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The dynamic relationship between money supply and economic growth

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Abstract

This study analyzes the influence of the financial sector to economic growth in Indonesia. The variables used are the country's financial sectors which are narrow money (M1), broad money (M2) and money the broadest money (M3), with an interest rate as a control variable. Economic growth is represented by Gross Domestic Product and producer price index. The analysis is performed using an Autoregressive Distributed Lag model (ARDL). The stability test is conducted using CUSUM test to see the changes in the structure and the effect of disruption to financial sector development relationship of economic growth. ARDL analysis results indicate that the development of the financial sector has a significant relationship with the country's economic growth. CUSUM analysis results suggest that the relationship of financial sector development-economic growth is stable against changes in economic structure.

Abstrak

Penelitian ini menganalisis pengaruh sektor keuangan terhadap pertumbuhan ekonomi di Indonesia. Variable sektor keuangan negara yang digunakan adalah oleh uang sempit, uang luas dan uang lebih luas, dengan tingkat bunga sebagai variable control. Pertumbuhan ekonomi negara diwakili oleh GDP dan Indeks harga produsen. Analisis dilakukan dengan menggunakan *Autoregressive Distributed Lag Model* (ARDL). Uji Kestabilan CUSUM digunakan bertujuan untuk melihat perubahan struktur dan pengaruh gangguan terhadap hubungan pembangunan sektor keuangan-pertumbuhan ekonomi. Hasil analisis ARDL menunjukkan bahwa pembangunan sektor keuangan mempunyai hubungan yang signifikan dengan pertumbuhan ekonomi negara. Hasil analisis CUSUM menyatakan bahwa hubungan pembangunan sektor keuangan-pertumbuhan ekonomi adalah stabil terhadap perubahan struktur ekonomi.

Introduction

The role of the financial sector in the economic growth is often contentious. Miller (1998) and Lucas (1988) states that the financial sector is over-stressed economic growth. Instead Schumpeter (1991), as well as the latest researchers using econometric methods, concluded that the financial sector is an important economic activity in a country. That view supports the finance-led growth hypothesis or supply-leading hypothesis. This means that the development of the financial sector is a prerequisite of economic development activities. Conversely, if financial development is influenced by economic growth, the state supports demand-following hypothesis.

Lee (2005) stated that there are at least two possible relationships between financial and real variables. First, the development of the financial sector follows the economic growth. Economic growth led to the increase in demand for financial products, resulting in a rise in financial and credit market activity. Thus, the development of the financial sector is demand-following. Second, the financial sectors are detrimental to economic development.

Supply leading hypothesis indicates causality of financial development towards real growth, where the financial sector development is Necessary condition

In Indonesia, the development of the financial sector is in line with the rapid economic growth and in line with the transformation of economic structure. In addition, the financial system has undergone more profound changes. Reform, liberalization and innovation in the financial sector has made the sector more advanced, strong and growing. This can be seen in the development of the country's financial system from various aspects such as institution-building, product and supervision of banks in Indonesia. These elements have been strengthening the financial sector in Indonesia as a driver of economic growth. The financial sector also plays an important role as a complement to the country's economic progress (Ansari, 2002). In this case, it can be seen that the development of the financial sector is a prerequisite for the economic development of the country.

Increasingly strong economic achievements, in addition to the appropriate financial policies, have resulted in changes in financial aggregates in 1999. The financial aggregates M1, which depicts a real decline in the previous year and the first year in 1999, has described the positive growth in April and onwards increased markedly amounted to 33.6% at the end of December 1999 (end of 1998: -14.6%). Likewise, the financial aggregates M2 and M3 also increased, though at a rate that is slower, to describe the annual growth rate of as much as 11.6% and 8.2% at the end of 1999 (1998, respectively increased by 1.5% and 2.7%). Overall, until now, the achievement of financial aggregate is broadly consistent with the objective of financial policy to provide sufficient cash to finance the growth of the real expenditure beside ensure price stability. However, the aggregate amount of finance becomes less stable over time. It is therefore important to know the factors that affect economic growth. This study examines the types of financial aggregates which are more dominant in causing rapid changes in affect economic growth such as M1, M2 or M3. The interest rate is one of the control variables in this research. In addition, this study also evaluates the theory that has been done by previous researchers, namely whether these theories can still be applied.

The question that arises is whether there is a twɵ way causal relationship between the financial sector and economic growth. The proxies used to describe the state of economic growth are GDP and index of producers (IP). High economic growth is expected to improve people's lives through an increase in employment opportunities. Economic growth also has close links with the financial sector. In other words, the ratio of the money supply and real lending interest rate can ensure economic growth through productive investment projects implementation. In addition, economic growth can determine the amount of the loan deals. Stable economic growth reflects the success of financial institutions to provide loan quotes. Thus, it is necessary to study the causality between the financial sector and economic growth.

On the basis of these research problems, it is important to examine the main factors affecting economic growth. Therefore the main objectivity of this study is to investigate the influence of the growth of the financial sector to economic growth and the index of manufacturers as a proxy for economic growth.

Methods

This study uses analysis approach of Autoregressive Distributed Lag (ARDL), where an Ordinary Least Square method (OLS) is used in estimating Unrestricted Equilibrium Correction Model (UECM). To estimate the UECM, this study applies OLS to the long term and short term equations. To analyze the presence of cointegration, this pa-

per compares an F-statistic (Wald-coefficient test) with F-critical values of 'Bound test'.

Stationarity test

Prerequisites for running the ARDL cointegration test is that each variable contains data that is stationary and not supposed to be on the same stationarity degrees. The data is said to be stationary if the mean and variance of such data is zero and unchanged over time. If the opposite situation applies, then the data is not stationary.

Enders (2010) shows that most of the economic data is not stationary, but they will be stationary at the first difference. If not the data is non-stationary, the estimate will yield a spurious results. McCallum (2010) and Hadri (2000) state that the situation was confirmed when the R^2 value is greater than the value of the Durbin-Watson statistic.

Cointegration analysis should include two major steps. The first step is to determine the stationarity terms of the variables. A variable is said to be integrated in order *d* if the variable requires differentiation *d* times to achieve stationarity. If the variable is *I*(1), this means that the variable has reached stationarity at first difference. This study uses stationarity test methods of Dickey Fuller (DF), Augmented Dickey Fuller (ADF) and Philips Perron (PP) (Dickey and Fuller (1979) and Phillips and Perron, 1988).

This study uses Augmented Dickey-Fuller test (ADF) that has been introduced by Said and Dickey (1984) in a stationary test data, with the following test equation:

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \sum \delta_t \Delta Y_{t-1} + \nu_t \quad (1)$$

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 T + \sum \delta_t \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

where $\Delta Y_t = Y_t - Y_{t-1}$ is the firt difference for *Y*, β_0 is constant, while ν_t and ε_t are residuals. *T* is time series. Equation (1) is the equation that determines the time order which has a time direction.

Both equations are affected by differences in the previous lag. Lag length used in the equation will determine the nature of ν_t and ε_t. It is important to determine that the residuals of the model are 'white noise', which has a zero mean and constant variance. This value can be achieved if the lag length used in VAR equation is the optimum length.

ADF test is used to test the null hypothesis that $\beta_1 = 0$ (data are not stationary) while the alternative hypothesis is $\beta_1 < 0$ (data are stationary). Had the null hypothesis is rejected then Y_t is stationary. To determine the optimum lag to get residual which are white noise, this study uses Akaike Information Criteria (AIC) (Akaike, 1980). Akaike (1997) recommends that the best test is the smallest AIC value.

Long run relationship analysis

ARDL 'Bound test': cointegration test

Cointegration approach by the ARDL Bound test model can be seen as a test of the economic theory which is important in the formulation and estimation of dynamic model(Engle and Granger, 1987). This method is also an attempt to avoid the spurious regression. Cointegration test using ARDL Bound test is recommended by Pesaran et al. (2001) and Narayan (2005) to determine the existence of cointegration between variables by using the completion of simultaneous equations. Bound ARDL cointegration test approach typically use Wald test-coefficient test or F-statistic. Additionally, this test can be done by estimating UECM in ARDL models by following the method of ordinary least squares (Hoque, 2007). ARDL method can also estimate the equation with more than one variable and can determine the relationship across variables in the case of small samples (Ghatak and Siddiki, 2001; Tang, 2003).

The existence of long-term relationships between the variables in the estimation is determined using the Wald test-coefficient or F-test with a level exhibited significantly used (1%, 5% to 10%). Organized statistical tests is essential to test the null hypothesis that explains the absence of cointegrated by setting the lag multiplier equals zero, while the alternative hypothesis would explain the intentions of cointegration and shows the relationship variable lag multiplier does not equal zero (Tang, 2003).

To estimate the elasticity of long-term relationships and to determine the value of each multiplier, each variable is calculated from the multiplier of lag explanatory variables divided by the multiplier lag variable, bound to put a negative value (Bardsen 1989; Narayan, 2004; and Marashdeh, 2005). If there is a long-term relationship between the variables, then there is one error correction. Furthermore, the estimates of the elasticity of short term variable describe the error correction against ARDL models. ARDL test statistic is computed using first differences (Pahlavani et al., 2005; Sharestha and Chowdhury, 2005; Tang 2003).

ARDL 'Bound Test' method construction

The formation of ARDL Bound test method is based on the OLS estimates on condition of UECM to see the existence of the long-term relationship and can explain the elasticity of short term and long term multiplier (Shrestha and Chowdhury 2005; Tang, 2003). ARDL test approach aims at determining the direction and long-term relationship, while the cause of the short-term relationship is tested by using the causality test of Granger (Ghazi and Abdulrazag, 2015). From the ARDL we get a model of dynamic error correction following a simple linear transformation (Banerjee et al., 1998).

To estimate the effect of financial development on economic growth and the index of producer (IP) as a proxy in determining the economic growth, equation in the form of logarithm is used as shown in equation (3) and (4);

$$LGDP_t = \alpha_0 + \alpha_1 \sum_{i=1}^{j} LM_{i=j} + \alpha_3 LIR_t + \mu_t \quad (3)$$

$$LIP_t = \alpha_0 + \alpha_1 \sum_{i=1}^{j} LM_{i=j} + \alpha_2 LIR_t + \mu_t \quad (4)$$

where LGDP is economic growth, LIP is *indeks produsen* (IP) as proxy for financial sector (M1, M2, M3), LIR is interest rate. According to Pesaran et al. (2001) and Bahmani-Oskooee and Nasir (2004), economic growth and *Indeks produsen* (IP) as a proxy for economic growth in equation (3) and (4) can be explained in UECM for ARDL model as follows:

$$\begin{aligned}\Delta(LGDP) = {} & a_0 + a_1 t + \sum_{i=1}^{n1} a_{2t} (LGDP)_{t-1} \\ & + \sum_{i=0}^{n2} a_3 (LM1)_{t-1} + \sum_{i=0}^{n3} a_4 \Delta(LIR)_{t-1} \\ & + \eta_1 (LGDP)_{t-1} + \eta_2 (LM1)_{t-1} \\ & + \eta_3 (LIR)_{t-1} + \mu_t \end{aligned} \quad (5)$$

$$\begin{aligned}\Delta(LIP) = {} & a_0 + a_1 t + \sum_{i=1}^{n1} a_{2t} (LGDP)_{t-1} \\ & + \sum_{i=0}^{n2} a_3 (LM1)_{t-1} + \sum_{i=0}^{n3} a_4 \Delta(LIR)_{t-1} \\ & + \eta_1 (LGDP)_{t-1} + \eta_2 (LM1)_{t-1} \\ & + \eta_3 (LIR)_{t-1} + \mu_t \end{aligned} \quad (6)$$

The parameter α_i, i = 2,3,4 explain the dynamic multiplier which summarizes the ARDL model in the short term, while η_i, i = 1,2,3 explains the long run equation. To determine the selection of the lag in the model, we need to consider the lag long for each variable in the study. This study chooses the maximum lag to 5 for the ARDL models.

To determine the cointegration across variables, this study uses the Wald test-coefficient approach or F-test to test $\eta_1 = \eta_2 = \eta_3 = 0$. In the F test, Wald-test coefficient is compared to the critical F of

ARDL Bound Test 'contained in Narayan (2005). Variable of *I*(0) shows the results of cointegration test based on the Lower-bound. Variable of *I*(1) shows the results of the test cointegration test based on the 'Upper bound'.

Diagnostic model

Diagnostic test in the formation of ARDL is conducted to check for normality distribution (J-B normality Test). The other diagnostic tests are the correlation in time series, ARCH and test of heteroskedasiticity contained in equation (3) and (4). Test of Breusch Godfrey Lagrange Multiplier (BGLM test) which evaluated the correlation will be conducted, because this test is important in determining the structural changes that apply to the model. The structure stability test of CUSUM and the rectangle CUSUM test are used to see the changes (Paul, 2014). In addition, ARCH test, heteroskedasticity test and autocorrelation test are also carried out in ARDL model estimation (Laurenceson and Chai, 2003; and Shrestha and Chowdhury, 2005). ARCH models are used in estimating equation conditional mean and conditional variance equation.

Results and Discussion

Sequential time stationarity test

Augmented Dickey-Fuller test (ADF) is used to determine the existence of unit roots in time series. Statistical test of time series using ADF and Phillips-Perron can be described in Table 1 and 2.

Tables 1 and 2 show the results of the unit root test by using ADF and Philips-Perron (PP). The results of this test indicate the null hypothesis for the variable M3 is rejected, using the ADF test and Philips-Perron. All variables are stationary in first difference or *I*(1) at the significant level of 10%. This means that all the time series is not stationary and move randomly in-level variable except M3. Certainty of optimum lag in the VAR model ARDL is set at the lowest AIC. The optimum lag results are shown in Table 3.

Table1: Results of ADF Test

Variable	Order I(0)		First Difference I(1)	
	I(0)	I(0) & Tren	I(0)	I(0) & Tren
LGDP	-0.631817 [5]	-1.95710 [5]	-4.173427***[4]	-3.16791***[4]
LIP	- 1.51355 [5]	-2.33680 [5]	-4.411101***[4]	-5.57268***[4]
LM1	-0.71925 [0]	-2.17012 [0]	-6.68549** [0]	-7.63488***[0]
LM2	-1.03336 [0]	-1.59699 [0]	-7.03541** [0]	-7.06872***[0]
LM3	-3.33488 [0]	-1.58885 [0]	-5.023084** [0]	-5.73628***[0]
LIR	-1.33524 [0]	-1.88755 [0]	-6.41924***[0]	-6.89213***[0]

Table 2: Result of Phillips Perron

Variable	Order I(0)		First difference I(1)	
	I(0)	I(0) & Tren	I(0)	I(0) & Tren
LGDP	-1.85918 [62]	-3.60736 [9]	-9.88012***[61]	-11.14633***[61]
LIP	- 1.583160 [7]	-3.571883 [3]	-5.379491***[61]	-8.18841*** [11]
LM1	-0.865372 [2]	-2.35310 [0]	-7.65837***[2]	-8.31949***[2]
LM2	-0.93343 [3]	-1.88259 [3]	-6.01835***[2]	-6.03665***[2]
LM3	-3.83952*[3]	-1.75694 [3]	-5.33266***[3]	-6.76820***[2]
LIR	-1.76060 [4]	-3.37501 [4]	-7.465534***[4]	-7.48680***[4]

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10%, respectively. Entries in brackets are the optimum lag based on AIC.

Table 3: Criteria to Choose the Optimum Lag in VAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	328.3943	NA	4.97E-10	-7.288698	-7.036635	-7.167770
1	628.3077	739.5847	2.79E-15	-17.77812	-18.72775*	-19.35076
2	632.0888	59.83308	1.23E-15	-20.18342	-17.23778	-19.42841*
3	694.7377	35.99925	3.27E-15	-20.17268	-18.34439	-19.07304
4	772.0529	44.83308	1.46E-15	-23.20615	-16.58784	-18.77287
5	763.9325	47.91758*	8.99E-16*	-22.77941*	-16.20358	-18.77249

Notes: Entries in * show the lowest value that give the optimum lag. The optimum lag is a guide to choose the lag in a cointegration test and the construction of the ARDL model.

ARDL Bound test result for GDP

To estimate the effect of financial development M1, M2 and M3 to economic growth, this study uses the four-lag in the formation of UECM ARDL models for analysis in equation (5). ARDL Bound test results are described in Table 4, 5 and 6.

Tables 4, 5 and 6 explain the results of the ARDL analysis described by Pesaran et al. (2001) and Narayan (2005). Table 7 shows the results of cointegration in equation (5) that the results of the F-statistic based on wald-test to determine the cointegration across variables is 7.343707 for M1, is 17.288386 for M2, and 6.736670 for M3. The statistics for all equations pass on the critical test value (upperbound)of 6,230 at significant level of 1%, which indicates that the null hypothesis that there is no cointegration is rejected for all the equations. This shows the existence of a significant long term relationship between the variables of economic growth and financial variables.

Table 4: Estimation Result of the ARDL Model for LGDP using M1
(Using OLS Estimation Method)

Variable	Coefficients	t-statistic	Prob
C	1.973070***	3.533379	0.0017
@trend	0.005714***	4.318021	0.0028
LGDP(-1)	-0.333821***	-4.366682	0.0000
LM1(-1)	0.129671**	2.493103	0.0130
LIR(-1)	0.062868***	6.557715	0.0002
D(LGDP(-4))	0.437453***	5.141845	0.0000
D(LM1)	0.254408***	4.687340	0.0019
D(LM1(-3))	0.162731*	1.954808	0.0535
D(LIR)	0.068804**	2.439563	0.0489
D(LIR(-2))	-0.067351**	-2.576753	0.0184
D(LIR(-4))	-0.082124***	-3.083733	0.0024
R^2 Adj		0.645811	
SE		0.028699	
F-statistic		11.77391	
Prob(F-statistic)		0.000000	
Diagnostic Test			
J-B Normality Test:		0.458889 [0.733762]	
Brusch-Godfrey Serial Correlagion LM Test:		1.874436 [0.108883]	
ARCH TEst:		0.237711 [0.618871]	
Ramsey RESET Test:		2.337879 [0.188748]	

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10%, respectively. Entries in brackets are probability values.

Table 5: Estimation Result of the ARDL Model for LGDP using M2
(Using OLS Estimation Method)

Variable	Coefficients	t-statistic	Prob
C	3.017373***	5.989915	0.0000
@trend	0.005613***	3.436854	0.0021
LGDP(-1)	-0.9037337***	-6.288964	0.0000
LM2(-1)	0.473334***	5.788451	0.0000
LIR(-1)	-0.009822	-0.575781	0.3754
D(LGDP(-1))	0.6982082***	4.433397	0.0001
D(LGDP(-2))	0.314886**	2.331758	0.0238
D(LGDP(-3))	0.277856**	2.699322	0.0118
D(LGDP(-4))	0.560833***	5.626316	0.0000
D(LM2)	0.587439***	3.638841	0.0007
D(LM2(-1))	-0.420798***	-3.877549	0.0019
D(LM2(-3))	0.338505*	1.723767	0.0930
D(LIR)	0.066833**	2.539366	0.0157
D(LIR(-4))	0.0667316**	2.498219	0.0191
R^2 Adj		0.703333	
SE		0.021732	
F-statistic		11.63231	
Prob(F-statistic)		0.000000	
Diagnostic Test			
J-B Normality Test: 0.098876 [0.963747]			
Brusch-Godfrey Serial Correlagion LM Test: 0.967327 [0.395548]			
ARCH Test: 2.733788 [0.102375]			
Ramsey RESET Test: 1.673388 [0.221342]			

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10%, respectively. Entries in brackets are probability values.

Table 6: Estimation Result of the ARDL Model for LGDP using M3
(Using OLS Estimation Method)

Variable	Coefficients	*t*-statistic	Prob
C	3.769958***	3.294436	0.0001
@trend	0.006353***	3.376618	0.0001
LGDP(-1)	-0.484878***	-4.149955	0.0001
LM3(-1)	0.142453**	2.267705	0.0274
LIR(-1)	0.033700*	1.938741	0.0577
D(LGDP(-1))	0.289733**	2.178760	0.0348
D(LGDP(-4))	0.515595***	5.964531	0.0000
D(LM3)	0.478757*	2.006740	0.0507
D(LM3(-2))	0.527351	1.537775	0.1236
D(LIR)	0.077373**	2.538740	0.0146
D(LIR(-2))	-0.072754**	-2.468600	0.0177
D(LIR(-3))	-0.088770***	-2.788133	0.0033
R^2 Adj		0.536738	
SE		0.025834	
F-statistic		8.422361	
Prob(F-statistic)		0.000000	
Diagnostic Test			
J-B Normality Test: 0.908878 [0.636555]			
Brusch-Godfrey Serial Correlagion LM Test: 1.978709 [0.112355]			
ARCH Test: 1.2086402 [0.298097]			
Ramsey RESET Test: 1.6776030 [0.201878]			

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10%, respectively. Entries in brackets are probability values.

Table 7: Result of Cointegration Test in ARDL for Financial Development using LGDP

Null Hypothesis: No Cointegration.		
GDP Equation: Equation (M1) Equation (M2) Equation (M3)		
F-statistic 7.343707*** 17.288386*** 6.736670***		
Critical Value l, Bound Test:	Lower *I*(0)	Upper *I*(1)
Significant level 1% 5.170 6.230		
Significant level 5% 3.877 4.726		
Significant level 10% 3.278 4.058		
Result: Reject H0 at 1% towards three equations. Therefore, variables in equations are cointegrated.		
Notes: F-statistic (Wald test) is the compound of LGDP(-1), LM(-1) and LIR(-1), equalized to zero or C(3)=C(4)=C(5)=0. The critical bound value is taken from Narayan (2005). Case IV: Unrestricted intercept and restricted trend. Entries in ***, ** and * ae significant at 1%, 5% dan 10% significance level.		

The analysis shows that the imbalance relationship between these variables is a short-term phenomenon. Here is an analysis of elasticity of short term and long term to see a significant relationship between variables in the analysis using ARDL models.

The results of ARDL model estimation in explaining the long-term elasticity are presented in Table 8, 9 and 10. The estimation results of equation (5) in Table 9 shows that the coefficient value of M2 is 0.525574, indicating that GDP is significantly affected by the financial sector development M2. This influence is beyond the influence of the M1 and M3, in the long term. The estimation results of equation (5) in Table 10 shows that the value of the coefficient M3 is 0.323198, indicating that GDP is significantly affected by the construction of the M3 in the long term. 1% increase in M2 and M3 will enhance the economic growth of 0.525574 and 0.323198, respectively. This means that the more the savings deposit (SVD) on the banking system, the more credit that can be given to boost economic growth. The discovery of this study supports the hypothesis boost money supply, namely that the variable financial sector is a prerequisite for a shift in spending.

The short-term elasticity analysis shows that GDP is significantly affected by M3, followed by M2 and M1 (see Tables 8, 9 and 10). These findings suggest that state expenditure in the short term is affected by the M3. The coefficient of M3, namely 0.800779, indicates that the state spending is significantly more influenced by M3 compared to M1 (amounting to 0.479884) and M2 (of 0.343756). The results of this study are consistent with the view McKinnon (1973) which states that the interest rate is a prerequisite for the process of economic growth in a country.

Table 8: Elasticity of Financial Development (M1) using (LGDP)

Variable	Dependent Variable D(LGDP)	
	Short Run	Long Run
LM1	0.479884***	0.375785**
LIR	-0.083391***	0.1987112***

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10% level, respectively.

Table 9: Elasticity of Financial Development (M2) using (LGDP)

Variable	Dependent Variable D(LGDP)	
	Short Run	Long Run
LM2	0.343756***	0.525574***
LIR	0.132279***	-0.009261

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10% level, respectively.

Table 10: Elasticity of Financial Development (M3) using (LGDP)

Variable	Dependent Variable D(LGDP)	
	Short Run	Long Run
LM3	0.800779**	0.323198**
LIR	-0.074777***	0.077428*

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10% level, respectively.

ARDL Bound for IP

Test ARDL Bounds test results on the effect of financial development on economic growth, where the index of producer (IP) is used as a proxy in determining economic growth, are described in Table 11, 12 and Table 13.

The results of the analysis of cointegration tests using ARDL analytical approach to equation (6) shows that the F-statistic based on wald-test to the Equation (6) are 6.850787, 13.37570 and 23.263999, exceeding the upper critical (upper bound) of 6.230 at 1% significant level. This indicates that the null hypothesis of no relation cointegration is successfully rejected for all the equations. This means that there is a significant long-term relationship across financial variables, although the economic growth is measured using spendding measurement index. Therefore, the analysis of the elasticity of long-term and short term is conducted to see the types of money supply that significantly affect economic growth. Cointegration results are presented in Table 14.

Table 11: Estimation Result of the ARDL Model for LIP using M1 (Using OLS Estimation Method)

Variable	Coefficients	*t*-statistic	Prob
C	-0.469526	-1.223365	0.2265
@trend	0.001336	1.430855	0.1276
LIP(-1)	-0.367379***	-4.622373	0.0000
LM1(-1)	0.187474***	3.739389	0.0003
LIR(-1)	-0.004377	-0.338638	0.7513
D(LIP(-1))	0.368161***	3.067308	0.0078
D(LIP(-4))	0.447718***	4.657009	0.0000
D(LM1)	0.251871***	3.378876	0.0073
D(LM1(-1))	-0.248183***	-2.807733	0.0063
D(LM1(-4))	-0.215586***	-2.518938	0.0173
D(LIR(-1))	-0.037273	-1.527785	0.1835
D(LIR(-3))	-0.062431**	-2.563345	0.0186
R^2 Adj		0.597569	
SE		0.022498	
F-statistic		8.893874	
Prob(F-statistic)		0.000000	
Diagnostic Test			
J-B Normality Test: 2.016877 [0.364331]			
Brusch-Godfrey Serial Correlagion LM Test: 1.383725 [0.278792]			
ARCH Test: 0.001342 [0.97078]			
Ramsey RESET Test: 1.730537 [0.129387]			

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10%, respectively. Entries in brackets are probability values.

Table 12: Estimation Result of the ARDL Model for LIP using M2
(Using OLS Estimation Method)

Variable	Coefficients	*t*-statistic	Prob
C	-0.457837	-1.111932	0.2919
@trend	0.001483	1.140688	0.2333
LIP(-1)	-0.518177***	-6.308937	0.0000
LM2(-1)	0.2137651***	4.456713	0.0001
LIR(-1)	-0.044380***	-2.917720	0.0053
D(LIP(-1))	0.431481***	4.126337	0.0001
D(LIP(-3))	0.188713*	1.795893	0.0770
D(LIP(-4))	0.474684***	5.496388	0.0000
D(LM2)	0.342287**	2.34493	0.0231
D(LM2(-1))	-0.190574	-1.458931	0.1313
D(LIR)	0.044771*	1.739833	0.0835
D(LIR(-4))	0.063736**	2.408883	0.0201
R^2 Adj		0.579726	
SE		0.028563	
F-statistic		7.708391	
Prob(F-statistic)		0.000000	
Diagnostic Test			
J-B Normality Test: 0.623313 [0.732053]			
Brusch-Godfrey Serial Correlagion LM Test: 1.830263 [0.108023]			
ARCH Test: 0.358310 [0.554422]			
Ramsey RESET Test: 1.835599 [0.106771]			

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10%, respectively. Entries in brackets are probability values.

Table 13: Estimation Result of the ARDL Model for LIP using M3
(Using OLS Estimation Method)

Variable	Coefficients	*t*-statistic	Prob
C	-0.870333**	-2.375343	0.0213
@trend	0.004313***	3.897771	0.0002
LIP(-1)	-0.784770***	-6.800075	0.0000
LM3(-1)	0.329777***	6.487122	0.0000
LIR(-1)	-0.040037***	-2.741392	0.0033
D(LIP(-1))	0.683772***	5.013929	0.0000
D(LIP(-2))	0.198388*	1.803390	0.0773
D(LIP(-3))	0.272723***	2.853305	0.0066
D(LIP(-4))	0.569737***	5.247819	0.0000
D(LM3)	0.528300***	2.697329	0.0034
D(LM3(-1))	-0.259739	-1.387876	0.1771
D(LM3(-2))	0.347779*	1.937000	0.0533
D(LIR)	0.059233**	2.616775	0.0172
D(LIR(-2))	0.046522*	1.867334	0.0631
D(LIR(-4))	0.067817**	2.607858	0.0137
R^2 Adj		0.672713	
SE		0.020812	
F-statistic		9.528914	
Prob(F-statistic)		0.000000	
Diagnostic Test			
J-B Normality Test: 4.6077882 [0.097392]			
Brusch-Godfrey Serial Correlagion LM Test: 1.151929 [0.325395]			
ARCH Test: 0.806337 [0.373770]			
Ramsey RESETTest : 2.449567 [0.021487]			

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10%, respectively. Entries in brackets are probability values.

Table 14: Result of Cointegration Test in ARDL for Financial Development using LIP

Null Hypothesis: No Cointegration	
LIP Equation: Equation (M1) Equation (M2) Equation (M3)	
F-statistic: 6.850787***	13.37570*** 23.263999***
Critical Value of Bound Test:	Lower*I*(0) Upper *I*(1)
Significant Level 1% 5.162 6.230	
Significant Level 5% 3.837 4.772	
Significant Level 10% 3.235 4.034	
Result: Reject null hypothesis at 1% significance level towards three equations. Therefore, the variables in the equations are cointegrated.	

Notes: F-statistic (Wald test) is the compound of LIP(-1), LM(-1) and LIR(-1), equalized to zero or C(3)=C(4)=C(5)=0. The critical bound value is taken from Narayan (2005). Case IV: Unrestricted intercept and restricted trend. Entries in ***, ** and * ae significant at 1%, 5% dan 10% significance level.

Based on the results of long-term elasticity estimates in Tables 15, 16 and 17, it can be concluded that financial variables M1 significantly affect economic growth, followed by M2. M1 coefficient value, which is 0.503329, shows that an increase of 1% in M1 will be followed by growth in producer index, as a proxy for economic growth, amounting to 0.503329. This means that the money in circulation and demand deposits can accelerate the increase in the expenditure sector which will further enhance the economic growth of a country.

The analysis of the short-term elasticity provides the opposite result, namely that the M3 significantly affect the growth of output, followed by M2 and M1 (Tables 15, 16 and 17). The coefficient of M3, namely 0.612771, indicates that GDP is more influenced by M3 than M2 and M1. This situation is similar to the results of analysis by using the size of the economic growth (GDP), which indicates that the short term elasticity is significantly affected by M3. It supports the discovery of Allen and Ndikumana (1998) in South Africa, where private lending and financial institutions liability (M3) significantly affect the growth of the country's GDP.

Overall, the results showed that money has a greater strength in explaining economic growth compared to the interest rate. Long-term elasticity analysis showed that M1 and M2 are more important in explaining the variation in the percentage of GDP compared to the M3. However, in the short term, M3 is very significant in affecting economic growth.

Table 15: Elasticity of Financial Development (M1) using (LIP)

Variable	Dependent Variable D(LIP)	
	Short Run	Long Run
LM1	-0.2092338***	0.503329***
LIR	-0.093474**	-0.01238

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10% level, respectively.

Table 16: Elasticity of Financial Development (M2) using (LIP)

Variable	Dependent Variable D(LIP)	
	Short Run	Long Run
LM2	0.150338**	0.424372***
LIR	0.109655**	-0.087833**

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10% level, respectively.

Table 17: Elasticity of Financial Development (M3) using (LIP)

Variable	Dependent Variable D(LIP)	
	Short Run	Long Run
LM3	0.612771***	0.419997***
LIR	0.171875***	-0.052101***

Notes: Entries in ***, ** and * are significant at 1%, 5% and 10% level, respectively.

Diagnostic test

This test is performed on the residuals of ARDL models to ensure thatall models and the data are sufficient. Based on normality test using the Jarque-Bera Test, it can be concluded that the data are normally distributed except for the measurement of M3 on the producer price index where normal distribution is significant at the 10% level. Test of autoregressive using 'Serial Correlation Breusch-Godfrey LM test' shows that in GDP and IP equations, the residuals are white noise with zero mean and constant variance. ARCH test using the F-statistic also shows the lack of influence of ARCH for all financial aggregates. The specifications test using Ramsey RESET returns that the model used is appropriate. The test results are described in Table 18.

Stability test

Based on the stability test using CUSUM test or Chow test as conducted by Nielsen and Sohkanen (2011) and Funke (2005) in Eroland using CUSUM and CUSUM Square test to test the stability of the money, this study obtained results that the aggregate financial equation is not able to change structures studied in the analysis equation. Residual movement is on the path of stability for statistical CUSUM plot is around zero and does not exceed 5 per cent confidence interval lines.

Table 18: Diagnostic Test for Residuals in ARDL Model

	Normality Test	AR Test (Breusch- Godfrey Serial Correlation LM test)	ARCH Test	Ramsey RESET Test
Hypothesis:	Ho: Normal	Ho:Residuals are white noise	Ho:No Influence (ARCH Test)	Spesifikasi model
LGDP:M1	t-statistic =0.4328 Prob=0.7899	F-statistic =1.8733 Prob=0.1083	F-statistic =0.2567 Prob=0.6186	F-statistic =2.3339 Prob=0.1389
LGDP:M2	t-statistic =0.0932 Prob=0.9539	F-statistic =0.9533 Prob=0.3340	F-statistic =2.7327 Prob=0.1037	F-statistic =1.6777 Prob=0.2071
LGDP:M3	t-statistic =0.9088 Prob=0.6876	F-statistic =1.9988 Prob=0.1275	F-statistic =1.2098 Prob=0.2766	F-statistic =1.6462 Prob=0.2033
LIP:M1	t-statistic =2.0178 Prob=0.3353	F-statistic =1.3837 Prob=0.2781	F-statistic =0.0012 Prob=0.9729	F-statistic =1.7813 Prob=0.1735
LIP:M2	t-statistic =0.6783 Prob=0.7870	F-statistic =1.8812 Prob=0.1031	F-statistic =0.3383 Prob=0.5374	F-statistic =1.8833 Prob=0.1037
LIP:M3	t-statistic =4.6077 Prob=0.0933**	F-statistic =1.1529 Prob=0.3233	F-statistic =0.8167 Prob=0.3773	F-statistic =2.4373 Prob=0.0192*

Notes: Entries in *, **and *** are significant at 1%, 5% and 10% level, respectively.

Conclusion

Analysis of ARDL shows that all financial aggregates, both narrow and broad money, showed a positive trend and have a flow that follows the trend. The analysis of ARDL Bounds test indicates that the null hypothesis is rejected. This means that there is a cointegration relationship between financial variables with the determiner. Financial variables, namely M1 and M2, influence changes in the long-term economic growth. This conclusion supports the hypothesis that the financial sector to encourage economic growth. However, the study also found that for the case of M3, the opposite results are obtained.

Through short-term elasticity test, the paper obtained evidence of short-term relationship between the determinants of economic growth (GDP) and the (IP) with financial aggregates M1, M2 and M3. This decision is consistent with previous studies in which financial aggregates M2 and M1 significantly affect the change in output.

Stable interest rate is more appropriate as a basis for policy making. CUSUM stability test using the test in this study suggests that all financial aggregates are stable. The study also suggests that financial aggregates M2 and M1 can be used as the basis for policy making. M3 are considered less suitable as a determinant of economic growth and as an instrument of financial policy. Therefore, central banks need to increase the vast financial aggregates M2.

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