa et al. (2023), found that electronic money and credit card transactions exert a significant positive influence on economic growth, while debit card transactions may have a weaker or even negative effect. Conversely, Mahesa (2021) reported significant positive effects of debit card transactions in both the short and long term, but no significant effect from credit card usage. Other works, such as Wasiaturrahma&Kurniasari (2021), observed that electronic money had a positive but statistically insignificant relationship with economic growth, while instruments like the *Bank Indonesia Real Time Gross Settlement* (BI-RTGS) system played a more substantial role. These variations are often attributable to differences in research periods, aggregation levels (national vs. regional), and methodological approaches, including time-series models, panel regressions, and vector error correction models.

Against this backdrop, the present study contributes to the literature by adopting a comprehensive analytical framework that examines multiple digital payment instruments—electronic money, debit cards, and credit cards—alongside CPI and chip-based technology in a unified model. By employing provincial-level panel data for the period 2021–2024 and utilizing the Fixed Effect Model (FEM), this research offers a regionally disaggregated perspective that extends beyond the predominantly aggregate-level analyses in prior studies.

Conceptual Framework

The theoretical foundation of this study is rooted in Irving Fisher's Quantity Theory of Money, which posits that the quantity of money in circulation, when multiplied by its velocity, determines nominal economic output. In the context of a digital economy, the volume and value of digital payment transactions can be interpreted as a proxy for the demand for money in its electronic form. Higher transaction values are expected to increase the velocity of money, reduce transaction frictions, and stimulate aggregate economic activity.

From this perspective, electronic payment instruments, such as electronic money, debit cards, and credit cards are hypothesized to have a direct and positive effect on economic growth by facilitating faster, safer, and more efficient exchanges of goods and services. The Consumer Price Index (CPI) is included as a macroeconomic control variable, given its role as a measure of inflation that can influence real purchasing power and aggregate demand. Additionally, the technological attribute of electronic money, specifically the distinction between chip-based and server-based systems, is considered to capture differences in transaction security and user adoption patterns.

The framework considers five key variables: transaction values of electronic money, debit cards, and credit cards; the Consumer Price Index (CPI) as an indicator of inflation; and a dummy variable distinguishing chip-based from server-based electronic money. Regional economic growth, represented by GRDP per capita, is modeled as a function of these variables:

GRDP per capita = f (E-money, Debit Card, Credit Card, CPI, Chip-Based Dummy)

In this formulation:

E-Money Transactions: represent digital financial transactions conducted using stored-value instruments,

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expected to have a positive effect on economic growth through enhanced transaction efficiency and accessibility.

Debit Card Transactions: capture direct account-based payments, which may contribute to economic growth depending on their level of adoption and usage patterns.

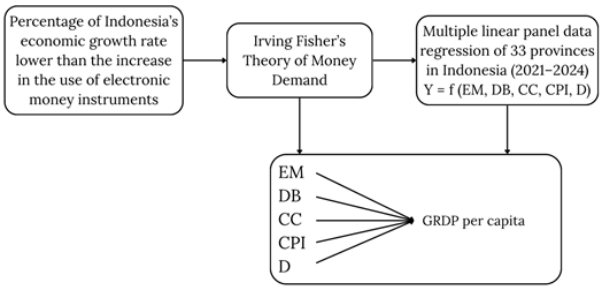
Credit Card Transactions: reflect deferred payment mechanisms that can stimulate consumption and investment but may also be influenced by credit constraints.

Consumer Price Index (CPI): acts as a proxy for inflation, influencing the real value of consumption and investment.

Chip-Based Technology Dummy: differentiates between chip-based and server-based electronic money systems, potentially affecting transaction security and user confidence.

This conceptual framework posits that by enhancing the velocity and efficiency of money circulation, digital payment instruments contribute to higher regional economic output, provided that inflation remains within a manageable range and technological infrastructure supports secure and widespread usage. The empirical analysis will test these relationships using panel data for 33 Indonesian provinces over the period 2021–2024, employing the Fixed Effect Model (FEM) to account for regional heterogeneity.

Figure 1.Framework.



Hypothesis

Based on the theoretical foundations and empirical findings reviewed, this study formulates the following hypotheses:

H1: Electronic money transaction values have a positive and significant effect on regional economic growth in Indonesia.

H2: Debit card transaction values have a positive and significant effect on regional economic growth in Indonesia.

H3: Credit card transaction values have a positive and significant effect on regional economic growth in Indonesia.

H4: The Consumer Price Index (CPI) has a significant effect on regional economic growth in Indonesia.

H5: The use of chip-based electronic money has a significant effect on regional economic growth in Indonesia.

These hypothesis reflect the expectation that higher adoption of digital payment instruments enhances economic performance, while inflation and technological attributes may influence the magnitude and direction of these effects.

METHODOLOGY

This study employs a quantitative research design to examine the impact of digital payment instruments on regional economic growth in Indonesia. The analysis covers 33 provinces over the period 2021–2024, utilizing secondary data obtained from official publications of Bank Indonesia (BI) and the Central Statistics Agency (BPS).

Variables

The dependent variable is regional economic growth, proxied by Gross Regional Domestic Product (GRDP) per capita at constant prices. The independent variables include: (1) the value of electronic money transactions; (2) the value of debit card transactions; (3) the value of credit card transactions; (4) the Consumer Price Index (CPI) as a measure of inflation; and (5) a dummy variable representing chip-based versus server-based electronic money.

Model Specification

The study applies a panel data regression model to capture both cross-sectional and time-series variations. Following preliminary tests (Chow, Hausman, and Breusch-Pagan Lagrange Multiplier), the Fixed Effect Model (FEM) is selected as the most appropriate specification (Gujarati, 2015). The general form of the model is:

$$GRDP_{it} = \alpha_i + \beta_1 Em_{it} + \beta_2 DB_{it} + \beta_3 CC_{it} + \beta_4 CPI_{it} + \beta_5 Dummy_{it} + \varepsilon_{it}$$

Where i denotes the province, t the year, α_i the individual specific effect, and ε_{it} the error term.

Estimation Procedure

The analysis proceeds in several stages. First, descriptive statistics are computed to provide an overview of variable distributions and trends over time. Second, panel data specification tests are conducted to determine the most suitable estimation model. The Chow test compares the FEM against the pooled OLS model, while the Hausman test distinguishes between fixed and random effects specifications. The Breusch–Pagan Lagrange Multiplier test assesses the appropriateness of random effects relative to pooled OLS.

Once the FEM is confirmed as the optimal specification, classical assumption diagnostics are performed. These include multicollinearity testing using the variance inflation factor (VIF), heteroskedasticity testing via the White test, and autocorrelation detection using the Durbin–Watson statistic and Breusch–Godfrey test. The statistical significance of the model is evaluated through the F-test for joint significance and the t-test for individual parameter significance, with a significance threshold of 5%. The coefficient of determination (R^2) is reported to indicate the explanatory power of the model.

Justification of Method

The choice of the FEM is motivated by the expectation that unobserved, time-invariant characteristics such as local infrastructure quality, financial literacy, and institutional efficiency affect both digital payment adoption and economic performance at the provincial level. By controlling for these

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fixed effects, the FEM provides unbiased and consistent parameter estimates, ensuring that the measured relationships reflect within-province variations over time rather than cross-sectional differences alone (Gujarati, 2015).

Through this methodological approach, the study aims to generate robust empirical evidence on the role of digital payment instruments in driving regional economic growth, while accounting for inflationary factors and technological variations in electronic money systems.

RESULT AND DISCUSSION

This section presents the findings of the empirical analysis, including descriptive statistics, diagnostic tests, and regression results, followed by an in-depth discussion relating the outcomes to the theoretical framework and previous studies. The analysis uses panel data from 33 Indonesian provinces covering the period 2021–2024, with GRDP per capita as the dependent variable and three main categories of digital payment transactions, ATM/Debit cards, Credit cards, and Electronic money alongside the Consumer Price Index (CPI) as independent variables and Chip Based Technology as dummy variable.

Model Selection Test

The selection of the appropriate panel data estimation method is crucial to obtaining unbiased and efficient parameter estimates. Two primary specification tests were conducted: the **Chow Test** and the **Hausman Test**.

Table 1. Model Selection Test

Model Testing	P-Value
Chow Test	0.0000
Hausman Test	0.0230

Chow Test results indicated a probability value of 0.0000 (< 0.05), suggesting that the Pooled Least Squares (Common Effect Model) is not suitable, and that individual effects should be incorporated. Consequently, either the Fixed Effect Model (FEM) or the Random Effect Model (REM) is preferred.

Hausman Test results produced a probability value of 0.0230 (< 0.05), leading to the rejection of the REM in favor of the FEM. This finding confirms that the unobserved provincial effects are correlated with the explanatory variables, thereby justifying the use of the Fixed Effect Model.

Fixed Effect Model Estimation Results

Table 2. Fixed Effect Model Estimation

Variable	Coefficient (β)	t-Statistic	P-Value
Constant (C)	10.70219	6.110592	0.0000**
Electronic Money (X1)	0.127998	3.836736	0.0002**
Debit Card (X2)	-0.039713	-1.560408	0.1220
Credit Card (X3)	0.084369	3.333347	0.0012**
Consumer Price Index (X4)	-0.232878	-1.370741	0.1737
Chip Based (D)	-0.041070	-2.567693	0.0118**

**Significance 5%

With a t-table value of 1.97838, variables whose absolute t-statistic exceeds the threshold are **Electronic Money (EM)** (3.836736), **Credit Card (CC)** (3.333347), **Dummy (Chip-Based)** (2.567693), and the **Constant** (6.110592). These variables are therefore statistically significant. Based on **p-values (< 0.05)**, the significant variables are **EM** (0.0002), **CC** (0.0012), **Dummy** (0.0118), and **Constant** (0.0000).

In terms of coefficient signs:

- **Positive coefficients** are found for **EM** (+0.127998), and **CC** (+0.084369), indicating that an increase in these variables is associated with higher GRDP per capita.
- **Negative coefficients** are found for **DB** (–0.039713), **CPI** (-0.232878) and **Dummy** (–0.041070), implying that an increase in these variables tends to reduce GRDP per capita, though the effects are statistically insignificant.

These results indicate that **Electronic Money** and **Credit Card** are the dominant factors with a significant positive influence on regional economic growth during the observation period, while Debit Card, Credit Card, and Consumer Price Index variables do not show significant contributions at the 5% significance level.

Classical Assumption Diagnostics

Prior to interpreting the regression estimates, diagnostic tests were performed to ensure that the FEM meets classical econometric assumptions:

- **Multicollinearity Test (VIF)**: All Centered VIF values < 10 → no multicollinearity detected.

Table 3.Multicollinearity VIF Test

Variable	Centered VIF
C	NA
EM	2.400744
DB	1.368663
CC	2.419696
CPI	1.562558
DUMMY	2.208349

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- **Heteroskedasticity Test (White)**: p-chi square value is 0.2125 > 0.05 → no heteroskedasticity present.

Table 4.Heteroskedasticity White Test

Prob. F(13,118)	0.2130
Prob. Chi-Square(13)	0.2125

- **Autocorrelation Test (Breusch Godfrey)**: chi-square values is 0.7135 > 0.05 → no autocorrelation issues.

Table 5. Autocorrelation BG Test

Prob. F(2,124)	0.7259
Prob. Chi-Square(2)	0.7135

These results collectively indicate that the FEM satisfies the Gauss-Markov assumptions, ensuring that the estimators are Best Linear Unbiased Estimators (BLUE).

Hypothesis Testing

a. **t-Test (Partial Significance)**
Electronic Money has a positive and significant effect on GRDP per capita at the 5% level ($p < 0.05$) with t-Statistic value (3.836736) > t-table value (1.97838).
Debit Card has a negative but insignificant effect with t-Statistic value (1.560408) < t-table value (1.97838).
Credit Card has a positive and significant effect on GRDP per capita at the 5% level ($p < 0.05$) with t-Statistic value (3.333347) > t-table value (1.97838).
Consumer Price Index has a negative and insignificant effect ($p > 0.05$) and t-Statistic value (1.370741) < t-table value (1.97838).
Dummy has a negative and significant on GRDP per capita at the 5% level ($p < 0.05$) with t-Statistic value (2.567693) > t-table value (1.97838).

b. **F-Test (Simultaneous Significance)**
The F-statistic value of 731.1658 with $p < 0.05$ indicates that all independent variables jointly have a statistically significant influence on GRDP per capita.

c. **Coefficient of Determination (R^2)**
The Adjusted R^2 value of 0.994896 suggests that 99.49% of the variation in GRDP per capita is explained by the model's independent variables, leaving only 0.51% attributable to other factors not included in the analysis.

Discussion of Variable Influence

Electronic Money on Economic Growth
The strong and significant positive coefficient (β = 0.127998) highlights electronic money as a critical driver of economic growth. Its efficiency, accessibility, and compatibility with QRIS and mobile banking platforms likely accelerated regional economic activity. This finding corroborates prior studies such as Cahyani&Khoirudin (2023), which emphasized e-money's role in enhancing transaction speed, reducing costs, and broadening market participation.

Debit Card on Economic Growth
The negative, though insignificant, effect (β = -0.039713) suggests a substitution effect where debit card transactions are being replaced by more versatile digital payment tools. Ismanda (2019) similarly found a declining role of debit cards in stimulating economic activity, potentially due to their limited suitability for microtransactions.

Credit Card on Economic Growth
While credit card transactions exhibit a positive coefficient (β = 0.084369), the relationship is statistically significant. This result may be due to the benefits obtained from using a credit card are different from other digital payment instruments, which makes users interested.

Consumer Price Index on Economic Growth
The coefficient for IHK is negative but insignificant (β = -0.232878), indicating that inflationary pressures, as reflected in CPI, do not have a statistically significant short-term effect on GRDP per capita during the study period.

Dummy Variable on Economic Growth
The negative and significant coefficient (β = -0.041070) demonstrates that the implementation of the chip-based card technology negatively contributed to GRDP per capita. This may be linked to transformation of technology on digital payment which started used server-based technology.

CONCLUSION, POLICY IMPLICATIONS, AND SUGGESTION

Conclusion
This study empirically examined the impact of various non-cash payment instruments namely Debit Card transactions (DB), Credit Card transactions (CC), Electronic Money transactions (EM), the Consumer Price Index (CPI), and the implementation of the Chip-Based Technology (Dummy) on regional economic growth as measured by Gross Regional Domestic Product (GRDP) per capita in 33 Indonesian provinces from 2021 to 2024. The analysis was conducted using panel data regression with the Fixed Effect Model (FEM) as the optimal specification.

The results indicate that Electronic Money transactions and Credit Card transactionshave a positive and statistically significant effect on GRDP per capita, demonstrating their important role in enhancing regional economic performance. Conversely, the Chip-Based Technology exerts a negative and statistically significant impact, suggesting potential transitional costs or reduced transaction volumes associated with its implementation. Both Debit Card transactions and the Consumer Price Indexexhibit negative but statistically insignificanteffects, indicating limited or negligible influence on short-term economic growth.

Collectively, these findings confirm that the transformation of Indonesia's payment system toward innovative and efficient digital instruments can foster economic growth, particularly

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through instruments that enhance transaction speed, convenience, and accessibility, while also highlighting the need for careful policy design to mitigate unintended adverse effects from regulatory changes.

Policy Implications

The significant positive effects of Electronic MoneyandCredit Cardtransactions on GRDP per capita underscore their role as vital drivers of regional economic growth in Indonesia. Policymakers should therefore prioritize expanding digital payment infrastructure, ensuring interoperability between platforms, and creating incentive schemes to encourage wider adoption, particularly in rural and underbanked areas. These measures would enhance transaction efficiency, reduce costs, and stimulate economic participation across diverse socio-economic segments.

In contrast, the negative and significant effect of the Chip-Based Card Policy signals that regulatory interventions, while beneficial for security, can cause short-term disruptions if not managed carefully. To mitigate such impacts, gradual implementation, comprehensive public communication, and technical support should accompany similar policy changes. Furthermore, the negative but insignificant influence of Debit Cardtransactions and the Consumer Price Indexsuggests a limited short-term impact, yet both should remain under observation for potential shifts in economic relevance. A balanced policy approach that fosters innovation while minimizing transitional frictions is essential to maximize the benefits of payment system modernization.

Suggestion

For future research, the following recommendations are proposed:

1. **Incorporate Additional Variables** – Include other relevant indicators such as digital literacy levels, the financial inclusion index, and additional macroeconomic variables to provide a more comprehensive analysis of the relationship between digital payments and economic growth.
2. **Extend the Observation Period** – Use a longer time frame or higher-frequency data (e.g., quarterly or monthly) to capture short-term fluctuations, seasonal patterns, and potential structural changes in the payment system.
3. **Enhance Methodological Rigor** – Apply advanced econometric techniques or alternative model specifications to improve the robustness and validity of research findings.

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