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Article

Does Digital Finance Reduce Cash Holdings? Evidence on Money Demand in ASEAN

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ABSTRACT

This study investigates the impact of digital finance, alongside globalization and exchange rates, on money demand in six ASEAN countries (Indonesia, Malaysia, Singapore, Thailand, Philippines, and Vietnam) from 2015-2023. The primary purpose is to analyze how digital financial transformation influences cash holdings and monetary stability in a developing regional context, an area with limited empirical evidence. Utilizing a panel data regression approach with fixed effects model estimation, the research employs indicators suc as ATM density, mobile subscriptions, internet penetration, the KOF Globalization index, and official exchange rates. The main findings remain dominant drivers: ATM access and globalization have positive effects on broad money demand. However, a composite Digital Financial Inclusion Index consolidating digital variables exhibits a strong positive significant effect, digital advancements holistically strengthen financial deepening. The study contributes to monetary economics by highlighting the complex, evolving nexus between digitalization and money demand in emerging economies.

Keywords: Money demand, Digital Financial Inclusion, ASEAN.
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INTRODUCTION

The transformation of digital financial technology has made many advances along with the development of digitalization. This transformation not only changes the way people transact but also affects trade relations between countries. Easy access to technology also accelerates a country's trade expansion. Digitalization has strengthened trade access to be more efficient, thus driving an increase in trading volumes.

Digital financial inclusion has made it easier for people to access financial services. Digital financial inclusion includes financial services over the internet and building a strong financial system, especially in countries that are beginning to adopt and build a strong financial system, especially in

countries that are beginning to adopt technological developments (Falavigna et al., 2024). Digital financial services include mobile payments, online insurance, online loans, which have the potential to reduce the occurrence of credit from traditional financial institutions that do not receive supervision and guarantees from official institutions (Inoue, 2024).

This transformation has direct implications for the dynamics of money demand. The demand for money, which reflects the need for economic agents to hold liquid assets that can be easily used as a measuring tool (Hulsman, 2009), is becoming increasingly influenced by the adoption of digital financial services. As the use of digital payments and internet-based financial services increases, the structure of real cash balance demand in the economy may change. This is important in the context of monetary policy, because understanding the determinants of money demand is the foundation for the effectiveness of monetary instruments, because understanding the determinants of money is the foundation for the effectiveness of monetary instruments in controlling inflation, growth, and macroeconomic stability (Oyadeyi, 2025; Prasetyo, 2018)

Understanding the behavior of money demand is an important area of study in economics because it has a central role in controlling inflation, the effectiveness of monetary policy, and various other macroeconomic aspects (Friedman, 1956). In addition, the issue of the stability of money demand is also a major concern in the literature (Wang et al., 2024), Because the success of the implementation of the monetary targeting framework depends on the stability of the money demand function.

Technological advancements such as internet banking, electronic payments, digital money, mobile payment services, and digital wallets have changed the way the banking industry provides services to its customers (Al Khub et al., 2024). These innovations have the potential to improve bank operational efficiency, improve the performance of financial institutions, and in turn strengthen the stability of the banking sector (Ullah et al., 2025). However, the development of financial technology also brings new forms of risk that can threaten the stability of the financial system (Bank of England, 2019).

Although the influence of financial technology on the demand for money has been extensively researched in high-income countries, there is still little research examining this issue in developing countries with fairly rapid technological growth in developing countries (Ozili, 2018). Considering the rapid development of digital financial technology and its potential impact on money demand behavior and monetary stability, as well as the lack of comprehensive empirical evidence in the context of developing countries, in-depth research is needed. Therefore, this study seeks to fill this gap in analyzing how digital financial dynamics, globalization, and macroeconomic conditions can affect the demand for money in the ASEAN region.

LITERATURE REVIEW

Money Demand

The theory of money demand is one of the main pillars in monetary economics that is used to explain the behavior of individuals and economic actors in holding money and allocating their wealth to various forms of assets. The classic theory of money demand put forward by Fisher (Persons & Fisher, 1911) through the Quantity Theory of Money places money primarily as a means of transaction, where the demand for money is determined by the nominal level of income and is assumed to have a relatively stable speed of circulation. This approach was later developed by the Cambridge School

which emphasized that individuals hold money as part of wealth to finance daily economic activities.

Keynes (1936) expanded the classical framework through the theory of liquidity preference by putting forward three main motives for money demand, namely transactional motives, just in case, and speculation. This theory provides a solid basis for analyzing changes in money demand behavior due to economic dynamics and financial system developments. Further developments are indicated by the monetarist approach and portfolio theory. Friedman views money as one of the assets in an individual's wealth portfolio, where the demand for money is determined by the permanent income and the relative rate of return of the alternative asset. The transformation of the financial system through digital finance brings new implications to the theory of money demand. Digital finance, which includes mobile banking, e-money, internet banking, and fintech-based payment systems, has improved efficiency and lowered the cost of using financial services (Gnos, 2025).

Wang et al., (2024) research found that digital finance can change the function of money demand in monetary aggregates (M0, M1, M2). Key findings show that the influence of digital services has an effect on the stability of money demand, especially M2. This shows that digital finance can overhaul the classic relationship between money demand and its determinants. Other research also revealed that the use of digital finance will reduce the demand for cash in a certain period of time (Dewanta et al, 2022). Accelerating the circulation of non-cash money with the penetration of digital instruments can accelerate the circulation of money and affect the behavior of the demand for money.

Digital Finance Inclusion

Digital Financial Inclusion is an expansion of financial access based on digital technology that aims to overcome the financial exclusion of marginalized groups, such as low-income communities, MSME actors, and women in remote areas (World Bank, 2018). This concept is rooted in three main pillars: accessibility through digital infrastructure, the availability of low-cost financial services, and digital financial literacy to ensure effective use (Ullah et al., 2024). Theoretically, DFI can be analyzed through the lens of Innovation Diffusion Theory (Rogers, 2004), the adoption of digital financial services follows stages ranging from innovators to laggard groups, with the main challenges being digital gaps and cultural resistance. The Agency Theory approach (Jensen & Meckling, 1979) explains how DFI reduces information asymmetry and dependence on traditional intermediaries, while Capability Theory (Sen, 2005) emphasizes DFI's role in expanding individual economic freedom through access to capital and microinsurance.

DFI implementation is measured through the scope, depth of product, and quality of services (Banik & Roy, 2023), with driving factors such as pro-fintech policies and inhibitions such as low digital literacy (OECD, 2022). Synergy between government policies, private innovation, and multilateral collaboration is key in expanding DFI in an inclusive and sustainable manner (GPFI, 2020). Thus, DFI not only transforms the conventional financial system, but also acts as a catalyst for inclusive economic development.

H1: Digital Financial Inclusion has a positive effect on Money Demand

Globalization

Economic globalization is the process of increasing economic integration between countries characterized by trade openness, international capital flows, and cross-border mobility of goods, services, and information. In the context of monetary economics, globalization has important implications for money demand behavior because

the increasingly open economy leads to an increase in the intensity of international transactions, exposure to global financial markets, and changes in the structure of the domestic financial system (Zaidi et al., 2024).

Some empirical studies show that globalization can affect the stability of the function of money demand. Global economic integration has made the traditional relationship between money demand, income, and interest rates less stable, especially in developing and emerging economies. Globalization increases the country's exposure to external shocks such as exchange rate fluctuations, volatility in capital flows, and changes in global monetary policy, all of which can affect people's preferences in holding money (Chigeto et al., 2024)
H2: Globalization has a positive effect on money demand

Exchange Rate

Exchange rates affect the demand for money, both through the effect of currency substitution and the effect of wealth. Many studies have found that the appreciation/depreciation of domestic currencies changes the preference to hold domestic assets so that it affects the demand for real money (Bahmani-Oskooee et al, 2018). Asymmetry and non-linearity often appear, domestic depreciation tends to have a different impact than appreciation. Based on the currency substitution effect approach, the depreciation of the domestic exchange rate encourages people to reduce their ownership of domestic money and switch to foreign currencies that are considered more stable (Alper, 2017). This causes the demand for domestic money to decrease. Conversely, the appreciation of the domestic currency can increase confidence in the national currency and encourage an increase in the demand for domestic money (Nguyen et al., 2024).

In the modern economic framework, the exchange rate has an effect on money demand, and this influence tends to be stronger when supported by the high level of globalization and the development of digital finance. Exchange rates have a significant influence on the demand for money in the long run, especially in developing countries and countries with relatively open financial systems (Lal et al., 2023).
H3: Exchange Rate has a positive effect on Money Demand.

METHODOLOGY

Data

This study employs a panel dataset covering six ASEAN countries: Malaysia, Singapore, Indonesia, Viet Nam, Philippines, and Thailand. The selection of countries is based on consistent data completeness criteria for variables during the study as well as the country's representation of economic diversity and the level of development of financial markets in the ASEAN region. The study period spans from 2015-2023, which includes the critical phase of the adoption of institutionalization of digital financial technology post-policy acceleration of financial inclusion in many ASEAN countries. The dataset is compiled from multiple authoritative sources, including the World Development Indicator and KOF for Globalization. All variables used in the study are presented in Table 1.

Table 1. Variable Definition

Variable	Acronym	Description	Measured	Source
Dependen: Money Demand	M	The most common international standard (M2 or equivalent), normalized by GDP	Broad Money (% of GDP)	World Bank
Independen: Automated Teller Machine	ATM	Number of ATM users	Total per 100,000 adults	World Bank

Mobile Subscriptions	MOB	Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service	Mobile Subscriptions (per 100 people)	World Bank
Internet Penetration	IP	Internet users are individuals who have used the Internet (from any location) in the last 3 months	Individual Using Internet (% population)	World Bank
Globalization	GO	Globalization Index measures the economic, social and political dimensions of globalization	Globalization Index	KOF
Exchange Rate	ER	Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market.	Official exchange rate (LCU per US$, period average)	World Bank

Source: Author Computation

The money demand variable is proxied with the real Broad Money (M2). The selection of M2 as a proxy is based on an empirical convention in the literature on the function of money demand, where the broad monetary aggregate is accepted as a measure of the balance of the publicly held money stock. Digital Financial Inclusion uses proxies that are based on empirical evidence in financial inclusion, namely Availability, Access, and Awareness (Gabor et.al, 2017). ATMs represent the availability of physical infrastructure, mobile subscriptions reflect access to the main device (mobile money), and internet connectivity reflects awareness and capacity to engage in the digital economy. This construct is in line with the research of (Demirguc-Kunt et al., 2018) which uses similar indicators to measure the development of fintech and digital financial inclusion.

Globalization shows the level of integration of a country with the world measured using the KOF Globalization Index. The composite index on a scale of 0-100 includes three dimensions: economic (trade flows, investments, and restrictions), social (interpersonal contacts, information flows, and cultural proximity), and political (membership in international organizations, participation in UN missions, and international agreements).

The exchange rate shows a country's bilateral effective real exchange rate against the US Dollar measured as the average period official exchange rate (LCU per US$) and adjusted for the difference in inflation between the domestic country and the United States.

Model

The analysis integrates data from multiple countries, combining time-series and cross-sectional dimensions in a panel data structure. Panel data analysis is employed to obtain richer and more diverse information while mitigating heterogeneity across observations. The econometric model used in this study is specified as follows:

$$M_{it} = \beta_0 + \beta_1 ATM_{it} + \beta_2 MOB_{it} + \beta_3 IP_{it} + \beta_4 GO_{it} + \beta_5 ER_{it}$$

The stages of panel data regression methodology in this study are carried out systematically as follows. First, model selection is carried out through a chow test to compare the common effect model with a fixed effect, followed by a thirst test to choose between fixed effect and random effect. Second, after the selected model, classical assumptions are checked, namely the multicollinearity test (VIF), the autocorrelation test, and the heteroscedasticity test. If there is a violation, it is applied in the form of a robust standard error or generalized least square (Widarjono, 2018; Alvitiani et al., 2019).

RESULT AND DISCUSSION

Descriptive Statistics

Descriptive statistics based on 54 observations across six ASEAN countries (Indonesia, Malaysia, Thailand, Singapore, the Philippines, and Vietnam) for the 2015–2023 period reveal significant disparities in regional financial development. The Money Demand variable, proxied by Broad Money as a percentage of GDP, ranges from a minimum of 38.76% in Indonesia to a maximum of 153.36% in Thailand. Regarding digital finance indicators, the density of ATMs averaged 56.35 units per 100,000 adults, while mobile subscriptions recorded an average of 144.04 per 100 inhabitants. On the macroeconomic front, the globalization index maintained a consistent average of 72.11%, reflecting stable regional integration. Conversely, the exchange rate exhibited an extreme distribution with a mean of 4,311.22, a result of the vast denominational scales between regional currencies, ranging from the high-valued Singapore Dollar to the more volatile Rupiah and Dong.

Table 2. Descriptive Statistics

	M	ATM	MOB	IP	GO	ER
Mean	105.1159	56.34967	144.0359	69.51375	72.11111	4311.220
Median	122.6768	52.12172	143.5780	73.99595	71.50000	34.93177
Maximum	153.3630	114.2714	181.2220	98.02060	83.00000	22602.05
Minimum	38.76024	23.98978	110.9620	22.06270	61.00000	1.336233
Std. Dev.	36.82894	27.36627	19.36125	21.69212	8.213350	7547.690
Observations	54	54	54	54	54	54

Source: Author Computation

Model Selection Test

Initial estimates use fixed effects, followed by an F test for individual effects. The p-value obtained was less than 0.05, indicating statistical significance and comfirming the existance of individual effects. To validate the findings, this study also used integrated Ordinary Least Square (OLS) estimation performed a Chow test, which yielded a p-value below 0,05, confirming the suitability of the fixed effects model. Furthermore, the random effects model was tested using the Hausman test, which also produced a p-value of less than 0,05. These results confirm that the fixed effects model is the most appropriate specification for this study.

Table 3. Models Selection Result

	Test	Prob	Interpretation
Common Effect vs Random Effect	Breush Pagan LM test	< 0.05	Random effects is appropriate
Pooled OLS vs Fixed effects	F test for individual effects	< 0.05	Fixed effects is appropriate
Fixed effects vs Random effects	Hausman test	< 0.05	Fixed effects is appropriate
Overall	Fixed effects is appropriate		

Source: Author Computation

Fixed Effect Models

The results of the panel data regression model estimate show interesting dynamics in determining the demand for money in six ASEAN countries. This model has a fairly strong clear power with an R-Square value of 70.27% which means that the variation in money demand measured as the ratio of Broad Money to GDP can be applied by independent variables used in this study.

Of the five independent variables studied, only two were shown to have a statistically

significant effect. First, the density of ATMs showed a significant positive influence with a coefficient of 0.81. This means that every addition of one ATM unit per 100,000 adult population contributes to an 81% increase in the demand for money. The existence of ATMs not only facilitates transactions, but also strengthens public trust in the formal financial system, which will encourage a preference to hold assets in the form of large amounts of money.

Second, the level of globalization emerged as the strongest driver with a positive coefficient of 2,448. This means that every one-point increase in the globalization index is associated with a 2.5% increase in the demand for money. These results are consistent with the theory that the integration of the global economy through cross-border trade, investment, and financial flows increases the need for domestic liquidity and financial instruments. A more open economy tends to have a better financial sector.

On the other hand, the other three variables did not show a statistically significant influence. The insignificance of these two digital variables suggests that in the context of this study, the acceleration of digital technology adoption has not significantly affected the demand for money in a broad definition. Adanaya transitions on a change in the composition of money from currency to electronic money rather than a change in its aggregate amount. Meanwhile, the exchange rate shows a large but insignificant positive coefficient. This is because the volatility and exchange rate characteristics between countries are very different, the stable Singapore Dollar to the more volatile Indonesian Rupiah and the Vietnamese Dong so that it is difficult to identify the relationship with the demand for money.

Overall, these findings provide an idea that traditional institutional factors (such as ATM access) and globalization still play a central role in shaping the demand for money in ASEAN. Meanwhile, digital transformation, although growing rapidly, has not shown a strong statistical influence in the period observed. The implication of the policy is that the financial sector's deep-seated efforts need to continue to strengthen conventional financial infrastructure, in order to see the long-term impact of digitalization on money demand behavior.

Table 4. Hypothesis Test Result

	Coefficient	Prob	α	Interpretation
ATM	0.817	0.00	<0.05	Statistically significant positive impact
IP	0.139	0.23	>0.05	Statistically not significant
MOB	-0.113	0.47	>0.05	Statistically not significant
GO	2.448	0.00	<0.05	Statistically significant positive impact
ER	7.80	0.88	>0.05	Statistically not significant
R-Square 0.7027				

Source: Author Computation

Robustness Test

This study uses a robustness check on the main findings, by building a digital financial index that links three aspects of digital financial infrastructure including ATM density, internet penetration, and mobile subscriptions into one composite measure. The measurable index adopts from the research (Mulungula et al, 2022) with the following formula:

$$DFI = \frac{ATM + IP + MOB}{3}$$

The results of the estimation of alternative models with DFI as the single explanatory variable show that digital financial indices have a positive and statistically significant effect on money demand. The DFI coefficient of 6.659 and a p-value of 0.00 indicates that any increase in this index increases the money demand by 6%. The large DFI coefficient

indicates that digital transformation as a whole is a very strong driver for the deepening of the financial sector. Simultaneous enhancement of digital access, connectivity, and infrastructure not only facilitates transactions but also expands the user base of formal financial systems and encourages financial inclusion.

The implications of the results of this robust test are twofold, first, this result validates the theoretical proportions that the development of digital finance will strengthen the effectiveness of other dimensions so that it has an impact on deepening the financial system to a greater extent. Second, these findings reinforce the core conclusion that digital transformation is a crucial driver of money demand in the ASEAN Region, while offering a more integrated policy perspective. Thus, this robust test can be the focus of analysis from partial impacts towards a more comprehensive understanding of the synergistic role of digitalization in shaping monetary issues in emerging economies.

Table 5. Robustness Result

	Coefficient	Prob	α	Interpretation
DFI	6.659	0.00	<0.05	Statistically significant positive impact

Source: Author Computation

Discussion

This study shows that in the research period (2015-2023), traditional financial structures and global economic integration are still the main pillars in strengthening the financial sector. The significant influence of ATMs is in line with research (Khera et al., 2021) which emphasizes that physical access to financial service points remains a fundamental requirement for financial inclusion and inclusion, especially in developing countries that are still gradual in technology adoption. Meanwhile, the strong influence of globalization supports the findings of (Zaidi et al., 2024) which states that increased trade and financial integration is positively correlated with the M2 to GDP ratio, as cross-border capital flows and the complexity of international transactions increase the demand for domestic liquidity.

On the other hand, the insignificance of internet penetration and mobile subscriptions is contrary to the hypothesis built in this study. The findings are in line with studies (Arango-et al., 2021) which observes the time lag between the adoption of digital technology and its measurable macroeconomic impact. In the early stages, digitization may have more impact on changing the composition of money (e.g. substitution from currency to electronic money) than increasing the aggregate level of broad money. Frenkel's research (Nguyen et al., 2024) Which suggests that in a floating exchange rate regime with managed floating, the short-term relationship between the exchange rate and the monetary aggregate is often volatile and obscured by policy factors.

To test the robustness of these findings, we capture the holistic impact of digitalization, by consolidating three digital variables into one Digital Financial Index (Gruin et al, 2020). The results actually show a positive and significant influence. This significant shift provides evidence that these robust findings are consistent with the International Monetary Fund's 2022 framework in the Digital Financial Inclusion Index, which affirms that the impact of digitalization on the financial system is synergistic and non-linear. This means that the economic benefits of adopting new technologies are fully realized only when the various components of access, infrastructure, and use evolve simultaneously. In other words, ATMs alone or the internet alone may not be enough, but the combination of the two with mobile devices creates an ecosystem capable of driving inclusion and demand for money significantly (Le Quoc, 2024).

The difference between the basic model and the robust model confirms the hypothesis of Dahlberg et al's positive feedback loop in digital financial transformation. Increased access to ATMs expands the user base, which in turn increases the incentive to adopt digital services (via the internet and mobile phones), which in turn the use of formal financial services will increase the monetary aggregate. Thus, this robust test not only validates the importance of digital transformation, but also revises the interpretation of the basic model: digitalization can be seen to be impactful when analyzed with an entire construct rather than with separate variables. Overall, this study highlights the complexity of the relationship between digitalization and the demand for money.

CONCLUSION AND RECOMMENDATION

This study concludes thas, within observed period (2015-2023), traditional financial infrastructure and economic globalization remain the primary pillars shaping broad money demand in the ASEAN region. Access to physical banking infrastructure, proxied by ATM destiny, and the degree of global economic integration consistently exhibit significant positive effects relevance in financial deppening. Contrary to initial expectations, individual indicators of digital penetration, mobile subscription and internet usage did not show statistically significant direct impact on aggregate money demand.

However, a robustness check employing a composite Digital Financial Inclusion Index reveals a strong and significantly positive relationship, indicating that the impact of digitalization is both synergistic and holistic. The full effect on money demand materializes when digital access, connectivity, and usage advance concurrently, creating a reinforcing ecosystem that promotes engagement with the formal financial system. Interestingly, exchange rate variables were found to be insignificant, likely due to the high heterogeneity and volatility among the diverse currencies within ASEAN. Overall, these findings highlight the complex and non-linear relationship between digital transformation and monetary dynamics in emerging economies.

Further research is required to expand the data scope, incorporating more direct variables related to digital transactions and utilizing non-linear analysis to identify the critical thresholds of digitalization's impact on monetary stability. To maximize these synergistic effects, it is essential to develop an integrated digital financial ecosystem that encompasses service quality, digital financial literacy, and policies supporting comprehensive adoption.

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