Exchange Market Pressure: Evidences from ASEAN Inflation Targeting Countries

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20 August 2017

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Abstract

Monetary model of Exchange Market Pressure (EMP) is one of the best-known measures to determine size of intervention, which is needed to attain any favored exchange rate target. This study intends to examine the relationship between EMP and its determinant in ASEAN inflation targeting countries during 2006Q1-2016Q4. Monetary model of Exchange Market Pressure is employed. The results show that all variables are corresponding with the theory implies, except change in real income for Indonesia and Thailand, and change in world prices for Philippines. Thus, additional pressure by financial crisis is only found in Indonesian rupiah and Thai baht exchange rates. This study also proves that independent variables, which are used, can attempt favorable prediction of the value of EMP, especially during financial crisis. In the context controlling EMP, this study finds that these countries prefer to hold their currency exchange rate level by managing domestic credit and interest rate.

Keywords: Exchange Market Pressure, Exchange Rate, Intervention, Inflation Targeting, Financial Crisis

JEL: F31, F33, F37

1. Introduction

Started from December 18, 1946 and ended on August 15, 1971, the Bretton Woods system was legitimately become global monetary framework of fixed exchange rates system, it remains almost twenty-five years (Bordo, 1993), where countries have limited choices for their monetary strategy (Rose, 2007). All the member countries conform to link their currency to U.S. dollar and to peg their exchange rates (Raji et al., 2014). If country's currency undervalued to the U.S. dollar, a country will increase the value of its currency through purchase its currency in exchange from

U.S. dollar. Conversely, if country's currency overvalued to the U.S. dollar, a country will decrease the value of its currency through sell its currency in exchange for U.S. dollar.

In the exchange rates fixed system, any excess demand for a foreign currency will cause deficits on balance of payments and it will be absorbed by losing foreign reserve (Ziramba, 2007). At that time come up one monetary method which has acknowledged substantial attention during Bretton Woods which later called by the Monetary Approach to Balance of Payment (Mussa, 1974; Johnson, 1977; Girton and Roper, 1977; Bilquees, 1989; Ziramba, 2007; and Raji et al. 2014), where this method determines the factors that affect country's balance of payment. Johnson (1977) mentioned that the Monetary Approach to Balance of Payments (MABOP) theory gives fundamental implications for policy during this period.

Bretton Woods system collapses just after President Richard Nixon ended trading of gold at the fixed price in 1971 (Bordo, 1993), since that many member countries have been allowed to run under floating exchange rates system. The MABOP is no longer suitable, because under floating exchange rates any excess demand for a foreign currency will cause depreciation on exchange rate level. Therefore, arise new method which called by monetary approach to Exchange Rate Determination. This monetary approach determines the depreciation of domestic currency to absorb any excess demand for a foreign currency in foreign exchange markets (Weymark, 1998).

Between the Bretton Woods collapses in 1971 and the Asian financial crisis in 1997, several countries in South East Asian pegged their currencies. Indonesian exchange regime was a crawling pegs its rupiah to the U.S. dollar; meanwhile Thailand had maintained its baht with a basket of currencies including U.S. dollar. For the Philippines, although it was officially said that exchange rate system was free floating since 1984, but in fact its exchange rate system was managed floating. Moreover, just before the crisis (during 1995-1997) the peso was again pegged to the U.S. dollar (Hossain, 2011).

The Asian financial crisis 1997 was successfully causes contagion effect of currency pressures in South East Asian such as Thai baht, Indonesian rupiah, Philippine peso, Malaysian ringgit. All that countries had a fixed exchange rate against U.S. dollar in the pre-crisis period (Hossain, 2011) and these countries try to change exchange rate system while a crisis (Horen et al, 2006). Several monetary authorities in South East Asian like Indonesia, Thailand, and Philippines moved their exchange rate system to manage or 'dirty' float (Rana, 1998).

Unlike from country under the fixed exchange rate system which removes any excess demand for a foreign currency by adjusting foreign reserves, or country under the freely floating exchange rate system by depreciating the exchange rate. Under managed 'dirty' float exchange rate system, any excess demand for a foreign currency can be removed by changes in the exchange rate, foreign reserves, and domestic credit at the same time. Weymark (1998) points out the best-known measure to determine these changes are Girton and Roper's (1977) exchange Market Pressure (EMP) model.

Girton and Roper (1977) interpret EMP as sum of exchange rate depreciation and foreign reserve outflows which will provides us a measure of the volume of intervention needed to attain any favored exchange rate target through adjusting in reserve or exchange rate level. The model draws on a combination of the monetary approach to the balance of payments and exchange rate determination (Kim, 1985). Because EMP is formulated by combining the previous model, therefore it can be universally and easily applicable in all exchange rate regime; fixed, floating, or managed floating (Paraskevi, 2014). Generally, the main discussion of EMP is movements of foreign reserve and exchange rate (Tanner, 2000).

After the Bretton Woods system fall, exchange rates have a high volatility, uncertain, and affected to world's economy. Several economists and business executives frequently call this volatility is risky, because it raises the uncertainty in international business transactions (Mankiw, 2012). High exchange rate volatility has become a main problem for many countries and bothered many policy makers especially during currency crises. Since that, determination of exchange rate and its stabilization become a primary requirement to maintain economy certainty (Oruc, 2015) and one of the competitiveness indicator for newly industrializing economies (NIEs) (Rajan, 2012).

There are several marked contributions on EMP especially for Asian countries in recent years (see Aizenman and Binici (2015), Rajan (2012), Horen et al. (2006), Bautista and Bautista (2005) and Tanner (2001, 2002) among others).

Some these papers focused on the severity of exchange rate volatility in emerging countries and others emphasized during the financial crisis.

Nevertheless, so far still there is no study available, which exclusively devoted on EMP in ASEAN inflation targeting countries. This paper intends to examine exchange market pressure in the case of ASEAN inflation targeting countries i.e. Indonesia, Thailand, and Philippines. These three ASEAN countries provide a good example for testing this approach because these countries have many similar characteristics.

First, selected countries can be treated as a small open economy, so world monetary conditions and world prices, both are given for them. Second, after the Asian Financial Crisis in 1997, these countries implemented managed 'dirty' float to their exchange rate system until now. This reason appropriates with Ziramba (2007) and Tanner (2000) which suggested that the monetary model of Exchange Market Pressure is more convenient to tests under managed float system.

Third, these countries are inflation targeting countries (IT), where Rose (2007) and Lee and Poon (2013) stated that inflation targeting countries have lower exchange rate volatility and fewer capital outflow compared to similar countries that do not target inflation, which means inflation targeting countries tend to hold their currency exchange rate level rather than let them depreciation or appreciation.

The main objective of this study is to analyze the relationship between EMP and its determinant in ASEAN inflation targeting countries (Indonesia, Thailand, and Philippines) over the period 2006Q1-2016Q4. The rest of this paper is organized as follow. Part 2 describes literature study concerning EMP in general

and reviews several previous relevant studies. Part 3 represents methodology that used in this study, including source of data, econometric model, and empirical procedures. Part 4 shows analysis of empirical results. Finally, some conclusions and recommendations are presented in Part 5.

2. Literature Review

First time exchange market pressure introduced by Girton and Roper (1977). The model was constructed for the Canadian managed float during the period 1952-1962. Their model designed to define what "exchange market pressure" is. They concluded that EMP is pressure on foreign reserves and exchange rate when occur an excess demand for foreign currency.

The basic theoretical proposition of EMP is an excess demand for foreign currency in the context of a managed float can be relieved by some combination of the two i.e. a currency exchange rate depreciation, and/or an outflow in foreign reserves (Girton and Roper, 1977; Kim, 1985). Thus, Girton and Roper (1977) interpret EMP as the simple sum of the changes in foreign reserves and the changes in the exchange rate: $emp = fr + ex$; where *EMP* is sum of the change in foreign reserves (fr) and the change in exchange rate (ex). Assumptions that employed in the Girton and Roper model are: 1) purchasing power parity (PPP) holds if deviations from its absolute version are stationary, 2) Interest rate differential is constant, and 3) equilibrium in both domestic and foreign money market.

Many economists afterwards followed Girton and Roper model of the EMP since Girton and Roper were the pioneers on the EMP research. In this section, author will present several studies on the EMP including some researchers that following Girton and Roper model of the EMP.

Connolly and Silveira (1979) applied Girton and Roper model of EMP to the postwar Brazilian monetary experience over two decades period, 1955-1975. They picked Brazil for testing this approach because it one of example a postwar managed float system and can be treated as a "small, open" economy which means that world prices and monetary conditions are given. This notably fit with objective of most modern monetary models, which preclude the problems of monetary dependence. Specifically, the small-country assumption allows us to design a simple one-country equation of managed floating which depends upon four essential aspects such as money demand, money supply, purchasing power parity, and monetary equilibrium. Connolly and Silveira (1979) find that the simple Girton and Roper model of EMP performs well in explaining movements of reserves and the exchange rate.

While in Korea, the Girton and Roper model of exchange market pressure used by Kim (1985) to check the hypothesis that magnitude of market pressure is independent whether the monetary authorities absorb the market pressure in the exchange rate or in foreign reserves under a managed float system during March

1980 to July 1983. Kim (1985) stated Korea fits with the model of exchange market pressure because it can be treated as a small-open economy. In the case of Korea, Kim also indicates that the most exchange market is absorbed by adjustments in foreign reserves.

By using co-integration and error correction methodology, Modeste (2005) discovered a significant relationship between growth in the foreign debt and increases in exchange market pressure in Guyana based on annual data during period 1968 to 2000. After controlling for other factors that affect changes in foreign reserves and exchange rate, the other significant variables in the case Guyana are the changes in domestic credit, the growth in the relative price of crude oil, the growth in exports, the tightness of US monetary policy, and changes in the level of uncertainty in the local economy.

Tanner (2000) using a vector autoregression approach provided several evidences that monetary authorities respond by expanding domestic credit to increases of EMP in some emerging countries (Brazil, Chile, Mexico, Indonesia, Korea, and Thailand) during the 1990s. In 2002, Tanner examined the relationship between monetary policy and EMP in 32 emerging countries, and Tanner finds out that in most countries the shocks to monetary policy can influence EMP where tighter money will reduce EMP.

By using a VAR methodology and Granger Causality test in the case of the Philippine peso, Bautista and Bautista (2005) investigated how Philippines monetary authorities respond to EMP with monthly data for the period January

1990 to April 2000 and summarized that declining in domestic credit growth and increasing in the interest rate differential both reduce EMP.

In 2007, Ziramba (2007) applied the monetary model of the Exchange Market Pressure to the South African experience with floating exchange rate and managed float systems using annual data for the period 1970-1993. The findings are there is significant negative relationship between the domestic credit growth, money multiplier growth, and the rates of change in the EMP, but in other side, there is no evidence effect of domestic real income on EMP. This implies that during 1970 to 1993, the South African monetary authorities responded to EMP by some combinations i.e. depreciating currency and losing foreign reserves.

In context relationship between EMP and foreign debt, Modeste (2005) investigated EMP through application of the Error Correction Methodology based annual data from 1968 to 2000 in Guyana and summarized that there is significant relationship between growth in the foreign debt burden and increasing EMP in Guyana.

While speculation effects to EMP has been researched by Feridun (2008). Feridun examined the determinants of EMP and currency crisis in Turkey during September 2009 to April 2001 using Autoregressive Distributed Lag (ARDL), the binary logit and ordered logit. Feridun finds out that speculative pressure in the exchange market and currency crisis in Turkey are linked to the repeals in the capital flows. His findings supported by Aizenman and Binici (2015) through dynamic panel model estimation using quarterly data over the 2000-2014 period on

OECD and emerging countries, which is found that external factors have important role in driving EMP for both OECD and emerging countries such as short-term gross portfolio inflows and outflows.

The monetary model of Exchange Market Pressure is formed from the money demand function, money supply function, and purchasing power parity (Connolly and Silveria, 1979; Kim, 1985). First, the money demand function is written in equation (1) as:

$$Md = k.P.RY.IR \quad (1)$$

Md in (1) stands for money demand defined as the domestic price level (consumer price index), *P;* the real income (real gross domestic product), *RY*; the nominal interest rate, *IR*; and *k* is assumed constant according to Connolly and Silveira (1979). Therefore, nominal interest rate was included in the money demand function based on Girton and Roper (1977) and Weymark (1998).

Second, situation of equilibrium in the money market is the imposition of the purchasing power parity condition (Kim, 1985). Under the assumption of a small-open country, the purchasing power parity (PPP) show the ratio of domestic price (*P*) and world price (*PF*) through the nominal exchange rate (*E*). It is shown by equation (2).

$$EX = P/PF \quad (2)$$

From equation (2), *P* is substituted in the money demand function (1), so we get equation (3)

$$Md = k.EX.PF.RY.IR \quad (3)$$

Third, since the growth in the money supply is equal to the change in foreign reserves (*F*) plus the change in domestic credit (*D*), define the money supply function following Mundell (Connolly and Silveira, 1979) as shown in equation (4). The equation (4) shows that source of money supply, which composes variation in foreign reserves via the balance of payment and a variation in domestic credit via the banking system.

$$Ms = FR + DC \quad (4)$$

According to equilibrium, demand for money should equal with money supply as given in equation (5).

$$Md = Ms \quad (5)$$

By substituting equations (3) and (4) into equation (5), differentiating, taking logarithm, and after the expression has been algebraically manipulated (its derivation shown in appendix, p. 49), the following EMP equation is obtained as written in equation (6) and it became fundamental equation to test EMP.

$$emp = \beta_1 dc - \beta_2 pf - \beta_3 ry - \beta_4 ir \quad (6)$$

3. Research Method

3.1. Data

This study uses quarterly time series data during period 2006 to 2016. Data on the world price (US consumer price index), real income (gross domestic product), domestic credit, interest rate, exchange rate, and foreign reserves were collected from the CEIC Data. Here are the definitions of the data that will use throughout this paper:

- Nominal Exchange Rate

The nominal exchange rate is the relative price of the currencies of two countries (Mankiw, 2012; Krugman, 2007). Therefore, in this case, nominal exchange rates defined as IDR/USD for Indonesia, THB/USD for Thailand, and PHP/USD for Philippines (measured as the volume of domestic currency that can be purchased with 1 U.S. dollar).

- Foreign Reserves

Foreign reserves are held for foreign exchange markets intervention by the monetary authorities to avoid an excessive depreciation or appreciation of the nation's currency (Salvatore, 2012), notably for those countries with highly open goods and capital markets and/or a fixed exchange rate as the keystone of monetary policy (Roger, 1993). Foreign reserves are one of component that composes the base money.

- Domestic Credit

Domestic credit is a key in understanding the relationship between international capital flows and domestic macroeconomic and financial variables (Lane and

McQuade, 2013). According to the World Bank, definition domestic credit is financial resources provided by financial institutions, such as through loans, purchases of nonequity securities, and trade credits, and other accounts receivable that establish a claim for repayment. Variation in domestic credit will influence money supply through the banking system.

- World Price (US Consumer Price Index)

The Consumer Price Index (CPI) transforms the prices of many goods and services into a single index measuring the overall level of prices, CPI is the most frequently used measure of the level of prices (Mankiw, 2012). Author chooses U.S. Consumer Price Index to represent world price level because U.S. has a currency that widely used in international transactions (Federal Reserve, 2010) and U.S. known as largest-open economy in the world today due to gross domestic product, average income, and population. That means U.S. economy can affect other economy countries, particularly for this case is world price level through its Consumer Price Index.

- Real Income (Real Gross Domestic Product)

This research uses Real GDP data to represent real income. Real GDP is widely used by economists and commonly considered as a better measurement of economic well-being, which counts the economy's output of goods and services without being affected by changes in prices (Mankiw, 2012). Opposed with it, there is nominal GDP which is measures the value of goods and services measured at current prices, it can rise either because prices increase or because quantities increase, so it not precisely to represent real income.

- Interest Rate

This research picks nominal interest rate based on study Girton and Roper (1977) and Weymark (1998) which is added nominal interest rate in the money demand function. By explanation, changes in the price level determine the rate of inflation. Inflation affects the nominal interest rate. Because the nominal interest rate is the cost of holding money, it may affect the demand for money (Mankiw, 2012).

3.2. Model and Empirical Procedures

This study employed the monetary model of Exchange Market Pressure that became fundamental equation of EMP:

$$emp = \beta_1 d - \beta_2 p^* - \beta_3 y - \beta_4 r \quad (6)$$

On the dependent variable is the EMP each country and the independent variables are domestic credit, world price, real income, and interest rate. This equation based on Girton-Roper (1977) and followed by Connolly and Silveira (1979), Kim (1985), Ziramba (2007), Raji et al. (2014), and Paraskevi (2014). Additionally, in this study author will add dummy crisis variable into model.

With equation (6), we can deal with main objectives of this study that is explaining about relationship between EMP and other components, and defining the EMP calculations all at once.

Before going to the model analysis, it is needed to consider variables stationarity. Wooldridge (2013) stated that stationary process be a necessary step in the analysis of time series. Feridun (2008) found that several previous studies on

EMP ignore the time-series properties, which one of them is stationarity, and it, became one weakness from their studies. Feridun justified that non-stationary data may create some econometric problems in time series studies, such as spurious regression, which later the economic interpretation will not be valid. Since stationary process has important role in time series studies, so firstly author will run stationary test. This testing is used to determine the order of integration of the variables.

After stationarity test, author will run the regression of EMP model. EMP equation has ordinary least squares form. Wooldridge (2013) mentioned that ordinary least squares in time series data commonly leads to violated the assumptions of uncorrelated errors (serial correlation present) and it will lead to non-robust standard errors in the regression results. Therefore, author must ensure that regression in EMP model has robust standard errors. Horen et al. (2006), Raji et al. (2014), and Paraskevi (2014) advise to handle serial correlation and non-robust standard errors in case of EMP equation by lagging (using values of the target variable from the previous period(s) as predictors in the model) and using HAC standard errors with Newey-West estimator. Newey-West estimator corrects the standard errors of parameter to reach its robustness through capture problem of autocorrelation and heteroscedasticity in context of the model's error terms overtime (Newey and West, 1986).

After the estimation regression conducted, there are some required tests or called by residual diagnostic test including: 1) heteroskedasticity, in this study using the white's test for heteroskedasticity; and 2) autocorrelation, by using the Breusch-

Godfrey serial correlation LM test. Moreover, Ziramba (2007) suggests conducting stability regression test through CUSUM and CUSUMSQ test.

Finally, after defined and analyzed EMP calculations for these countries, we continue to other objectives, that is investigating find out how each ASEAN inflation targeting country hold their exchange rate level, through the adjusting foreign reserves and/or exchange rate level or through managing domestic credit and interest rate.

4. Results and Discussion

4.1 Stationary Test

According to empirical procedures that have been mentioned before in section 3.2, the first procedure that must be done is a stationarity test. A common method of stationarity test is using several different tests and seeing where which provide the identical result (Mahadeva and Robinson, 2004). Thus, author adopts two kinds of stationarity test, first is using Augmented Dickey-Fuller (ADF) test which has advantage included sufficient lagged dependent variables to eliminate the residual of correlation, and second is using Phillips-Perron (PP) because it is the most commonly used as alternative to the ADF test.

Stationary test consists of estimation stationarity test at various significance levels. If the test statistic is greater than the critical value, the null hypothesis of non-stationarity is rejected. Nevertheless, if the test statistic is smaller than the critical value, the null hypothesis of non-stationarity cannot be rejected and this will lead to spurious regression, this means that we might summarize incorrectly to a significant relationship between two parameters, which are in fact, might be not

related. The models below are the results of the stationary test in each variable that will used in the model:

Variable	Order	Indonesia		Thailand		Philippines	
		ADF	PP	ADF	PP	ADF	PP
EMP	I(0)	-1.48	-1.53	-2.07	-2.27	-1.76	-1.60
	I(1)	-4.39***	-4.38***	-3.70***	-3.66***	-3.93***	-3.88***
FR	I(0)	-1.41	-1.43	-2.07	-2.27	-1.76	-1.59
	I(1)	-4.43***	-4.41***	-3.70***	-3.66***	-3.93***	-3.88***
EX	I(0)	-0.87	-0.40	-2.81*	-2.75*	-2.88*	-2.17
	I(1)	-5.00***	-4.49***	-3.70***	-3.71***	-4.08***	-4.12***
DC	I(0)	-0.33	-0.36	-1.00	-1.02	1.94	4.88
	I(1)	-4.24***	-4.13***	-4.28***	-4.30***	-5.10***	-5.47***
PF	I(0)	-1.41	-2.85*	-1.41	-2.85*	-1.41	-2.85*
	I(1)	-8.01***	-6.47***	-8.01***	-6.47***	-8.01***	-6.47***
RY	I(0)	-2.30	-2.55	-2.44	-2.57	-3.93	-2.43
	I(1)	-2.74*	-4.47***	-5.39***	-4.99***	-6.20***	-4.09***
IR	I(0)	-3.60***	-1.92	-2.87*	-1.76	-2.21	-1.91
	I(1)	-3.85***	-3.64***	-4.28***	-4.30***	-4.72***	-4.33***

Null hypothesis: variable has a unit root
Level of significance: *** represent 1%; ** represent 5%; * represent 10%

Table 1. Stationary Test Results

As we can see in results above, in order I(0) or level, only few variables are stationer and significant at 10% (EX Thailand, EX Philippines, PF, and IR Thailand), and only IR Indonesia which significant at 1%. While, in order I(1) or first difference, all variables are stationer in both ADF and PP tests and significant at 1%, only RY Indonesia which significant at 10%. According to these results, author will use all variables in first difference to avoid spurious regression.

4.2 Regression Results with Robust Standard Errors

The regression model that will used in this study is monetary model of EMP (shown in equation (6), as mentioned in previous section, which has been modified with dummy crisis variable.

As explained earlier in section, author will run the regression with lagging (using values of the target variable from the previous period(s) as predictors in the model) and using HAC standard errors with Newey-West estimator to avoid violation of the assumptions of uncorrelated errors and to make sure the regression has robust standard errors.

	AIC	SC	HQ
Indonesia	6	1	2
Thailand	6	1	6
Philippines	6	1	6

Optimum lag: a minimal value in each information criteria shown by *

Table 2. VAR Lag Order Selection Criteria

These results above show that optimum lag is different in each information criteria. According to Liew (2004), the AIC are more convenient when observations are less than 60, while the HQ is more efficient when observations are above 120. Because observation in this study is, 44, which mean less than 60, so author will use optimum lag, based on AIC, which is for all these countries have lag optimum at six. Therefore, author will follow Paraskevi (2014) which apply that optimum lag for each independent variable, then by omitting one insignificant variable at a time.

Table 3 shows the results of EMP regression with robust standard errors for Indonesia, Thailand, and Philippines.

Table 3 .Results of the EMP regression
Estimation: least square, using observations 2006Q1 – 2016Q4 (T=44)
HAC std. error and covariance (Barlett Kernel, Newey-West Fixed)
Dependent variable: EMP

Var.	Indonesia		Var.	Thailand		Var.	Philippines	
	Coef.	Prob.		Coef.	Prob.		Coef.	Prob.
c	-0.135	0.0002	*C*	-0.082	0.0007	*const*	-0.067	0.0036
dc	2.539	0.0000	*dc*	1.255	0.0000	*dc*	1.862	0.0000
dc(-1)	-0.696	0.0000	*dc(-2)*	0.845	0.0959	*dc(-1)*	1.317	0.0000
dc(-3)	0.379	0.0654	*pf*	3.330	0.0001	*dc(-2)*	0.762	0.0484
dc(-5)	0.662	0.0004	*pf(-4)*	3.635	0.0024	*dc(-4)*	1.399	0.0005
pf	4.463	0.0021	*pf(-6)*	4.083	0.0204	*dc(-6)*	-0.979	0.0024
pf(-5)	-3.944	0.0002	*ry(-2)*	-0.006	0.0023	*pf(-2)*	-3.933	0.0005
ry(-1)	-0.005	0.0866	*ry(-3)*	-0.005	0.0010	*pf(-3)*	-2.134	0.0043
ry(-2)	-0.011	0.0040	*ry(-6)*	-0.002	0.0003	*pf(-6)*	3.106	0.0043
ry(-3)	-0.003	0.0911	*ir*	-0.153	0.0218	*ry*	0.007	0.0000
ry(-4)	-0.009	0.0022	*ir(-3)*	-0.254	0.0015	*ry(-1)*	0.002	0.0069
ry(-5)	-0.006	0.0172	*ir(-6)*	-0.168	0.0011	*ry(-3)*	0.004	0.0163
ry(-6)	-0.012	0.0001	*dumm*	-0.077	0.0002	*ry(-4)*	0.005	0.0000
ir(-2)	-0.637	0.0001				*ry(-5)*	0.002	0.0408
dumm	0.219	0.0005				*ry(-6)*	0.003	0.0016
						ir(-1)	0.546	0.0010
						ir(-6)	-0.590	0.0000
						dumm	-0.041	0.2596

Adjusted R-squared Indonesia	0.829269
Adjusted R-squared Thailand	0.682974
Adjusted R-squared Philippines	0.771327

Note:
dc: domestic credit
pf: world price
ry: real income
ir: interest rate
dumm: dummy crisis

The regression results provide several essential information related to the Exchange Market Pressure model. For Indonesia and Thailand, almost all variables are statistically significant and their signs are corresponding with theory implies,

except the sign of real income. This means if growth rate of domestic credit and/or interest rate increases, there will be proportional depreciation of domestic currency and/or loss of foreign reserves, therefore EMP will increase. Afterward, raising in world prices will cause domestic products and services are comparatively cheaper, so it will increase in exports which means bring more reserves and decreasing EMP.

For the sign of change in real income for Indonesia and Thailand, it is not corresponding with the EMP model. The result present that growth of real income has negative sign. Negative sign for real income that means if growth of real income increases there will be depreciation of Indonesia rupiah and/or loss of foreign reserves (EMP increases). This is opposite with theory implies which expect that raising in real income growth means more additional reserves (EMP decreases). From this incongruity, author identifies that relationship between real income and import demand in Indonesia and Thailand might be positive and elastic in short term, consequently the growth of real income for Indonesia increases may attract more import product and services, and it will lead to increase of EMP.

While the sign results for Philippines, there are some differences with EMP regression results for Indonesia and Thailand. More specifically, the coefficient sign of change in real income be corresponding with EMP model, while sign of change in the world prices be opposite with the theory implies. Author identified this incongruity is corresponding with data of exports and imports of Philippines that recorded on UN Comtrade 2006-2016 and World Bank Philippines Economic Update 2016-2017. Although world price relatively higher than domestic, net exports growth Philippines remained a source of weakness for the Philippines

economy as the rapid expansion net of imports outpaced export growth since 2006 and demand for Philippine exports remained relatively weak among the country's major trading partners. These reasons cause raising in world prices might not reducing EMP in Philippines.

The last control variable is dummy crisis variable, which provide significant results in EMP of Indonesia and Thailand, that means while crisis period there are additional pressures to the exchange rate Indonesia rupiah and Thai baht. While for EMP Philippines, dummy crisis variable in EMP model provide statistically insignificant, that means additional pressure to foreign market Philippines during financial crisis does not present.

Furthermore, from these regression results, we know that the model provides a high R-squared, approximately equal to 0.83 for Indonesia, 0.62 for Thailand, and 0.77 for Philippines. This can be also observed in Figures 1.2, and 3.

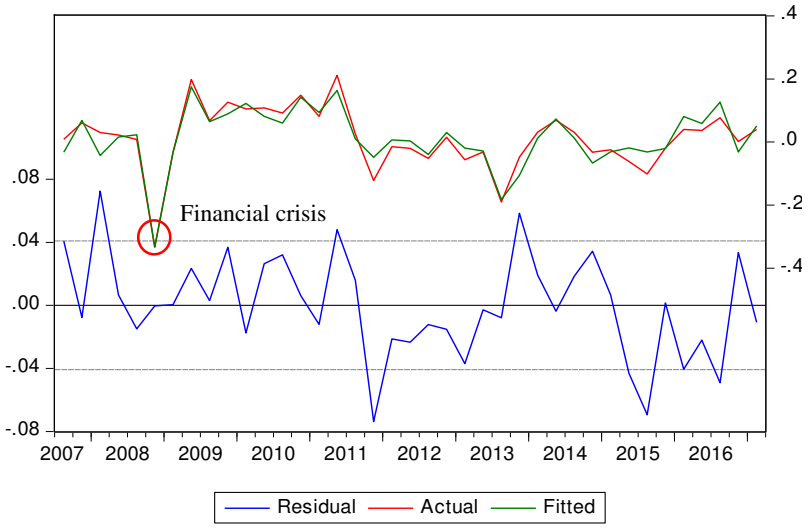


Figure 1. Actual-Fitted graph for EMP of Indonesia

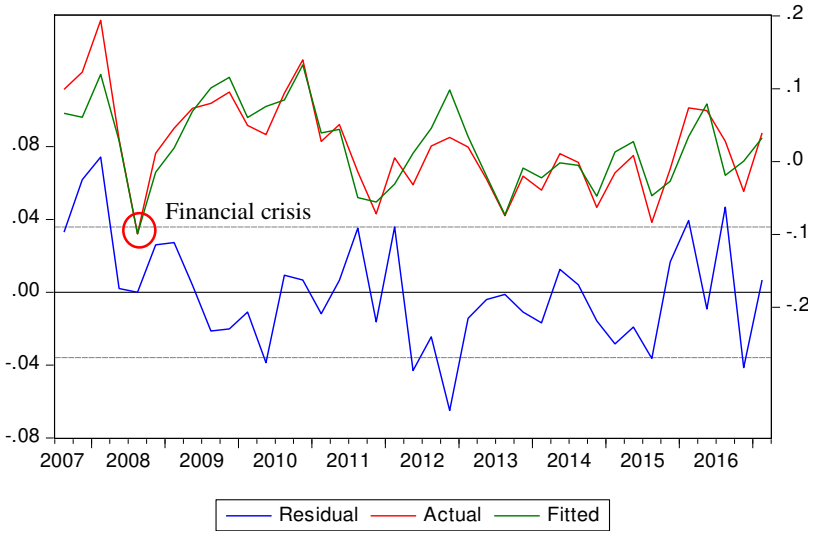


Figure 2 Actual-Fitted graph for EMP of Thailand

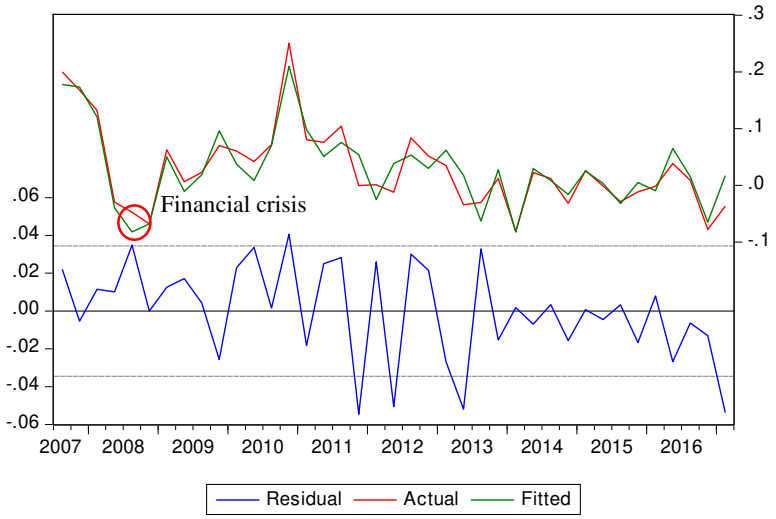


Figure 3. Actual-Fitted graph for EMP of Philippines

The sign predicted by the independent variables of the regression are very close to the actual values of EMP during examined period. Therefore, the independent variables which were used can attempt a favorable prediction of the value of EMP. Especially during financial crisis 2008, the residual almost zero. This result supports previous studies by Bertoli et al (2008), Pontines and Siregar (2006), Heriqbaldi (2012), and Paraskevi (2014).

4.3 Residual Diagnostic Test

Residual diagnostic test be a required test, which including autocorrelation and heteroscedasticity. According to empirical procedures that had been mentioned previous section, we will use Breusch-Godfrey serial correlation LM test to check presence of autocorrelation and White's test to check presence of heteroscedasticity. The diagnostic test results show that heteroscedasticity and autocorrelation are not present in the regression estimation. Residual diagnostic test is presented in table 3.

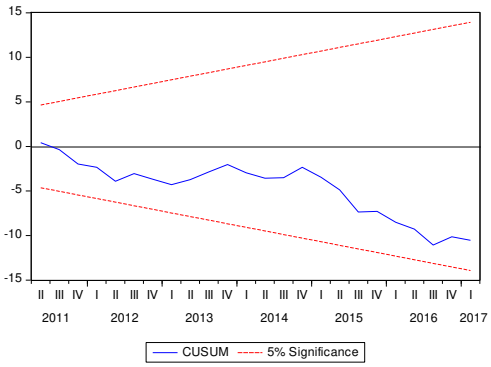
Table 3. Results of residual diagnostic tests

	Indonesia		Thailand		Philippines	
	Obs*R-squared	p-value	Obs*R-squared	p-value	Obs*R-squared	p-value
LM test for autocorrelation null hypothesis: no autocorrelation	8.5221	0.2023	7.5696	0.2714	8.2632	0.2194
White's test for heteroscedasticity null hypothesis: heteroscedasticity not present	14.854	0.3882	6.8768	0.8656	18.7308	0.3442

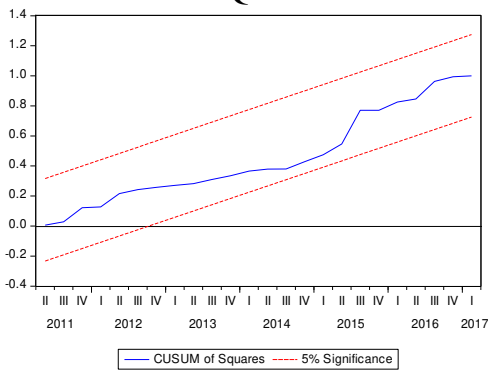
4.4 Stability Regression Test

According to Ziramba (2007), the hypothesis of a stable regression in EMP regression should be accepted. Therefore, author will use CUSUM and CUSUMSQ to see the stability of regression, where if the blue line out from inner two red line that means the regression unstable, or conversely. The results of CUSUM and CUSUMSQ test are presented shown in figure 4.

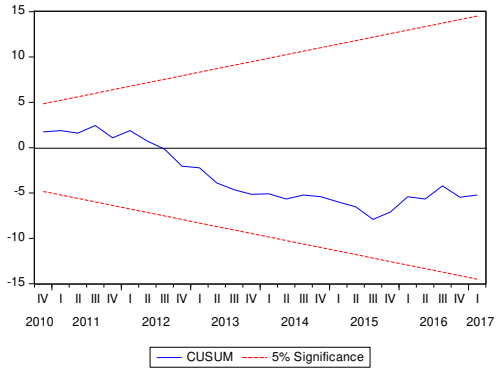
CUSUM: Indonesia



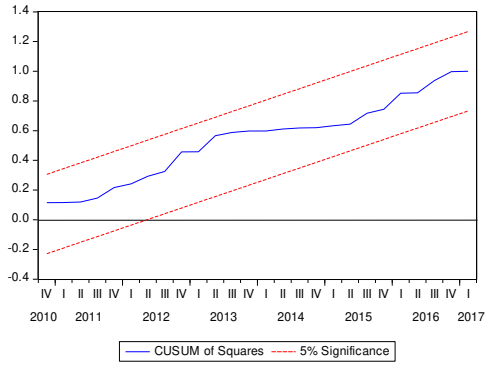
CUSUMSQ: Indonesia



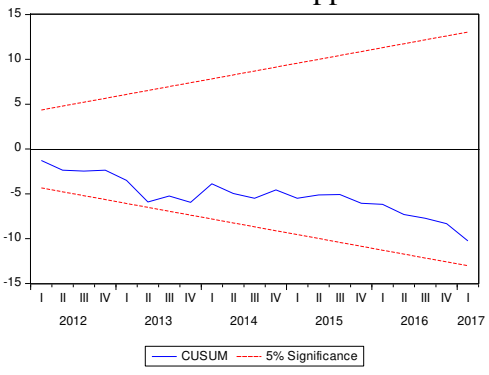
CUSUM: Thailand



CUSUMSQ: Thailand



CUSUM: Philippines



CUSUMSQ: Philippines

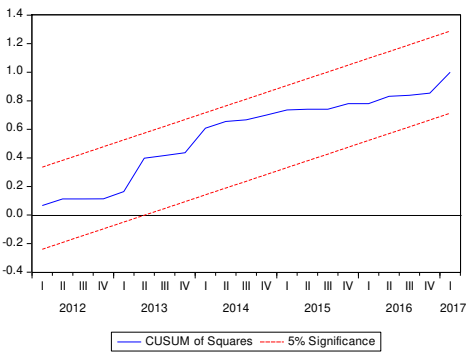


Figure 4.4 Results of stability regression tests

Clearly, from figure 4.4 we can see the CUSUM and CUSUM SQ test show that all regressions are stable. That means this regression is favorable to define EMP calculation for these ASEAN inflation-targeting countries.

4.5 Additional *Q* Parameter

After defined and analyzed EMP calculations for ASEAN Inflation Targeting countries, we continue to other objectives that is investigating find out what a preference of ASEAN inflation targeting country to manage their exchange rate level, through the adjusting in foreign reserves and/or exchange rate level or through managing domestic credit and interest rate.

To investigate it, Connolly and Silveira (1979) offered through adding the ratio of exchange rate to foreign reserve (*ex*/*fr*) in EMP equation, the new parameter is symbolized as *Q*, where $Q = (ex\text{-}1)/fr\text{-}1$). If *Q* significant, the higher *Q* that means monetary authorities prefer to reduce an EMP by depreciation of the currency rather than losing foreign reserves. Nevertheless, if *Q* is insignificant that means the value of EMP is not sensitive affected by the composition between exchange rate and reserves, however, other components such as domestic credit and interest rate. This suggestion also followed by Kim (1985), Ziramba (2007), Raji et al. (2014), and Paraskevi (2014).

Therefore, author running the regression again and this time including *Q* as an independent variable, for the results as shown below.

Table 4. Results EMP regression of Indonesia with *Q* parameter
Estimation: least square, using observations 2006Q1 – 2016Q4 (T=44)
HAC std. error and covariance (Barlett Kernel, Newey-West Fixed)
Dependent variable: EMP

Var.	Indonesia		Var.	Thailand		Var.	Philippines	
	Coef.	Prob		Coef.	Prob		Coef.	Prob
const	-0.137	0.0001	*const*	-0.082	0.0001	*const*	-0.065	0.0049
dc	2.606	0.0000	*dc*	1.244	0.0000	*dc*	2.015	0.0000
dc(-1)	-0.511	0.1134	*dc(-2)*	0.805	0.0114	*dc(-1)*	1.306	0.0000
dc(-3)	0.302	0.1577	*pf*	3.190	0.0071	*dc(-2)*	0.679	0.0649
dc(-5)	0.579	0.0100	*pf(-4)*	3.712	0.0019	*dc(-4)*	1.306	0.0012
pf	4.629	0.0027	*pf(-6)*	4.032	0.0017	*dc(-6)*	-0.949	0.0037
pf(-5)	-3.729	0.0012	*ry(-2)*	-0.006	0.0028	*pf(-2)*	-3.729	0.0019
ry(-1)	-0.005	0.0746	*ry(-3)*	-0.005	0.0053	*pf(-3)*	-2.265	0.0040
ry(-2)	-0.011	0.0015	*ry(-6)*	-0.003	0.0447	*pf(-6)*	2.854	0.0039
ry(-3)	-0.003	0.1049	*ir*	-0.144	0.0385	*ry*	0.007	0.0001
ry(-4)	-0.008	0.0056	*ir(-3)*	-0.257	0.0001	*ry(-1)*	0.001	0.1477
ry(-5)	-0.005	0.0832	*ir(-6)*	-0.168	0.0060	*ry(-3)*	0.004	0.0218
ry(-6)	-0.012	0.0004	*dumm*	-0.078	0.0689	*ry(-4)*	0.005	0.0001
ir(-2)	-0.557	0.0678	*Q*	-10.62	0.4413	*ry(-5)*	0.001	0.2308
dumm	0.223	0.0003				*ry(-6)*	0.004	0.0052
Q	0.049	0.3971				*ir(-1)*	0.520	0.0013
						ir(-6)	-0.594	0.0000
						dumm	0.048	0.5586
						Q	4.974	0.2439

Adjusted R-squared for Indonesia	0.829955
Adjusted R-squared for Thailand	0.678175
Adjusted R-squared Philippines	0.767970

Note:
dc: domestic credit
pf: world price
ry: real income
ir: interest rate
dumm: dummy crisis

From the results all second regression, we got that *Q* for these countries is statistically insignificant. That means, inflation targeting countries in ASEAN

prefer to hold their currency exchange rate level by managing through domestic credit and interest rate, rather than directly intervention through losing foreign reserve or let the domestic currency depreciate, because the EMP for these countries during 2006Q1 to 2016Q4 do not sensitively influenced by composition of foreign reserves and/or exchange rate. This results also appropriate with past several studies, such as Girton and Roper (1977), Connolly and Silveira (1979), Kim (1985), and Ziramba (2007), and Paraskevi (2014).

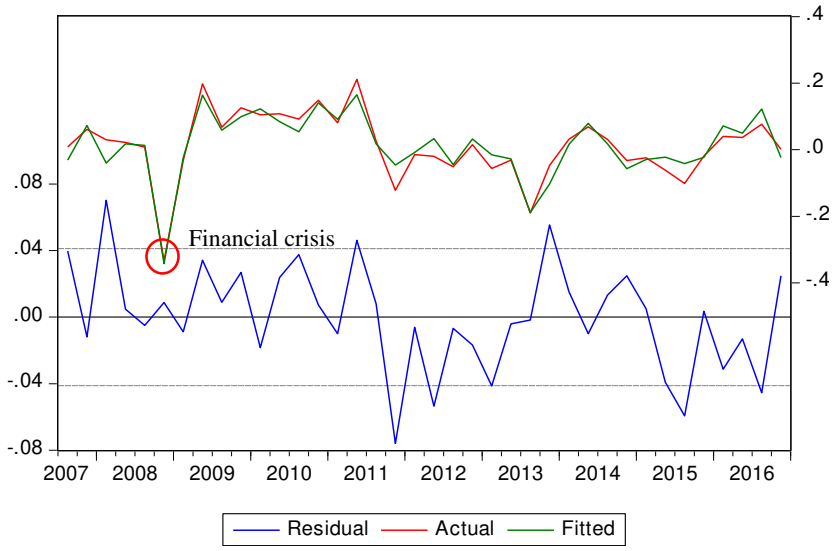


Figure 5. Actual-Fitted for 2nd EMP regression of Indonesia

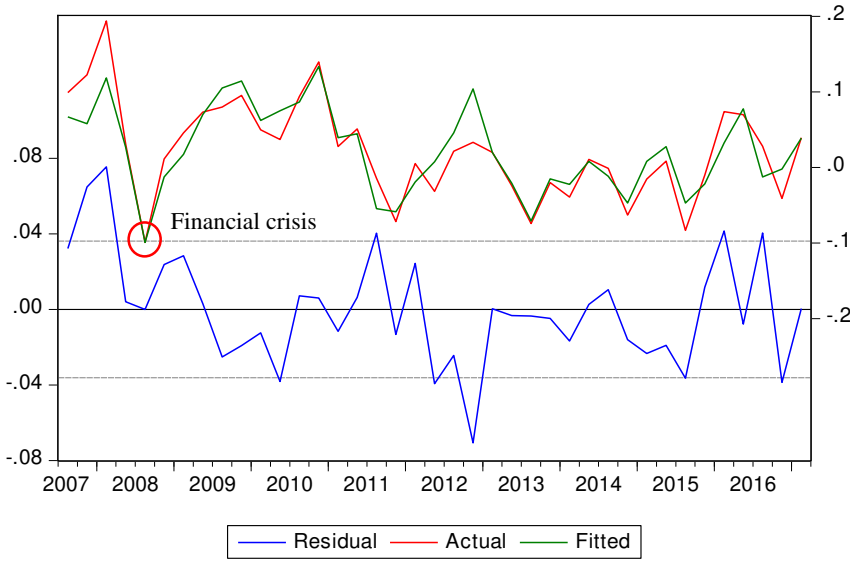


Figure 6. Actual-Fitted for 2nd EMP regression of Thailand

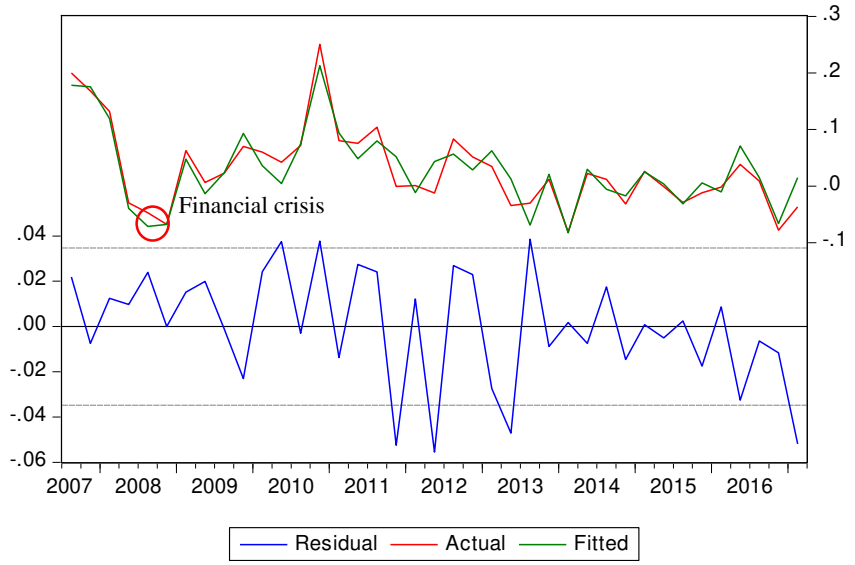


Figure 7. Actual-Fitted for 2nd EMP regression of Philippines

4.5.1 Residual Diagnostic on Regression with *Q* parameter

Table 5. Results of residual diagnostic tests after included *Q* parameter

	Indonesia		Thailand		Philippines	
	Obs*R-squared	p-value	Obs*R-squared	p-value	Obs*R-squared	p-value
LM test for autocorrelation null hypothesis: no autocorrelation	9.9874	0.1252	7.6760	0.2628	6.2618	0.3945
White's test for heteroscedasticity null hypothesis: heteroscedasticity not present	12.181	0.6652	6.8275	0.9108	20.777	0.2908

Diagnostic test results above show that there is no heteroscedasticity and autocorrelation in the new regression estimation.

5. Conclusions and Recommendations

Since high exchange rate volatility has become a main problem for many countries and bothered many policy makers particularly during currency crisis, determination of exchange rate and its stabilization become a primary requirement to maintain economy certainty.

EMP model is the best-known measure today to determine size of intervention, which needed to attain any favored exchange rate target. It covers up the weaknesses of monetary approach to Balance of Payments, which has acknowledged substantial attention during Bretton Wood's system, and monetary approach to Exchange Rate Determination which familiar in freely floating exchange rate system.

This study intends to examine the relationship between EMP and its determinant; domestic credit, world price, real income, and interest rate in ASEAN

inflation targeting countries (Indonesia, Thailand, and Philippines) during 2006-2016 by using quarterly data. To define EMP calculations for these countries and investigate what factor(s) that can increase and reduce EMP in these countries, the empirical analysis was based on monetary model of Exchange Market Pressure that proposed by Girton-Roper (1977) which also followed by Connolly and Silveira (1979), Kim (1985), Ziramba (2007), Raji et al. (2014), and Paraskevi (2014).

The results show that all variables are corresponding with Girton and Roper (1977), Connolly and Silveira (1979), Kim (1985), Ziramba (2007), Raji et al. (2014), and Paraskevi (2014), except for real income for Indonesia and Thailand, and world prices for Philippines. These incongruities corresponding with Sinha (2006) and trade report by UN Comtrade and World Bank.

During financial crisis, author finds that there are additional pressure to the Indonesian rupiah and Thai baht exchange rate, but does not present in case of Philippines peso. Therefore, the independent variables which were used can attempt a favorable prediction of the value of EMP. Especially during financial crisis 2008, the residual almost zero.

To find out what a preference of ASEAN inflation targeting country to manage their exchange rate level, the second regression conducted by additional Q parameter which suggested by Connolly and Silveira (1979) and followed by Kim (1985), Ziramba (2007), Raji et al. (2014), and Paraskevi (2014). In the results, author got that Q for these countries is statistically insignificant. It implies that inflation-targeting countries in ASEAN prefer to hold their currency exchange rate level. by managing through domestic credit and interest rate, rather than directly

intervention through losing foreign reserves and/or let the domestic currency depreciate, because the EMP for these countries during 2006Q1 to 2016Q4 do not sensitively influenced by composition of foreign reserves and/or exchange rate. In the context managed float, his result appropriate with several studies by who suggested this additional parameter.

This monetary model of EMP has been proved by this study that all variables can attempt a favorable prediction of the value of EMP. Therefore, the government and policy makers in maintaining financial stability can use it. This proof strengthens past several studies such as Bertoli et al (2008), Pontines and Siregar (2006), Heriqbaldi (2012), and Paraskevi (2014). Furthermore, the evidence provided in this study may also can be used by government from other countries as guideline for government in making appropriate policy to prevent financial crisis and to increase their economic performances.

However, although the results of this study support several studies, but it should be mentioned that this study still needs to develop. Many ways can strengthen EMP studies in these ASEAN inflation-targeting countries. For further studies on EMP, author suggest that it can be developed through adding other variables in the model such as money multiplier, relative price of crude oil, the growth in exports, the tightness of U.S. monetary policy, or by using other econometric approach, such as VAR, VECM, ARDL, Granger Causality, etc.

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