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Money Demand Analysis through Business Cycle in Indonesia

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ABSTRACT

There is still debate about the role of monetary aggregates (money demand) and their nature in the domestic economy, whether there is a direct affect and indirect affect. After the 2008 crisis, monetary aggregates became a monetary policy tool that played an important role in maintaining domestic economic stability. This study aims to examine macroeconomic variables on the demand for money in Indonesia from 2000Q1-2021Q4 using the VECM approach. The business cycle is used as a proxy for the income variable with the Hodrick-Prescott Filter method on the GDP variable. The results show that income has a high degree of variability in the demand for money and there is a sensitivity in the response of the demand for money to fluctuations in domestic interest rates. The implication of this research the application of domestic interest rates at the lowest level can encourage income which can increase the demand for money in Indonesia.

1. Introduction

One of the lesson from 1997 crisis and the 2008 global financial crisis, Bank Indonesia as the monetary authority reviewed monetary policy become more stable for the domestic economy. One of the instruments used in policy is the demand for money or agregate monetary which plays an important role in maintaining stability. Many researchers have analyzed the previous demand for money from either developed or developing countries. Research conducted by Prawoto (2000) discusses the demand for money and its influencing factors using macro variables, namely income, interest rates and price changes. In order to obtain comprehensive results, money in the narrow sense (M1) and money in the broad sense (M2) can be used in the money demand model. There are research results showing that the income variable tends to be higher than the interest rate and inflation variables, this proves that the use of money for transactions and precautions is higher. In addition, demand in the long term will be greater than in the short term because money in the long term can hold various liabilities that banks have offered to the public.

Research of the demand for money continues to grow and more challenging. This makes the demand for money play a very important role in the monetary policy framework. There is a goal in the implementation of monetary policy in developing countries, namely the stability of commodity prices and exchange rates. The demand for money has become a major factor in the economy and monetary policy framework since the emergence of the discipline of economics in both the short and long term. (Folarin & Asongu, 2019; Rogoff, 2017). Research that has been conducted by Kurniawan (2020) using the ARDL approach states that the demand for money has cointegration based on the bound test. In this study it was found that income and inflation had a positive and significant effect on M1 and M2 in the short and long term, domestic interest rates had a positive effect on M2 but not significant on M1 in the short and long term, while foreign interest rates had a negative effect. to M2 but not significant to M1 in the short term and long term. Meanwhile, the exchange rate has a negative effect on M1 and M2 both in the short and long term. Whereas Folarin & Asongu (2019) conducted research in Nigeria also stated that income, domestic interest rates, foreign interest rates, and exchange rates have cointegration using the ARDL test approach which has cointegrated both in the short term and long term which has been developed by Pesaran et al (2001). The study covers quarterly data from 1992 to 2015, showing that the demand for money in the narrow (M1) and broad (M2) terms using the CUSUM and CUSUMQ approaches is stable in Nigeria.

Research by James (2005) shows that income and interest rates have been cointegrated with the demand for money in M2 in data for 1983-2000 in Indonesia. The results of this study were also using the CUSUM and CUSUMQ test approaches which show that the demand for money in Indonesia is stable. Meanwhile, another study by Narayan (2007) analyzed the function of the demand for money in Indonesia in 1970-2005 using the Johansen approach. The test results show that the money demand for both M1 and M2 in the variables of income, exchange rates, domestic interest rates and foreign interest rates have been cointegrated. This research was also tested using the Hansen test approach which shows that the demand for money in Indonesia is unstable. The stability test for money demand above shows inconclusive results, where the research developed by James (2005) shows that the demand for money in Indonesia is stable, while the research developed by Narayan (2007) and Kurniawan (2020) shows that it is unstable, which implies that inflation targeting policies are more appropriate implemented in Indonesia compared to monetary targeting policies. Poole (1970) states that the demand for money can be used as a formula used by monetary authorities by applying monetary aggregates as a policy tool. Contrary to Friedman (1975) who stated that monetary aggregate as a policy tool does not play a direct role in the policy process, Friedman places more

emphasis on the main target of monetary policy, namely real output. With the development of the literature, it shows that one of the main targets of monetary policy is the level of price stability, with that the implementation of inflation targeting policies can be applied compared to money targeting or monetary aggregates. Meanwhile, Duca & VanHoose (2004) stated that the development of financial innovation will have a practical impact on the implementation of monetary policy so that research related to the demand for money is important to do to provide policy alternatives to monetary authorities. Based on the literatures that money demand have cointegration means that money demand function have long run estimations.

Widodo (2015) analyzes the effect of money demand in the narrow sense (M1) using the Error Correction Mechanism (ECM) approach. The results of his research show that the GDP variable has no effect on the short term, while the exchange rate and price level variables have a positive effect on the demand for money (M1) in the short term. However, the interest rate variable has a negative effect on the demand for money (M1). The results of this study also show that the GDP and price level variables have a positive influence on the demand for money (M1) in Indonesia in the long term. Exchange rates and interest rates have a negative influence on the demand for money (M1). Meanwhile, inflation has a positive effect on the demand for money in both the short and long term. Another debate about the characteristics of the demand for money is the use of interest rates. Rao & Kumar (2009) state that the use of interest rates in developing countries becomes inappropriate when the demand for money is stable. This study uses the interest rate variable as a function of opportunity variables which can be used as information as the opportunity cost of holding money, this indicates that the money demand function becomes more sensitive to changes in interest rates. To obtain comprehensive information and sensitive nature of money demand. The use of interest rates based on domestic interest rates and foreign interest rates. Because the two interest rates have a different role on the demand for money.

To bridge the differences between previous studies, this study apply the concept of the business cycle either economic growth and its relation to the demand for money, especially in Indonesia. Economic growth describes aspects of improvement in economic development (Susilo et al., 2020) but does not capture the real volatility of economic activity. Research on the business cycle and demand for money was applied by Goyal & Kumar (2018) in India using the Kalman Filter approach as a proxy for income and showed that the parameter of income elasticity of demand for money (in the narrow sense) is greater than the parameter of income elasticity of demand for money in a broad sense. This study contribute to the literature; 1) application of the business cycle using the HP filter approach as a proxy for income elasticity; 2) test the income elasticity of money demand in a broad sense for the short and long term using the vector error correction model (VECM) approach; 3) application of the time-series model and its relation to macroeconomic variables on the demand for money in Indonesia.

2. Literature Review

M. Friedman & Schwartz (1963) observe money and business cycle and they stated that in the US business cycle the movement of monetary aggregates consisting of the money supply and bank deposits (the money supply in the broadest sense/M2) systematically precedes the movement of real output. The amplitude of money movements correlates closely with general business cycle movements and half the amplitude of money cycle movements is revenue. From the supply side, the pattern of the money cycle is the money component of public ownership between income and deposits. Stock of money is closely and systematically related to income in the business cycle rather than investment. Freeman & Huffman (1991) stated that nominal money stock has a positive correlation with output. Changes in the money stock are

endogenous reactions and do not cause changes in output. Šustek (2010) states that the causality of economic activity is towards money and not vice versa, and the monetary base is endogenous through the Taylor rule.

The role of monetary policy is crucial, apart from having a strong correlation with output throughout the business cycle, global influence can also be mitigated through strong monetary policy. Debate about the role of monetary aggregates is growing as stated by Woodford (2001) hat theoretically setting central bank interest rates is consistent with inflation and output gaps, this cannot be separated from the instability of monetary aggregates as a monetary policy instrument. However, research on monetary aggregates has implications for monetary policy on stability test for money demand shows inconclusive results, where the research developed by James (2005) shows that the demand for money in Indonesia is stable, while the research developed by Narayan (2007) and Kurniawan (2020) shows that it is unstable, which implies that inflation targeting policies are more appropriate implemented in Indonesia compared to monetary targeting policies.

The relevance of monetary aggregates is shown by Nelson (2003) on the basis of literature on monetarist schools showing that there is a relationship between money and inflation as well as money and aggregate demand. The developments and dynamics of inflation that occurred were caused by money growth. The relevance of money and aggregate demand is not through real balance effects but in money being used as a proxy for the substitution effect of monetary policy. The role of monetary aggregate is important because it can increase the value of money against monetary policy. Study from Goyal & Kumar (2018) shows that the elasticity of money demand in term of narrow money is greater than the elasticity of money demand in term of broad money and interest rate are semi-elastic to the demand for money because the value of coefficient close to one. The results show that money supply plays important role in the domestic economy in India.

Another study developed by Telyukova & Visschers (2013) states that the standard business cycle using the role of money in the model has the limitations in demand for money model. The limitations are the lack of realistic predictability of money in business cycles and the only uncertainty affect money its aggregate. Research focus on money demand and uncertainty developed by Kurniawan et al., (2022); Bahmani-Oskooee & Baek (2016) dan Bahmani-Oskooee & Nayerim (2018) and shows that economic uncertainty will increase volatility of output and led to people's decision to holding the money and allocate their wealth. However, there are several advantages of using the business cycle in the model for money demand, the advantages that can capture the volatility of changes in incomes and its more realistic than income using a proxy of GDP etc (Hodrick et al., 1991).

3. Research Method

This study use the Vector Error Correction Model (VECM) method to analyze quarterly data from the period 2000 – 2021. Variables including in the model money demand function are income, domestic interest rates, foreign interest rates, value exchange rate and money supply in Indonesia. Data sources are taken from Indonesian banks, the Fed and researchers calculations. The income variable used a proxy for the GDP variable which is filtered using the Hodrick Presscott Filter (HP) method. The HP Filter method aims to determine the long-term trend component appraisal. Specifically, this method is a linear filter on two sides (backward-forward) which is used as a calculation of the smoothed-trend series (s) resulting from the output (y) by minimizing the loss function (L) value of the y variance with lambda λ 1600 for quarterly data.

Error correction term in the model has two meanings there are for the long-term estimation and the dynamics model for the short-run estimation. This econometric approach tries to explain the impacts of macroeconomic variables on money demand in Indonesia through business cycle as proxy for income. This model is presented by the following:

$$\Delta MD_t = \beta_{12} + \beta_{13}\begin{pmatrix}\gamma\\ \mu\end{pmatrix} MD_{t-1} + \sum_{i=1}^{n}\varphi_{11i}\Delta MD_{t-1} + \sum_{j=1}^{m}\varphi_{12j}\Delta Inc_{t-j} + \sum_{k=1}^{q}\varphi_{13q}\Delta r_{t-k} + \sum_{l=1}^{w}\varphi_{14}\Delta r^*_{t-l} + \sum_{l=1}^{w}\varphi_{14}\Delta Exc_{t-l} + \varepsilon_t \quad \text{.....(1)}$$

VECM estimation has the error correction term as dynamic model (θECM_{t-1}), which measures for the speed of adjustment of augmented money demand to its equilibrium level. In VECM, macroeconomic variables in the model (MD, Inc, r, r*, Exc) are endogenous in order to establish the long and short-run relationship in model for money demand. β_{12} is an unrestricted intercept in this model, β_{13} is a matrix of coefficients measuring the speed of adjustment to equilibrium, $\sum_{i=1}^{n}\varphi_{11i}$ is a matrix of coefficients measuring short-run effects, $\sum_{j=1}^{m}\varphi_{12j}$, $\sum_{k=1}^{q}\varphi_{13k}$ and $\sum_{l=1}^{w}\varphi_{14l}$ are the matrix of coefficients measuring short-run effects of exogenous variables, γ presents the matrix of long-run coefficients, μ is the restricted intercept in the co-integrating vector and ε_t is the error term.

4. Results and Discussion

All observation in this study are 88 from quarterly data begin 2000 to 2021. Table 1 shows that the variables money demand (M2), r (domestic interest rate), and Exc (exchange rate) have small data variability due to the standard deviation value smaller than the average value, while the output gap (Inc) and r* (foreign interest rates) variables have high data variability because the standard deviation value is greater than the average value.

Table 1. Statistic Descriptive

Variables	N	Min	Max	Mean	Std. Deviation
MD	88	13.395	15.878	14.668	0.763
Output Gap	88	-0.052	0.053	0.007	0.020
r	88	3.500	17.620	7.980	3.433
r*	88	0.070	6.500	1.644	1.899
Exc	88	8.935	9.703	9.287	0.201

Source : data processed

The stationery test using the Augmented Dickey Fuller (ADF) approach. Unit root testing is applied to determine whether the data from the variables used have unit root problems or not. If a data is not stationary (there is a unit root problem) then it can produce an spurious regression, or a relationship between economic variables that looks significant but in real terms is not significant.

Table 2. Stationery Test

Variable	Level ADF-Statistics	First Difference ADF-Statistics
MD	2.087	-9.585***
Output Gap	-3.357***	-5.826***
r	-2.417	-4.613***
r*	-4.249***	-2.967**
Exc	-0.883	-11.525***

Source: data processed

Table 2 shows the result for unit root test by ADF approach at the level, only output gap variables and foreign interest rates which can be stated there is no unit root problem and on the first difference, it can be said that all variables, money demand, output gap (income), domestic interest rates, foreign interest rates, and the exchange rate have an ADF-statistic value that is smaller than the critical value at α 5% or 0.05, so that it can be said to be stationary

or pass the Unit Root Test at the first difference level or I(1)) which means that all the variables used in the model have consistency in the mean and variance values (Abdillah, 2023).

Cointegration test was carried out using the Johansen's Cointegration Test method. If there are cointegrated between variables means that there is equilibrium in long-term (Sujianto & Azmi, 2020). Based on Table 3 show the model has 2 (two) cointegrated ranks at a five percent significance level either trace and maximum eigenvalue approach. Taken together, these results suggest that there are at least two long-run (cointegrating) relationship among MD, output gap, r, r* and Exc means those variables have a movements and relationship of stability in the long term.

Table 3. Cointegration Test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No of CE (s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob. **
None*	0.334024	82.94353	69.81889	0.0031
Atmost 1*	0.307483	48.39083	47.85613	0.0445
Atmost 2	0.135325	17.15991	29.79707	0.6282
Atmost 3	0.039924	4.800794	15.49471	0.8296
Atmost 4	0.015614	1.337691	3.841465	0.2474
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
None*	0.334024	34.55270	33.87687	0.0415
Atmost 1*	0.307483	31.23093	27.58434	0.0162
Atmost 2	0.135325	12.35911	21.13162	0.5126
Atmost 3	0.039924	3.463103	14.26460	0.9112
Atmost 4	0.015614	1.337691	3.841465	02474

Source: data processed

Table 4 shows that VECM estimation there is no variables has significant affect in short-run estimation, this happens because the model in this study is a relationship between monetary and macroeconomic model, so that a variable takes time or lag to react to other variables so that generally the reaction of a variable to other variables occurs in the long run. The result of the cointegration value (CointEq1) has a negative coefficient value and t-statistic higher than t-table, which means that if an error occurs in the short term, the model will correct and regain its equilibrium in the long term by taking 5 quarters.

Table 4. Short and Long run Estimation of VECM

Variable	Short-Term Coefficient	T-Statistics
CointEq1	-0.052	-2.753**
MD (-1)	-0.051	-0.454
MD (-2)	-0.090	-0.795
Output gap (-1)	0.207	0.311
Output gap (-2)	1.110	1.798
r (-1)	-0.002	-0.085
r (-2)	0.009	0.403
r* (-1)	-0.061	-1.830
r* (-2)	-0.004	-0.121
Exc (-1)	-0.155	-0.618
Exc (-2)	0.257	1.051
C	0.037	2.587
Variable	Long-Term Coefficient	T-Statistics
Output gap (-1)	33.327	3.425***
r (-1)	0.381	6.934***
r* (-1)	0.025	0.300
Exc (-1)	0.100	0.138

Source: data processed

Table 4 shows that in the long term VECM estimation there are two variables that affect the demand for money in Indonesia, this is taken from the t-statistics value which is greater than the t-table, namely the output gap variable and domestic interest rates and these two variables show a value positive coefficient. The remaining variables, namely foreign interest rates and exchange rates, have a t-statistics value smaller than the t-table, indicating that these two variables have no effect on the demand for money in Indonesia in the long run.

The output gap in the model used as a proxy for income. An equilibrium condition occurs when there is a demand and supply of money, an increase in the money supply (JUB) is caused by an increase in per capita income. People's income rises it will have an impact on the demand for money or the money supply which will increase. The magnitude (based on VECM result) of income in the long term has a high elasticity value of 33.33. These findings are in line with research developed by Kurniawan (2020), Setiadi (2013), Narayan (2007) and James (2005). The results of the research support the theory developed by the Classics (The Quantity Theory of Money) that the demand for money is affected by income, while also supporting the theory of Keynes about the motive for holding money, namely the motive for transactions and precautions which is determined by income. The sensitivity of money demand in Indonesia occurs when there is a change in domestic interest rates compared to foreign interest rates. The results of the study show that this is because an increase in interest rates can cause the demand for money to increase. Not as expected that the relationship between the domestic interest rate has a negative relationship while a positive relationship because an increase in the domestic interest rate raises the opportunity cost of holding money. An increase interest rates can occur as a sign of increasing inflation in Indonesia, so that the application of increased interest rates is to prevent higher inflation. The finding support the previous study conducted by Narayan (2007) and contrast with the research developed by James (2005) and Widodo (2015).

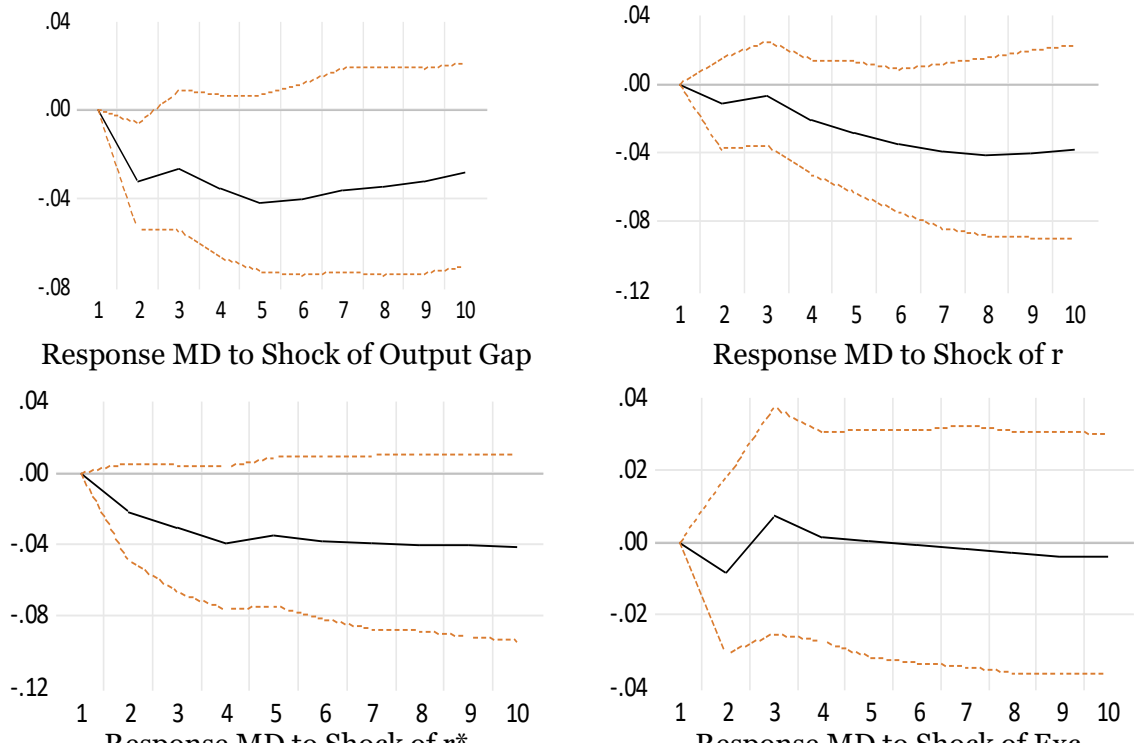

Figure 1. Response of Money Demand on Macroeconomic Shock

Source: data processed

Shock the output gap variable in this case as a proxy for income is responded negatively by the demand for money, where when our income decreases, we will be more likely to save money or save so that the demand for money will also decrease. The demand for money has decreased because declining income will make people more selective in consumption and will save more, this is in line with Abdulkheir (2013). A negative response is shown from the demand for money to fluctuations in domestic interest rates. It can be said that when interest rates rise, the demand for money will decrease. The interest rates increase, people will be more to save the money than to consume.

With fluctuations in foreign interest rates responded negatively by the demand for money, it conclude that increasing foreign interest rates will result in the depreciation of the rupiah. If the value of the interest rate is too large between interest rates abroad and in Indonesia, then the value of the rupiah will continue to be depressed or weak, people will tend to want to consume dollars compared to rupiah. Exchange rate fluctuations will be responded negatively by the demand for money, it can be said that when the exchange rate in a country's currency (US Dollar) is higher against the rupiah, the rupiah value will weaken. The system in Indonesia uses market mechanisms that occur and return to supply and demand. Exchange rate volatility in a country will result in weaker domestic goods causing imported goods to become more expensive.

Table 5. Forecast Error of Variance Decomposition

		Variance Decomposition of Money Demand				
Period	S.E.	MD	*Output gap*	r	r*	Exc
1	0.115709	100.0000	0.000000	0.000000	0.000000	0.00000
2	0.162196	93.51486	3.946153	0.4406153	1.855115	0.243238
3	0.195381	91.04248	4.535216	0.422603	3.676322	0.323378
4	0.227972	87.28426	5.753956	1.144234	5.574741	0.242809
5	0.258803	84.52385	7.059721	2.055556	6.728860	0.189259
6	0.288001	82.38635	7.639686	3.092168	6.728860	0.152935
7	0.314288	80.79651	7.714371	4.146878	7.211738	0.130498
8	0.338768	79.57074	7.670894	5.040009	7.599367	0.118988
9	0.361555	78.82139	7.518849	5.638085	7.907289	0.114384
10	0.382598	78.42607	7.254449	5.994592	8.213058	0.111826

Source: Data processed

Forecast Error Variance Decomposition is used to calculate how big the influence of random shocks from certain variables to endogenous variables. Another advantage using variance decomposition are analysis the strengths of each variable in influencing other variables over a long period of time Basuki & Yuliadi (2015). Overall, the output gap variables, domestic interest rates and foreign interest rates have a high contribution to the variability of the demand for money in Indonesia, where the output gap dominates the variability of the demand for money, while the exchange rate has a small contribution to the demand for money in Indonesia.

5. Conclusion

The HP filter method on the GDP variable as a proxy for income shows consistent results with the several previous studies within the VECM model framework in the long run the variables of income and domestic interest rates have a significant effect on the demand for money in Indonesia. The Variance Decomposition method produces that the highest variability is shown in the income variable. An increase in income will result in an increase in the demand for money, which can illustrate that people's welfare has increased. The results of the impulse response function show the sensitivity of the response of money demand to interest rate shocks in Indonesia, these findings support a policy known as the Taylor rule

which can increase inflation and output after shocks to monetary aggregates or money demand. The policy implication is to set domestic interest rates at the lowest level to be able to encourage income which can increase the demand for money in Indonesia. Future work can further an explore and analysis about the demand for money on the micro foundations. it can capture how shock affect to income on household view and impact in their wealth.

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