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# META-ANALYSIS OF MONEY DEMAND IN INDONESIA

*Galih Riyandi*<sup>1</sup>

## Abstract

*Studies on the demand for money in Indonesia are widely available. The use of various estimation techniques has given various results, which to some extent is difficult to derive a definitive conclusion about the behavior of the demand for money in this country. This paper aims to find out the tendency of the demand for money in Indonesia by analyzing the long run and the short run income and opportunity cost elasticity. We use fixed effects and unweighted average meta-analysis. The result shows that income and opportunity cost elasticity are consistent with theory of money demand. This result can be used as an empirical foundation to future studies about demand for money in Indonesia.*

*Keywords: demand for money, meta analysis, fixed effects.*

**JEL Classification code:** E41, E52

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## I. INTRODUCTION

Quantitative studies on the analysis of money demand in Indonesia have started long ago. Knell and Stix (2003) even stated that the analysis of the demand for money is one of the most popular areas for economic science researchers as evidenced by the thousands of articles that discuss the demand for money from different countries and time periods. Analysis of the demand for money still plays an important role in the analysis of macroeconomic policy, especially in choosing the appropriate monetary policy. The phenomenon of the globalization of financial markets, domestic financial liberalization and innovation econometric techniques make research on the demand for money more popular in recent decades (Sriram, 2001).

Research on the analysis of demand in Indonesia has done them by Aghevli (1976), Aghevli et.al (1979), Insukindro and Sugiyanto (1987) and Jaya (1990) on the partial adjustment model. Then followed by Price and Insukindro (1994) and Sriwiyanto(2004) approach to *error correction mechanisms* and the *Forward Looking Model*, and Insukindro (1998) using a buffer stock money demand. The advent of new approaches in the analysis of the demand for money resulted in the GETS and FMOLS models by Singh and Kumar (2007) and the ECM-ARDL approach by Achسانی (2010).

However, based on observations in the research literature, money demand in Indonesia has yielded a variety of analytical results. One of the focuses of this research is the income elasticity and the elasticity of the estimated opportunity cost with a fairly wide range. This has led to difficulties in finding a common symptom of the demand for money in Indonesia. Based on narrative review of studies conducted Phase (1994), he stated that some studies showed conflicting empirical results, with some outliers on the coefficient values of certain variables. This leads to the conclusion that the simplification of the theory of the demand for money is blurred using an empirical approach.

This paper collects and examines various analytical results on money demand in Indonesia using a technique known as fixed effects meta-analysis by Lipsey and Wilson (2001: 129-133). The purpose of this paper is to examine the behavior of money demand as a common symptom in Indonesia through the observation of the long-term and the short term elasticity, both for income elasticity and opportunity cost elasticity and / or semi-elasticity of previous studies. Meta-analysis can be used to help solve problems that arise due to the different variations of the study results. Ultimately this technique can be used to estimate the income elasticity and the elasticity of the opportunity cost. This paper developed a meta-analysis of different techniques of analysis-quantitative analysis of money demand has been made. Meta-analysis used in this paper provides comprehensive quantitative summaries of previous quantitative analyzes and examines the elasticity of the short and long runs separately.

The material presented in this paper are expected to provide new insights into understanding the behavior of money demand in Indonesia that can help policy makers in

designing appropriate monetary policy and assist in the development of research money demand in Indonesia in the future.

Next section of this paper discusses the theoretical specification, section 3 discusses the research methodology, section 4 discusses the results of the analysis of the research, and the final section discusses conclusions.

## II. THEORY

Sriram (1999) briefly give a conclusion that the theory of demand for money is the theory of the *demand for real balances* to the equation:

$$M/P = f(S, OC)$$

Demand of real balances  $M/P$  is a function of the scale variable ( $s$ ) that represents economic activities and the opportunity cost of holding money ( $OC$ ).

Knell and Stix (2003) provide a more complete model of the equation of money by entering *wealth* as a factor affecting the demand for money

$$m_t - p_t = \gamma_0 + \gamma_1 Y_t + \gamma_2 i_t^{own} + \gamma_3 i_t^{out} + \gamma_4 \pi_t + \gamma_5 w_t + \gamma_6 X_t + \varepsilon_t$$

$m_t - p_t$  is the logarithm of real money demand,  $Y_t$  variable is the logarithm of the scale,  $i_t^{own}$  is the nominal interest rate of financial assets as defined by the monetary aggregate variables,  $i_t^{out}$  is the interest rate for one of the variables out of the definition of monetary aggregates,  $\pi$  is the rate of inflation,  $w_t$  is the variable approach to *wealth* and  $X_t$  is a vector of other variables that can have a systematic impact on aggregate demand of money.

Price and Insukindro (1994) explain the M1 money demand model for an open country such as Indonesia assuming log linearity as follows:

$$m_t = a + by_t + cr_t - d\bar{r}_t$$

Domestic money demand is affected by income,  $y$  (as the scale variable approach) and as a consequence of the open economy, the holder of money has two alternative options, domestic assets and foreign assets. The domestic interest rate is denoted  $r$  and interest rates on holding foreign assets represented by  $\bar{r}$ .

### III. METHODOLOGY

#### 3.1 The Concept of Meta-Analysis

This study used meta-analysis as an analytical tool. According to Stanley and Jarell (1989), meta-analysis is an analysis of some of the empirical analysis that aims to combine and clarify the literature on some important parameters. In brief, meta-analysis can be understood as a form of a series of studies conducted as a survey of research results, performs procedure *coding*, collecting samples or populations of such research, stores information on the characteristics and quantitative results and then performs data analysis by adapting conventional statistical techniques to investigate and to describe the shape of the data (Lipsey and Wilson, 2001:1).

Some experts argue that the primary purpose of meta-analysis is to get statistically significant results (Simon, 2000: 308). This is consistent with the use of statistics in the meta-analysis. However, the statistical significance of the results is not everything. Simon (2000: 308) explains that in the meta-analysis in the field of medical science of statistical significance does not necessarily answer questions of medical experts about how to provide appropriate care to patients. Therapeutic effect size (*The size of treatment effect*) no less important, especially when dealing with the therapeutic use of hazardous substances and the treatment of patients with a high cost. Simon summed up that the general benefit of statistical analysis in clinical studies or in the meta-analysis was to obtain therapeutic effect size estimates with the goal of helping the process of clinical decision making.

To summarize the evidence (discovery) of various analysis tools, the meta-analysis convert the statistical results into a metric that can be compared (Stanley, 2001). Gene Glass in 1976 and 1977 popularized the term meta-analysis which introduces the concept of *effect size* to integrate these empirical findings of existing literatures (see Stanley, 2001). According to Lipsey and Wilson (2001:3) the size effect is statistically significant quantitative measure symbolizing each sample of quantitative research results. To obtain the effect size statistical tools are used. The statistics effect size produces a standardized statistic found in the sample and that can be interpreted (Lipsey and Wilson, 2001:4). Other forms of effect size in the field of economics are elasticity, semi-elasticity, partial correlation coefficients, *t-statistics*, and regression coefficient (Stanley, 2001).

Using meta-analysis is more satisfying than a literature review in a narrative synthesis of research results. Knell and Stix' s (2003) research stated empirical money demand literature surveys generally stop after it shows the results of descriptive statistics and histograms of the estimated elasticities, but the meta-analysis uses a statistical test to obtain more satisfactory results.

### 3.2 Research with Meta-Analysis on the Economy

Table 1 provides a summary of the research in the field of economics that have used meta-analysis.

Table 1. Studies using Meta-analysis in Economics	
Study	Subject
Stanley and Jarell (1989)	The introduction of meta-regression analysis
Jarell and Stanley (1990)	<i>Union wage premium</i>
Smith and Kaoru (1990)	<i>Recreation benefits</i>
Phillips (1994)	Education and productivity
Card and Krueger (1995)	Minimum wage effects
Espey (1996, 1998)	The elasticity of fuel demand
Doucouliaagos (1997)	Demand for labor in Australia
Baaijens, Nijkamp and Montfort (1998)	<i>Regional multipliers</i>
Stanley (1998)	Testing Ricardian Equivalence
Ashenfelter et al. (1999)	<i>Returns of education</i>

Source : Stanley (2001)

## IV. RESULTS AND ANALYSIS

In general, money demand models for a country with a closed economy is influenced by the level of income and the nominal interest rate, while in the case of an open country like Indonesia there is the option of holders of money to choose alternative assets such as domestic assets and foreign assets that earn interest (Price and Insukindro, 1994 ). Therefore, some recent studies include a variable interest rate abroad (e.g. LIBOR) in the analysis of the demand for money. However, the variable interest rates abroad are not used in the analysis of this study. Another approach used to measure the opportunity cost elasticity is the inflation rate as in Aghevli (1976), Aghevli et al. (1979), Insukindro and Sugiyanto (1987), Ilijas (1998), Bahmani-oskooee and Rehman (2005), and Yu and Gan (2009).

This study gathered 23 researches. The results of these researches are used as in meta-analysis. Descriptions about the characteristics of the data are listed in Table A1 in the Appendix. The table provides information on the sample observation period, monetary variables (real and nominal), variable scale, the opportunity cost variables and other variables, the unit root test, cointegration test, stability test and the key findings of research on the demand for money that has been done in the case of Indonesia. This information can be used by readers as a guide for future researchers in conducting an assessment of similar research.

Table A2 (in Appendix) presents the income elasticity, opportunity cost elasticity or semi-elasticity both for the short and the long term. In general, these studies have used standard procedures of the study. Research conducted using a structured ECM from the unit root test to test cointegration. Some studies have even put a money demand stability test. In general, research on money demand in Indonesia use monetary variable components of M1, M1, and M2. Variable scale that is widely used is the Gross Domestic Product, and the opportunity cost variable used is the rate of 3-month deposit interest rate and or the rate of inflation. A stability test conducted also showed that generally money demand in Indonesia is stable.

According to Stanley (2001), one form of the effect size in the analysis and the social sciences is the elasticity or semi-elasticity. The effect size calculations can be done using an unweighted average, fixed effects, random effects, and the effects of the combination (mixed effects). This study only uses fixed effects methods to calculate the average size of the elasticity effects of independent variables. Calculating the average effect size (*mean effect size*) in this study is limited to the analysis of the income elasticity and the opportunity cost elasticity or semi-elasticity in the short term; while the long-term elasticity analysis only using an unweighted average, since data on standard deviations or t-statistics of the estimation results are generally not considered in the sample study research.

This paper divides 23 samples into 6 groups according to the definition of the money used for the primary study investigators. Distribution groups can be seen in table 4 as follows.

	<b>Income Elasticity of money in the short-term</b>	<b>Income Elasticity of money in the long-term</b>	<b>The opportunity cost elasticity of money in the short-term</b>	<b>Opportunity Cost Elasticity of money in the Long-term</b>	<b>Semi Elasticity Opportunity Cost of money in the short-term</b>	<b>Semi Elasticity Opportunity Cost of money in the long-term</b>
Components of the money in the narrow sense	5	8	1	1	4	7
Money in the narrow sense (M1)	14	16	8	6	7	11
Money in a broad sense (M2)	14	17	6	5	7	13

Calculation of average effect sizes can be seen in detail in the appendix, while the counting result average effect sizes can be seen in table 5 as follows.

**Table 3.**  
**The results of calculation of the average effect sizes using fixed effects.**

Definition of money	Effects Size of the Short Run Income Elasticity	Effects Size of the Short Run Opportunity Cost Elasticity	Effects Size of the Short Run Opportunity Cost Semi Elasticity
Components of the money in the narrow sense	0,1289 (2,1903) CI: Mean ES lower: 0,0136 Mean ES upper: 0,2443	-	-0,0025 (-1,4689) CI : Mean ES lower: -0,0058 Mean ES upper: 0,0008
Money in the narrow sense (M1)	0,3095 (13,6650) CI: Mean ES lower: 0,2651 Mean ES upper: 0,3539	-0,0077 (-1,4876) CI: Mean ES lower: -0,0178 Mean ES upper: 0,0024	-0,00297 (-9,59540) CI: Mean ES lower: -0,0035 Mean ES upper: -0,0023
Money in a broad sense (M2)	0,0323 (6,35043) CI: Mean ES lower: 0,0223 Mean ES upper: 0,0423	-0,0463 (-7,12264) CI: Mean ES lower: -0,0590 Mean ES upper: -0,0336	-0,0011 (-2,72707) CI: Mean ES lower: -0,0020 Mean ES upper: -0,0003

Notes:

- CI is a Confidence Interval (Range Trust); CI calculations are presented in the appendix.
- The number in parentheses is the value of z obtained by dividing the mean effect size with standard deviation (standard error), calculating the mean effect size and standard error are presented in the appendix.
- Analyze the opportunity cost elasticity of the M1 component in the short term were not analyzed because of limited sample study.

Based on Table 3, the z-statistic for the effect size of the income elasticity of M1 component, the income elasticity of the M1, the income elasticity for M2, the M2 opportunity cost elasticity, opportunity cost semi-elasticity of M1 and M2, exceed the critical value, hence the average effect size are statistically significant and the 95 percent confidence interval around the average effect size are not zero. The statistical significance also increases the accuracy of the average effect size in the data (Lipsey and Wilson, 2001: 132).

Based on Table 3, the average value of the effect size of the components of the short term income elasticity of narrow money (M1) is 0.1289. These results are consistent with the theory of money demand that changes in component of money demand (M1) is associated with changes in income. The average value of the short-term income elasticity effect size for M1 is less than 1 (one) which is inelastic. This means that a 1 percent increase in income leads to an increase in money demand component of M1 by less than 1 percent. The average value of the effect size of the opportunity cost semi-elasticity of M1 in the short term is -0.0025. This result is consistent with the theory that changes in the demand for money M1 is negatively associated with changes of opportunity costs (interest rates or inflation). The increase in interest rates would decrease the demand for money in the short-term. The average value of the effect



size of the opportunity cost semi-elasticity of the M1 in the short term is less than 1 (one) which is inelastic. The increase of interest rates by 1 (one) percent will increase the demand for M1 by less than 1 (one) per cent in the short term.

For comparison, Table 4 presents the calculation results of the average and median effect size analysis both for the income elasticity and also the elasticity or semi-elasticity of the opportunity cost in the short term using an *unweighted average*.

<b>Definition of Money</b>	<b>Average Size Effect of Short Run Income Elasticity</b>	<b>Average Size Effect of Short Run Opportunity Cost Elasticity</b>	<b>Average Size Effect of Short Run Opportunity Costs Semi-Elastic</b>
Components of the money in the narrow sense	0,1178* 0,17**	-	-0,4113* -0,3667**
Money in a narrow sense (M1)	0,26905* 0,2675**	-0,1865* -0,0835**	-0,2952* -0,003**
Money in a broad sense (M2)	0,33431* 0,2845**	-0,05343* -0,044**	-0,15189* -0,003**

Note: \*) mean, \*\*) median.  
The analysis of the opportunity cost elasticity of the M1 in the short term were not analyzed because of limited study sample.

Based on Table 4, the mean and the median of effect size of the short run income elasticity of money in the narrow sense (M1) is 0.1178 and 0.17 respectively. These results are consistent with the theory that changes in the demand for money M1 is in line with the changes of the income. The mean and the median effect size of the income elasticity of M1 component in the short term is less inelastic. A 1 percent increase in income leads to an increase in money demand by less than 1 percent. The mean and the median effect size of the opportunity cost semi-elasticity of M1 component in the short term is -0.4113 and -0.3667 respectively. These results are consistent with the theory that changes in the demand for money M1 is reversely associated with the changes of opportunity costs (interest rates or inflation). The increase in interest rates would decrease the demand for component of M1 money in the short run. The mean and the median effect size of the opportunity cost semi-elasticity of M1 are inelastic in the short term. The increase in interest rates by 1 (one) percent will increase the demand for M1 by less than 1 (one) percent.

The calculation for the size effect on the analysis of the long run income elasticity and the long run opportunity costs elasticity or semi-elasticity can be seen in Table 5 as follows.

**Table 5.**  
The results of the effect size calculations using an unweighted average.

Definition of Money	The Size Effect of Long Run Income Elasticity	The Size Effect of Long Run Opportunity Cost Elasticity	The Size Effect of Long Run Opportunity Costs Semi Elasticity
Components of the money in the narrow sense	0,95078* 0,9192**	-	-2,31622* -1,5**
Money in a narrow sense (M1)	1,19713* 1,13**	-0,14105* -0,11**	-2,06529* -0,06**
Money in a broad sense (M2)	1,65882* 1,526**	-0,25858* -0,28**	-0,50643* -0,01**

Note: \*) mean, \*\*) median.

The analysis for the long run opportunity cost elasticity of M1 component in the long run were not analyzed because of limited study sample.

Based on Table 5, the mean and the median effect size of the long run income elasticity of money in the narrow sense (M1) is 0.95078 and 0.9192 respectively. These results are consistent with the theory that changes in the demand for money are associated with the changes in income. The mean and the median effect size of the long run income elasticity of M1 is close to 1 (one) which means close to unitary elasticity. This means that changes in money demand is proportional to changes in income. The mean and the median effect size of the long run opportunity cost semi-elasticity of M1 is -2.31622 and -1.5. These results are consistent with the theory that changes in the demand for money reversely associated with the changes in opportunity costs (interest rates or inflation). The increase in interest rates will reduce demand for money. The mean and the median effect size of the opportunity cost semi-elasticity of M1 are elastic in the long run. The increase in interest rates by 1 (one) percent will increase the demand for money M1 by more than 1 (one) percent.

Based on the mean and the median of Tables 5 and 6 it can be seen that in general, by any definition of money, the income elasticity and the opportunity cost elasticity or semi-elasticity, are in accordance with the theory in the short run and is inelastic. In the long-term analysis (Table 5), the mean value and the median of income elasticities and opportunity cost elasticity or semi-elasticity, by any definition of the money, in the long run is consistent with the theory. The income elasticity of the components of M1 and its component are close to 1 (close to unitary) in the long run, while the income elasticity of the M2 is elastic in the long run (mean = 1.6588 and median = 1.526). The elasticity of the opportunity cost of the M1 and its component are inelastic, while the long run opportunity cost semi-elasticity of M1's component is elastic. Conversely, the long run opportunity cost semi-elasticity of M2 is inelastic. In long run opportunity cost semi-elasticity of M1, there is contrary results between the mean value and the median. The mean of the long run opportunity cost semi-elasticity of M1 is elastic, but the median shows the opposite result of inelastic.

## V. CONCLUSION

This paper concludes that the results of the meta analysis on short run income elasticity and the short run opportunity cost elasticity or semi-elasticity according to any definition of money is consistent with the theory. This is evident from the mean and the median effect size of the income elasticity of demand for money (all definitions of money), which are positive. The mean and the median effect size of opportunity cost elasticity of demand for money (all definitions of money) are negative and consistent with the theory of demand for money. In general, the income elasticity and the opportunity cost elasticity or semi-elasticity by any definition of money in Indonesia is inelastic in the short run, either using the fixed effects or using an unweighted average.

Based on the long-term analysis, this paper concludes that in general the income elasticity and the opportunity cost elasticity or semi-elasticity of the money by any definition is consistent with the theory. The income elasticity of the components of M1 and M1 in the long run is close to 1 (close to unitary) and the income elasticity of the M2 in the long run is elastic. The elasticity of the opportunity cost of the M1 and its component are inelastic. The long run opportunity cost semi-elasticity of M1's component is elastic. Conversely, the long run opportunity cost semi-elasticity of the M2 is inelastic. In the long run opportunity cost semi-elasticity of M1 there are different results between the mean and the median values. The mean value of the long run opportunity cost semi-elasticity of M1 is elastic, but the median showed the opposite result, which is inelastic.

Until now, it is still rare for researchers in Indonesia to use meta-analysis as an analytical tool in integrating existing researches, especially in the field of monetary economics. Meta-analysis can help economic and non-economic researchers integrate research results easily. Using meta-analysis to analyze money demand in Indonesia provides a new view in determining the value of the average effect size of the income elasticity of money demand, a measure of the effect of the opportunity cost elasticity or semi-elasticity of money demand. The average value of the effect size of the meta-analysis study can be used as a basis or hypothesis in the analysis of money demand in Indonesia in the future either using econometric analysis tools, literature review and statistics. Meta-analysis with fixed effects methods, the *confidence interval* and statistical significance estimation makes results more convincing.

The calculation of the average income elasticity and opportunity cost elasticity and / or semi-elasticity of all definitions of money do not significantly affect the demand for money in the short term, therefore, the Central Bank could consider the opportunity cost elasticity in formulating the inflation target to direct the market participants and the public expectation on inflation and interest rate, so the inflation will not miss the targeted one.

Research on the demand for money using meta-analysis in the future is expected to collect a larger sample and to obtain a more complete information about the characteristics of the sample (for example: *standard error* and *t-statistics*) to enable deeper exploration about the characteristics of the demand for money in Indonesia.

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APPENDIX

Table A1. Summary of data used in the meta-analysis.

No	Research	Sample Period/ Frequency	Monetary variables	Explanatory variables			Model	Unit Root Test	Degrees of Integration and Cointegration Test	Stability Test	Important findings
				Variable Scale	Opportunity Cost	Other					
1	Aghevli (1976)	1968.1 - 1973.4 Quarterly	Log (Real M2)	-Inflation Rate	-	PAM	-	-	-	The estimates in accordance with the theory	
2	Aghevli et al. (1979)	1968.2 - 1976.4 Quarterly	Log (Real M1) Log (Real M2)	-Level of inflation expectations	-	PAM	-	-	-	The estimates in accordance with the theory	
3	Insukindro dan Sugiyanto (1987)	1970.1 - 1986.1 Quarterly	Log (Real M1) Log (Real M2)	-Log interest rate on deposits of government banks pemerintah - Log rate of inflation expectation	- Dummy variable 1983	PAM	-	-	-	Banking deregulation negatively affect demand for M1 and positively affected demand for M2	
4	Jaya (1990)	1973.1 - 1987.4 Quarterly	Real M1 Real M2	Average rate of interest on savings and time deposits	Dummy variable for seasonal factors of money demand in Indonesia	PAM	-	-	-	Model SAM (Shock Absorber Model) was superior to the model PAM (Partial Adjustment Model)	
5	Price dan Insukindro -1994	1969.1 - 1987.4 Quarterly	Ln (real CHP) Ln (real DD)	-Level of interest rates on deposits, -Interest rate LIBOR	Dummy variable in the analysis of ECM	ECM, Forward Looking Model	DF, ADF	I (1) EG (1987) J (1988) JJ (1990)	Chow test, Salkever (1976), dummy variable approach to the analysis of ECM	EG (1987); Cointegration relationships are weak on variables CHP J(1988) ; There are two cointegration vectors in both equations LIBOR that are not important variables in the analysis of ECM	

No	Research	Sample Period/ Frequency	Monetary variables	Explanatory variables			Model	Unit Root Test	Degrees of Integration and Cointegration Test	Stability Test	Important findings
				Variable Scale	Opportunity Cost	Other					
6	Insukindro (1998)	1987.1 - 1997.4 Quarterly	Log (Real C) Ln Real M1 Ln Real M2	Log (Real GDP) -Tingkat suku bunga riil (selisih tingkat suku bunga deposito 3 bulan dengan inflasi)	- -	Insukindro-ECM (-ECM)	DF, ADF	I (1) -EG (1991)	-	-EG: Cointegration of all variables in the long run- ECM: Unanticipated changes to the M1 encourage temporary changes in demand for currency (C)	
7	Ilijas (1998)	1983 - 1996 Quarterly	Ln Real M1 Ln Real M2	Ln GDP -Tingkat deposito 3 bulan (bertuk Logaritma natural dalam model M2 -Ln CPI	- Financial deepening Index - Dummy variable 1988	ECM	-	-EG (1987)	Chow-break point test, Chow-forecast testand CUSUM recursive test	- Stability test: M1 and M2 money demand is stable during the period of observation	
8	Darsono (1999)	1970.1 - 1996.4 Quarterly	Log C Log M1 Log M2 Log Reserve Money Log Modified M1	Log Nominal interest savings Log Effective Exchange Rate	Log	ECM	DF ADF Innovation Outlier (IO) Procedure	I (1) -EG (1987) -J (1988)	-	-EG : C and M have a long-term relationship with the explanatory variables -J : C : There is 1 cointegration vector, RM: There is 1 cointegration vector, NM: At least there is 1 cointegration vector, BM: there are less than / equal to 2 cointegration vectors	
9	Insukindro dan Alliman (1999)	1984.2 - 1997.4 Quarterly	Ln (Real C)	Domestic interest rates	-	ECM	DF, ADF	I (1) hanya pada tingkat suku bunga domestik -EG	-	Model ECM Log-inis superior to the linear ECM models.	
10	Pasaribu (2002)	1970 - 2001 Quarterly	Ln (Real M1)	Real interest rates	-	ECM	ADF, PP	I (1)	-	Model ECM-GARCH is better than forecastin	

No	Research	Sample Period/ Frequency	Monetary variables	Explanatory variables			Model	Unit Root Test	Degrees of Integration and Cointegration Test	Stability Test	Important findings
				Variable Scale	Opportunity Cost	Other					
11	Simorangkir (2002)	1968.1 - 1997.4 Quarterly	Ln (real M1) Ln (Real M2)	Ln (Real GDP) -Ln deposit interest rate of 6 months	-	PAM	-	-	Chow (1960) dan CUSUM SQ Recursive Least Square Test	-Chow stability test: Occurs due to structural changes in the M2 PAKTO 1988 -CUSUMSQ: PAKTO 1988 affects the stability of M2	
12	OukHeon-2002	1983.1 - 1999.3 Quarterly	Real M1 Real M2	Real GDP -3-month deposit rate for M1 -CMR for M2	-	ECM	ADF PP	-I (1) -EG (1987)	Chow	M1 and M2 money demand for the period 1983.1-1999.3 generate positive opportunity cost elasticity (not according to the theory), but the elasticity of the money demand equation 1983.1-1996.4 accordance with the theory. -Stability Test: money demand equation M1 and M2 1983.1-1996.4 stable	
13	Suherman (2003)	1990.1-2002.4 Quarterly	Log (Real C)	Log (Real GDP) 1 month deposit interest rate	-Log Nilai Tukar Ekspektas -variabel boneka pengaruh musiman	ECM	DF, ADF	-I (1) -EG Two Step Procedure (1987)	-	EG: Cointegration relationship between variables in the long run	
14	Sriwiyanto (2004)	1978.4 - 2003.4 Quarterly	Log M1	Log nominal GDP -Interest rates on 3-month deposits	-Log nilai tukar	-ECM -SE ECM Phillip-Loretan	DF, ADF	-I(0) -JJ (1990)	-	In the long run there is a relationship between the demand for money, inflation, income, interest rates and	



No	Research	Sample Period/ Frequency	Monetary variables	Explanatory variables			Model	Unit Root Test	Degrees of Integration and Cointegration Test	Stability Test	Important findings
				Variable Scale	Opportunity Cost	Other					
15	Bahmani-Oskooee dan Rehman (2005)	1973.1 - 2000.4 Quarterly	Ln (Real M1) Ln (Real M2)	Ln (Real GDP) Inflation Rate	Ln Real exchange rate	-ECM ARDL	-	- ARDL (Pesaran et al., 2001)	CUSUM dan CUSUM SQ of residual	the exchange rate on deposits in the country for three months  -ARDL cointegration test: There is a long-term relationship with the explanatory variables M1 -RESET-Test: Mis-specification models M2 money demand	
16	Achsani et al (2005)	1990.1 - 2002.3 Quarterly	Log (Real M2)	-Log long-term interest rates -Log CPI	Dummy variable for 1998 quarter 1, 2 and 3	PAM	PP	-	CUSUM SQ	Fuzzy Clustering provide an analytical framework to determine the robustness analysis of economic relations	
17	Sidiq (2005)	1990.1- 2004.2 Quarterly	Log (Real M1) Log (Real M2)	-3-month deposit interest rate - 3 month interest rate LIBOR -Inflation Rate	Exchange rates	ECM	DF	I (1)	Chow	-The exchange rate effect on M1 and M2 -Test stability: Equations M1 and M2 money demand is stable in the period of observation	
18	James (2005)	1983.1 - 2000.4 Quarterly	Log (Real M2)	- Interest rates on the money market-3 Months US Treasury Bill rate	Dummy for 1990 dan 1998	ECM-ARDL	ADF	- I (1) -ARDL (Pesaran et al., 2001)	CUSUM dan CUSUM SQ of residual	- Stability test: stable M2 money demand equation -RESET TEST fail to reject H0 at 5% alpha - Financial liberalization affects M2	

No	Research	Sample Period/ Frequency	Monetary variables	Explanatory variables			Model	Unit Root Test	Degrees of Integration and Cointegration Test	Stability Test	Important findings
				Variable Scale	Opportunity Cost	Other					
19	Ronaldo (2008)	1990.1 - 2005.4 Quarterly	Ln (Real M2)	Ln (Real GDP) -Interest rates on 3-month SBI-JIBOR	-Tingkat suku bunga kredit/modal kerja - Variabel boneka untuk krisis ekonomi	ECM	ADF	- I (1) -EG (1987) -J (1988)	-	Estimates in accordance with the theory	
20	Sulaiman (2008)	1999.4 - 2006.4 Quarterly	Log M1	Log GDP -Log interest rates on 3-month deposits -Log Inflation Rate	-	-ECM -Buffer Stock Model -VAR	ADF	- I (1) - EG (1987)	-	In the long-term and short-term GDP, interest rates and inflation affect M1 Buffer-Stock: AR (2) significant only in the short term -VAR: GDP, interest rates and inflation effect on M1	
21	Lestano et al.(2009)	1980.1 - 2004.4 Quarterly	Ln (Real M1) Ln (Real M2)	-Interbank Bank Rate - Short Term US Treasury Bill	Ln Real exchange rate	ECM-ARDL	ADF	-ARDL (Pesaran, Shin, Smith, 1996, 2001)	CUSUM dan CUSUM SQ of Residual	Stability Test: M1 money demand is stable, while the M2 money demand is unstable in the period of observation	
22	Yu dan Gan (2009)	1987.1 - 2007.4 Quarterly	Log (Real M1) Log (Real M2)	- Money-market interest rates - Inflation-rate expectations	Interest rates on loans	ECM	PP	- I (1) - EG (1987)	-	- EG: There is a long-term relationship between real money balances and explanatory variables - ECM: There is a short-term relationship between M2 and real income, interest rate loans, money market interest rates and inflation	

No	Research	Sample Period/ Frequency	Monetary variables		Explanatory variables			Model	Unit Root Test	Degrees of Integration and Cointegration Test	Stability Test	Important findings
			Variable Scale	Opportunity Cost	Other							
23	Achsani (2010)	1990.1 - 2008.3 Quarterly	Ln (Real M2)	-CMR	-		VECM dan ARDL	DF, ADF	-I (1) -VECM (J, 1988 dan JJ, 1990) -ARDL (Pesaran dan Shin, 1995 dan Pesaran et al., 1996)	CUSUM dan CUSUM SQ of residual	-VECM (5) :M2 money demand is unstable -ARDL : M2 money demand is stable	

Notes:

- ADF : Augmented Dickey- Fuller Unit Root Test
- ARDL : Auto Regressive Distributed Lag
- C : Currency
- CHP : Currency Held by Public deposits
- CMR : Call Money Rate
- CPI : Consumer Price Index
- DD : Demand Deposit
- DF : Dickey-Fuller (1979) Unit Root Test
- ECM : Error Correction Mechanism
- EG : Engle-Granger (1987 or 1991) Cointegration Test
- GDP : Gross Domestic Product
- J : Johansen (1988) Cointegration Test
- JJ : Johansen-Juselius (1990) Cointegration Test
- M1 : Money in the narrow sense, consists of currency outside banks and demand
- M2 : Money in a broad sense, consisting of M1 and quasi money
- OLS : Ordinary Least Square
- PAM : Partial Adjustment Model
- PP : Phillips-Perron (1988) Unit Root Test
- VECM : Vector Error Correction Mechanism

Table A2. Income elasticity, opportunity cost elasticity and opportunity cost semi-elasticity in the short and long term

No	Research	Sample Period / Frequency	Short Run				Long Run						
			Model	Monetary Variables Approach	Income Elasticity for Monetary Variables	Opportunity Cost Elasticity of the Monetary Variables		Model	Monetary Variable	Income Elasticity for Monetary Variables	Opportunity Cost Elasticity of the Monetary Variables		
						Elastisitas	Semi Elastisitas				Elasticity	Semi Elasticity	
1	Aghvili (1976)	1968.1 - 1973.4 Quarterly	PAM	M2	0,49	-	-	PAM	M2	2,29	-	-	-
2	Aghvili et al (1979)	1968.2 - 1976.4 Quarterly	PAM	M1 M2	0,334 0,292	- -	-0,726* -0,823*	PAM	M1 M2	1,629 1,848	-	-3,54* -5,20*	-
3	Insukindro dan Sugiyanto (1987)	1970.1 - 1986.1 Quarterly	PAM	M1 M2	0,1816 0,0432	-0,0963 -0,0237* -0,0861 -0,0345*	-	PAM	M1 M2	0,9891 0,3989	-0,524 -0,129* -0,787 -0,315*	-	-
4	Jaya (1990)	1973.1 - 1987.4 Quarterly	PAM	M1 M2	0,258 0,0125	-0,077 0,015	-	PAM	M1 M2	1,0445 0,1811	-0,3117 0,2173	-	-
5	Price dan Insukindro (1994)	1969.1 - 1987.4 Quarterly	ECM	CHP DD	0,17 -0,01	-	-0,73 -0,91	EG	CHP DD	0,88 1,3	-	-1, -1,9	-
6	Insukindro (1998)	1987.1 - 1997.4 Quarterly	Insukindro-ECM (I-ECM)	C	0,5171	-	-0,0019	EG	C	0,9270	-	-	-0,0053
7	Ilijas (1998)	1983 - 1996 Quarterly	ECM	M1 M2	0,4998 0,7215	-0,9229* -	-	EG	M1 M2	1,1551 1,871	-	-	0,006

No	Research	Sample Period / Frequency	Short Run			Long Run						
			Model	Monetary Variables Approach	Income Elasticity for Monetary Variables	Opportunity Cost Elasticity of the Monetary Variables	Monetary Variable	Income Elasticity for Monetary Variables	Opportunity Cost Elasticity of the Monetary Variables			
					Elastisitas	Semi Elastisitas		Elasticity	Semi Elasticity			
8	Darsono (1999)	1970.1 - 1996.4 Quarterly	ECM	C M1 M2	0,289 0,277 0,277	0,621* -0,090 -0,046	-	J C	0,7395 1,4342 1,0049	-0,0922 -0,004 -0,1282	-	
9	Insukindro dan Aliman (1999)	1984.2 - 1997.4 Quarterly	ECM	C	-0,3771	-	-0,0034	EG	C	0,9114	-	-0,0063
10	Pasaribu (2002)	1970-2001 Quarterly	ECM ECM-GARCH	M1 M1	0,766 0,758	-	-0,003 -0,279	EG ECM-GARCH	M1 M1	1,09 3,5754	-	-0,723 -1,316
11	Simorangkir (2002)	1968.1 - 1997.4 Quarterly	PAM	M1 M2	0,229 0,345	-0,015 -0,042	-	PAM	M1 M2	1,387 2,1562	-0,091 -0,262	-
12	Ouk-Heon(2002)	1983.1 - 1996.4 Quarterly	ECM	M2	0,25	-	-0,04	EG	M1 M2	1,14 2,05	-	-0,04 -0,02
13	Suheman (2003)	1990.1- 2002.4 Quarterly	ECM	-	-	-	-	EG	C	1,0384	-	-0,002
14	Sriwiyanto (2004)	1978.4 - 2003.4 Quarterly	ECM	M1	0,4878	-	-0,0024	J	M1	1,5277	-	-0,0075
15	Bahmani-oskoeeedan Rehman (2005)	1973-2000 Quarterly	ECM	M1	0,1	-	-1,05*	ARDL	M1	1,29	-	-16,69*
16	Achsani et al., (2005)	1990.1 - 2002.3 Quarterly	PAM	M2	0,47	-0,127	-	PAM	M2	1	-0,28	-

No	Research	Sample Period / Frequency	Short Run				Long Run					
			Model	Monetary Variables Approach	Income Elasticity for Monetary Variables	Opportunity Cost Elasticity of the Monetary Variables	Model	Monetary Variable	Income Elasticity for Monetary Variables	Opportunity Cost Elasticity of the Monetary Variables		
						Elastisitas	Semi Elastisitas			Elasticity	Semi Elasticity	
17	Sidiq (2005)	1990.1 - 2004.2 Quarterly	ECM	M1 M2	0,6256 0,6641	-	0,00085*	EG	M1 M2	0,02675 0,01669	-	-0,00166*
18	James (2005)	1983.1 - 2000.4 Quarterly	UECM	M2	0,6835	-	-0,1973	ARDL	M2	1,526	-	-0,16
19	Ronaldo (2008)	1990.1 - 2005.4 Quarterly	ECM	-	-	-	-	EG J	M2	1,1586	-	-0,0045
20	Sulaiman (2008)	1999.4 - 2006.4 Quarterly	ECM	M1	0,1759	-0,3049 0,0371*	-	EG	M1	0,5554	-0,1370 0,0387*	-
21	Lestano et al., (2009)	1980.1 - 2004.4 Quarterly	ECM	M1 (AIC) (SBC) M2 (AIC) (SBC)	-0,389 -0,537 0,141 0,155	-	-0,003 -0,003 -0,003 -0,003	ARDL	M1 (AIC) (SBC) M2 (AIC) (SBC)	0,2 1,12 3,82 3,67	-	-0,01 -0,01 -0,01 -0,01
22	Yu dan Gan (2009)	1987.1 - 2007.4 Quarterly	ECM	-	-	-	-	EG	M1 M2	0,99 1,36	-	-0,06 -0,01* -0,14 -0,89*
23	Achsani (2010)	1990.1 - 2008.3 Quarterly	ARDL	M2	0,1356	-	0,0022	VECM (5) ARDL	M2 M2	0,6453 3,2040	-	0,0266 0,0819

Notes

- \*) : Inflation or expected inflation rate as the opportunity cost variable approach
- ARDL : Auto Regressive Distributed Lag
- AIC : Akaike Information Criterion
- C : Currency
- CHP : Currency Held by Public
- DD : Demand Deposit
- ECM : Error Correction Mechanism
- EG : Engle-Granger (1987 or 1991) Cointegration Test
- J : Johansen (1988) Cointegration Test
- JJ : Johansen-Juselius (1990) Cointegration Test
- M : Money in the narrow sense, consists of currency outside banks and demand deposits
- M2 : Money in a broad sense, consists of M1 and quasi money
- OLS : Ordinary Least Square
- PAM : Partial Adjustment Model
- SBC : Schwarz Bayesian Criterion
- VECM : Vector Error Correction Mechanism

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