ECONOMIC UNCERTAINTY AND THE DEMAND FOR MONEY IN MALAYSIA: A BOUNDS TESTING ESTIMATION

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In this study, we construct the Divisia monetary aggregates for Malaysia and use them to conduct a comparison study by comparing the relative performance of different monetary aggregates using a specific money demand function proposed by Atta-Mensah (2004). The ARDL bounds test results indicate that Divisia M2 is more superior to the simple sum counterparts in generating a stable and plausible money demand function. The empirical finding also gains strong support for the inclusion of the EUI variable as proposed by Atta-Mensah as it exerts significant short-term as well as long-run impacts on the demand for money. The result shows that when a properly constructed monetary aggregate is used, money is still able to closely link to the fundamental macroeconomic indicators.

1. Introduction

Asian developing countries started to liberalize their financial markets as early as the late 1970s. During the 1980s, almost all Asian countries had liberalized their domestic financial systems. In many of these countries, including Malaysia in this study, the key reforms were aimed at liberalizing interest rates, reducing controls on credit, enhancing competition and efficiency in financial system, strengthening supervisory framework and promoting the growth and deepening of financial markets. These developments have altered the channels of monetary policy, and affected the relationship between money demand and economic activity. The appearance of newly issued financial assets has blurred the definition of money because most of these financial assets are immediate or easy access, and given the market-related interest rates. The traditional simple sum aggregate cannot distinguish between the transaction service and store of value function provided by them.

The emergence of financial intermediaries, new financial instruments, more developed money and capital markets and other financial assets are some of the by-products of financial innovation. Since these financial assets are different in their 'moneyness', an optimal monetary aggregate should not treat them as perfect substitutes, and then simply assign equal weight to each of the monetary component included in the aggregate. Instead, a more appropriate monetary aggregation approach should be the one that weighs each asset in the aggregate according to the degree of moneyness. This idea has long being discussed and the theoretical derivation of the weighted monetary aggregate, namely Divisia monetary aggregate was first introduced by Barnett in 1980.

The Divisia monetary aggregates are derived from the aggregation methods that are based on both microeconomic and index number theories. In contrast to the simple sum aggregates, which give equal weight to all component assets, they can capture the various substitution effects between monetary assets by assigning different weights for different component assets with regard to their transactions services. These optimal weights depend jointly on the quantities and prices (user costs) of the assets included in the aggregate. Thus, Divisia monetary aggregates seem better able to cope with financial innovation than their simple sum counterparts, and should be considered a more valid measure of monetary services in the economy. The empirical validity of Divisia monetary aggregates, however, is an empirical issue though they are theoretically superior to the simple sum aggregates.

Although the use of Divisia monetary aggregates has gained much attention from economists, the exploration in this area is relatively limited in the context of Asian developing country like Malaysia. The main objective of this study is to construct the Divisia monetary aggregates for Malaysia and use them to conduct a comparison study by comparing the relative performance of different monetary aggregates (Divisia versus simple sum) using a specific money demand function proposed by Atta-Mensah (2004). One of the merits of the proposed money demand function is that it consists of an economic uncertainty index (*EUI*) variable which can capture the instability element in the economy, and thus, increase the explanatory power and credibility of the obtained results in building a more reliable money demand function. The rest of this paper is organized as follows. Section 2 provides a brief explanation on the construction of Divisia money. Section 3 discusses on the model specification. Section 4 reports the results and lastly, Section 5 contains the conclusion.

2. Divisia Monetary Aggregates

The procedures of constructing Divisia money begin with the computation of total expenditure on monetary assets (*Y*). The *Y* at time *t* (see Anderson et al., 1997) is computed as follows:

$$Y_t = \sum_{i=1}^{n} \pi_{it} \overline{m}_{it} \tag{1}$$

where π_{it} is the user cost of monetary asset *i* at time *t* and $\overline{m}_{it}$ is the optimal stock of monetary asset *i* at time *t*. The π_{it} is the interest rate differentials between the rate of return of a benchmark asset (which is a risk-free asset) and the own rate of return of a monetary asset. The nominal user cost of the monetary asset can be measured by:

$$\pi_{it} = \frac{\overline{p}_t (R_t - r_{it})}{(1 + R_t)} \tag{2}$$

with R_t is the benchmark rate and r_{it} is the rate of return of an asset. $\overline{p}_t$ is the CPI. The benchmark rate is the highest rate of return of a risk-free monetary asset that does not provide any monetary services. After computing Y_t, the expenditure share on monetary asset *i* at time *t* can be assessed by:

$$s_{it} = \frac{\pi_{it}\overline{m}_{it}}{Y_t} \qquad (3)$$

where the total user cost of the optimal monetary aggregates is divided by the total expenditure. The expenditure share is then utilized to obtain the average expenditure share, which is expressed as:

$$\bar{s}_{it} = \frac{1}{2}\left(s_{it} + s_{i,t-1}\right) \qquad (4)$$

where $\bar{s}_{it}$ is the average of the sum of s_{it} and s_{it-1} . Finally, $\bar{s}_{it}$ is inserted into the formula to compute growth rate of Divisia monetary aggregate that can be formulated as (see Habibullah, 1999, p.80):

$$G(DM) = \sum_{i=1}^{n} \bar{s}_{it} G(\overline{m}_{it}) \qquad (5)$$

3. The Money Demand Model

A stable money demand function is very important for effective monetary policy as it enables policy makers to examine the relationship between monetary aggregates and macroeconomic variables that are vital for determining the performance of economic programs (Bahmani-Oskooee and Karacal, 2006). However, evolution in the financial system has contributed to money demand instability. As a result of rapid financial liberalization and reform, the traditional money demand function which relates real money balances to a scale variable and an opportunity cost variable is deemed inadequate to capture the effects of such financial market developments. In addition, the level of economic uncertainty is also crucial in affecting the amount of money demanded in the market, particularly those who are more risk-averse and make portfolio decisions against a backdrop of macroeconomic uncertainty (Atta-Mensah, 2004).

Following Atta-Mensah (2004), the money demand model used in this study consists of a scale variable, an opportunity cost of holding real money, and an economy uncertainty index (*EUI*) as follows:

$$\frac{M_t^d}{P_t} = \beta_0 + \beta_1 RGDP_t + \beta_2 R_t + \beta_3 EUI_t + \varepsilon_t \qquad (6)$$

where M_t^d / P_t denotes the real monetary aggregate, and P_t is the price level measured by CPI. The real monetary aggregates used include real simple sum M1 and M2 (*RSM1* and *RSM2*) and real Divisia M1 and M2 (*RDM1* and *RDM2*). *RGDP* represents real output. Following macroeconomic theory, when *RGDP* increases, the transaction demand as well as precautionary demand for money will also increase, thus, we expect an estimate of β_1 to be positive. On the other hand, as the speculative demand for money motive is inversely related to the opportunity cost of holding money, β_2 is expected to be negative value.

The opportunity costs for simple sum M1 and M2 are proxied by savings deposit rate. However, the opportunity costs for Divisia monetary aggregates are the dual price indexes stemming from the construction of the Divisia measures [1]. The *EUI* proposed by Atta-Mensah (2004) can be constructed using GARCH technique to extract the volatilities of five important macroeconomic variables which have the ability to affect the stability of an economy. These variables include the stock market (proxied by stock index), the bond market (proxied by long-term interest rate), monetary policy uncertainty (proxied by short-term interest rate), external shocks (proxied by the bilateral exchange rate) and lastly economic activity (proxied by real GDP)[2].

Quarterly time series for sampling period from 1981:Q1 to 2005:Q4 will be used in the analysis. As Malaysia experienced financial liberalization in late of 1970s, the starting year of the sample period is deemed appropriate to capture these financial development effects. All the data can be obtained from various issues of the *Quarterly Statistical Bulletin* published by Bank Negara Malaysia (BNM). The data series are transformed into natural logarithms before any test or estimation is conducted.

4. Empirical Estimation

In this study, the Autoregressive Distributed Lag (ARDL) bounds testing approach developed Pesaran et al. (2001) will be used to examine the money demand function. As pointed out by Narayan and Narayan (2005), the bounds test which is based on the estimation of an Unrestricted Error Correction Model (UECM) has several advantages over the conventional type of cointegration techniques. First, it obviates the uncertainty associated with pre-testing for unit roots as it does not require the information for the order of integration of the variables. Second, it is more robust when applied on a small sample study compared to Engle and Granger (1987) or Johansen type of cointegration methods. Third, the short as well as long-run parameters of the model could be estimated simultaneously, removing problems associated with omitted variables and autocorrelations (Narayan, 2004). The UECM exists in the following form as expressed in Equation (7):

$$\begin{aligned}\Delta \ln RM_t^d &= \beta_0 + \beta_1 \ln RM_{t-1}^d + \beta_2 \ln RGDP_{t-1} + \beta_3 \ln R_{t-1} + \beta_4 EUI_{t-1} \\ &+ \beta_5 \sum_{i=1}^{p} \Delta \ln RM_{t-i}^d + \beta_6 \sum_{i=0}^{p} \Delta \ln RGDP_{t-i} \\ &+ \beta_7 \sum_{i=0}^{p} \Delta \ln R_{t-i} + \beta_8 \sum_{i=0}^{p} \Delta EUI_{t-i} + \varepsilon_t \qquad (7)\end{aligned}$$

where RM_t^d, $RGDP_t$, R_t and EUI_t are real money balances, real GDP, opportunity cost of holding real money balances and the *EUI*, respectively; Δ

[1] For an explanation of the usage and idea behind the dual user cost, see Barnett (1980), Chou (1991) and Anderson et al. (1997).
[2] For a detailed discussion on *EUI*, see Atta-Mensah (2004, p. 5-7).

denotes a first difference operator; ln represents natural logarithmic transformation; β_0 is an intercept and ε_t is a white noise error term.

To estimate the long-run relationship, Equation (7) is first estimated by an OLS technique. Then, the no-cointegration null H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ is tested against the alternative of H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$ using *F*-test. Pesaran et al. (2001) provide two sets of critical value bounds for the *F*-statistics. If the computed *F*-statistic is smaller than the lower bound critical value, the H_0 cannot be rejected. If the computed *F*-statistic is greater than the upper bound critical value, the H_0 is rejected, indicating the existence of long-run equilibrium cointegration relationship. However, if the computed *F*-value lies within the critical value band, then the result would be inconclusive. The general-to-specific procedure by Hendry and Ericsson (1991) can be used to obtain a parsimonious UECM by dropping sequentially the insignificant first difference variables. The long-run elasticity of the independent variable is then calculated using the ratio of the estimated coefficient of one-lagged level independent variable over the estimated coefficient of one-lagged level dependent variable (multiplied with a negative sign). In addition, we can detect the short-run causality through the *F*-test applied to the joint significance of the sum of the lags of each explanatory variable (in first difference) in the equation.

Table 1 reports the ARDL bounds test results. The findings indicate that all the models show long-run cointegration relationship with their determinants as the obtained *F*-statistic values are greater than the upper bound critical value at no less than 10% level of significance. The diagnostic tests further indicate that all the estimated models have stable parameters[3] and do not suffer from any problem of normality, autocorrelation, heteroscedastic errors and misspecification. In the short-run, we found that all the explanatory variables do have the ability to Granger-cause real money balances in different models.

For the implied long-run elasticity, empirical results specify that only the Divisia M2 model can generate desired coefficients that conform to the theory's *a prior* expectations[4]. The long-run real income elasticity for *RDM2* is close to one as proposed by the quantity theory of money. The dual price interest rate variable is negatively correlated with *RDM2*. The *EUI* also shows a correct negative sign, indicating the economic agents will reduce the demand for *RDM2* balances due to portfolio investment adjustment when the market is in an uncertainty status. Therefore, Divisia M2 is regarded as an appropriate monetary policy variable in the economy of Malaysia. The findings also gain strong support for the inclusion of *EUI* variable in the money demand model as it exerts significant short-term as well as long-run impacts on the demand for money.

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[3] Except for RDM1 model in which the plot of CUSUM of square statistics indicates that the estimated parameters are unstable across the sample period under study.

[4] In the *RSM1* model, although all the long-run estimates are statistically significant, the estimated coefficient of *EUI* is negative, which is contradictory with *a prior* prediction seeing that it is less likely for the economic agents to reduce the demand for real narrow money balances when there is a great oscillation in business cycle.

Table 1: ARDL Bounds Test Results

	RSM1	RDM1	RSM2	RDM2
Computed F-statistic:	**3.88***	**3.93***	**7.62****	**8.58****
Decision:	**Reject H_0**	**Reject H_0**	**Reject H_0**	**Reject H_0**
Short-run Causality:				
Real GDP	30.76**	4.16**	13.66**	11.54**
Interest Rate	3.60**	4.82**	6.78**	4.79**
EUI	8.11**	6.20**	3.52*	4.94**
Long-run Elasticity:				
Real GDP	1.21**	0.69*	1.57**	0.96**
Interest Rate	-0.14**	0.48**	-0.02	-0.09**
EUI	-0.08**	0.15*	-0.04	-0.13**
Diagnostic Tests:				
JB	0.607[0.738]	4.350[0.114]	0.932[0.628]	2.071[0.355]
AR[4]	0.414[0.798]	1.429[0.234]	0.659[0.623]	1.318[0.273]
ARCH[1]	0.140[0.709]	1.066[0.305]	0.002[0.963]	0.104[0.747]
RESET[1]	0.063[0.803]	0.668[0.417]	3.053[0.085]	3.383[0.070]
CUSUM	Stable	Stable	Stable	Stable
$CUSUM^2$	Stable	Unstable	Stable	Stable

Notes: The 5% and 10% lower and upper bounds critical values are 3.23 & 4.35, and 2.72 & 3.77, respectively. The bounds critical values are obtained from Pesaran et al. (2001, pp. 300). JB is the Jarque-Bera statistic for testing normality. AR[4] is the Lagrange Multiplier test of 4^{th} order serial correlation. ARCH[1] is the 1^{st} order test for ARCH. RESET refers to Ramsey RESET specification test. CUSUM and $CUSUM^2$ are the cumulative sum of recursive residuals stability test and cumulative sum of squares of recursive residuals stability test, respectively. Asterisks (*) and (**) denote significant at 10% and 5% level, respectively.

5. Conclusion

Given that the traditional simple sum money no longer can serve as a useful monetary policy tool, the monetary authorities in some of the Asian countries have gradually shifted from monetary targeting to other sort of policy targets. At current, the central banks of Indonesia, the Philippines and Thailand are using inflation targeting, Malaysia is adopting interest rate targeting and Singapore follows the exchange rate targeting. Nevertheless, recent development in the global markets such as the prolong increases in the international crude oil prices since 2005 have created strong inflationary pressures in the economies of Asian including Malaysia. As a result, BNM forces to adjust the targeting variables to better cope with these changes. For example, BNM has increased the OPR several times from 2.7% in 2005 to 3.5% in 2007 with the intention of controlling the inflationary pressure. However, frequent increases in interest rate do not bode well for economic growth and businesses in the country as frequent increases lead to uncertainties and also higher cost of borrowings for businesses.

The findings in this study provide empirical support on the possibility of a return to monetary targeting in Malaysia using the Divisia money proposed by Barnett (1980). The ARDL bounds test estimation results indicate the Divisia M2 is more superior to the simple sum counterparts in generating a stable and plausible money demand function. The result shows that when a properly constructed monetary aggregate is used, money is still able to closely link to the fundamental macroeconomic indicators. Thus, unlike the simple sum monetary aggregates, the Divisia monetary aggregates are able to exert significant impact towards real economic activity. This result is very important in the sense it opens an avenue for the monetary authority to adopt the Divisia monetary aggregates in formulating its monetary policy.

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