Pertanika J. Soc. Sci. & Hum. 21 (S): 29 - 46 (2013)

SOCIAL SCIENCES & HUMANITIES

Journal homepage: http://www.pertanika.upm.edu.my/

Monetary Policy and Exchange Market Pressure in Malaysia

Tey Sheik Kyin, Lee Chin* and Muzafar Shah Habibullah

Department of Economics, Faculty of Economics and Management, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

ABSTRACT

Exchange market pressure (EMP), which provides a measure of the volume of intervention necessary to achieve any desired exchange rate target, is the latest model used in the measurement of exchange rate conditions. In order to obtain a more complete picture of Malaysia's condition and to examine how Bank Negara handles different exchange market pressures, this study considers the Malaysian exchange rate in relation to that of its two major trading partners– namely, Japan (RM/YEN exchange rate) and the United States (RM/USD exchange rate)– to construct EMP models. Monthly data from 1990:1 to 2008:9 were used in this study, and the sample period was further divided based on crisis periods and Malaysia's experience employing different exchange rate regimes. Vector autoregression (VAR) modeling was used. The study's findings suggest that the prescription of traditional theory was not followed by Malaysia and that Bank Negara should implement a different monetary policy with a different EMP model only under crisis and fixed exchange rate regimes.

JEL Classification Codes: F31, E52

Keywords: Exchange market pressure, monetary policy

INTRODUCTION

Since the management of the exchange rate is crucial to a country's wellbeing, there has been a growing number of theories and empirical exchange rate models aiming to analyze exchange rate movements. Exchange market pressure (EMP), which refers to the magnitude of money market disequilibrium arising from international excess demand or supply of domestic currency, is one of the latest models used in the measurement of exchange rate conditions. Girton and Roper (1977), who are the best- known authors in the field, state that EMP can be measured quantitatively by

ARTICLE INFO

Article history:
Received: 21 May 2012
Accepted: 31 July 2013

E-mail addresses:
leechin@upm.edu.my (Lee Chin),
muzafar@upm.edu.my (Muzafar Shah Habibullah)
* Corresponding author

ISSN: 0128-7702

forming a summary statistic from observed changes in exchange rate and foreign exchange reserves of the domestic central bank; furthermore, it provides a measure of the volume of intervention necessary to achieve any desired exchange rate target (p.537). One of the advantages of EMP indices is that they can be calculated without having to obtain closed-form solutions for expectations and without having to specify the nature of stochastic disturbances to the economy. If the exchange rate is free-floating, EMP could be observed directly; if the exchange rate is fixed, the changes in foreign exchange reserve reflect the magnitude of the imbalance; if under managed float, EMP is observed by changes in the exchange rate and foreign exchange reserves. Therefore, EMP measurement can be used in various exchange rate regimes.

In the literature, numerous studies have tried to find the implications of policy responses by monetary authorities. The IMF and several studies (e.g., Basurto & Glosh, 2000; Dekle *et al.*, 2002) have supported the traditional theory that higher interest rates help to strengthen the currencies; however, some argue that the suggestion made by traditional theory and the IMF is ineffective and exacerbates the already great depreciation of domestic currency (e.g., Furman & Stiglitz, 1998; Ohno *et al.*, 1999; Pakko, 2000; Radelet & Sachs, 1998; Wong *et al.*, 2005). On the other hand, Caporale *et al.* (2005) found mixed results– that tightening monetary policy helped to defend the exchange rate during tranquil periods but had the opposite effect during the Asian financial crisis. In the case of Malaysia in the mid 1980s, there was rapid economic growth, during which fiscal surpluses were maintained, monetary expansion was not excessive and inflation was generally under control. Such rapid economic growth, however, exposed several signs of macroeconomic fundamentals being seriously at risk and led to an unexpectedly vulnerable economy and to subsequent crisis. The Asian financial crisis, which erupted in mid 1997, caused Malaysia to lose most of its currency reserves, and the national currency experienced rapid devaluation as a result. Bank Negara's initial response to the crisis was to hike up the interest rate and tighten fiscal policy, which was advocated by the IMF and traditional views as a way to protect weakened currency. Nevertheless, the results found that with a hike in interest rates, exchange rates kept depreciating. It seems that the interest rate policy did not bring the expected outcome.

Therefore, this study aims to investigate whether the monetary shocks that drove the EMP to increase resulted in the crash and ultimate collapse of the Malaysian *ringgit*. Since Malaysia adopted a different exchange rate regime after the crisis, this study aims to compare how Bank Negara handles different EMPs under different exchange rate regimes by constructing two separate EMP models- namely, an RM/YEN EMP model and an RM/USD EMP model. It is important to understand the responses of EMP to monetary shocks under various regimes. Under a fixed exchange rate, what are the responses of EMP to monetary shocks and what are the responses of monetary shocks to the EMP? Under a managed float, will the responses differ? This study answers these questions clearly. In addition, this study assesses which instrument is more influential in managing EMP and helps determine whether output growth plays a role and should be omitted as an explanatory variable or not.

The remainder of this study is organized as follows: Section 2 provides a review of the literature; Section 3 presents a theoretical framework to measure EMP and VAR approach; Section 4 briefly discusses the empirical results of the analysis; and Section 5 presents a summary and policy implications.

LITERATURE REVIEW

The term 'exchange market pressure' (EMP) was coined by Girton and Roper (1977) to explain both exchange rate and the central bank's intervention in the foreign exchange market. By using a monetary model, Girton and Roper derived EMP as the sum of exchange rate depreciation and reserve outflows (scaled by base money), which means that currency market imbalance can be removed through reserve or exchange rate changes. It is calculated as:

$$emp_t = \Delta e_t + \Delta f_t \quad (1)$$

where emp_t stands for the exchange market pressure at time *t*, Δe_t for the changes in the exchange rate at time *t,* and Δf_t for the foreign reserves at time *t.*

Weymark (1995), however, argued that Girton and Roper's definitions of EMP are too narrow and model-specific. According to Weymark, the specification and assumptions of Girton and Roper's model do not employ domestic credit changes to influence the exchange rate levels that rise from international excess demand or supply of domestic currency. Weymark stated that the exchange-rate- equivalent measure of EMP is the best way to measure the size of external imbalance and is a useful measure of the magnitude of speculation since EMP values measure the size of the exchange rate change that would occur if the policy authority unexpectedly refrained from intervening in the exchange market (p.280-281).

In the early stages of empirical testing on EMP, numerous studies focused on the determinants of EMP and generally used the Ordinary Least Square (OLS) method. The empirical test of the EMP was first done by Girton and Roper (1977) and was tested on the postwar economy (1952-1974). Their results showed that all variables' coefficients were significant at the 5%t confidence level and carried the correct signs– i.e., negative signs for coefficients of Canadian domestic growth and US output growth and positive signs for coefficients of US money growth and Canadian output growth. Thus, Girton and Roper's EMP model became one of the crucial models in measuring EMP and has been applied extensively with certain modifications (Bahmani-Oskooee & Shiva, 1998; Burdekin & Burkett, 1990; Connolly & Silveira, 1979; Kim, 1985; Klaassen & Jager, 2006; Mah, 1998; Pentecost, 2001; Tatomir, 2009).

Some studies tried to link EMP indices to the currency crisis by constructing EMP as single-crisis indices that are expected to systematically behave differently prior to crisis and hence provide reliable warnings of potential crises (Eichengreen *et al.*, 1995; Kaminsky *et al.*, 1998, 1999; Sachs *et al.*, 1996). These studies predicted that currency crises would occur when the measure of EMP indices exceeds a certain threshold. Since there is no consensus in favor of these EMP indices, a few studies have tried to examine and compare different versions of EMP indices and reached similar conclusions– namely, that there are three variations in three sets of EMP indices and the speculative pressure can provide a better measure by employing extreme value theory (Liu & Zhang, 2009; Mcfarlane, 2010; Pontines & Siregar, 2004). Gunsel *et al.* (2010) and Hgerty (2010) both used the EMP index as a crisis indicator and tried to examine the linkage between economic fundamentals and currency crisis for different groups of countries. Gunsel *et al.* (2010) concluded that a decrease in the budget balance deficit, the real exchange rate and the ratio of M2 to foreign reserve all increase the probability of currency crises, while Hgerty (2010) found that higher inflation, government borrowing and oil prices all appear to precipitate crises. Aizenman and Hutchison (2010) who focused on the transmission of global crisis into emerging markets found that emerging markets with higher total foreign liabilities had greater exposure and were much more vulnerable to crisis. They found that emerging markets respond to global shock by allowing greater exchange rate depreciation and comparatively less reserve loss.

In the literature, several studies examined the degree of intervention and interrelation between monetary policy and EMP through different econometric tests, such as Structural VAR, vector error correction model (VECM), dynamic OLS, and two stage least square (2SLS) (e.g., Bautista & Gochoco-Bautista, 2005; Bielecki, 2005; Kamaly & Erbil, 2003; Khawaja, 2007; Kurihara *et al.*, 2011; Liu, 2009; Tanner, 2001, 2002; Younus, 2005). In general, most of the empirical work used VAR to examine the interrelation between monetary policy and EMP, and most of the results were similar: domestic credit was positively correlated with EMP, confirming the prediction of the traditional monetary theory (Bautista & Gochoco-Bautista, 2005; Kamaly & Erbil, 2003; Kurihara *et al.* 2011; Tanner, 2001, 2002). There were, however, several studies (Garcia & Mallet, 2007; Khawaja, 2007) which found that an increase in the interest rate was associated with increased EMP. This positive correlation between interest rate and EMP is contrary to the traditional theory that higher interest rates should, in principle, help strengthen a currency. Kurihara *et al.* (2011), who examined how monetary authorities handle EMP under different exchange rate systems, found that use changes in interest rate to combat EMP will result in a stable foreign exchange market during a managed float but will be less effective in a floating exchange rate. They also found that a sterilization policy was present under a floating exchange rate system.

METHODOLOGY

This study closely followed Girton and Roper's EMP model, which was derived from a model of equilibrium in the money market. The EMP model, which is defined as a summation of exchange rate depreciation and reserves outflow, is shown below:

$$\begin{aligned} emp &= e - r_m \\ &= dc_m - h_f - \beta y_m + \beta y_f \\ &\quad - \vartheta + \alpha i_m - \alpha i_f \end{aligned} \qquad (2)$$

This model (Equation 2) predicts that an increase in EMP means exchange rate depreciation, a decline in international reserves (reserve outflow), or both. From the EMP theoretical model, there are six variables relevant to exchange market behavior: domestic credit growth (dc_m), domestic output growth (y_m), world money supply (h_f), domestic interest rate (i_m), world output growth (y_f) and the world interest rate (i_f). Furthermore, r_m is domestic reserves, e is exchange rate, θ is the deviation from PPP, β is income elasticity (where $\beta > 0$); and α is interest rate semi-elasticity (where $\alpha > 0$). Since this study's interest is to test the interaction among EMP, monetary policy and output growth, the EMP model in this study is expressed as follows:

$$emp = (e - r_m) = dc - \beta y_m + \alpha i_m \qquad (3)$$

where all foreign variables are considered constant terms. Equation (3) predicts that the exchange rate and/or the growth rate of foreign reserve are reactions to domestic credit growth, interest rate change and domestic output shocks.

The VAR approach is commonly used as a system of forecasting interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. Simply put, VAR is a system of linear equations and each variable is a function of its own lags and the lags of the other variables in the system (Mansor, 2005). VAR in level or unrestricted VAR, which allows data to decide on whether the effects of shocks are permanent or not (Ramaswamy and Slok, 1998) is used in this study. The VAR system is as follows:

$$X_t = a_0 + a_1 X_{t-1} + a_2 X_{t-2} + ... + \nu_t \qquad (4)$$

where X_t = *(dc, i, y, emp)* is a vector of variables, a_i is a vector of coefficient, and $\nu_t = (\nu_d, \nu_i, \nu_y, \nu_{emp})$ is a vector of error term.

The impulse response function (IRF) and variance decomposition (VD) are the main types of structural analysis of the VAR model and illustrate the dynamic characteristics of empirical analysis. The impulse response function permits inferences on the direction of response of a variable interest to one standard deviation shock in another variable. Meanwhile, variance decomposition indicates the percentage of a variable's forecast error variance attributable to innovation in all variables considered in the system. The standard method of constructing IRFs and VDs is to use the Choleski decomposition.

The critical elements in the specification of the VAR model are the ordering of variables and the determination of lag length. Misspecification of the ordering and lag length will generate inconsistent coefficient estimates, resulting in the distortion of impulse responses and variance decomposition. The ordering of variables in this study considers domestic credit, which is fully determined by monetary authorities as the most exogenous variable, followed by the policy variable, which is partly determined by monetary authorities and partly determined by market i.e., interest rate; output growth, which is influenced by monetary variables; and EMP, which is considered to be the most endogenous variable. To determine lag length, this study follows Johansen's (1992) suggestion that the chosen lag length that residuals of the regression do not exhibit serial correlation.

The monthly data[1] utilized in this study cover the period 1990:1 to 2008:9. The data are divided into periods in order to provide a better overview of the interrelation between EMP and monetary policy shocks under various exchange regimes. The division into sub-periods is based on Malaysia's experience of crisis and adoption of different exchange rate regimes. The crisis period began when the Thai baht was hit by a massive speculative attack on May 14-15, 1997; it ended in August 1998 when Malaysia implemented selective capital control and a fixed exchange rate regime was adopted. Therefore, in the case of the RM/YEN exchange rate in the EMP model, the data are divided into three periods: pre-crisis from 1980:1 to 1997:4; within-crisis period from 1997:5 to 1998:8; and post-crisis from 1998:9 to 2007:9. Since the exchange rate of the *ringgit* was pegged against the US dollar at RM3.80/$1 USD in September 1998 and Malaysia changed its exchange rate regime from fixed to managed float in July 2005, the post-crisis period for the RM/USD EMP model has been further subdivided as follows: post-crisis I, the period when Malaysia implemented a fixed exchange rate; and post-crisis II, when Malaysia implemented a managed float system. Therefore, in the case of the RM/USD exchange rate in the EMP model, the data are divided into four sub-periods: pre-crisis from 1980:1 to 1997:4; within-crisis period from 1997:5 to 1998:8; post-crisis I from 1998:9 to 2005:6; and finally, post-crisis II from 2005:7 to 2008:9.

All variables are in growth form, and the variables included in the empirical model are: growth in exchange rate (Δe[2]), changes in reserve scaled by lagged monetary base, ($\Delta r / M_{t-1}$), changes in domestic credit scaled by lagged monetary

[1]The variables used in this study have dynamic properties and can be best captured with high frequency data.

[2]The exchange rate, RM/YEN is a cross rate, which is calculated from the RM/USD and YEN/USD nominal exchange rates.

base (Δdc / M_{t-1}[3]), changes in domestic interest rate or money market rate (Δi [4]), and output growth (Δy [5]). The data were obtained from International Financial Statistical (IFS).

EMPIRICAL RESULTS AND DISCUSSION

The integration orders of all variables used in analysis were verified through the unit root tests of Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS). The results (as shown in Appendix A) for the RM/YEN EMP model and RM/USD EMP model showed that all three unit root tests reported the same result: all variables were stationary at level form in all three sample periods tested. Since the model employs all variables in growth form, it was not surprising that almost all variables were stationary in level. For the RM/YEN EMP model, the lag length chosen for which the residuals of the regression do not exhibit serial correlation for pre-crisis, within-crisis and post-crisis periods were 5, 1, and 11, respectively. Meanwhile, for the RM/USD EMP model, the lag length chosen for pre-crisis, within-crisis, post-crisis I and post-crisis II periods were 4, 1, 5 and 1, respectively.

Fig.1, Fig.2 and Fig.3 are impulse responses function (IRFs) of the RM/YEN EMP model for pre-crisis, within-crisis, post-crisis periods, respectively. Meanwhile, Fig.4, Fig.5, Fig.6 and Fig.7 are IRFs of the RM/USD EMP model for pre-crisis, within-crisis, post-crisis I and post-crisis II periods.

One of the main questions investigated in this study is how the interest rate affects exchange market pressure. The results suggest that the EMP responds positively to interest rate shock (i) in pre-crisis and post-crisis periods for both EMP models of RM/YEN and RM/USD nominal exchange rates. From the IRFs of both EMP models, the initial responses of EMP to i were nearly zero; nevertheless, they were positive during the crisis period and the period when Malaysia implemented a managed float exchange rate regime. These findings suggest that the case of Malaysia did not follow traditional theory's prescription that currency pressure can be reduced by raising the interest rate. The findings are opposite to that of Tanner (2001, 2002) and Bautista and Gochoco-Bautista (2005). There is a possibility that a preserve effect is caused by raising the domestic interest rate, which is argued by Furman and Stiglitz (1998), Radelet and Sachs (1998) and Wong *et al.* (2005).

The results suggest that the response of EMP to the shocks in domestic credit (dc) is ambiguous. From the results of the RM/YEN EMP model, the responses are negative in the pre-crisis period but become positive after the crisis. RM/USD EMP models show

[3]Domestic credit is defined as the difference between the monetary base and foreign assets. Thus, domestic credit growth is $(\Delta(M_t - FA_t))/M_{t-1})$.

[4]The central bank of Malaysia directly influences the interbank rate through its intervention in the money market; therefore the overnight interbank rate is used as a monetary policy indicator. (Domac, 1999; Mansor, 2005)

[5] Monthly data on real income is not available. The use of industrial production as proxy for real income is well established (Khawaja, 2007).

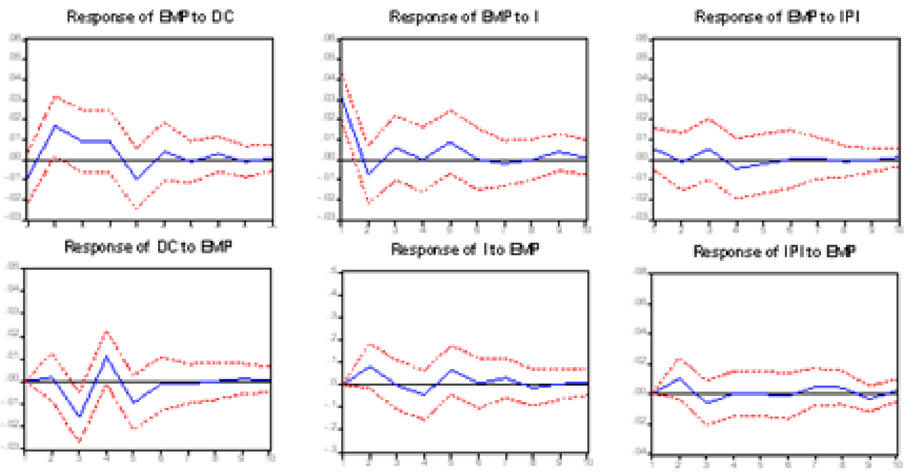

Fig.1: The Impulse Response Functions of RM/YEN EMP Model for Pre-crisis Period.

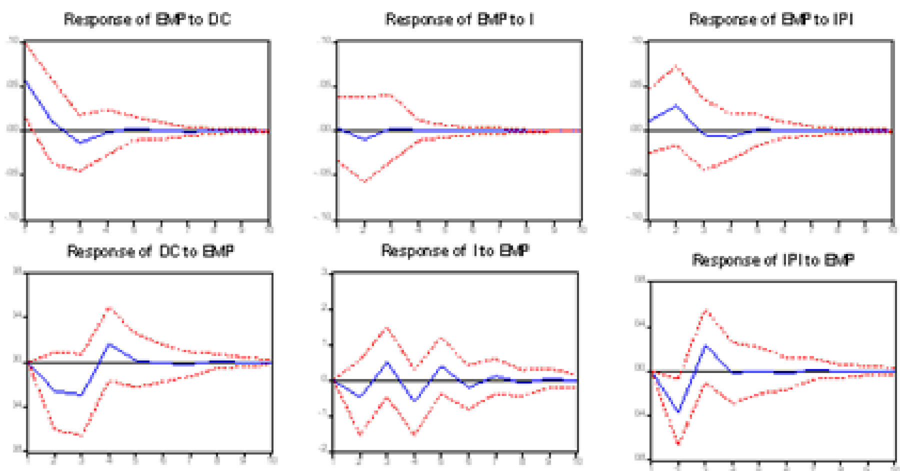

Fig.2: The Impulse Response Functions of RM/YEN EMP Model for Within-crisis Period.

the same results as RM/YEN EMP models–namely, that *dc* has positive effects on EMP during crisis and after crisis except in post-crisis I, which is the period when Malaysia adopted a fixed exchange rate regime. The responses of EMP to domestic credit shocks in post-crisis I under the RM/USD EMP model were negative. The responses in both EMP models were mixed; however, what we can be sure of here is that currency pressure can be reduced by decreasing the domestic credit during a crisis regardless of whether Malaysia is facing high or low EMP.

Another main question in this study is "How did monetary authorities respond to EMP?" Surprisingly, the results suggest that monetary authorities responded identically to different EMPs (i.e., RM/YEN EMP and RM/USD EMP). The results of both RM/YEN and RM/USD EMP models showed

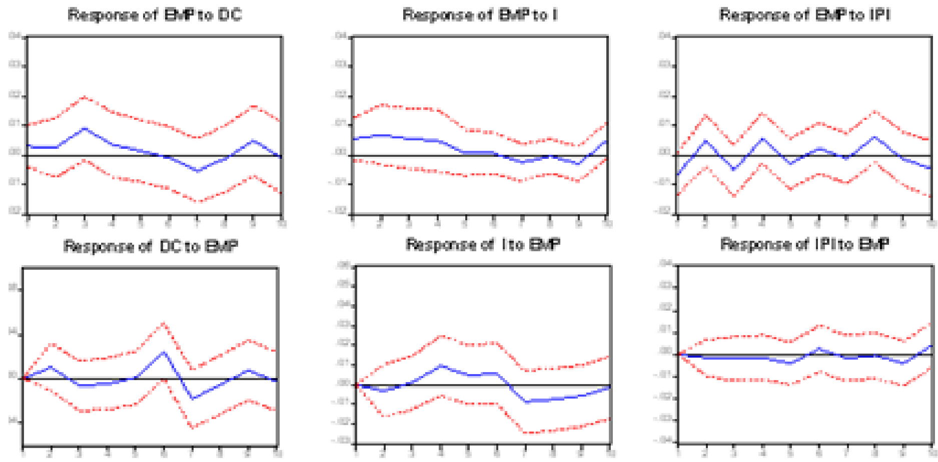

Fig.3: The Impulse Response Functions of RM/YEN EMP Model for Post-crisis Period.

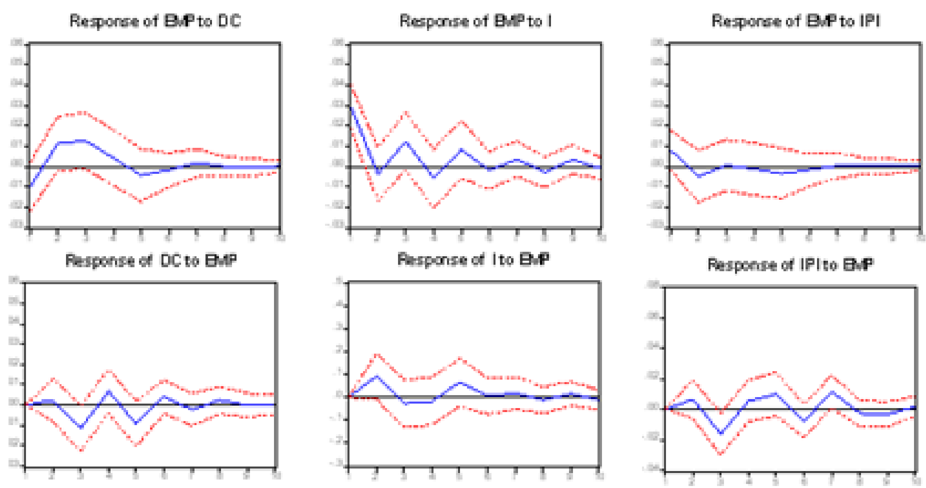

Fig.4: The Impulse Response Function of RM/USD EMP Model for Pre-crisis period.

that there was a lagged positive response of EMP on *dc* in pre-crisis period and post-crisis periods, and that there was a negative response during the crisis period. These findings suggest that Malaysia tends to intervene through sterilized reserve outflows by expanding rather than contracting domestic credit in non-crisis periods. Tanner (2001) has stated that such a policy reaction reflects a weak financial system that preceded the crises. Some have argued that sterilization may increase speculation against currency and that the central bank will not defend the currency, thereby exacerbating the already high EMP (Bautista & Gochoco-Bautista, 2005). Since then, Malaysia has tended not to sterilize and has instead tried to contract domestic credit growth when a crisis occurs (negative response of domestic credit to exchange

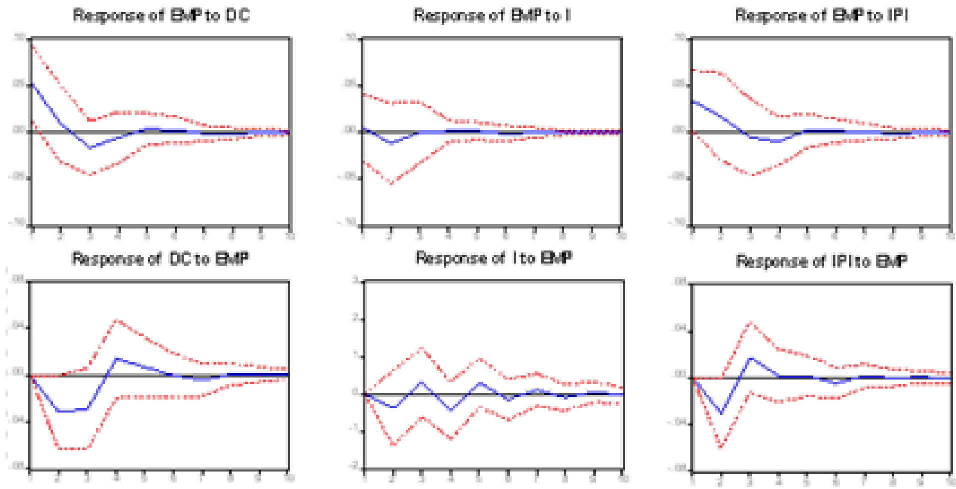

Fig.5: The Impulse Response Function of RM/USD EMP Model for Within-crisis.

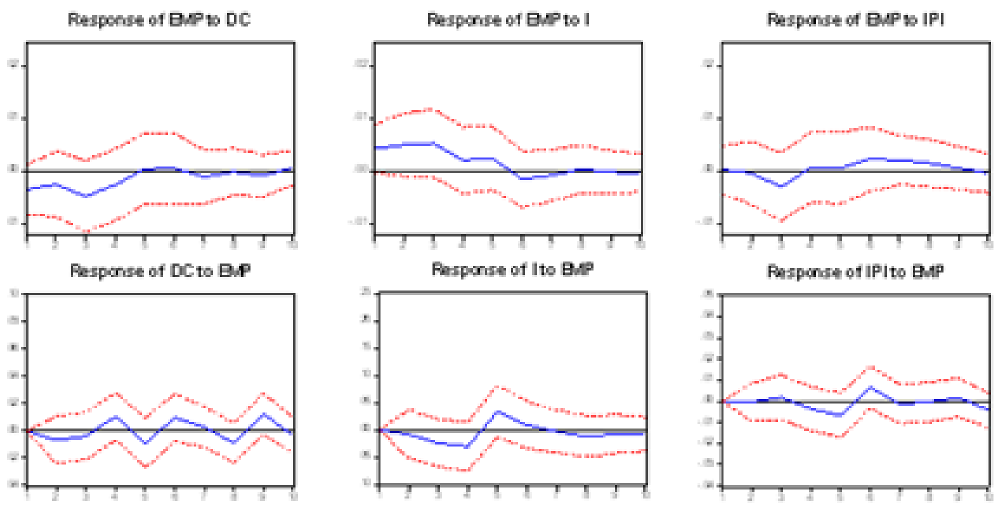

Fig.6: The Impulse Response Function of RM/USD EMP Model for Post-crisis I Period.

market pressure); however, expanding monetary policy was reapplied after the crisis. Perhaps, this might help to stimulate the weak economy.

Finally, one last question that was investigated in this study is "Does output growth (y) affect exchange market pressure?" From the IRFs of the RM/YEN EMP model, it was found that a shock in *y* does affect the EMP negatively at least in period 1 during crisis and post-crisis periods. However, there was only an inverse relationship during post-crisis II, the period when Malaysia adopted a managed float exchange regime in the RM/USD EMP model. As Garcia and Malet (2007) explained, the inverse relationship between output growth and EMP can be intuitively

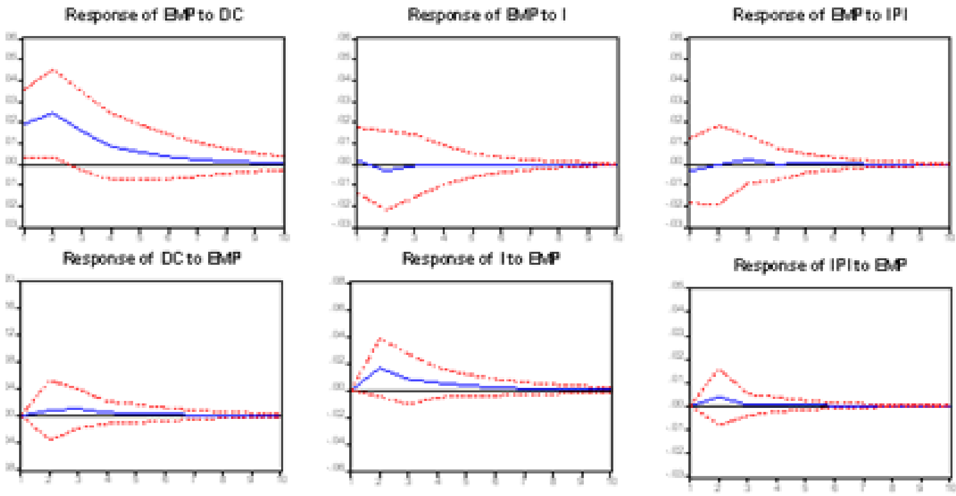

Fig.7: The Impulse Response Function of RM/USD EMP Model for Post-crisis II Period.

justified by the virtue of the model itself, where lower output growth implies a smaller increase of money demand that requires an adjustment via either a loss of reserves or a drop in the nominal exchange rate (high EMP).

The results also show that monetary authorities implement different monetary policies with different exchange rate regimes. When facing exchange market pressure or high pressure in currency, monetary authorities tend to decrease domestic credit and interest rates to defend the exchange rate when a crisis occurs or during a fixed exchange rate regime; however, during a managed float exchange rate regime (i.e., pre-crisis and post-crisis II periods), Malaysia will likely choose to increase domestic credit and interest rate in the face of high EMP.

In conclusion, the case of Malaysia rejects the assumption that a tight monetary policy should, in principle, help strengthen the local currency. The responses of exchange market pressure to shocks in domestic credit are mixed, while an increase in interest rate does not help to reduce the EMP. On the other hand, monetary authorities implement different monetary policies with different exchange rate regimes.

Tables 1 and 2 present the results of variance decompositions for the RM/YEN EMP and RM/USD EMP models. Variance decompositions show that domestic credit is an important source of shocks in exchange market pressure, followed by interest rates. These suggest that domestic credit and interest rate are important instruments for managing exchange market pressure. Moreover, VDs also show that output growth plays a role in the shocks of EMP during the crisis period. In addition, EMP is an important source of shocks in output growth in pre-crisis and within-crisis periods. Therefore, output growth should not be omitted from the EMP study.

TABLE 1
Variance Decompositions of RM/YEN EMP Model

	Pre-crisis		Within-crisis		Post-crisis	
Period	1		1		1	50
VDs of dc						
dc	100	74.753 (37)	100.00	50.986 (14)	100.00	57.014
i	0.000	5.261 (41)	0.000	0.530 (14)	0.000	5.701
y	0.000	2.185 (39)	0.000	20.154 (12)	0.000	24.182
emp	0.000	17.802 (34)	0.000	28.329 (14)	0.000	13.102
VDs of i						
dc	13.243	15.612 (44)	5.629	6.600 (18)	7.608	15.502
i	86.757	71.512 (42)	94.371	61.415 (17)	92.392	57.661
y	0.000	6.759 (43)	0.000	12.001 (15)	0.000	17.225
emp	0.000	6.117 (39)	0.000	19.985 (18)	0.000	9.612
VDs of ipi						
dc	0.532	10.252 (33)	0.111	4.003 (14)	7.706	14.454
i	0.012	4.647 (43)	1.776	1.110 (16)	0.007	8.807
y	99.456	80.297 (38)	98.113	49.851 (15)	92.291	71.665
emp	0.000	4.805 (36)	0.000	45.036 (15)	0.000	5.075
VDs of emp						
dc	2.196	14.052 (36)	38.974	29.052 (12)	0.712	13.060
i	29.912	26.169 (39)	0.103	0.868 (11)	2.448	9.016
y	0.832	1.840 (36)	1.568	8.566 (12)	3.220	14.468
emp	67.061	57.939 (39)	59.355	61.514 (11)	93.621	63.456

Notes: *dc* is domestic credit growth, *emp* is exchange market pressure, *i* is interest rate and *y* is output growth. () is the period when the shocks are stable.

CONCLUSION AND POLICY IMPLICATIONS

This study adopted two EMP models and attempted to examine how the monetary authorities in Malaysia handle different EMPs. The results of the study offer several suggestions: first, the prescription of the traditional theory that currency pressure can be reduced by raising the interest rate was rejected in the case of Malaysia; second, currency pressure can be reduced by decreasing domestic credit when a crisis has occurred no matter which currency pressure Malaysia is facing; third, monetary authorities responded equally to different exchange market pressures; and finally, monetary authorities implement different monetary policies with different exchange rate regimes.

Several policy implications emerged. First, a hike in interest rate will drive EMP to increase, resulting in the crash and collapse of the Malaysian *ringgit*. Monetary authorities should choose to decrease interest rate in the face of high EMP; however, contracting monetary

TABLE 2
Variance Decompositions of RM/USD EMP model

	Pre-crisis		Within-crisis		Post-crisis I		Post-crisis II	
Period	1		1		1		1	
VD of dc								
dc	100	78.2964(26)	100	46.1176(18)	100	64.8448(63)	100	94.9285(16)
i	0	8.5492(31)	0	1.2379(21)	0	7.8034(61)	0	1.3246(14)
ipi	0	1.4682(22)	0	19.5072(20)	0	18.9715(67)	0	2.5167(16)
emp	0	11.6863(27)	0	33.1374(20)	0	8.3801(66)	0	1.2302(18)
VD of i								
dc	12.422	14.4837(20)	6.9078	6.9145(23)	0.3514	9.1581(65)	1.1224	10.3498(18)
i	87.578	74.2105(21)	93.0922	61.8531(24)	99.6486	76.2312(59)	98.8776	69.4728(17)
ipi	0	4.5359(21)	0	21.7252(21)	0	8.5085(76)	0	12.7040(14)
emp	0	6.7699(29)	0	9.5071(24)	0	6.1022(67)	0	7.4733(19)
VD of ipi								
dc	0.4516	6.0414(25)	0.007	4.2540(18)	0.337	5.6550(68)	7.2773	18.2443(12)
i	0.0193	5.1586(26)	0.3253	2.5095(22)	3.459	9.3405(64)	1.3809	1.1245(11)
ipi	99.5291	73.2661(25)	99.6677	66.0734(18)	96.204	80.6247(62)	91.3418	79.6829(16)
emp	0	15.5339(23)	0	27.1631(18)	0	4.9804(64)	0	0.9483(16)
VD of emp								
dc	3.2342	11.0004(22)	35.9845	29.3249(16)	2.8924	6.4704(74)	13.9733	26.3056(17)
i	30.1741	31.2359(24)	0.4047	1.6188(17)	4.1844	10.2062(61)	0.1311	0.2577(13)
ipi	2.1577	2.6601(22)	15.2723	14.7237(15)	0.0078	2.7422(67)	0.3327	0.2901(14)
emp	64.4339	55.1036(25)	48.3386	54.3326(14)	92.9154	80.5812(64)	85.5629	3.1466(16)

Notes: *dc* is domestic credit growth, *emp* is exchange market pressure, *i* is interest rate and *y* is output growth. () is the period when the shocks are stable.

policy works to strengthen the currency during crisis. Second, domestic credit is a useful instrument for managing exchange market pressure, followed by interest rates. Therefore, policy makers should emphasize domestic credit rather than interest rates as a monetary policy tool. Third, the response of EMP to the shocks of domestic credit and interest rates in both EMP models are the same; this means that monetary authorities can use the same policy when facing different currency pressures. Lastly, monetary authorities should increase domestic credit when facing high EMP in non-crisis or fixed exchange rate regimes. However, when a crisis is occurring or during a period of managed float, monetary authorities should decrease domestic credit when facing high EMP. A decrease in domestic credit therefore will help to reduce the currency pressure.

REFERENCES

Aizenman, J., & Hutchison, M. M. (2010). *International financial market and transmission of crisis: Determinant of EMP and absorption by reserves*. Paper presented in Conference on Global Economic Crisis: Impact, Transmission and Recovery, Number 3 .

Bahmani-Oskooee, M., & Shiva, R. (1998). A method of detecting whether a central bank engages in a black market for foreign exchange: Evidence from Iran. *Economics Letter*, 60, 97-103.

Basurto, G., & Ghosh, A. (2000). The interest rate-exchange rate nexus in the Asian crisis countries. *IMF Working Paper, No. 00/19*. Washington: International Monetary Fund.

Bautista, Carlos C., & Gochoco-Bautista M. S. (2005). Monetary policy and exchange market pressure: The case of the Philippines. *Journal of Macroeconomics,* 27, 153-168.

Bielecki, S. (2005). Exchange market pressure and domestic credit evidence from Poland. *The Poznan University of Economics*, *5*(1), 20-36.

Burdekin, R., & Burkett, P. (1990). Re-examination of the monetary model of exchange market pressure: Canada 1963-1988. *The Review of Economics and Statistics,* 72, 677-681.

Connolly, M., & Da Silveira, J. D. (1979). Exchange market pressure in post-war Brazil: An application of the Girton-Roper monetary model. *American Economic Review,* 69, 448-454.

Caporale, G. M., Cipollini, A., & Demetriades, P. O. (2005). Monetary policy and the exchange rate during the Asian crisis: Identidication through heteroscedasticity. *Journal of International Money and Finance,* 24, 39-53.

Dekle, R., Hsiao, C., & Wang, S. (2002). High interest rates and exchange rate stabilization in Korea, Malaysia, and Thailand: An empirical investigation of the traditional and revisionist views. *Review of International Economics*, 10, 64-78.

Domac, I. (1999). The distributional consequence of monetary policy: Evidence from Malaysia. *World Bank Policy Research Working Paper No.2170*, World Bank.

Eichengreen, B., Rose, A., & Wyplosz, C. (1994). Speculative attacks on pegged exchange rates: An empirical exploration with special reference to the European monetary system. *Working Papers 4898*, National Bureau of Economics Research.

Eichengreen, B., Rose, A., & Wyplosz, C. (1995). Exchange market mayhem: The antecedents and aftermath of speculative attacks. *Economics Policy,* 10, 249-312.

Furman, J., & Stiglitz, J. E. (1998). Economic crises: Evidence and insights from East Asia. *Brookings papers on Economics Activity*, 1-135.

Garcia, C., & Malet, N. (2007). Exchange market pressure, monetary policy, and economic growth: Argentina, 1993-2004. *The Development Economies, XLV*(3), 253-82.

Girton, L., & Roper, D. (1977). A monetary model of exchange market pressure applied to the postwar Canadian experience. *American Economic Review,* 67, 537-548.

Goldfajn, I., & Gupta, P. (1999). Does monetary policy stabilize the exchange rate following a currency crises. *IMF Working Paper 99/42*. Washington: International Monetary Fund.

Gunsel, N. R., Tursoy, T., & Rjoub, H. (2010). An empirical analysis of currency crises, fundamentals and speculative pressure. *African Journal of Business Management*, *4*(6), 972-978.

Hgerty, S. W. (2010). Exchange market pressure and currency crises in Latin America: Empirical test of their macroeconomics determinants. *Economic Bulletin*, *30*(3), 2210-2219.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economics Dynamics and Control,* 12, 231-254.

Johansen, S. (1992). Testing weak exogeneity and the order of cointegration in UK money demand data. *Journal of Policy Modeling,* 14, 313-334.

Kamaly, A., & Erbil, N. (2003). A VAR analysis of exchange market pressure: A case study for the MENA region. *Working Paper 2025*. Retrieved from http://www.erf.org.eg/CMS/getFile.php?id=43

Kaminsky, G. L., Lizondo, S., & Reinhart, C.M. (1998). Leading indicators of currency crises. *International Monetary Fund Staff Paper 45*.

Kaminsky, G. L., & Reinhart, C. M. (1999). The twin crises: The causes of banking and balance-of-payments problems. *American Economic Review*, 89, 473-500

Kim, I. (1985). Exchange market pressure in Korea: An application of Girton- Roper Monetary model. *Journal of Money, Credit and Banking*, 17, 258-263.

Khawaja, M. I. (2007). Exchange market pressure and monetary policy: Evidence from Pakistan. *PIDE Working Paper,* 31. Islambad: Pakistan Institute of Development Economics.

Klaassen, F., & Jager, H. (2006). Model-free measurement of exchange market pressure. *Tinbergen Institute Discussion Paper*, TI2006-112/2.

Kurihara, Y., Yukushima, A., & Minegishi, S. (2011). Exchange market pressure on floating exchange rate system in Asia: Revisited. *International Review of Business and Social Sciences*, *1*(2), 22-38.

Liu, X., & Zhang, J. (2009). RMB exchange market pressure and central bank exchange market intervention. *China and World Economy*, *17*(3), 75-92.

Mcfarlane, L. (2010). Exchange market pressure, currency crises and monetary policy: Evidence from Jamaica. *Working Paper Bank of Jamaica*.

Mah, Jai Sheen (1998) Exchange Market Pressure in Korea: Dynamic Specification, *Applied Economics Letter,* 5, 765-768.

Mansor, H. I. (2005). Sectoral effect of monetary policy: Evidence from Malaysia. *Asian Economics Journal,* 19, 83-102.

Mansor, H. I. (2006). Stock prices and bank loan dynamics in a developing country: The case of Malaysia. *Journal of Applied Economics, IX*, 71-89.

Ohno, K., Shirono, K., & Sisli, E. (1999). Can high interest rates stop regional currency falls? *ADB Working Paper Series, no., 6*. Asian Development Bank Institute.

Pakko, M. K. (2000). Do high interest rates stem capital outflows? *Economics,* 67, 187-192.

Pentecost, J. E., Hooydonk, V. C., & Poeck, V. A. (2001). Measuring and estimating exchange market pressure in the EU. *Journal of International Money and Finance,* 20, 401-418.

Pontines, V., & Siregar, R. (2004). Exchange market pressure and extreme value theory: Incidence of currency crises in East Asia and Latin America. Retrieved from http://repec.org/esausm04/up.18986.1077770584.pdf

Radelet, S., & Sachs, J. (1998). The East Asian financial crisis: Diagnosis, remedies, prospects. *Brookings Papers on Economic Activity,* 1, 1-74.

Ramaswamy, R., & Slok, T. (1998). The real effects of monetary policy in the European Union: What are the differences? *IMF Staff Papers, 45*, 374-396.

Sachs, J., Tornell, A., & Velasco, A. (1996). Financial crises in emerging markets: The lessons from 1995. *National Bureau of Economic Research Working Paper No. 5576*. Cambridge, MA: National Bureau of Economic Research.

Sims, C. A. (1980). Macroeconomics and Reality. *Econometrica,* 48, 1-49.

Tanner, E. (2001). Exchange market pressure and monetary policy: Asia and Latin America in the 1990s. *IMF Staff papers,* 47, 311-33.

Tanner, E. (2002). Exchange market pressure, currency crises, and monetary policy: Additional evidence from emerging markets. *IMF Working Paper,* wp/02/14.

Tatomir, S. (2009). Exchange market pressure on the Croation Kuna. *Financial Theory and Practice*, *33*(2), 187-199

Thornton, J. (1995). Exchange market pressure in Costa Rica, 1986-92: An application of the Girton-Roper Model. *International Economics Journal,* 9, 67-72.

Weymark, D. N. (1995). Estimating exchange market pressure and the degree of exchange market intervention for Canada. *Journal of International Economics,* 39, 273-295.

Weymark, D. N. (1998). A general approach to measuring exchange market pressure. *Oxford Economics Papers,* 50, 106-121.

Wong, S. C., Jomo, K. S., & Chin, K. F. (2005). Malaysian 'Bail outs'?: Capital controls, restructuring and recovery. In K.S. Jomo (Ed.), *The 1997-98 East Asian Crises and Crisis and Crisis Management in Malaysia 1997-1998*, (pp. 1-46). Singapore: Singapore University Press.

Younus, S. (2005). Exchange market pressure and monetary policy. *Policy Analysis Unit (PAU) Working Paper*, wp0603.

APPENDIX A

TABLE A
The Unit Root Tests for RM/YEN EMP Model

	ADF		PP		KPSS		I
	Constant	Constant with trend	Constant	Constant with trend	Constant	Constant with trend	
Pre- Crisis : 1980M1 - 1997M4							
dc	-13.20 (0)[a]	-13.17 (0)[a]	-14.03 (8)[a]	-14.27 (9)[a]	0.116 (18)	0.102 (18)	I(0)
i	-10.92 (0)[a]	-10.88 (0)[a]	-10.87 (2)[a]	-10.83 (2)[a]	0.178 (0)	0.163 (0)	I(0)
ipi	-13.37 (0)[a]	-13.40 (0)[a]	-13.45 (4)[a]	-13.50 (3)[a]	0.109 (3)	0.027 (3)	I(0)
emp	- 8.49 (0)[a]	- 8.45 (0)[a]	- 8.49 (0)[a]	- 8.45 (0)[a]	0.049 (2)	0.048 (2)	I(0)
Within- Crisis: 1997M5 - 1998M8							
dc	- 3.47 (0)[b]	- 4.44 (0)[b]	- 3.48 (1)[b]	- 7.12 (10)[a]	0.317 (1)	0.060 (1)	I(0)
i	- 7.96 (0)[a]	- 7.66 (0)[a]	- 7.72 (1)[a]	- 7.67 (2)[a]	0.090 (1)	0.089 (1)	I(0)
ipi	- 5.55 (0)[a]	- 5.36 (0)[a]	-10.74 (14)[a]	-11.17 (14)[a]	0.356 (10)	0.111 (3)	I(0)
emp	- 4.19 (0)[a]	- 4.44 (0)[b]	- 4.26 (4)[a]	- 8.31 (14)[a]	0.290 (6)	0.109 (3)	I(0)
Post- Crisis : 1998M9 - 2007M9							
dc	-12.00 (0)[a]	-12.03 (0)[a]	-11.98 (2)[a]	-12.03 (0)[a]	0.135 (2)	0.100 (3)	I(0)
i	-13.88 (0)[a]	-14.38 (0)[a]	-12.41 (7)[a]	-13.07 (7)[a]	0.453 (12)	0.145 (15)	I(0)
ipi	-11.40 (1)[a]	-11.41 (1)[a]	-21.36 (9)[a]	-22.24 (10)[a]	0.300 (43)	0.110 (30)	I(0)
emp	- 8.58 (0)[a]	- 9.00 (0)[a]	- 8.64 (3)[a]	- 8.95 (9)[a]	0.455 (2)	0.051 (5)	I(0)

Notes: a and b denotes significance at 1% and 5% levels. Figures for ADF are the t-statistics for testing the null hypothesis that the series is nonstationary. Figures for KPSS are LM-statistics for testing the null hypothesis that the series is stationary. Figures in parenthesis are lag length for ADF and bandwidth for PP and KPSS.

TABLE B
The Unit Root Tests for RM/USD EMP Model

	ADF		PP		KPSS		I
	Constant	Constant with trend	Constant	Constant with trend	Constant	Constant with trend	
Pre- Crisis: 1980M1 – 1997M4							
dc	-13.20(0)^{a}	-13.17(0)^{a}	-14.03(8)^{a}	-14.27(9)^{a}	0.117(18)	0.102(18)	I(0)
i	-10.92(0)^{a}	-10.88(0)^{a}	-10.87(2)^{a}	-10.83(2)^{a}	0.178(0)	0.163(0)	I(0)
ipi	-13.37(0)^{a}	-13.39(0)^{a}	-13.45(4)^{a}	-13.49(3)^{a}	0.109(3)	0.027(3)	I(0)
emp	- 8.76(0)^{a}	- 8.76(0)^{a}	- 8.76(1)^{a}	- 8.76(1)^{a}	0.169(0)	0.098(0)	I(0)
Within- Crisis: 1997M5 – 1998M8							
dc	- 3.47(0)^{b}	- 4.44(1)^{b}	- 3.48(1)^{b}	- 7.12(10)^{a}	0.317(1)	0.138(5)	I(0)
i	- 7.96(0)^{a}	- 7.66(0)^{a}	- 7.72(1)^{a}	- 7.67(2)^{a}	0.090(1)	0.089(1)	I(0)
ipi	- 5.55(0)^{a}	- 5.36(0)^{a}	-10.74(14)^{a}	-11.17(14)^{a}	0.449(13)	0.141(4)	I(0)
emp	- 3.80(0)^{b}	- 3.94(0)^{b}	- 3.82(3)^{b}	- 6.49(7)^{a}	0.221(4)	0.138(4)	I(0)
Post- Crisis I: 1998M9 – 2005M6							
dc	-10.92(0)^{a}	-10.85(0)^{a}	-11.03(2)^{a}	-10.95(2)^{a}	0.101(1)	0.073(1)	I(0)
i	-12.28(0)^{a}	-12.64(0)^{a}	-11.76(3)^{a}	-12.33(2)^{a}	0.441(10)	0.146(16)	I(0)
ipi	- 9.81(1)^{a}	- 9.79(1)^{a}	-17.21(1)^{a}	-17.96(2)^{a}	0.056(1)^{c}	0.046(1)	I(0)
emp	- 5.45(0)^{a}	- 5.87(0)^{a}	- 5.47(1)^{a}	- 5.87(1)^{a}	0.352(5)	0.144(16)	I(0)
Post- Crisis II: 2005M7 – 2008M9							
dc	- 6.03(0)^{a}	- 6.06(0)^{a}	- 6.03(0)^{a}	- 6.06(0)^{a}	0.251(1)	0.202(1)	I(0)
i	- 3.87(8)^{a}	- 4.07(1)^{b}	- 6.11(4)^{a}	- 6.65(3)^{a}	0.349(4)	0.079(4)	I(0)
ipi	- 9.74(0)^{a}	- 9.62(0)^{a}	-21.32(14)^{a}	-21.89(14)^{a}	0.239(14)	0.133(10)	I(0)
emp	- 1.85(0)*	- 1.71(0)*	- 1.94(1)*	- 1.79(2)*	0.109(3)	0.113(3)	I(0)

Note: a and b denotes significance at 1% and 5% levels and * denote the series is nonstationary at level. Figures for ADF and PP are the t-statistics for testing the null hypothesis that the series is nonstationary. Figures for KPSS are LM-statistics for testing the null hypothesis that the series is stationary. Figures in parenthesis are lag length for ADF and bandwidth for KPSS. All series are logarithm transformed.