Does the Bank of Thailand have the control over the money supply?

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July 2019

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Abstract:

This paper estimates the broad money multiplier for Thailand using monthly data from 1997M1 to 2017M12. It is found that there is nonlinear relationship between money supply and monetary base. An increase in monetary base causes the broad money supply to increase proportionally, and vice versa. This implies that the estimated money multiplier is stable during the period of investigation. This finding suggests that the Bank of Thailand has the ability to control the broad money supply. The finding also points to the soundness of the current monetary policy regime.

Keywords Money multiplier, exogeneity of money supply, cointegration
JEL Classification C22, E51, E52

1. Introduction

Many economists have frequently argued that the money supply is endogenously determined (Howells and Hussein, 1998; Badarudin et al., 2011, 2013; Thenuwara and Morgan, 2017, among others). The theory of money endogeneity focuses on bank loan as a determinant of changes in the money supply. Some previous studies emphasize the effects of monetary regimes on the money supply process. These studies mainly suggest that there is no long-run relationship between monetary base and money supply in advanced economies. Only the evidence from a developing economy of Sri Lanka lends support to the Post-Keynesian theory of money endogeneity. When the money supply is endogenously determined, the central bank will not be able to control the money supply via a change in monetary base. In the monetarists' view point, the broad money supply is exogenously determined by the central bank. Few previous studies find that the money multiplier is stable. The stability of money multiplier implies that the money supply is determined exogenously (Baghestani and Mott, 1997: Bhatti and Khawaja, 2018; Ongan and Gocer, 2019). If there exists a stable long-run relationship between money supply and monetary base, the money multiplier is stable and predictable. Therefore, the central bank will be able to control the money supply. Whether the money supply is endogenously or exogenously determined is a controversial issue.

Understanding the money supply process is crucial in that policymakers and related economic agents will know whether or not the central bank can conduct sound monetary policy. Most previous studies employ linear cointegration tests, which assume that the adjustment towards the long-run equilibrium is symmetric. However, when this long-run relationship is not linear, the results can be misleading. Since there is no consensus about the stability of money multiplier, the present paper contributes to the literature in that it gives evidence of stable money multiplier in an emerging market economy. The period of study is during the post 1997 Asian financial crisis. Nonlinear cointegrtion tests suggest that the long-run relationship between broad money supply and monetary base is stable.

The paper is structured as follows. Section 2 explains empirical model and the estimation techniques. Section 3 reports empirical results, and the last section concludes.

2. Methodology

The empirical model that is used to estimate the money multiplier is expressed as:

$$LM_t = a_0 + a_1 D_t + a_2 LMB_t + e_t \tag{1}$$

where LM_t is the log of broad money supply (M2), LMB_t is the log of monetary base, and D_t is an unknown break point dummy variable. Eq. (1) can be used to test for cointegration between money supply and monetary base. The residual-based test for cointegration proposed by Gregory and Hansen (1996) is employed. If the ADF* statistic is greater than the 5% critical value, the null hypothesis of no cointegration is rejected and thus cointegration between the two variables exists. However, if the ADF* statistic is smaller than the 5% critical value, the null hypothesis is accepted and thus cointegratin between the two variables does not exist. If cointegration is not found, it is possible that the long-run relationship is nonlinear with asymmetric adjustment towards the long-run equilibrium.

The models that take into account of asymmetric adjustment mechanism are recently developed by Enders and Granger (1998) and Enders and Siklos (2001). These are modified models of the conventional residual-based tests for cointegration. The first model is known as the threshold autoregressive (TAR) model, which is a nonlinear extension of the residual-based framework. The nonlinear cointegration function of the TAR model is specified as:

$$\Delta e_t = I_t \rho_1 e_{t-1} + (1 - I_t)\rho_2 e_{t-1} + \sum_{i=1}^{k} \beta_i \Delta e_{t-i} + v_t \tag{2}$$

where Δ is first difference operator, I_t is the heaviside indicator function such that it is one if e_{t-1} is greater than or equal to τ and it is zero if e_{t-1} is smaller than τ, and τ is the value of the threshold. The first differences of the lagged error term are augmented to Eq. (2) to remove serial correlation.

According to the TAR model, the necessary and sufficient conditions for the sequence of e_t is that ρ_1 and ρ_2 are less than zero and $(1+\rho_1)(1+\rho_2)$ is less than one. Since the value of τ is unknown, this value is to be estimated. For the momentum threshold autoregressive (MTAR) model, the nonlinear cointegration function differs from the TAR model. The test equation is expressed as:

$$\Delta e_t = M_t \rho_1 e_{t-1} + (1 - M_t)\rho_2 e_{t-1} + \sum_{i=1}^{k} \beta_i \Delta e_{t-i} + v_t \tag{3}$$

In Eq. (3), the heaviside indicator function is defined as M_t is one if Δe_{t-1} is greater than or equal to τ, and it is zero if Δe_{t-1} is less than τ.

The negative values of ρ_1 and ρ_2 meet the requirement of necessary condition for convergence if the absolute values of both coefficients are less than one. In testing for nonlinear cointegration, the F-test for TAR and MTAR models has a non-standard distribution due to the presence of nuisance parameters that are only identified by the alternative hypothesis. Therefore, the test critical values must be computed by simulations suggested by Ender and Siklos (2001). The Φ statistic or the F-statistic for the null hypothesis that $\rho_1=\rho_2=0$ is smaller than the critical value, the null hypothesis of no cointegration is accepted in both the TAR and MTAR models. On the contrary, if the Φ statistic is larger than the critical value, the null hypothesis of no cointegration is rejected. For asymmetric adjustment towards the long-run equilibrium, the null hypothesis that $\rho_1=\rho_2$ must be tested. When the F-equal is larger than its critical value, the null hypothesis will be rejected and thus there exists asymmetric adjustment towards the long-run equilibrium. Otherwise, asymmetric adjustment is not found.

3. Empirical Results

The data from 1997M7 to 2017M12 are obtained from the Bank of Thailand website. The broad money supply (M2) and monetary base series are seasonally adjusted and transformed to logarithmic series. Before estimating the model in Eq. (1), the ADF tests for unit root with constant and trend are performed. The linear trend is included in the tests because the series of broad money supply (M) and money base (MB) exhibit rising trends (see Figure A2 in the appendix).

Table 1
Results of ADF tests for unit root, 1997M7-2017M12.

Variable	ADF statistic	Lag
LM	-1.455	2
ΔLM	-6.652***	2
LMB	-2.398	2
ΔLMB	-10.387***	3

Note: The optimal lag length is determined by Akaike Information Criterion (AIC), and ***, ** and * indicate significance at the 1% level.

The test results reported in Table 1 suggest that variables are integrated of order one, i.e., they are I(1) series. Therefore, the residual-based tests for cointegration can be applied. Firstly, the Gregory and Hansen (1996) cointegration test with unknown level shift is applied. The result of the estimated long-run relationship is reported in Table 2.

Table 2
The long-run relationship between broad money supply and money base, 1997M7-201712.
Dependent variable: LM_t

Variable	Coefficient	Std. Error	t-statistic	p-value
LMB_t	0.770***	0.011	71.853	0.000
D_t	0.131***	0.014	9.065	0.000
Intercept	5.602***	0.138	38.803	0.000
Adj. R^2 = 0.973, F = 4,462.715				

Note: ***, ** and * indicates significance at the 1%, 5% and 10%, respectively.

The estimate of Eq. (1) reveals that there is a positive relationship between broad money supply and monetary base. A 1% increase in monetary base causes the money supply to increase by 0.77%. The unknown break point is at 2002M5, which is two years after the implementation of inflation targeting. This break slightly strengthens the long-run relationship. The ADF* statistic is -3.92 which is smaller than the critical value of -4.61 at the 5% level of significance. Therefore, the null hypothesis of linear cointegration between broad money supply and monetary base is rejected.

The residual-based test for linear cointegration assumes that the process of adjustment towards long-run equilibrium is symmetric. However, the long-run relationship between variables might be nonlinear with asymmetric adjustment. The results of the estimated TAR and MTAR models expressed in Eqs. (2) and (3) are reported in Table 3.

Table 3
Estimated results of TAR and MTAR models, 1997M7-2017M12.

Parameters	Models	
	TAR	MTAR
ρ_1	-0.049 (0.045)	-0.084 (0.043)
ρ_2	-0.341 (0.067)	-0.359 (0.082)
κ	3	3
Threshold value	-0.050	-0.013
t-Max	-1,101 [-1.826]	-1.953 [-1.743]
Φ	13.261 [7.530]	10.782 [8.126]
F-equal	14.267 [6.636]	9.541 [8.694]

Note: Standard error is in parenthesis, κ is the number of lag of differenced residuals determined by AIC. The threshold values are endogenously determined. The numbers in bracket are the 5% critical values. The critical values for the Φ statistic are determined by 1,000 numbers of simulations.

The results in Table 3 indicate that the convergence condition is met, i.e., ρ_1 and ρ_2 are less than zero with the absolute values of less than one , and $(1+\rho_1)(1+\rho_2)$ is less than one in both TAR and MTAR models. The Φ statistics are larger than the 5% critical values, which suggest that the null hypothesis of no nonlinear cointegration can be rejected. Thus it can be concluded that the estimated long-run relationship in Eq. (1) reported in Table 2 is nonlinear. Furthermore, the F-equal statistics are larger than the 5% critical values, which suggest that there is asymmetric adjustment towards the long-run equilibrium. It should be noted that the t-Max statistics have low power of tests and thus are not important.

The stability tests using CUSUM and CUSUM of squares are shown in Figure A2 in the appendix. Both tests show that the long-run relationship between broad money supply and monetary base is stable because the blue lines are within the bands. This suggests that there is the stability of money multiplier of 0.77 over the period of floating exchange rate regime. This finding is not in line with the results of Thenuwara and Morgan (2017) who find that the broad money multiplier is not stable in Sri Lanka. Furthermore, Ongan and Gocer (2019) find that monetary base influences the narrow money supply while it does not influence the broad money supply in Canada.

4. Conclusions

Using monthly data during 1997M7 and 2017M12, cointegration tests are performed to estimate the long-run relationship between broad money supply and money base in Thailand. The estimation methods are linear and nonlinear cointegration tests. The results from residual-based test for cointegration, which takes into account an unknown structural break, show that there is no cointegration between broad money supply and monetary base. Therefore, a linear long-run relationship does not exist. When the threshold and momentum threshold cointegration tests are applied to the data, the results suggest that the long-run relationship between the two variables is nonlinear with asymmetric adjustment towards the long-run equilibrium. The results also reveal that the broad money multiplier is stable over the period of the floating exchange rate regime. The stability of money multiplier found in this paper supports the monetarists' approach. Regarding the policy implications in this case, the Bank of Thailand should maintain the current monetary regime so that it can have power to control the money supply.

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Appendix

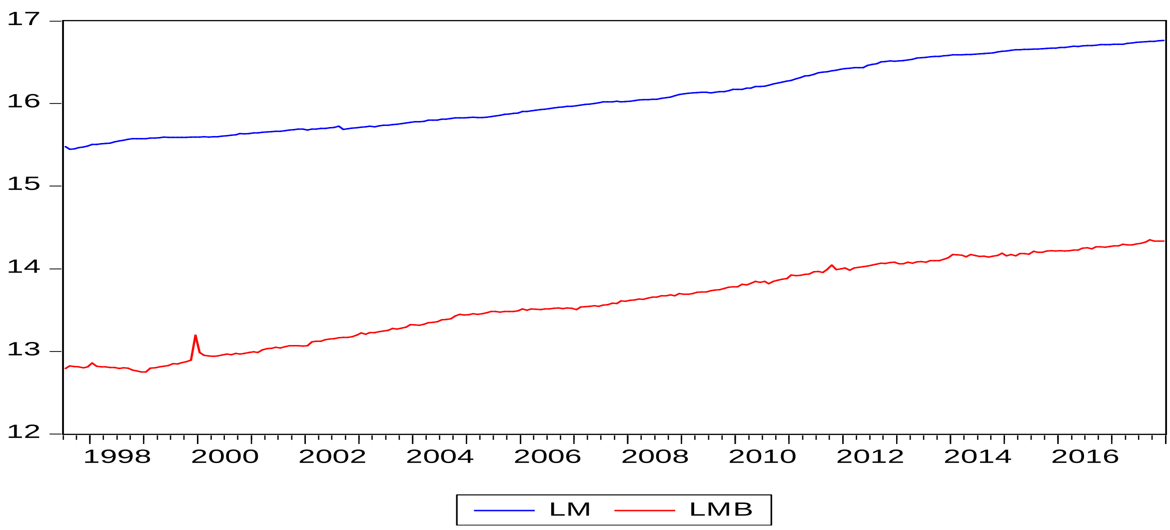
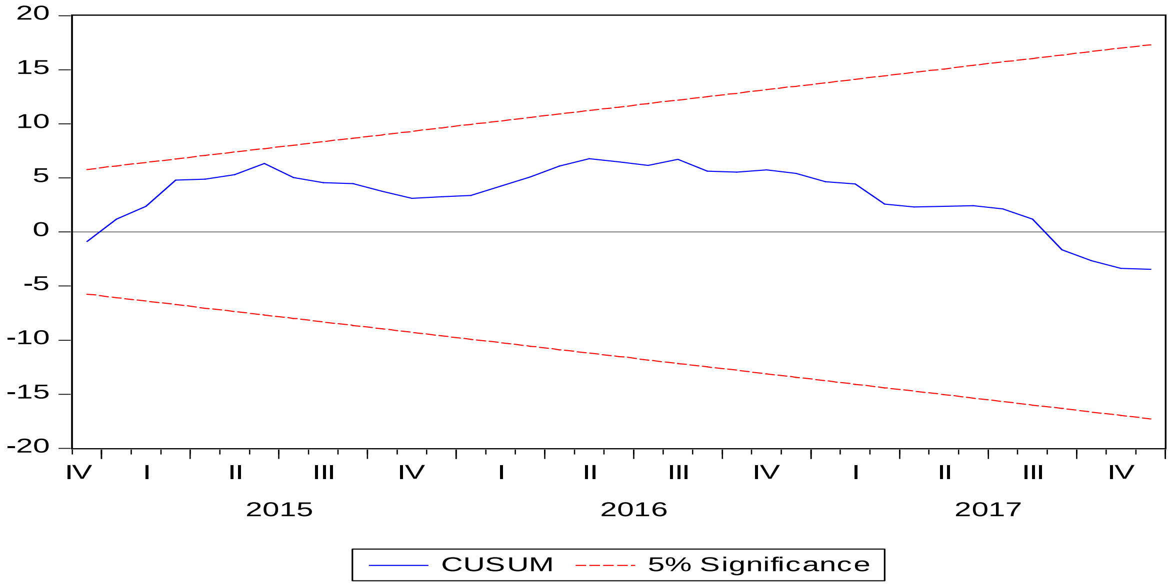


Figure A1 Co-movements of money supply and money base.



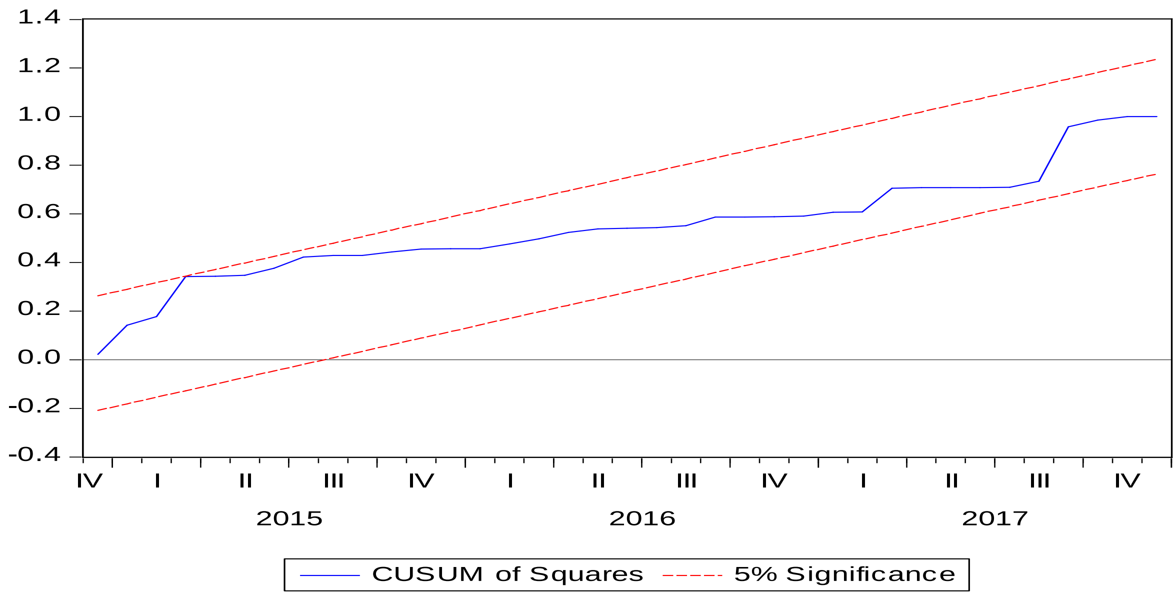


Figure A2 Stability of the long-run equation.