E-money and Stock: Empirical Evidence from Indonesia and Thailand

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Abstract
E-money is a type of electronic or digital payment that replaces cash payments. These technological developments will have an impact on reducing the use of cash. The use of e-money possibly affects stock, which is a form of securities. Therefore, the purpose of this study is to assess the relationship between e-money and stock. The study uses the two-stage least squares model to analyze quarterly data for 2011Q1-2019Q4. The study found no relationship between stock and e-money in Indonesia, whereas, in Thailand, there was a relationship between stock and e-money. There is no relationship between e-money and stock in Indonesia and Thailand. The study recommends the Indonesian government or central bank adopt the policies that Thailand has implemented in stock that affects e-money. Stocks can affect the use of e-money due to the profits or losses of the stock that will impact the use of e-money.

Keywords:
e-money, stock, two-stage least squares.

How to Cite:
Introduction

The development of e-money in Indonesia and Thailand is inseparable from the development of the payment system. Indonesia started using e-money in 2009, whereas Thailand began using it in 2010, with transaction values increasing from year to year. Indonesia is one of the main drivers of e-money growth in Southeast Asia, Malaysia, Singapore, the Philippines, and Thailand. Differences in the development of e-money in Indonesia and Thailand can be seen in Figures 1 and 2. Indonesia will be the largest equity market in Southeast Asia, with a total value of shares on the Indonesia Stock Exchange of $ 529 billion. The value of the Indonesian stock market is now approaching Thailand’s, which is in decline. Thailand, which took over from Singapore as the largest Southeast Asian equity market in May 2019, is struggling with the strengthening of the Baht and its SET index as a benchmark. These developments make Indonesia and Thailand relevant case studies.

Market capitalization offers a significant explanation for the existence of short-term dependency, while liquidity is associated with long-term dependency. After isolating general shocks in time, market volatility has a more significant impact on efficiency (Todea & Ple, 2013). When expected inflation decreases, investors invest more in the stock market, long-term bonds, and unappreciated real balances, which reduces short-term deposits (Lioui & Tarelli, 2019). This research will discuss e-money transactions and stock in Indonesia and Thailand. Figures 1 and 2 show the fluctuations in e-money and stock in both countries.

Kartika & Nugroho (2015) found that gross domestic product, M1, and money circulation positively and significantly affected electronic money transactions. Igamo (2018) tested the variables of payment efficiency and money demand function and found that the
increase in the level of consumption and M1 growth, in the long run, is influenced by electronic money. Igamo’s long-term analysis found that the increase in electronic money use has a positive and significant impact on consumption levels. Moreover, this increase has a negative and significant impact on narrow money growth (M1).

A study by Chhapra et al. (2018) indicated a significant impact of the monetary policy component (discount rate, inflation, money supply, and exchange rate) on the stock and bond markets. Moreover, Sidik et al. (2018) found that financial inclusion causes an increase in demand for base money (M0) in developed countries. Conversely, an increase in financial inclusion decreases the demand for base money (M0) in developing countries.

Figure 2. E-money and Stock in Thailand

Majid (2018) studied the volatility of monetary policy variables, interest rates, exchange rates, and the money supply. The study found that all these variables affect the volatility of Islamic and conventional stock markets. This finding implies that the same factors determine the volatility of Islamic and conventional stock markets. Thus, to stabilize the market, volatility in the money supply, interest rates, and exchange rates must be controlled. Neda (2014) found that e-money can replace the currency in circulation, which is part of the monetary aggregate of the Central Bank. Its effect is not significant, as the Central Bank noted a shallow currency decline in circulation due to the increased use of e-money. Al-laham & Al-tarawneh (2009) found that the development of e-money will affect the effectiveness and implementation of monetary policies.

Tiberiu et al. (2019) found that currency substitution is related to the sensitivity of money demand toward the interest rate spread between Central and Eastern European countries and the Eurozone. Furthermore, Bahmani-oskooee & Nayeri (2020) uncovered that increasing uncertainty could stimulate the public to hold more cash to cover their uncertain future expenses. Conversely, if an increase in uncertainty is associated with an
increase in the expected level of inflation, the public can choose to have less cash and more real assets to hedge against inflation in the future.

A study by Belongia & Ireland (2019) shows a stable demand for money that links monetary aggregates (interest rates). Besides, Jawadi & Sousa (2013) found that the demand for money is related to inflation. On the other hand, their study showed that the elasticity of money demand is related to inflation, interest rates, GDP, and variations in exchange rates. Lioui & Tarelli (2019) studied the long-term portfolio choices by investors who hold real balances, stock indices, multiple bonds, and money market accounts. They found that investors allocate more to the stock market, long-term bonds, and unappreciated real balances when expected inflation decreases, thereby reducing short-term deposits. Furthermore, Todea & Ple (2013) showed that foreign portfolio investment has a positive and significant effect on the information efficiency of the eleven Central and Easter stock markets in Europe during the 1999-2010 period.

Based on Figures 1 and 2, e-money and stock in Indonesia and Thailand fluctuate each year. This study aims to analyze and explain the variables that affect e-money and stock in Indonesia and Thailand. The study applies a novel approach by studying the relationship between e-money with stock. Based on the findings, the study develops policy recommendations for the governments of Indonesia and Thailand.

Method

The analysis model uses Two-Stage Least Squares (TSLS) because of the many uses of e-money compared to stock. This shows the relevance of assessing how e-money and stock are related in Indonesia and Thailand. After obtaining the TSLS results for Indonesia and Thailand, the study compares these findings to see which country has better TSLS results. The study uses data for the period of 2011Q1-2019Q4. The variables used in this study are e-money, stock, economic growth, interest rates, inflation, real effective exchange rates, and money supply. Tables 1 and 2 provide a description and sources of the research data.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-money (EM)</td>
<td>E-money Transaction Value</td>
<td>Bank Indonesia</td>
</tr>
<tr>
<td>Stock (SK)</td>
<td>Market Capitalization - the aggregate number of shares</td>
<td>Indonesia Stock Exchange</td>
</tr>
<tr>
<td>Economic Growth (EG)</td>
<td>Real GDP based on 2010 constant</td>
<td>Statistics Indonesia</td>
</tr>
<tr>
<td>Real Effective Exchange Rate (REER)</td>
<td>The relative price of the currencies of two countries in trading in goods and services</td>
<td>Bank for International Settlements</td>
</tr>
<tr>
<td>Inflation (INF)</td>
<td>Customer Price Index</td>
<td>Bank Indonesia</td>
</tr>
<tr>
<td>Rate (R)</td>
<td>Deposits rate in percentage per annum</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>Money Supply (MS)</td>
<td>Nominal values of M2</td>
<td>Bank Indonesia</td>
</tr>
</tbody>
</table>
Table 2. Description Variables and Data Sources for Thailand

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-money (EM)</td>
<td>E-money Transaction Value</td>
<td>Bank of Thailand</td>
</tr>
<tr>
<td>Stock (SK)</td>
<td>Market Capitalization - the aggregate number of shares</td>
<td>Bank of Thailand</td>
</tr>
<tr>
<td>Economic Growth (EG)</td>
<td>Real GDP based on 2010 constant</td>
<td>Bank of Thailand</td>
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<td>Money Supply (MS)</td>
<td>Nominal values of M2</td>
<td>Bank of Thailand</td>
</tr>
</tbody>
</table>

The simultaneous equation model consists of two or more endogenous variables, and an exogenous variable influences each endogenous variable. For more details, see the conceptual framework for the simultaneous equation model in Indonesia and Thailand in Figure 3.

Figure 3. Conceptual Framework for the Simultaneous Equation Model in Indonesia and Thailand

Based on the conceptual framework in Figure 3, the simultaneous equation model in Indonesia and Thailand can be written with the following equation:

\[
\ln EM_{1t} = \alpha_{10} + \alpha_{11}\ln EG_{1t} + \alpha_{12}\ln REER_{2t} + \alpha_{13}\ln INF_{3t} + \alpha_{14}R_{4t} + \alpha_{15}\ln MS_{5t} + \alpha_{16}\ln EM_{1t} + \varepsilon_{1t}
\]

\[
\ln SK_{2t} = \alpha_{20} + \alpha_{21}\ln REER_{2t} + \alpha_{22}\ln INF_{3t} + \alpha_{23}R_{4t} + \alpha_{24}\ln MS_{5t} + \alpha_{25}\ln EM_{1t} + \varepsilon_{2t}
\]
where:

- EM and SK: endogenous variables
- EG, REER, INF, R, MS: exogenous variables
- $\alpha_{10}$ and $\alpha_{20}$: constants
- $\alpha_{11} - \alpha_{25}$: structural parameter
- $\varepsilon_t$: residual
- Ln: natural logarithm

Results and Discussion

To find out whether simultaneous equations are identified or overidentified, the study assesses whether $K_k$ is greater or smaller than $m-1$: ($K_k < m-1$): identified or ($K_k > m-1$): overidentified. The identification of simultaneous equations can be seen in Table 3. Based on the results of identifying simultaneous equations in Table 3, the simultaneous equation model is found to be overidentified. Therefore, the study uses the Two-Stage Least Squares (TSLS) method of analysis.

<table>
<thead>
<tr>
<th>Variables</th>
<th>K/m</th>
<th>Equation (1)</th>
<th>Equation (2)</th>
<th>Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endogen</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>Overidentified</td>
</tr>
<tr>
<td>Exogen</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>Overidentified</td>
</tr>
</tbody>
</table>

Source: Author Calculations

This section presents the estimation results for the simultaneous e-money equations and the simultaneous stock equations for Indonesia and Thailand in the equations below:

### Simultaneous E-money equation for Indonesia:

$$\ln EM_{1t} = -153.418 + 14.443\ln EG_{1t} - 0.022\text{REER}_{2t} - 0.061\ln INF_{3t} - 0.211R_{4t} - 2.560\ln SK_{2t}$$

### Simultaneous Stock equation for Indonesia:

$$\ln SK_{2t} = 1.884 + 0.0003\text{REER}_{2t} - 0.012\ln INF_{3t} - 0.011R_{4t} + 0.904\ln MS_{5t} - 0.008\ln EM_{1t}$$

### Simultaneous E-money equation for Thailand:

$$\ln EM_{1t} = -99.402 + 5.776\ln EG_{1t} + 0.022\text{REER}_{2t} + 0.040\ln INF_{3t} + 0.064R_{4t} + 1.466\ln SK_{2t}$$

### Simultaneous Stock equation for Thailand:

$$\ln SK_{2t} = -7.583 + 0.007\text{REER}_{2t} + 0.020\ln INF_{3t} - 0.091R_{4t} + 1.427\ln MS_{5t} - 0.036\ln EM_{1t}$$

The coefficient of determination is useful to measure the ability of the model to explain endogenous variables. Specifically, the smaller the value of $R^2$, the more limited the model’s ability to explain endogenous variables. Vice versa, the greater the value of $R^2$, the better the model’s ability to explain endogenous variables. Tables 4 and 5 present the coefficient of determination $R^2$ for e-money and stock in Indonesia and Thailand.
Table 4. Coefficient of Determination for E-money and Stock in Indonesia

<table>
<thead>
<tr>
<th>Endogenous Variables</th>
<th>Coefficient of Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-money</td>
<td>0.899</td>
</tr>
<tr>
<td>Stock</td>
<td>0.938</td>
</tr>
</tbody>
</table>

Based on Table 4, the coefficient of determination $R^2$ for e-money in Indonesia shows that the variables of economic growth, real effective exchange rate, inflation, interest rates, and stock contribute 89.9 percent to e-money in Indonesia. Meanwhile, the remaining 10.1 percent is influenced by other variables not included in the e-money equation. Moreover, the coefficient of determination $R^2$ for the stock is 93.8 percent, which shows the real effective exchange rate, inflation, interest rates, money supply, and e-money to stock in Indonesia. Meanwhile, the remaining 6.2 percent is influenced by other variables not included in the stock equation.

Table 5. Coefficient of Determination for E-money and Stock in Thailand

<table>
<thead>
<tr>
<th>Endogenous Variables</th>
<th>Coefficient of Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-money</td>
<td>0.931</td>
</tr>
<tr>
<td>Stock</td>
<td>0.924</td>
</tr>
</tbody>
</table>

Based on Table 5, the coefficient of determination $R^2$ for e-money in Thailand is 93.1 percent, this shows the contribution of the variables of economic growth, the real effective exchange rate, inflation, interest rates, and stock e-money in Thailand. Meanwhile, the remaining 6.9 percent is influenced by other variables not included in the e-money equation. The coefficient of determination $R^2$ for the stock is 92.4 percent. This shows the real effective exchange rate, inflation, interest rates, money supply, and e-money to stock in Thailand. Meanwhile, the remaining 7.6 percent is influenced by other variables not included in the stock equation.

Table 6. F-Test Statistic for Indonesia and Thailand

<table>
<thead>
<tr>
<th>Variables</th>
<th>F-Test</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-money (Indonesia)</td>
<td>54.859</td>
<td>0.0000</td>
</tr>
<tr>
<td>Stock (Indonesia)</td>
<td>90.536</td>
<td>0.0000</td>
</tr>
<tr>
<td>E-money (Thailand)</td>
<td>84.535</td>
<td>0.0000</td>
</tr>
<tr>
<td>Stock (Thailand)</td>
<td>72.642</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

The F-test shows whether all exogenous variables influence the endogenous variables. The results of the F-tests for Indonesia and Thailand can be seen in Table 6. Based on table 6, the e-money equations produced F-values of 54.859 and 84.535 for Indonesia and Thailand. Therefore, economic growth, the real effective exchange rate, inflation, interest rates, and stock influence e-money in Indonesia and Thailand. Furthermore, the
stock equations resulted in F-values of 90,536 and 72,642 for Indonesia and Thailand, respectively. Thus, the real effective exchange rate, inflation, interest rates, money supply, and e-money influence stock in Indonesia and Thailand.

The t-test shows the influence of the exogenous variables on the endogenous variables. The T-test results for e-money and stock in Indonesia and Thailand can be seen in Tables 7 and 8. Based on Table 7, economic growth (EG) influences e-money in Indonesia and Thailand with a probability value of 0.0004 and 0.0026, respectively. These values are smaller than 0.10, which signals a positive and significant relationship based on Kartika & Nugroho (2015). This finding explains that an increase or decrease in economic growth (EG) will affect fluctuations in e-money. The interest rate (R) has probability values of 0.0725 (Indonesia) and 0.7395 (Thailand) that are smaller than 0.10, which signals a negative and significant relationship based on various studies (Belongia & Ireland, 2019; Jawadi & Sousa 2013; Tiberiu et al., 2019).

This finding explains that an increase or decrease in interest rates (R) will decrease or increase e-money. For Thailand, stock (SK) affects e-money with a probability value of 0.0990, which is smaller than 0.10 and signals a positive and significant relationship. Thus, an increase or decrease in stock (SK) will have an impact on e-money.

Based on table 8, the money supply affects stock with a probability value of 0.0000 (in Indonesia) and 0.0174 (in Thailand). These values are smaller than 0.10, so the money supply has a positive and significant relationship (see Chhapra et al., 2018; Majid, 2018). Consequently, an increase or decrease in the money supply (MS) will affect stock (SK) in Indonesia and Thailand.
This section compares the TSLS results, coefficient of determination, the F-test, and the t-test. This statistical analysis uncovered that Thailand has the best results for the e-money and stock equations because stocks influence e-money. An increase or decrease in stock will have an impact on fluctuations in e-money. Conversely, the influence of Indonesian interest rates is more significant than in Thailand because interest rates impact e-money.

The stock can affect the e-money in Thailand. The public will look at if the stock of economics will be observed if the stock is performing good performance will have an impact performance that will impact the value of the value (profit) will have an impact on the value of the e-money. In the event of an increase in the use of e-money. In comparison, it will affect the increase in the use of e-Money. At the same time, it will affect the increase in the use of e-money.

In contrast, it will affect the increase in the use of e-money. In comparison, it will affect the increase in the use of e-money. While the stock of poor performance will impact the reduction of value (loss) will impact the decrease of e-money. The interest rate policy can affect the e-money in Indonesia. The public will look at interest rate policies whether interest rates will increase or decrease. If the interest rate increases, the economic interest will save the banking money due to the added value. Where if interest rates decreased will have an impact on increased e-money.

Conclusion

This study discusses the causal relationship between economic concepts based on e-money and stock in Indonesia and Thailand. The analysis model uses Two-Stage Least Squares (TSLS) to assess the variables that affect e-money and stock in Indonesia and Thailand. The determinants are economic growth, interest rates, inflation, real effective exchange rate, and money supply, and the analysis uses quarterly data for the period of 2011Q1-2019Q4. The results show that economic growth and interest rates significantly affect e-money in Indonesia, whereas economic growth and stock have a significant effect on e-money in Thailand. Moreover, the money supply has a significant effect on the stock in Indonesia and Thailand. The study found no relationship between stock and e-money in Indonesia, whereas, in Thailand, there is a relationship between stock and e-money. There is no relationship between e-money and stock in Indonesia and Thailand.

Based on the findings, the study recommends that the Indonesian government or central bank consider Thailand's policies in stock that affect e-money. Stocks can affect the use of e-money due to the profits or losses of the stock that will impact the use of e-money. Whereas the government or the central bank of Thailand can design policies inspired by Indonesia's interest rate policy, the public will pay attention to the interest rate whether it has increased or decreased as it will determine the use of e-money.

Acknowledgments

This study work is supported by SIMLITABMAS (Sistem Informasi Penelitian dan Pengabdian Kepada Masyarakat) RISETDIKTI.
References


