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Cashless Payment System: The Effect of Card-Based Payment Instruments (APMK) and Electronic Money on Household Consumption in Indonesia

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Abstract

Technological innovations in the financial sector are able to stimulate economic growth, a phenomenon referred to as the Supply-Leading View proposed by Schumpeter. One form of such innovation is cashless payment systems. Based on the instruments used, these systems can be classified into two categories: payment instruments using card-based payment instruments (APMK) and electronic money. The implementation of cashless payment systems is expected to facilitate microeconomic payment transactions and reduce transaction costs at the macroeconomic level, thereby increasing household consumption. Accordingly, this study aims to analyse the effects of APMK and electronic money on household consumption, both in aggregate and by expenditure sector. The analysis employs a fixed-effects panel data model using data from 33 provinces in Indonesia covering the period from 2019 to 2023. The results indicate that both APMK and electronic money have a positive and statistically significant effect on household consumption. Furthermore, APMK has a positive and statistically significant effect on household consumption across expenditure sectors, although this effect is limited to certain sectors. Meanwhile, electronic money has a positive and statistically significant effect on household consumption across nearly all expenditure sectors. The policy recommendations of this study emphasize the importance of synergy between Bank Indonesia and the Government in improving digital financial literacy, particularly among population groups that have not yet adopted or fully understood the benefits of APMK. In addition, accelerating and ensuring the equitable distribution of the infrastructure required for APMK usage across all provinces is essential.

Keywords: Cashless Payment System, APMK, Electronic Money, Household Consumption

JEL Classification: D12, E50, and G59

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Introduction

A payment system is an important process in transactions, involving the transfer of monetary value between the parties involved. In high-value transactions, cash payment systems are increasingly considered inefficient. Moreover, security challenges and technological advancements are driving society to adopt payment systems that are more secure, faster, and more efficient. Financial innovation is the creation of new products, services, processes, or business models in the financial sector that aim to increase efficiency, broaden access, and strengthen the security of the financial system (Frame & White). To support the Fourth Industrial Revolution, Bank Indonesia established the National Non-Cash Movement (GNNT) to improve the effectiveness of transactions by reducing the risk often associated with cash payments, thereby creating a secure, effective, and efficient payment process through the

implementation of electronic payments across the local government, social assistance, and transportation sectors.

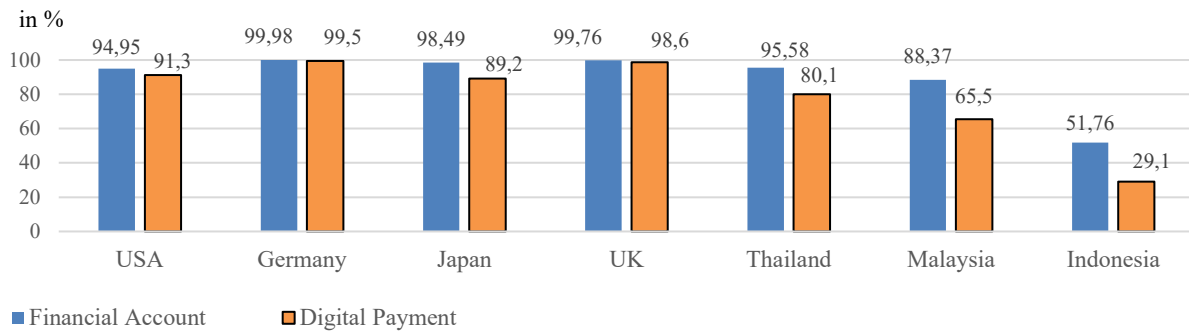


Figure 1. Comparison of Financial Account Ownership and Digital Payment Usage

Source: World Bank, 2021 (Resourced by author)

According to World Bank data (2021), the percentage of adults globally owning accounts at banks, financial institutions, or other money service providers increased to 76%, compared to 68% in 2017 and 51% in 2011. The use of mobile phones and the internet for financial transactions have increased, with 70% of account holders making or receiving digital payments in developing countries and 76% globally. However, compared to other countries, financial account ownership and the implementation of digital payments in Indonesia remain relatively low. Figure 1 illustrates a comparison between financial account ownership and digital payment usage in 2021 for individuals aged 15 and above. The figure indicates that 51.76% of Indonesians own financial accounts, while 29.1% use digital payments for purchase and payment transactions.

The low rates of financial account ownership and digital payment usage in Indonesia are caused by limited access to information technology, infrastructure maturity that has not fully reached remote areas across the country, and inadequate financial literacy among marginalized communities (BPS, 2022). Regarding Indonesia's transition towards a cashless society, records up to 2017 indicate that financial services remained relatively low, although bank account ownership indicated only a slight increase (Abbas, 2017). Therefore, community mentoring programs that engage directly with residents, particularly those in remote areas, are essential in fostering financial inclusion (Ministry of Communication and Informatics, 2023). Schumpeter (1912) stated that technological innovation driven by the financial sector can effectively stimulate real economic growth. This technological advancement also has the potential to boost public consumption, given that household consumption is a key component contributing to a country's GDP.

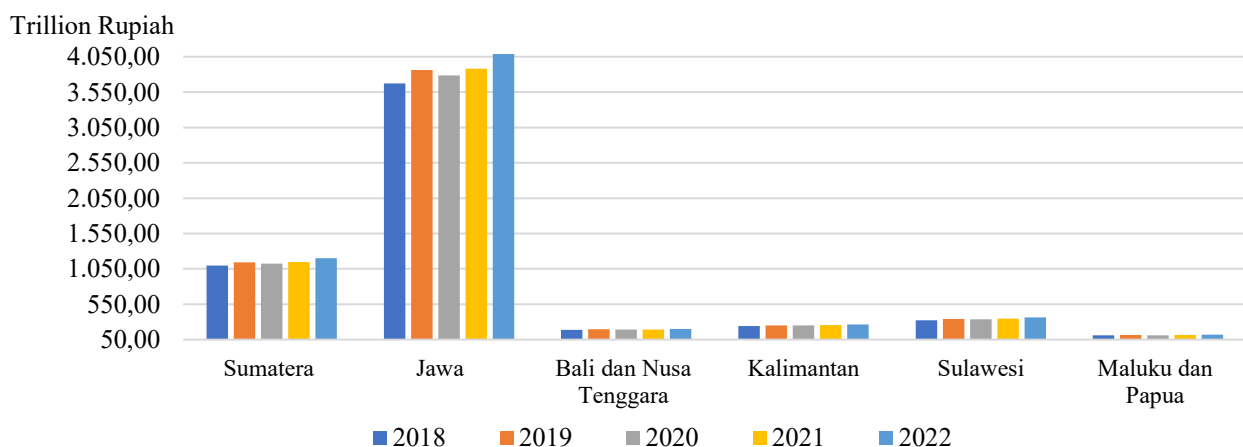


Figure 2. Household Consumption Expenditure Classified by Island Region

Source: Gross Regional Domestic Product of Indonesian Provinces 2018-2022, BPS (Resourced by author)

Figure 2 illustrates household consumption expenditure based on 2010 constant prices, classified by island region in Indonesia from 2018 to 2022. The distribution of household consumption expenditure across Indonesia remains uneven and is predominantly concentrated in Java. Several factors contributing to this uneven household consumption include: first, economic inequality driven by income differences across regions; second, education and human capital; third, infrastructure and accessibility, encompassing roads, electricity, and internet; and fourth, limited access to financial services. These findings align with a study conducted by [Bank Indonesia and the Regional Study Council of North Sumatra Province \(2020\)](#), which empirically demonstrates that enhancing financial inclusion can boost economic growth and reduce inequality, thereby leading to more equitable income distribution and poverty alleviation. According to [Rostow \(1960\)](#) on the theory of economic growth, there are five stages of economic development, and to reach the final stage, high mass consumption, a country must fulfil specific characteristics, such as educational access, infrastructure development, and technology utilization.

[Li et al. \(2023\)](#) found that the use of e-payment has a significant and positive effect on household consumption in China. [Igamo and Falianty \(2018\)](#) stated that electronic money can drive higher consumption over the long term. Additionally, a study by [Kotkowski and Polasik \(2021\)](#) revealed that cashless payment methods were already utilized before the COVID-19 pandemic and became even more frequently used during the pandemic. From the previous study, cashless payment systems have predominantly focused on a single instrument, namely electronic money. In addition, the majority of prior studies have been limited to evaluating the aggregate effects of cashless payment systems on household consumption. Thus, this study aims to further analyse the effect of cashless payment systems categorized by payment instruments, APMK and electronic money, on household consumption, as well as the differential effect of these two payment instruments across seven expenditure sectors: (1) food and beverages; (2) clothing, footwear, and related services; (3) housing and household goods; (4) health and education; (5) transportation and communication; (6) restaurants and hotels; and (7) others. In addition, this study utilizes a five-year panel dataset (2019–2023), capturing the transition period from the pre-pandemic to the post-pandemic era

Literature Review

Cashless Payment System

The demand for money is often linked to conditions that explain why individuals hold cash as a medium of exchange for transactions or for precautionary motives. One of the theories frequently linked to the quantity theory of money by [Fisher \(1911\)](#), as illustrated in the following equation:

$$M.V = P.Y \quad (1)$$

In this equation, M refers to the money supply, V refers to the velocity of circulation of money, P refers to the price level of goods and services, and Y refers to real output or income. In this theory, the money supply and the velocity of money are directly proportional to the price level and real income/GDP. Meanwhile, according to Marshall and Pigou (1917) in the Cambridge theory, money functions as a store of value or serves the purpose of convenience and security in holding cash. This implies that the motive for holding money is to conduct future transactions.

[Schumpeter \(1912\)](#) stated, through the supply-leading view theory, that technological innovation in the financial sector drives economic growth. This innovation plays an important role in stimulating economic expansion when supported by various parties, encompassing the processes of proper regulation and supervision. Financial technology advancements for transactions and cash withdrawals can reduce demand for cash ([Lippi & Secchi, 2009](#)). Consistent with these findings, [Siska and Falianty \(2018\)](#) found a negative and significant effect of financial innovation in payment systems on the narrow money (M1). In this regard, technological innovation in payment systems can substitute for the role of cash in the economy.

[Mishkin \(2008\)](#) stated that the payment system consists of the transactions conducted within an economy. This payment system has increasingly evolved alongside the development of modern banking. Generally, payment systems can be divided into two methods: cash and cashless. The payment methods used by the public can be influenced by various factors, such as preferences, economic levels, and culture ([Mulyati & Ascarya, 2003](#)). Cashless payment systems no longer rely on the physical use of

money, meaning they utilize digital media or instruments in each transaction. This system is driven by several factors, such as broader market reach, various security challenges, the effectiveness of cash transactions, and technological advancements.

Bank Indonesia classifies payment instruments into two types: Card-Based Payment Instruments (APMK) and electronic money. The APMK is regulated under Bank Indonesia Regulation Number: 11/ 11/PBI/2009, which includes debit cards, ATM (Automated Teller Machine) cards, and credit cards. Debit cards and ATM cards are cashless payment instruments directly linked to the cardholder's bank account. Meanwhile, a credit card is a cashless payment instrument operating on a debt mechanism with a specific debt limit for a given period. Electronic money, regulated under Bank Indonesia Regulation Number 11/12/PBI/2009, is a payment instrument used by the holder by depositing funds in advance. These funds are managed by the issuer, not as customer deposits, and are issued based on the deposited monetary value. The storage media used by electronic money include servers and chips.

Server-based electronic money requires a medium to facilitate every transaction. The required medium in this payment method is an electronic device, such as a mobile phone or smartphone. Users or consumers can download financial applications (digital wallets or e-wallets) on their smartphones. The only requirement for server-based electronic money cashless transactions are internet access. Meanwhile, for chip-based electronic money, the balance storage medium uses a chip, and this payment method typically utilizes a card.

Household Consumption

Consumption is a daily economic activity carried out by every human being. According to the classical theory of production by Adam Smith (1776), consumption is the final objective of production as an activity to fulfil human needs. Consumption is not limited to food as a primary necessity, but also includes goods and services to fulfil living needs. Based on [Mankiw \(2016\)](#), goods are defined as tangible items classified into durable and non-durable goods, while services represent intangible outputs purchased by consumers.

In Keynesian theory, current consumption is determined by current disposable income. In contrast, [Fisher \(1911\)](#) argued that consumers prefer to allocate their resources between consumption and saving by considering both present and future conditions. Likewise, the life cycle hypothesis theory proposed by [Modigliani and Brumberg \(1954\)](#) stated that an individual's income and consumption expenditure are shaped by their life cycle stages. Individuals plan their lifetime consumption and savings by forecasting future income. Therefore, they accumulate savings during their high-income working years to sustain consumption levels during retirement, since their earnings are relatively low during that stage. This long-term framework was further complemented by [Friedman \(1956\)](#) through the permanent income hypothesis. This theory explains that an individual's consumption level is driven by permanent income and transitory income. Permanent income refers to the long-term average income earned by an individual that is predictable, while transitory income derives from unexpected earnings.

From these various theories, income is one of the key factors influencing consumption levels. However, other arguments suggest that consumption is also driven by alternative factors. Technological advancements also have the potential to indirectly change people's consumption behaviour. [Hu et al. \(2023\)](#) stated that digital finance development can drive an increase in household consumption. However, the Solow (1956) growth model remains one of the most influential long-term economic growth theories, as illustrated by the following equation:

$$Y = A.K^a.L^{1-a} \quad (2)$$

In this function, Y refers to output, A refers to technology, K refers to capital (savings and investment), and L refers to labor force growth. According to this theory, factors such as savings, labor force growth, and technological progress can influence long-term economic growth.

Consumption can be defined as an activity carried out by households in spending their money to exchange it for goods or services ([Mankiw, 2016](#)). According to [BPS \(2023\)](#), households act as final consumers who purchase goods and services in the economy. BPS classifies household consumption expenditures into several categories, such as (1) food and beverages, (2) clothing and footwear, (3) housing and household equipment, (4) health and education, (5) transportation and communication, (6)

restaurants and hotels, and (7) others. In Indonesia, household consumption expenditure is one of the expenditure approaches utilized by BPS to calculate GDP over a specific period (typically one year).

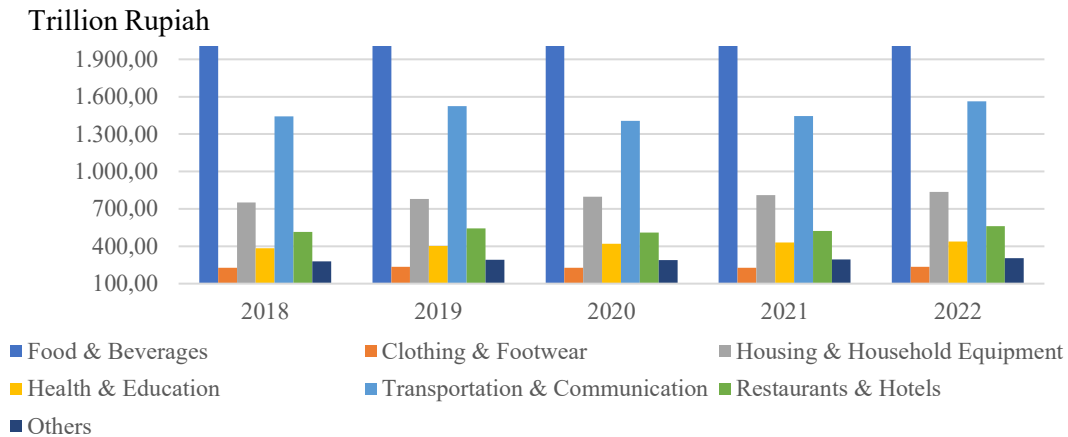


Figure 3. Household Consumption by Expenditure

Source: GRDP of Indonesian Provinces, 2018–2022, BPS (Resourced by author)

Figure 3 illustrates household consumption expenditure by sector in Indonesia from 2018 to 2022. The chart indicates that the food and beverages sector is the most heavily consumed category in Indonesia, as it represents a primary necessity. Meanwhile, the transportation and communication sector ranks as the second-largest category of consumption. Household consumption is influenced by numerous factors. Several economists stated that income can influence household consumption. In their studies, [Schmidt-Hebbel and Serven \(2000\)](#) and [Jin et al. \(2011\)](#) found that income inequality affects household consumption. Changes in household income influence purchasing power, which in turn is driven by the price level ([Rahardja & Manurung, 2008](#)). In addition, household consumption is also influenced by consumer behavior. Consumer behavior can be defined as the actions taken by consumers in searching, consuming, utilizing, and evaluating goods or services according to their needs ([Schiffman et al., 2013](#)). During the COVID-19 pandemic in 2020, household consumption experienced a decline, which was driven by a drop in income that subsequently led to a decrease in public purchasing power.

Research Method

Data Sources

This study used a quantitative approach with hypothesis testing. The data used in this study were secondary annual data obtained from the official online publication sources of authorized institutions or agencies. The data used in this study include APMK and electronic money data obtained from the Payment System and Financial Market Infrastructure Statistics (SPIP) of Bank Indonesia. Household consumption expenditure data were obtained from the GRDP of Indonesian provinces by expenditure category published by BPS (volume 10). Furthermore, data on per capita GRDP, homeownership status, and number of family members were sourced from BPS, while data on the per capita workforce with higher education backgrounds were obtained from the National Labor Force Survey (SAKERNAS).

Operational Definition of Variables

This study used panel data, combining time-series data over a 5-year period from 2019 to 2023 with cross-sectional data across 33 provinces in Indonesia. The dependent variable used in this study was household consumption, which was measured by the total volume of household consumption in each province for a given year. Furthermore, the variables of interest consist of, first, card-based payment instruments (APMK), measured by transaction volumes using debit, ATM, and credit cards, and second, electronic money, measured by the number of cards or instruments classified into chip-based and server-based.

In addition, the control variables consisted of per capita GRDP, which was measured by dividing the provincial GRDP by the total population of a given province; homeownership status, measured by the percentage of owner-occupied houses in urban and rural areas across each province; number of family members, measured by the percentage of households consisting of 4–5 members with male and female heads of household in each province; and the per capita workforce with higher education backgrounds, measured by dividing the number of higher education graduates in the labor force by the total population in each province. The selection of control variables in this study is based on previous studies showing that per capita income, homeownership status, number of family members, and educational level have a significant effect on household consumption (Li et al., 2023; Wang et al., 2023; Zhang et al., 2022). Furthermore, this study used a COVID-19 dummy variable, where 0 represented the years 2019 (before COVID-19) and 2023 (after COVID-19), and 1 represented the period from 2020 to 2022 (during the COVID-19 pandemic).

Empirical Model

The Fixed Effects Model (FEM) was the estimation method used in this study because it could anticipate potential omitted variable bias (OV) that might occur in provincial fixed effects not captured by the OLS model, such as geographical conditions and community culture. This method was used to examine whether APMK and electronic money had a significant effect on household consumption in Indonesia, and it can be specified as follows. The first hypothesis of this study aimed to test whether higher transaction volumes using APMK significantly increased household consumption, as specified in the following model:

$$\ln KRT_{it} = \beta_0 + \beta_1 \ln APMK_{it} + \beta_2 \ln PDR_0 + \beta_3 PTPK_{it} + \beta_4 KRS_{it} + \beta_5 JAK_{it} + DCovid_{it} + \gamma_i + \varepsilon_{it} \quad (3)$$

H_0 = APMK does not affect household consumption in Indonesia.

H_1 = APMK positively and significantly affects household consumption in Indonesia.

The second hypothesis aimed to examine whether an increase in the number of electronic money instruments or cards could increase household consumption, as specified in the model below:

$$\ln KRT_{it} = \alpha_i + \beta_1 \ln UE_{it} + \beta_2 \ln PDRBK_{it} + \beta_3 PTPK_{it} + \beta_4 KRS_{it} + \beta_5 JAK_{it} + \delta DCovid_{it} + \gamma_i + \varepsilon_{it} \quad (4)$$

H_0 = Electronic Money does not affect household consumption in Indonesia.

H_1 = Electronic Money positively and significantly affects household consumption in Indonesia.

In both models, i refers to each province, and t refers to the corresponding year. KRT_{it} represents household consumption, $APMK_{it}$ represents card-based payment instruments, UE_{it} represents electronic money, $PDRBK_{it}$ represents per capita gross regional domestic product, $PTPK_{it}$ represents the workforce with higher education backgrounds, KRS_{it} represents homeownership status, JAK_{it} represents number of family members, δD_Covid_{it} represents the COVID-19 dummy variable (where 1 represents the COVID-19 years and 0 represents the non-COVID-19 years), γ_i represents the provincial fixed effects, and ε_{it} represents the error term.

Results and Discussion

Descriptive Analysis

Before examining the effect of the variable of interest on the dependent variable using the panel data FEM, this study conducted a descriptive analysis detailing the mean, standard deviation, minimum, and maximum values for each variable as shown in Table 1. The total number of observation units is 165. North Kalimantan Province was excluded from this study due to the unavailability of transaction data on cashless payment systems in Bank Indonesia's SPIP reports for the 2019–2023 observation period. The high standard deviation in household consumption indicates economic disparities in household consumption across provinces. In addition, APMK and electronic money also exhibit high standard deviations, indicating that their usage remains uneven and is likely still concentrated in certain provinces. Meanwhile, the number of family members and homeownership status indicate relatively

small variations. Per capita GRDP varies considerably, a condition that indicates income inequality or disparity. The average per capita workforce with higher education backgrounds stands at 57.68%. Furthermore, the COVID-19 dummy variable indicates that approximately 60% of the samples were affected by the COVID-19 pandemic conditions.

Table 1. Results of the Descriptive Analysis for Each Variable

Variable	Unit	Observations	Mean	Std. Dev.	Min	Max
Household Consumption	Rupiah	165	184,000.00	288,000.00	14,300.000	1,200,000.00
APMK	Transactions	165	231.23	449.69	7.01	2,844.82
Electronic Money	Units	165	15.87	78.22	0.02	543.41
Number of Family Members	Percentage	165	42.88	3.60	35.33	52.89
Workforce with Higher Education Background per Capita	Percentage	165	57.68	13.89	25.49	106.49
Gross Regional Domestic Product per Capita	Rupiah	165	43,315.28	32,915.71	12,761.98	192,133.30
Homeownership Status	Percentage	165	81.09	8.61	45.04	93.35
Covid Dummy	Dummy	165	0.60	0.49	0.00	1.00

Averaging each variable yields five provinces with the highest and lowest values, as illustrated in Figure 4. The graph indicates that the highest means are predominantly driven by DKI Jakarta, whereas the lowest means are largely concentrated in eastern Indonesia. Factors suspected to cause this distributional unevenness include socioeconomic disparities across provinces, as well as differences in infrastructure and regional policies that may contribute to the dominance of specific provinces. Thus, advanced estimation methods are required to obtain more valid analytical results.

In Figure 5, the right graphic is the APMK scatter plot, which indicates a strong positive correlation. This indicates that an increase in the transaction volume of APMK is associated with an increase in household consumption. Similarly, the scatter plot on the right, which illustrates the relationship between electronic money and household consumption, indicates a positive correlation. This suggests that an increase in the number of electronic money cards/instruments is associated with an increase in household consumption. Although the scatter plot exhibits some variation in the distribution of data points, the correlation remains positive, as the points are still relatively close to the estimated regression line.

Results of the Main Model Estimation

The following section presents the estimation results for the models estimated in this study. Table 2 presents the estimation results for Equations (3) and (4) using the Fixed Effects Model (FEM). The FEM was selected following a series of regression model specification tests, namely the Chow test and the Hausman test, which were conducted to determine the most appropriate model among Pooled Ordinary Least Squares (Pooled OLS), the Fixed Effects Model (FEM), and the Random Effects Model (REM). Based on the Chow test results (Appendix 1), the FEM was selected as the preferred model. Similarly, the Hausman test results (Appendix 2) also indicated that the FEM was the preferred model. A comparison of the estimation results obtained using OLS, FEM, and REM is presented in Appendix 3. Accordingly, the regression results based on the FEM are presented in Table 2.

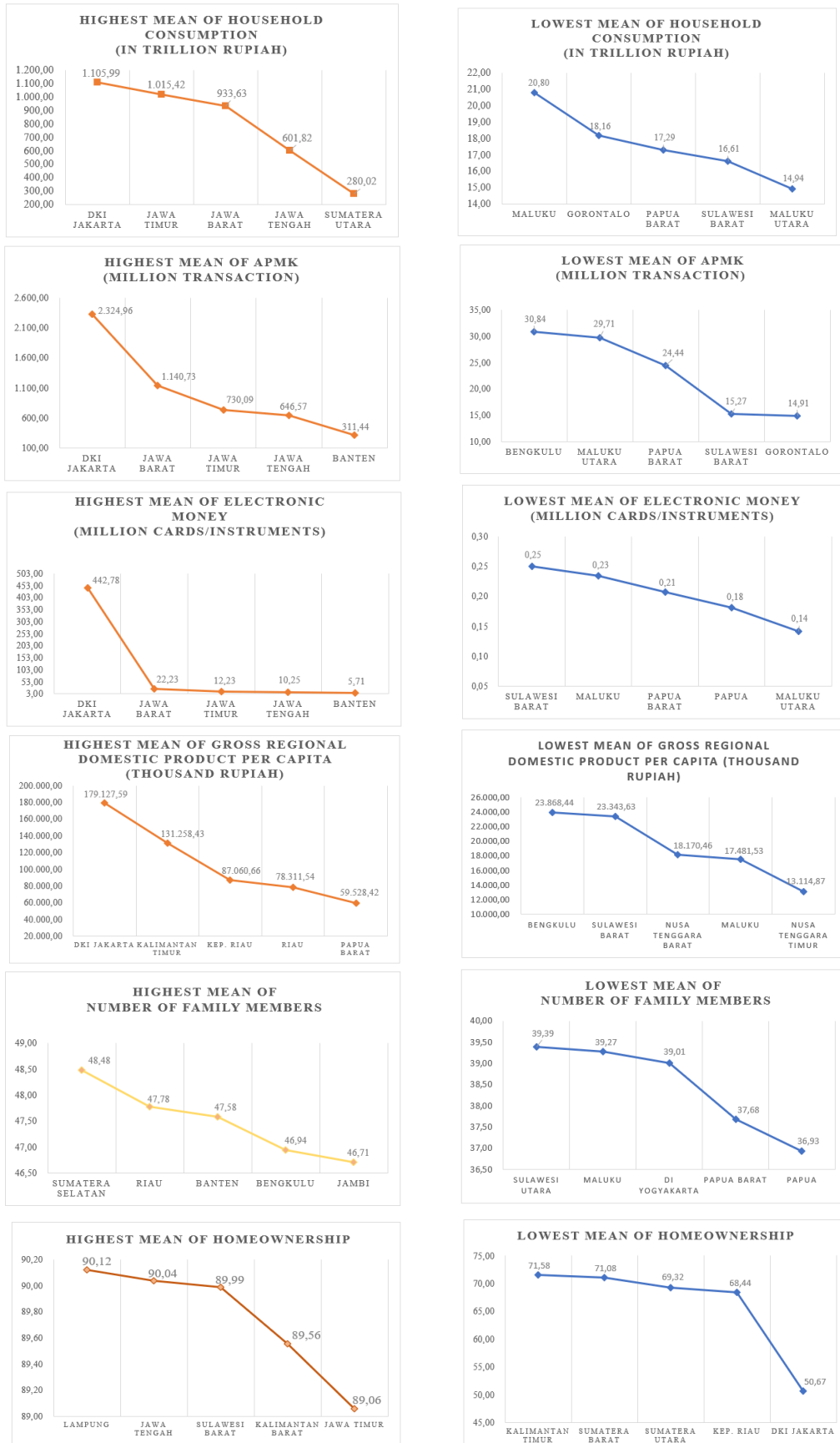


Figure 4. Highest and Lowest Means of the Study Variables
Source: Resourced by author

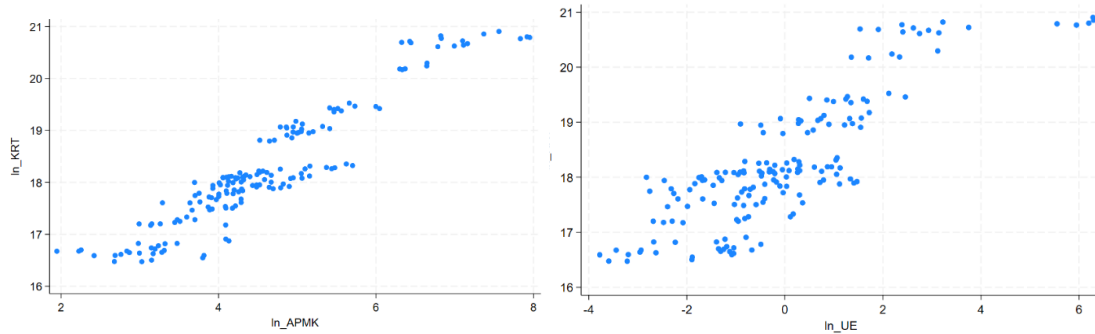


Figure 5. Comparison of Scatter Plots of APMK and Electronic Money against Household Consumption
Source: Resourced by author

Table 2. Results of Analysis of Fixed Effect Model (FEM)

Variables	ln_KRT	ln_KRT
ln_APMK	0.0366** (0.0137)	
ln_UE		0.0230*** (0.00393)
ln_PDRBK	0.149*** (0.0528)	0.121*** (0.0383)
PTPK	0.00111*** (0.000356)	-7.02e-06 (0.000367)
JAK	0.00526*** (0.000789)	0.00470*** (0.000751)
KRS	0.00365** (0.00143)	0.00245** (0.000917)
Dcovid	-0.0192*** (0.00397)	-0.0203*** (0.00266)
Constant	15.94*** (0.509)	16.59*** (0.397)
Observations	165	165
R-squared	0.806	0.862
Number of ID	33	33

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The Influence of APMK on Household Consumption

The estimation in Table 2 can be interpreted as the APMK variable is positively and significantly associated with household consumption. It is 5% of significance level, 1% increase of APMK volume transaction is able to increase household consumption for 0.0366%, ceteris paribus. The R^2 value indicates that the APMK variable accounts for 80.7% of the variation explained by the model. This finding is consistent with the results of Yanying et al. (2019), who reported a significant effect of debit and credit card transactions on household consumption in European countries. Several factors contribute to the adoption and use of APMK, including increased access to and utilization of technology, government support, and collaboration with various industries, such as retail and e-commerce, telecommunications, tourism, and hospitality.

The findings of this study are also consistent with those of Li et al. (2020), who found that financial inclusion is able to increase household consumption. An analysis by Moody's indicates that the increased use of credit and debit cards contributes to consumption and economic growth. This may be attributed to the ability of card-based payments to reduce transaction costs, expand consumers' access to credit, strengthen their confidence in the payment system, and improve the efficiency of the flow of goods and services (Zandi et al., 2013). The difference in the beta coefficients between APMK and electronic money suggests that, although APMK transactions are lower in volume than electronic money transactions, their transaction value is higher, resulting in a greater estimated effect on household

consumption. Furthermore, both paper-based and electronic payment methods can contribute to increases in GDP, trade, consumption, and tax revenue (Zhang et al., 2019).

The Influence of Electronic Money on Household Consumption

Following the estimation of the second hypothesis using the FEM, Table 2 indicates that the electronic money variable is positively and significantly associated with household consumption. At the 1% significance level, an increase of 1% in the number of electronic money cards/instruments is associated with a 0.0230% increase in household consumption, *ceteris paribus*. The R^2 value for the electronic money model is higher than the APMK model, reaching 0.862. This indicates that the model explains 86.2% of the variation in household consumption.

These findings are consistent with the study conducted by Igamo and Falianty (2018), which concluded that, in the long run, electronic money has a negative relationship with narrow money (M1) demand and a positive relationship with consumption levels. Furthermore, the COVID-19 pandemic accelerated the adoption of cashless payments in Indonesia. Physical distancing measures and health concerns encouraged consumers to have safer, contactless payment alternatives, such as digital payments (Tut, 2023). Server-based electronic money relies on electronic devices, such as mobile phones or smartphones, to access e-wallet applications and conduct transactions. Several studies conducted in China have also identified a positive and significant relationship between mobile-based cashless payments and household consumption (Li et al., 2023; Zhao et al., 2022; Zhang et al., 2022).

According to Zhang et al. (2022), mobile-based cashless payments contribute to increased household consumption through two main mechanisms. First, by promoting financial inclusion, cashless payment systems can expand households' access to financial services. Second, they can stimulate consumption activity and frequency by facilitating more efficient transactions at lower transaction costs. Based on the findings of previous studies and their relationship to the results of this study, it can be concluded that, in addition to being associated with higher household consumption, cashless payment methods, including APMK and electronic money, facilitate payment transactions. This may help to explain the increasing adoption of these payment methods in Indonesia over the years. This finding is further supported by the high level of statistical significance observed in the estimation results.

For both models, most of the variable control positively and significantly influences household consumption. Per capita income and homeownership status indicate that a household is in a stable economic condition. This stability may provide greater access to technology and electronic devices, thereby increasing household consumption (Li et al., 2023; Zhao et al., 2022; Wang et al., 2023). Households within this social group are more responsive to advances in financial technology, which may enhance their financial literacy and adoption of cashless payment instruments. Inequalities in access to digital facilities may influence household consumption, as Wang et al. (2023) found that the digital divide negatively affects household consumption.

Analysis of the Effects of APMK and Electronic Money on Household Consumption by Expenditure Group

A heterogeneity analysis was also conducted in this study by classifying the dependent variable, household consumption, into seven expenditure categories: (1) food and beverages; (2) clothing, footwear, and related services; (3) housing and household furnishings; (4) health and education; (5) transportation and communication; (6) restaurants and hotels; and (7) other expenditures. The heterogeneity analysis aims to assess whether the regression model used is appropriate for the entire dataset or whether a more complex model is required to account for potential heterogeneity across expenditure categories.

Based on Table 3, the APMK variable indicates a positive and statistically significant relationship with household consumption in the food and beverage sector at the 1% significance level, with a coefficient of 0.0450. This indicates that a 1% increase in APMK transaction volume is associated with a 0.0450% increase in household consumption in this sector, *ceteris paribus*. The use of APMK may be prevalent in the food and beverage sector because food and beverages constitute basic needs. APMK also indicates a positive and statistically significant relationship with household consumption in the health and education sector at the 5% significance level, with a coefficient of 0.0539. This indicates that a 1% increase in APMK transaction volume is associated with a 0.0539% increase in household

consumption in this sector, *ceteris paribus*. This finding suggests that APMK is also relevant to household expenditure on health and education, which constitute non-food basic needs.

Furthermore, APMK is also positively associated with household consumption in the transportation and communication sector at the 10% significance level, with a coefficient of 0.0373. This indicates that a 1% increase in APMK transaction volume is associated with a 0.0373% increase in household consumption in this sector, *ceteris paribus*. These findings suggest that transportation and communication, as secondary needs, may be responsive to innovations in payment systems. The differences in the beta coefficients suggest that the relationship between APMK and household consumption varies across expenditure sectors. The health and education sector has the highest coefficient among the sectors examined, indicating a comparatively stronger estimated relationship between APMK transaction volume and household consumption in this sector. Meanwhile, APMK is statistically significant only in certain sectors, suggesting that its relationship with household consumption may differ according to consumers' needs and priorities across expenditure categories.

Table 3. The Influence of APMK on Household Consumption by Expenditure Category

Variables	ln_KRT Food & Beverage	ln_KRT Clothing & Foot wear	ln_KRT Housing and Household Furnishings	ln_KRT Health and Education	ln_KRT Transportation and Communication	ln_KRT Restaurants and Hotels	ln_KRT Other
ln_APMK	0.0450*** (0.0155)	-0.0193 (0.0468)	0.0192 (0.0159)	0.0539** (0.0221)	0.0373** (0.0174)	0.0320 (0.0259)	0.0255 (0.0179)
ln_PDRBK	0.169*** (0.0531)	0.105 (0.0894)	0.106 (0.0652)	0.104 (0.0881)	0.161*** (0.0577)	0.00832 (0.148)	0.216*** (0.0491)
PTPK	0.0008 (0.0005)	-0.0029 (0.0022)	0.0018*** (0.0005)	0.0021** (0.0011)	0.0009 (0.0007)	-0.0010 (0.0015)	0.0013 (0.0009)
JAK	0.0067*** (0.0015)	-0.0009 (0.0029)	0.0033* (0.0017)	0.0032* (0.0018)	0.0061*** (0.0016)	0.0031 (0.0024)	0.0030 (0.0019)
KRS	0.0026 (0.0018)	0.0064* (0.0036)	0.0061** (0.0026)	0.0063*** (0.0023)	0.0029 (0.0020)	0.0067* (0.0035)	0.0016 (0.0021)
DCOVID	-0.0065 (0.0052)	-0.0385*** (0.0068)	0.00483 (0.0047)	0.0196*** (0.0065)	-0.0547*** (0.0056)	-0.0789*** (0.0144)	-0.0164*** (0.0056)
Constant	14.90*** (0.515)	13.62*** (0.781)	14.24*** (0.592)	13.52*** (0.858)	14.28*** (0.565)	14.36*** (1.405)	12.30*** (0.502)
Observations	165	165	165	165	165	165	165
R-squared	0.742	0.262	0.649	0.575	0.713	0.498	0.476
Province	33	33	33	33	33	33	33

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Table 4, electronic money indicates a positive and statistically significant relationship with household consumption across nearly all expenditure categories, except for clothing and footwear. The strongest estimated relationship is observed in the health and education sector, with a coefficient of 0.0462 that is statistically significant at the 1% level. This indicates that a 1% increase in the number of electronic money cards or instruments is associated with a 0.0462% increase in household consumption in this sector, *ceteris paribus*. Another factor contributing to the growth of electronic money payments in Indonesia is the expansion of online shopping platforms. These platforms provide consumers with a means of purchasing both primary and secondary goods and services. These findings are consistent with those of [Li et al. \(2023\)](#), who classified household consumption into primary and secondary needs and found a positive and statistically significant relationship between electronic payments and household consumption expenditure on restaurants and travel.

Furthermore, among secondary-needs expenditure categories, transportation and communication exhibit the strongest estimated relationship with electronic money, with a coefficient of 0.0154 that is statistically significant at the 5% level. This indicates that a 1% increase in the number of electronic money cards or instruments is associated with a 0.0154% increase in household consumption in this sector, *ceteris paribus*. One application of electronic money in the transportation sector is electronic toll collection (e-toll), as stipulated in Minister of Public Works and Housing Regulation No. 16 of 2017 concerning Cashless Transactions on Roads. In addition, the use of electronic payment cards

for rail transportation, including the MRT, LRT, Airport Rail Link, and KRL Commuter Line, as well as TransLink cards, has continued to develop in Indonesia, particularly in DKI Jakarta.

Table 4. The Influence of APMK on Household Consumption by Expenditure Category

Variables	ln_KRT Food & Beverage	ln_KRT Clothing & Foot wear	ln_KRT Housing and Household Furnishings	ln_KRT Health and Education	ln_KRT Transportation and Communication	ln_KRT Restaurants and Hotels	ln_KRT Other
ln_UE	0.0269*** (0.0048)	0.0014 (0.0096)	0.0265*** (0.0047)	0.0462*** (0.0081)	0.0154** (0.0064)	0.0143* (0.0076)	0.0124* (0.0068)
ln_PDRBK	0.139*** (0.0360)	0.0777 (0.0698)	0.0468 (0.0443)	0.0250 (0.0707)	0.157*** (0.0525)	0.0020 (0.149)	0.207*** (0.0435)
PTPK	-0.0005 (0.0004)	-0.0030 (0.0019)	0.0005 (0.0005)	-4.32e-05 (0.0010)	0.0001 (0.0008)	-0.0017 (0.0015)	0.0007 (0.0008)
JAK	0.0061*** (0.0013)	-0.0013 (0.0029)	0.0023 (0.0015)	0.0019 (0.0014)	0.0058*** (0.0018)	0.0029 (0.0025)	0.0028 (0.0021)
KRS	0.0012 (0.0011)	0.0057 (0.0034)	0.0040** (0.0016)	0.0034** (0.0015)	0.0025 (0.0018)	0.0062* (0.0034)	0.0011 (0.0024)
DCOVID	-0.00767** (0.0032)	-0.0410*** (0.0080)	0.0009 (0.0039)	0.0151*** (0.0050)	-0.0541*** (0.0051)	-0.0786*** (0.0142)	-0.0163*** (0.005)
Constant	15.63*** (0.401)	13.88*** (0.678)	15.23*** (0.426)	15.02*** (0.688)	14.58*** (0.529)	14.66*** (1.423)	12.59*** (0.478)
Observations	165	165	165	165	165	165	165
R-squared	0.812	0.258	0.752	0.744	0.719	0.502	0.486
Province	33	33	33	33	33	33	33

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Variations in the beta coefficients across expenditure sectors indicate that certain factors may be more important in some sectors than in others, reflecting differences in consumers' needs and priorities across expenditure categories. Based on these findings, the study concludes that the use of electronic money in Indonesia has continued to expand relative to the use of APMK. During the COVID-19 pandemic, for instance, Indonesia experienced an increase in the number of new e-wallet users (Ipsos, 2020). This finding is also supported by the analysis of the distribution of electronic money use across Indonesia's seven major islands, presented in Appendix 4. Although the number of cards or instruments is unevenly distributed across the islands, electronic money use exhibits a positive and statistically significant relationship with household consumption across most of them. Based on the analysis in Appendix 4, this study suggests that the adoption of electronic money may be influenced not only by the technological gap, but also by other factors.

Both APMK and electronic money indicate statistically insignificant relationships with household consumption in the clothing and footwear sector. This finding is consistent with an Ipsos (2022) survey conducted in Southeast Asia, which reported that Indonesian consumers' purchasing power had begun to be affected by rising prices of basic goods due to post-pandemic inflation. Consequently, Indonesian consumers began to exercise greater restraint in their secondary spending and prioritize purchases based on their needs. Meanwhile, Li et al. (2023) concluded that consumption of secondary goods, including clothing, is influenced by age, with older consumers tending to be more cautious when making purchases in this category.

Analysis Result of Robustness Check

This study conducts a robustness check by adding the money supply (JUB) in Indonesia as a control variable. The proxy used to measure the money supply is derived from the quantity theory of money, as presented in Equation (1). Accordingly, the money supply proxy for each province is calculated by multiplying the province's share of Indonesia's gross domestic product (GDP), based on its gross regional domestic product (GRDP), by the amount of currency in circulation in Indonesia. The results of the robustness check are presented in Table 5.

The robustness check results indicate that APMK is positively associated with household consumption at the 10% significance level, with a coefficient of 0.0262. This means that a 1% increase in APMK transaction volume is associated with a 0.0262% increase in household consumption, *ceteris paribus*. Similarly, electronic money is positively associated with household consumption at the 10% significance level, with a coefficient of 0.0199. This indicates that a 1% increase in the number of electronic money cards or instruments is associated with a 0.0199% increase in household consumption, *ceteris paribus*. The money supply variable is not statistically significant in either model. However, differences exist between the beta coefficients in the main model and those in the robustness check. These differences may indicate that cash continues to be used for payment transactions by some segments of the Indonesian population. This interpretation is consistent with the study by [Fujiki and Nakashima \(2019\)](#) in Japan, which found that cash usage remained relatively high. Their findings suggest that the Bank of Japan may need to respond by leveraging new technologies, such as QR codes, particularly given the limited effect of credit card use on reducing money demand.

The COVID-19 pandemic has a negative and statistically significant relationship with household consumption across all model specifications. According to data from Indonesia's Ministry of Manpower (Kemnaker), 137,439 workers were laid off by 22,753 companies in 2020, contributing to an increase in unemployment. The rise in unemployment reduced household income, prompting households to cut back on consumption and contributing to a decline in purchasing power ([Kemenko Perekonomian, 2021](#)). These findings highlight the need for the government to respond to crises such as the COVID-19 pandemic, which can alter consumer behaviour. This is consistent with the contraction in household consumption growth to -2.63% in 2020 and the decline in cashless payment growth to 6.1%, according to Statistics Indonesia (BPS and Bank Indonesia).

Table 5. Result of Robustness Check

Variables	ln_KRT	ln_KRT
ln_APMK	0.0262* (0.0132)	
ln_UE		0.0199*** (0.0044)
ln_PDRBK	0.125* (0.0738)	0.114** (0.0492)
PTPK	0.0007* (0.0004)	-5.13e-05 (0.0004)
JAK	0.0639 (0.0431)	0.0300 (0.0293)
KRS	0.0035*** (0.0012)	0.0039*** (0.0009)
Dcovid	0.0033** (0.0014)	0.0025** (0.0009)
Constant	-0.0263*** (0.665)	-0.0235*** (0.523)
Observations	165	165
R-squared	0.832	0.867
Number of ID	33	33

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Several factors may help explain why electronic money remains statistically significant at the 10% level in the robustness check, compared with APMK. This interpretation is supported by a survey conducted by [Ipsos \(2020\)](#) among young people in five major Indonesian cities. The survey found that most respondents had been using e-wallets for more than one year. E-wallets were primarily used to pay for online transportation services and food purchases, both through online applications and at physical outlets. The main factor driving e-wallet adoption was the convenience during transactions.

Conclusion and Recommendations

Conclusions

The results of this study support the study hypothesis that cashless payment systems, classified by

payment instrument into APMK and electronic money, are associated with household consumption. The findings are discussed as follows. Firstly, the estimated effects of APMK and electronic money on household consumption are consistent with previous studies. The influence of APMK on household consumption is positive and statistically significant, which is consistent with Yanying et al. (2019), who found a statistically significant relationship between debit and credit card transactions and household consumption in European countries. Similarly, the influence of electronic money on household consumption is positive and statistically significant. This finding is consistent with several studies reporting positive and statistically significant relationships between household consumption and cashless payment methods, including mobile payments, electronic money, and e-payments (Jiaying Li et al., 2023; Zhao et al., 2022; Zhang et al., 2022; Igamo & Falianty, 2018; Tut, 2023).

Secondly, the estimated effects of APMK and electronic money on household consumption vary by expenditure category. APMK has a positive and statistically significant relationship with household consumption in only certain expenditure categories, whereas electronic money has a positive and statistically significant relationship with household consumption across nearly all expenditure categories. However, neither APMK nor electronic money has a statistically significant relationship with household consumption in the clothing and footwear category.

Furthermore, the findings indicate that the development of cashless payment systems in Indonesia has shown an upward trend. Cashless payment systems not only promote consumption but also facilitate payment transactions. From a microeconomic perspective, the adoption of cashless payments can reduce transaction costs (Zhao, Wu, & Guo, 2022). Meanwhile, from a macroeconomic perspective, the adoption of cashless payments can reduce government expenditure by replacing paper-based and metal-based currency with electronic payment methods (Humphrey et al., 1996).

Finally, these empirical findings are consistent with Solow (1956) development theory, which explains that technological advancement is one of key drivers to long-term economic growth. Moreover, the findings of this study also support the supply leading view theory, pioneered by Schumpeter (1912), which suggests that technological innovation in the financial sector can stimulate economic growth. Such innovation plays an important role in promoting economic growth when supported by various stakeholders and accompanied by appropriate regulation and oversight.

Recommendation

Based on the findings of this study, several policy recommendations are proposed to improve the convenience of cashless transactions through the formulation of new policies and the refinement of existing policies, as follows. First, the policy implications of these findings highlight the importance of synergy between Bank Indonesia and the Government in improving digital financial literacy, particularly among groups of people who have not yet adopted card-based payment instruments (APMK) or fully understood the benefits they offer. In addition, efforts should be made to accelerate and ensure the equitable provision of facilities and infrastructure supporting the use of APMK across all provinces. These recommendations are consistent with the empirical findings, which indicate that APMK affects household consumption across expenditure categories only in certain sectors.

Second, synergy between Bank Indonesia and the Government is necessary to promote digitalization education among business operators, particularly those in the clothing sector at the provincial level. This initiative could stimulate a positive industry response to innovations in cashless payment systems, given that household consumption in the clothing sector remains relatively low.

Third, Payment system data should be regularly updated and harmonized at the regional level, including both provincial and regency/municipal levels, to identify disparities in the adoption of cashless payment systems. This recommendation is consistent with the descriptive analysis conducted in this study, in which North Kalimantan Province could not be included in the observation units due to limitations in the availability of Bank Indonesia's SPIP data.

Fourth, the government should consider adding questions to Statistics Indonesia's (BPS) National Socioeconomic Survey (SUSENAS) regarding household members' access to financial services, specifically their use of cashless payment instruments, including APMK and electronic money, during the previous 12 months. The survey should also capture the factors underlying their use or non-use of these instruments to provide a more comprehensive understanding of financial literacy and cashless payment adoption in Indonesia.

Study Limitations

This study has several limitations. First, the number of observational units is relatively limited. Second, the variables of interest are restricted to two payment instruments, namely APMK and electronic money, without examining the factors influencing the adoption of cashless payment methods. Lastly, the relatively short study period limits the ability to conduct a long-term analysis. In light of these limitations, the following recommendations are proposed for future study: (1) Future studies should expand the number of observational units and examine other cashless payment methods, such as QRIS, by product type or business category. This would enable a more in-depth analysis of the characteristics of consumption goods and differences in payment behaviour across categories; and (2) Future studies should investigate the factors influencing consumers' decisions to use cashless payment methods, as well as the long-term effects of increased spending associated with payment system innovations on consumers' financial well-being.

CRedit Authorship Contribution Statement

Indah Rizqia Chabsah: Conceptualization, Design of Methodology, Data Collection, Formal Analysis, Writing – original draft preparation, Writing – review and editing. **Telisa Aulia Falianty:** Advisor.

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During the preparation of this manuscript, the authors used DeepL Translator and Oxford Dictionary for language translation and vocabulary refinement, Grammarly for grammar checking, as well as ChatGPT (Basic) and Gemini (Basic) to assist in verifying and ensuring the accuracy of academic terminology. After utilizing these tools, the authors thoroughly reviewed, edited, and revised all generated content. The authors take full responsibility for the accuracy, integrity, and overall content of this published work.

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Appendices

A1. List of Abbreviation

No	Variables	ln_KRT
1	KRT	Household consumption
2	APMK	Card-based payment instruments
3	UE	Electronic money
4	PDRBK	Per capita gross regional domestic product
5	PTPK	Workforce with higher education backgrounds
6	KRS	Homeownership status
7	JAK	Number of family members
8	DCovid	COVID-19 dummy variable

A2. Comparison of OLS, FE, and RE Model Estimation Results on AMPK

Variables	OLS LnKRT	FEM LnKRT	REM LnKRT
ln_APMK	0.907*** (0.0253)	0.0366*** (0.00917)	0.0722*** (0.0176)
ln_PDRBK	0.0909 (0.0711)	0.149*** (0.0355)	0.192*** (0.0647)
PTPK	-0.0125*** (0.00218)	0.00111*** (0.000415)	0.000676 (0.000804)
JAK	0.00655 (0.00786)	0.00526*** (0.00121)	0.00634*** (0.00234)
KRS	0.00498 (0.00465)	0.00365*** (0.00108)	0.000754 (0.00202)
Dcovid	-0.0538 (0.0550)	-0.0192*** (0.00373)	-0.0199*** (0.00724)
Constant	13.21*** (0.997)	15.94*** (0.338)	15.54*** (0.627)
Observations	165	165	165
R-squared	0.917	0.806	
Number of ID		33	33

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

A3. Comparison of OLS, FE, and RE Model Estimation Results on AMPK

Variables	OLS LnKRT	FEM LnKRT	REM LnKRT
ln_APMK	0.541*** (0.0231)	0.0230*** (0.00268)	0.0257*** (0.00439)
ln_PDRBK	0.0557 (0.102)	0.121*** (0.0296)	0.155*** (0.0472)
PTPK	-0.0312*** (0.00303)	-7.02e-06 (0.000368)	-0.000360 (0.000604)
JAK	-0.0273** (0.0115)	0.00470*** (0.00103)	0.00529*** (0.00168)
KRS	-0.0129* (0.00652)	0.00245*** (0.000923)	0.00126 (0.00149)
Dcovid	-0.0616 (0.0786)	-0.0203*** (0.00309)	-0.0194*** (0.00506)
Constant	21.74*** (1.452)	16.59*** (0.298)	16.33*** (0.488)
Observations	165	165	165
R-squared	0.830	0.862	
Number of ID		33	33

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

A4. The Effect of Electronic Money on Household Consumption when Classified by Island

Vartiales	Sumatra ln_KRT	Java ln_KRT	Bali and NT ln_KRT	Kalimantan ln_KRT	Sulawesi ln_KRT	Maluku ln_KRT	Papua ln_KRT
ln_UE	0.0234*** (0.00391)	0.0405*** (0.00939)	0.0202*** (0.000826)	0.0197* (0.00751)	0.0103 (0.0152)	0.0265 (0.00523)	0.0447* (0.00596)
ln_PDRBK	0.259* (0.135)	0.179 (0.150)	0.254** (0.0294)	-0.115 (0.130)	0.142 (0.138)	0.0205 (0.0241)	-0.104 (0.0868)
PTPK	6.56e-05 (0.000448)	6.72e-05 (0.000741)	-0.000992 (0.000504)	0.00182 (0.00227)	8.51e-05 (0.00113)	7.27e-05 (0.000296)	-0.00299 (0.00128)
JAK	0.00216** (0.000807)	0.00449 (0.00271)	0.00179* (0.000457)	0.00367 (0.00294)	0.00480*** (0.00111)	0.000755 (0.00115)	0.00912 (0.0114)
KRS	0.00500*** (0.00130)	0.000807 (0.00283)	0.00244** (0.000308)	0.00528 (0.00547)	0.00843 (0.00476)	0.00541*** (2.98e-05)	-0.00291 (0.00279)
Dcovid	-0.0159*** (0.00301)	-0.0275** (0.00838)	-0.0204* (0.00623)	-0.0185 (0.00813)	-0.0227* (0.00947)	-0.0154 (0.00253)	-0.0959 (0.0584)
Constant	15.11*** (1.347)	17.69*** (1.529)	15.27*** (0.276)	18.50*** (1.029)	15.17*** (1.377)	16.06** (0.276)	18.65** (0.849)
Observations	50	30	15	20	30	10	10
R-squared	0.945	0.885	0.988	0.935	0.796	0.996	0.936
Number of ID	10	6	3	4	6	2	2

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

A5. The Effect of APMK on Household Consumption when Classified by Island

Vartiales	Sumatra ln_KRT	Java ln_KRT	Bali and NT ln_KRT	Kalimantan ln_KRT	Sulawesi ln_KRT	Maluku ln_KRT	Papua ln_KRT
ln_UE	0.0109 (0.0294)	0.0452 (0.0452)	0.0677 (0.0418)	0.0246 (0.0414)	0.0421 (0.0443)	0.0585* (0.00544)	0.105*** (0.000432)
ln_PDRBK	0.415** (0.183)	0.356** (0.118)	0.0748 (0.0863)	-0.202 (0.195)	0.165 (0.115)	0.0559 (0.0234)	-0.0623 (0.0315)
PTPK	0.00168** (0.000653)	0.000795 (0.000624)	0.000354 (0.000915)	0.00349* (0.00126)	0.000448 (0.000809)	0.00102 (0.000311)	-0.000303 (0.00123)
JAK	0.00317*** (0.000864)	0.00418* (0.00167)	0.00285 (0.00212)	0.00186 (0.00440)	0.00465* (0.00212)	0.000245 (0.00425)	0.00355 (0.0102)
KRS	0.00686** (0.00244)	0.000925 (0.00356)	0.000448 (0.00222)	0.0127* (0.00512)	0.00688 (0.00388)	0.00124 (0.000979)	0.00432 (0.00130)
Dcovid	-0.0124* (0.00615)	-0.0201* (0.00814)	-0.0320* (0.00994)	-0.0264 (0.0147)	-0.0264* (0.0123)	-0.0263*** (2.12e-05)	-0.0696 (0.0210)
Constant	13.13*** (1.712)	15.58*** (1.044)	16.79*** (0.798)	18.72*** (1.799)	14.88*** (1.083)	15.76** (0.288)	17.20** (0.671)
Observations	50	30	15	20	30	10	10
R-squared	0.914	0.810	0.932	0.906	0.803	0.993	0.931
Number of ID	10	6	3	4	6	2	2

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1