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Responsiveness of Monetary Policy to Economic Uncertainty: Evidence from the ASEAN-5 Plus 3 Countries

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Abstract

A notable feature of empirical research on the monetary policy rule is that not many studies rely on the responsiveness of the monetary policy to the goals of the central bank. Policy responsiveness aligns with the appropriate relative weights placed on the goals following their priority. To overcome this shortcoming, this study uses open economy Taylor rule in economic uncertainty and examines its empirical validity based on a sample of ASEAN five plus three countries, including Indonesia, Malaysia, Philippines, Singapore, Thailand, South Korea, Japan, and China. By employing the autoregressive distributed lag (ARDL) model, this study examines the long-run and the short-run relationships between economic uncertainty (i.e. output uncertainty, inflation rate uncertainty, and exchange rate uncertainty) and monetary policy. Additionally, this study examines the responsiveness of monetary policy in economic uncertainty for goal-based performance measures. The findings provide some policy implications; (i) both in the long run and/or short run, the central bank should consider the policy variables (namely, output, inflation rate, and the exchange rate) underlying the premise of unforeseen future economic events in its monetary policy decision makings for the best economic outcomes, and (ii) the responsiveness of monetary policy to the central bank's goals can serve as a benchmark (namely, the size of the weights in policy rule) in aligning smooth movements of the policy rate.

Keywords

Monetary policy, Taylor rule, Exchange rate, ARDL

1. Introduction

Monetary policy constitutes a pivotal strategy employed by central banks to regulate interest rates or the money supply, thereby exerting influence over prevailing economic conditions. The overarching objective of monetary policy encompasses multifaceted aims such as fostering stable economic growth, maintaining a consistent and low inflation rate, and ensuring stable exchange rates. To effectively communicate these goals in relation to prevailing economic conditions, central banks meticulously fine-tune interest rates. Achieving this precision necessitates the adoption of systematic monetary policy rules, such as the widely known Taylor rule. While extensive emphasis has been placed on explicating and prognosticating interest rate behaviors under diverse targeted objectives, the explication of feasible and meaningful approaches in the context of uncertain future economic events—

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termed economic uncertainty—remains somewhat limited. This prompts a fundamental question as whether further research in this realm augment our comprehension of economic uncertainty vis-à-vis economy-level performance targets and thereby enhance the precision of monetary policy.

Several studies have explored the relationship between economic uncertainty and monetary policy. Considering the uncertainty can typically be categorized as output uncertainty, inflation uncertainty, and exchange rate uncertainty, monetary policy responses to uncertainty can be reflected to prescriptions of monetary policy rule (Martin and Milas, 2009; Basu and Bundick, 2017). With respect to the output uncertainty, Billi (2011; 2012) suggest that an increase in the interest rate may counter the positive output gap (i.e. an overheating economy), further reduces the inflation and cool down the economy, thus the policymakers should put more focus on the output uncertainty. Guo and Ma (2016) estimate a time-varying coefficient Taylor rule in China by employing a smooth time-varying cointegrating approach and find that the response of the nominal interest rate to the output uncertainty is sensitive. Bauer and Neuenkirch (2017) observe that the response of the monetary policy to the output uncertainty may not consistent across different country. They suggest that the monetary policy responds negatively to the output uncertainty in the US, while it responds positively in the UK. Mushtaq et al. (2022) estimated the nonlinear Taylor rule and inflation-targeting in Pakistan by using the threshold regression technique found that the interest rate has responded positively and significantly to output uncertainty.

With respect to the inflation uncertainty, Mohanty and Klau (2004) suggests that most of the central banks change interest rates in response to inflation uncertainty. Moura and de Carvalho (2010) suggest that the central banks of Mexico and Brazil implement contractionary monetary policy (i.e. raise the interest rates) in order to deal with the inflation uncertainty. This finding is further supported by Guney (2016), who discovered that the Central Bank of the Republic of Turkey (CBRT) also implement a tight monetary policy, specifically increasing the interest rate to address the inflation uncertainty. However, Cochrane (2011) argues that increasing the interest rates in response to inflation will cause higher inflation uncertainty. Similarly, Dong et al. (2020) suggest that a higher interest rate might increase the inflation volatility in the US. With respect to the exchange rate uncertainty, Dennis (2003) suggests that policymakers should focus also on the real exchange rate uncertainty when setting interest rates. Balázs (2010) used a VAR model and suggests that the interest rate does respond to exchange rate uncertainty yet the responses are too small and thus incapable to reduce the exchange rate uncertainty significantly. Asari et. al. (2011) used time-series Vector Error Correction Model (VECM) approach and propose that the exchange rate uncertainty in Malaysia can be controlled effectively by raising the interest rate. Ajao and Igbekoyi (2013) and Ajao (2015) find that there is a significant negative relationship between the real interest rate and exchange rate uncertainty in the short run. However, Hameed and Rose (2018) suggest that there is no strong linkage between exchange rate uncertainty and interest rate. Kuncoro (2020) also suggests that the interest rate policy in the inflation-targeting framework is failing in lowering the exchange rate uncertainty.

The motivation for this study stems from recognizing that not many studies rely on the responsiveness of the monetary policy to the goals of the central bank. Policy responsiveness may align with the appropriate relative weights placed on the goals following their priority (Kozicki, 1999). In line with this, Greenspan (2003) suggests that one should define the characteristic of monetary policy landscape for conducting of monetary policy. Indeed, it is no harm by assuming the sources of uncertainty as the goals of the central. Williams (2019) argues that one cannot ignore the economic uncertainty in the domestic and international levels for monetary policy strategy. In the reality, many central banks or monetary authorities may experience different responsiveness levels of monetary policy to address unwanted economic uncertainty, such as inflation uncertainty (e.g., high inflation) and exchange rate uncertainty (e.g., currency depreciation[1])[2] (Federal Reserve Board, 2017, 2023; IMF, 2023). These central banks' responsiveness of the monetary policy, however, is rarely disastrously. Economic engineering in monetary policy to address economic uncertainty needs to be enhanced (Bernanke, 2010; BIS, 2014).

The objective of the study is to examine the responsiveness of monetary policy in economic uncertainty, namely output uncertainty, inflation rate uncertainty, and exchange rate uncertainty, for goal-based performance measures, such that the responsiveness of monetary policy to the central bank's goals can serve as a benchmark (i.e., the size of the weights in policy rule) in aligning smooth movements of the policy rate. To this aim, this study uses open economy Taylor rule in economic uncertainty based on a sample of ASEAN five plus three countries, namely Indonesia, Malaysia, Philippines, Singapore, Thailand, South Korea, Japan, and China. Prior to that, this study employs the autoregressive distributed lag (ARDL) method to examine the long-run and the short-run relationships between economic uncertainty and monetary policy. Following that, the study examines the responsiveness of monetary policy in economic uncertainty for goal-based performance measures through a monetary policy responsiveness approach.

The remainder of this paper is organized as follows. Section 2 provides the model and econometric methodology. Section 3 describes the data and empirical results. The conclusion is in Section 4.

2. Model and econometric methodology

2.1 Theoretical model

The theoretical model from the study is based on a standard Taylor (1993) rule (see Eq. (1)).

$$r_{g_t} = \beta_y y_{g_{t-1}} + \beta_\pi \pi_{g_{t-1}} + \zeta_t \tag{1}$$

From the above equation, all variables are in gap forms; a variable in gap form indicates a deviation of actual value from its potential value. Because of a variable in gap form denotes uncertainty (see, Golob, 1994; Gan, 2014; Ben-Haim et al., 2017; Gan, 2019; Gan and Kwek, 2023), r_g, y_g, and π_g represents interest rates uncertainty, output uncertainty, and inflation uncertainty, respectively. In the context of open economy, this study extends the Eq. (1) by including the exchange rate (see Eq. (2)).

$$r_{g_t} = \beta_y y_{g_{t-1}} + \beta_\pi \pi_{g_{t-1}} - \beta_e e_{g_{t-1}} + \zeta_t \tag{2}$$

where e_g is in gap form and represents exchange rates uncertainty. All variables are real terms, except π_g. ζ_t is the monetary policy shock. $\beta_y > 0$, $\beta_\pi > 0$, and $\beta_e < 0$ indicate the theoretical relationship between independent variables and the dependent variable. Based on the Eq. (2), the parameters of β_y, β_π, and β_e can also serve as the adjustment factors for output uncertainty, inflation uncertainty and exchange rate uncertainty, respectively.

2.2 Econometric methodology

[1] The high foreign interest rate may lead to domestic capital outflows and induce currency depreciation.
[2] This evidence is also available on the emerging markets' central bank website.

A cointegration test is employed to examine the long-run and the short-run relationships between economic uncertainty and monetary policy. One of the most prominent approaches is developed by the Engle and Granger (1987). Another method that developed by Johansen (1988, 1991) and Johansen and Juselius (1990) also widely be used since it more advanced than Engle-Granger test and is more efficient in multivariate systems. However, these cointegration tests has some limitations, for example, all of the time series must be non-stationary at their levels but stationary at their first differences, that is I(1). Also, the results of cointegration test varies based on the number of lags chosen, changing the lags will leads to different outcomes. To overcome the above limitations, this study employs the autoregressive distributed lag (ARDL) approach of Pesaran and Pesaran (1997) and Pesaran et al. (2001). With the ARDL approach, variables can be stationary at any level, whether purely I(0), purely I(0), or a combination of both. This eliminates the need for pre-testing variables to determine their order of integration. Although this study does not involve a small sample size, the ARDL approach is still deemed appropriate for small sample sizes. Moreover, this method enables the consideration that optimal lag lengths may differ among various variables. According to Akel and Gazel (2014), ARDL method provides statistically more robust results than alternative testing methods.

According to Pesaran and Pesaran (1997), the ARDL method comprised of two main steps. Firstly, the bound testing procedure (F-test) is employed to examine the presence of the cointegration, that is, the presence of the long-run relationship between the variables. The calculated F-Statistics will be compared with the critical values for the upper bound I(1) and lower bound I(0) at 5% significance level as determined by Pesaran et al. (2001). The null hypothesis and alternative hypothesis are:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$$
$$H_A: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$$

Considering the null hypothesis implies no cointegration, if the calculated F-Statistics is greater than I(1), then the null hypothesis is rejected and conclude that there is a long relationship. If the calculated F-Statistics is lower than I(0), then the null hypothesis is accepted, hence, no long run relationship. If the calculated F-Statistics falls between I(0) and I(1), then the results is inconclusive. Then, proceed to the second steps, namely the estimations of long-run coefficients of the variables. The optimal lag length is chosen based on Akaike information criterion (AIC). Without having any prior information about the direction of the long run relationship between economic uncertainty and monetary policy, Eq. (2) can be transformed into an ARDL equation, as shown in Eq. (3), with a constant term included in the model.

$$r_{g_t} = \alpha_0 + \sum_{i=1}^{p} \beta_{1i} r_{g_{t-i}} + \sum_{i=0}^{q} \beta_{2i} y_{g_{t-i}} + \sum_{i=0}^{q} \beta_{3i} \pi_{g_{t-i}} + \sum_{i=0}^{q} \beta_{4i} e_{g_{t-i}} + \delta_1 r_{g_{t-1}} + \delta_2 y_{g_{t-1}} + \delta_3 \pi_{g_{t-1}} + \delta_4 e_{g_{t-1}} + \varepsilon_t \quad (3)$$

where r_{g_t} is the interest rates uncertainty, while y_{g_t}, π_{g_t}, and e_{g_t}represents output uncertainty, inflation uncertainty, and exchange rates uncertainty, respectively. The parameters $\beta_1, \beta_2, \beta_3, \beta_4$ represent the short run relationship while $\delta_1, \delta_2, \delta_3, \delta_4$ represent the long run relationships in the model. In addition, α_0 is the constant and ε_t is the error term at time t. Meanwhile, p denotes the lags used for the dependent variable (i.e. r_{g_t}) while q denotes the lags used for the independent variables.

As the central focus of this study is to examine the responsiveness of monetary policy to economic uncertainty, a Wald test will be carried out to test the significance of individual parameters in a statistical model. Since there is no consensus on how to objectively measure the responsiveness of monetary policy, this paper applies the responsiveness of monetary policy approach proposed by Gan (2018). Based on the estimation result of the ARDL model, the Chi-squared statistics computed from the estimation results will be used to run the Wald test. Hence, the result of the Wald test will imply the responsiveness of the monetary policy through a relative weight, namely 0.5 or 1.0, based on the hypothesis proposed by Kozicki (1999) and Gan (2018). There are two null hypotheses of the responsiveness of the monetary policy, namely the fairly modest policy response (FMP) and more aggressive policy response (MAP). Particularly, fairly modest policy response (FMP) is the expectation that the weight on the adjustment factor is 0.5 whereas more aggressive policy response (MAP) is the expectation that the weight on the adjustment factor is 1.0. Implying an active policy response (AP) if both the null hypothesis of FMP response and the null hypothesis of MAP response is rejected. Active policy response (AP) implies that the responsiveness of monetary policy to the corresponding adjustment factors is rejected by the weight with larger magnitudes, such as 1.5 and 2.0.

3. Data description and the discussion of empirical results

A quarterly data over the period 1994Q1 till 20221 based on a sample of ASEAN five plus three countries, namely Indonesia, Malaysia, Philippines, Singapore, Thailand, South Korea, Japan and China, would be applied in this paper. There are four variables taken for this study, namely the interest rate (r_t), output (y_t), inflation (π_t), and the exchange rate (e_t). For estimation purposes, these variables will be expressed in gap form, namely the interest rate gap (r_{g_t}), the output uncertainty (y_{g_t}), the inflation uncertainty (π_{g_t}), the exchange rate uncertainty (e_{g_t}). The gap implies the deviations of the actual value from the potential value. In this paper, the potential value can be calculated by running the Hodrick-Prescott filter with the value of 1600 for smoothing parameter. Data is primarily sourced from the Bank for International Settlements Statistics (BIS Statistics), the International Financial Statistics (IFS), and the International Monetary Fund (IMF). The details of the data definitions are presented as follows:

- Interest rate (r_t): The real interest rate used in this study is the real Money Market Rate (MMR). The real interest rate is obtained by using the nominal MMR minus the inflation rate.
- Output $(\boldsymbol{y}_t)$: The real output used in this study is the real Gross Domestic Output (GDP). The real GDP is obtained by dividing nominal GDP by the GDP deflator, simply put, the CPI.
- Inflation (π_t): The inflation rate used in this study is in percentage and is denoted by the Consumer Price Index (CPI). It can be calculated by subtracting the past date CPI from the current date CPI and dividing the answer by the past date CPI (). Then multiply the results by 100 to get the inflation rate percentage.
- Exchange rate (e_t): The Real Effective Exchange Rate (REER) index is used as a proxy of the real exchange rate, in which an increase in the index implies an appreciation.

Based on the bound test with null hypothesis of no co-integration, Table 1 shows that the computed F-statistics for most of the countries (except for Singapore and Japan) are higher than the upper bound critical value of 4.35 at 5% significance level. This implies that the null hypothesis is rejected and conclude that long run relationships does exists between the economic uncertainty (i.e., output uncertainty, inflation rate uncertainty, and exchange rate uncertainty) and monetary policy.

	Indonesia	Malaysia	Philippines	Singapore	Thailand	Korea	Japan	China
Computed F-statistics (lag structure = 3)	17.445	5.243	8.397	4.182	5.571	7.668	3.200	7.759

Critical Bound's value at 5% level (three repressors case)
Lower Bound: 3.23
Upper Bound: 4.35
Pesaran et al. (2001), Table CI(iii) Case III: Unrestricted intercept and no trend, page 300.

Table 1: Bound testing for Cointegration Analysis

Following the estimation procedure as illustrated in subsection 2.2, the ARDL procedure is estimated by using the Microfit and EViews programs to examine the long run relationships. The results of the ARDL estimations of the open-economy Taylor rule and the diagnosis tests is reported in Table 2. These results suggest that, in the long run, the output uncertainty (i.e., $y_{g_{t-1}}$) and inflation uncertainty (i.e., $\pi_{g_{t-1}}$) are positively correlated with the interest rate uncertainty (i.e., $r_{g_{t-1}}$), while the exchange rate uncertainty (i.e., $e_{g_{t-1}}$) is negatively correlated interest rate uncertainty, across all countries (i.e., Indonesia, Malaysia, Philippines, Singapore, Thailand, South Korea, Japan and China). In terms of short-run relationships, the results suggest a significant relationship between output uncertainty and interest rate uncertainty for most countries, except for Korea. Additionally, inflation uncertainty is found to have a significant relationship with interest rate uncertainty in the short run for most countries, with the exceptions of Indonesia and Japan. For the relationship between exchange rate uncertainty and interest rate uncertainty, half of the countries (i.e., Indonesia, Malaysia, Philippines and Korea) suggest a significant relationship, while the other half (i.e., Singapore, Thailand, Japan and China) suggest an insignificant relationship. The empirical results above suggest that, in both the long run and the short run, the central bank should consider policy variables such as output, inflation rate, and exchange rate when making monetary policy decisions. This consideration is important for anticipating unforeseen future economic events and achieving the best possible economic outcomes. Furthermore, diagnosis tests such as heteroskedasticity test, Ramsey RESET test, ARCH test, normality test, and serial correlation test are performed to validate the model's acceptability (see Table 2).

Table 2: ARDL estimations of the open-economy Taylor rule

The R-squared values from the ARDL estimations for all countries are considerably high, exceeding 50%, with China recording the highest at 90.7% and Indonesia the lowest at 59.1%. Moreover, each country has passed the diagnosis tests and the results are favorable. The null hypothesis of the presence of heteroscedasticity is rejected for most countries, except for Korea. All countries have passed the Ramsey RESET test, indicating no misspecification in the functional form. Also, every country has passed the ARCH test. However, all the Jarque-Bera statistics indicate that the data is not normally distributed, potentially due to the high number of lags contributing to this non-normality. Besides, the Breusch-Godfrey LM statistics of most countries indicates that there is no serial correlation, except for Philippines, Singapore and Korea. Subsequent to that, stability tests such as the Cumulative Sum of Recursive Squares (CUSUM) and Cumulative Sum of Square of Recursive Residuals (CUSUMQ) tests are conducted to examine the stability of the model on the graphical representations at 5% significance level (see Figure 1). The plots of cumulative sum (CUSUM) of recursive residuals and cumulative sum of squares (CUSUMSQ) of recursive residuals indicate that the estimated parameters of Eq. (3) for every country are stable over the sample period, except for the CUSUMSQ of Indonesia, Malaysia, Singapore, Thailand, and Japan.

Figure 1:

In line with the objective of the study, this study examines the robustness of the monetary policy (i.e., Eq. 2) via the size of weight in the adjustment factors, namely the output gap, inflation gap and the exchange rate gap. According to the responsiveness of monetary policy approach proposed by Gan (2018), a Wald test will be carried out for the responsiveness measures with a relative weight, namely 0.5 or 1.0, and based on the hypothesis proposed by Kozicki (1999) and Gan (2018). The two null hypotheses regarding the responsiveness of the interest rate are: a fairly modest policy response (FMP), with a weight of 0.5 on the adjustment factor, and a more aggressive policy response (MAP), with a weight of 1.0 on the adjustment factor. Rejecting either null hypothesis implies an active policy response. As shown in Table 3, the summary results of the x^2-tests of the value of the parameter on the output uncertainty (i.e., $\beta_y = 0.5$ and $\beta_y = 1.0$) suggest that all countries have implemented active policy response to output uncertainty. The summary results of the x^2-tests of the value of the parameter on the inflation uncertainty (i.e., $\beta_\pi = 0.5$ and $\beta_\pi = 1.0$) suggest that most of the selected countries are likely to implement active policy response to inflation uncertainty, except Indonesia, Thailand and Japan appear to be fairly modest policy response. The summary results of the x^2-tests of the value of the parameter on the exchange rate uncertainty (i.e., $\beta_e = 0.5$ and $\beta_e = 1.0$) also suggest that all countries have implemented active policy response to exchange rate uncertainty. These findings suggest that the responsiveness of monetary policy to the central bank's goals can serve as a benchmark (i.e., the size of the weights in policy rule) in aligning smooth movements of the policy rate.

Table 3.

4. Conclusions

This paper examines the empirical validity of the responsiveness of monetary policy in economic uncertainty, namely output uncertainty, inflation rate uncertainty, and exchange rate uncertainty, for goal-based performance measures. Prior to this determination, this study examines the long-run and the short-run relationships between economic uncertainty and monetary policy by using the autoregressive distributed lag (ARDL) method. A quarterly data over the period 1994Q1 till 20221 based on a sample of ASEAN five plus three countries, namely Indonesia, Malaysia, Philippines, Singapore, Thailand, South Korea, Japan and China, are applied in this study. Overall, the results of ARDL estimations are favorable. The interest rate response positively to output uncertainty and inflation uncertainty, and negatively to exchange rate uncertainty. The findings suggest that, both in the long run and/or short run, the central bank should consider the policy variables (i.e., output, inflation rate, and the exchange rate) underlying the premise of unforeseen future economic events in its monetary policy decision makings for the best economic outcomes. Moreover, the results of Wald test also emphasize the importance that the responsiveness of monetary policy to the central bank's goals can serve as a benchmark (namely, the size of the weights in policy rule) in aligning smooth movements of the policy rate.

Nonetheless, the design of this study is subject to several limitations. Firstly, the monetary policy rule that discuss in this study only employ the Taylor's interest rule for research purposes. Additionally, this study only considered few variables that correlate with the interest rate as policy instrument, namely the uncertainty of output, inflation, and exchange rate. The sample size of the study is also considered small, which only involved only eight countries and sample period covered only from 1994Q1 to 2022Q1. Future research can explore larger size sample by involving more countries or expanding the sample period. Future research is strongly encouraged to replicate this study using various econometric methods, such as panel cointegration models, dynamic stochastic general equilibrium (DSGE) models, generalized method of moments (GMM), and others.

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List of Tables:

Table 2: ARDL estimations of the open-economy Taylor rule

Dependent variable: $d\Delta r_t$	Indonesia	Malaysia	Philippines	Singapore	Thailand	Korea	Japan	China
Method: least squares	ARDL (1,3,8,16)	ARDL (3,6,4,8)	ARDL (4,2,8,0)	ARDL (5,1,8,16)	ARDL (1,12,16,8)	ARDL (1,1,7,9)	ARDL (5,7,5,17)	ARDL (2,3,3,0)
Regressor	Coefficient							
Constant	0.033	-0.009	-0.005	-0.016	-0.021	0.0005	0.006	-0.002
	(0.299)	(0.557)	(0.698)	(0.361)	(0.404)	(0.953)	(0.891)	(0.868)
$dr_{g_{t-1}}$	0.025	-0.061			0.058	-0.005	-0.214	-0.297 **
	(0.839)	(0.662)			(0.749)	(0.964)	(0.773)	(0.016)
$dr_{g_{t-2}}$		-0.013					-0.271	-0.228 **
		(0.923)					(0.672)	(0.031)
$dr_{g_{t-3}}$		0.307 **					-0.266	
		(0.015)					(0.602)	
$dr_{g_{t-4}}$			0.018				-0.028	
			(0.839)				(0.940)	
$dr_{g_{t-5}}$				0.135			0.010	
				(0.169)			(0.966)	
dy_{g_t}	0.018		0.008 ***	0.015 ***		-0.004	0.050 **	0.011 **
	(0.464)		(0.001)	(0.003)		(0.557)	(0.036)	(0.011)
$dy_{g_{t-1}}$	-0.067 **		-0.011 ***	0.0004		0.006	0.010	0.005 ***
	(0.040)		(0.004)	(0.929)		(0.436)	(0.857)	(0.431)
$dy_{g_{t-2}}$	-0.038	-0.002	-0.006 **				-0.005	0.007
	(0.211)	(0.737)	(0.021)				(0.917)	(0.182)
$dy_{g_{t-3}}$	-0.011	-0.003					-0.003	0.010 **
	(0.711)	(0.555)					(0.940)	(0.019)
$dy_{g_{t-4}}$		-0.002					-0.005	
		(0.685)					(0.880)	
$dy_{g_{t-5}}$		-0.001			-0.013		-0.015	
		(0.856)			(0.358)		(0.610)	
$dy_{g_{t-6}}$		0.007 *			-0.004		-0.029	
		(0.091)			(0.805)		(0.311)	
$dy_{g_{t-7}}$					0.009		-0.031	
					(0.559)		(0.283)	
$dy_{g_{t-8}}$					0.014			

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					(0.387)			
$dy_{g_{t-9}}$					0.006			
					(0.732)			
$dy_{g_{t-10}}$					0.006			
					(0.705)			
$dy_{g_{t-11}}$					0.023			
					(0.138)			
$dy_{g_{t-12}}$					0.024 *			
					(0.071)			
$d\pi_{g_t}$		-0.667 ***	-0.557 ***	-0.590 ***		-0.376 ***		-0.525 ***
		(0.000)	(0.000)	(0.000)		(0.000)		(0.000)
$d\pi_{g_{t-1}}$		-0.329	-0.248	-0.432 *		-0.077	-0.609	-0.344 ***
		(0.123)	(0.191)	(0.052)		(0.557)	(0.486)	(0.002)
$d\pi_{g_{t-2}}$	0.095	-0.284	-0.189	-0.392 **	0.212	-0.195	-0.632	-0.304 ***
	(0.578)	(0.148)	(0.259)	(0.044)	(0.353)	(0.112)	(0.393)	(0.001)
$d\pi_{g_{t-3}}$	0.128	0.221	-0.083	-0.324 *	0.452 *	-0.175 *	-0.531	-0.055
	(0.573)	(0.165)	(0.575)	(0.061)	(0.062)	(0.092)	(0.362)	(0.215)
$d\pi_{g_{t-4}}$	0.093	0.009	-0.122	-0.281 *	0.511 *	-0.230 **	-0.255	
	(0.701)	(0.925)	(0.355)	(0.056)	(0.082)	(0.014)	(0.537)	
$d\pi_{g_{t-5}}$	0.056		-0.149	-0.101	0.678 **	-0.199 ***	-0.063	
	(0.832)		(0.177)	(0.468)	(0.042)	(0.009)	(0.800)	
$d\pi_{g_{t-6}}$	0.023		-0.080	-0.230 **	0.725 *	-0.099 *		
	(0.929)		(0.390)	(0.034)	(0.062)	(0.082)		
$d\pi_{g_{t-7}}$	-0.033		-0.061	-0.162 *	0.781 *	-0.129 ***		
	(0.895)		(0.441)	(0.079)	(0.065)	(0.001)		
$d\pi_{g_{t-8}}$	-0.001		0.080	-0.153 **	0.447			
	(0.998)		(0.185)	(0.027)	(0.318)			
$d\pi_{g_{t-9}}$					0.389			
					(0.381)			
$d\pi_{g_{t-10}}$					0.378			
					(0.380)			
$d\pi_{g_{t-11}}$					0.200			
					(0.616)			
$d\pi_{g_{t-12}}$					-0.036			
					(0.921)			
$d\pi_{g_{t-13}}$					-0.039			
					(0.906)			
$d\pi_{g_{t-14}}$					-0.032			
					(0.910)			

$d\pi_{g_{t-15}}$					0.022			
					(0.918)			
$d\pi_{g_{t-16}}$					0.047			
					(0.809)			
de_{g_t}			-0.008 *			-0.009 ***	-0.003	-0.004
			(0.092)			(0.000)	(0.774)	(0.513)
$de_{g_{t-1}}$						0.002	0.014	
						(0.461)	(0.371)	
$de_{g_{t-2}}$	0.003				-0.006	0.003	0.010	
	(0.723)				(0.711)	(0.240)	(0.458)	
$de_{g_{t-3}}$	0.006	-0.006			0.002	0.002	0.009	
	(0.391)	(0.453)			(0.909)	(0.457)	(0.583)	
$de_{g_{t-4}}$	0.007	0.012 *			0.001	0.003	0.018	
	(0.315)	(0.090)			(0.951)	(0.160)	(0.206)	
$de_{g_{t-5}}$	0.002	0.008			0.005	0.0003	0.022	
	(0.828)	(0.286)			(0.721)	(0.899)	(0.119)	
$de_{g_{t-6}}$	0.009	0.013 *			0.013	0.006 ***	0.006	
	(0.224)	(0.069)			(0.182)	(0.008)	(0.617)	
$de_{g_{t-7}}$	0.009	-0.003			0.008	0.001	0.011	
	(0.212)	(0.603)			(0.399)	(0.692)	(0.341)	
$de_{g_{t-8}}$	0.008	0.014 **		0.003	0.007	0.005 ***	-0.001	
	(0.262)	(0.029)		(0.839)	(0.526)	(0.007)	(0.915)	
$de_{g_{t-9}}$	0.010			-0.016		0.003	0.013	
	(0.168)			(0.322)		(0.112)	(0.208)	
$de_{g_{t-10}}$	0.01			-0.005			0.006	
	(0.145)			(0.728)			(0.591)	
$de_{g_{t-11}}$	0.009			-0.012			0.007	
	(0.206)			(0.389)			(0.466)	
$de_{g_{t-12}}$	0.007			0.019			0.007	
	(0.306)			(0.176)			(0.440)	
$de_{g_{t-13}}$	0.012 **			-0.008			0.003	
	(0.049)			(0.574)			(0.768)	
$de_{g_{t-14}}$	0.001			0.010			0.001	
	(0.855)			(0.448)			(0.925)	
$de_{g_{t-15}}$	0.002			0.009			0.004	
	(0.737)			(0.473)			(0.661)	
$de_{g_{t-16}}$	0.009 *			-0.003			0.002	
	(0.076)			(0.795)			(0.767)	
$de_{g_{t-17}}$							0.012	

													(0.125)			
$r_{g_{t-1}}$	-1.028	***	-0.536		-0.418	***	-0.476	***	-0.748	***	-0.251	**	-0.732		-0.387	***
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.010)		(0.364)		(0.002)	
$y_{g_{t-1}}$	0.021		0.002		0.022	***	0.010	*	0.014		0.014	**	0.012		0.004	
	(0.549)		(0.765)		(0.001)		(0.095)		(0.425)		(0.012)		(0.845)		(0.592)	
$\pi_{g_{t-1}}$	0.258		0.118		0.006		0.104		0.476	**	0.122		0.873		0.025	
	(0.169)		(0.622)		(0.978)		(0.689)		(0.047)		(0.434)		(0.370)		(0.842)	
$e_{g_{t-1}}$	-0.003		-0.001		-0.004		-0.002		-0.002		-0.001		-0.008		-0.006	
	(0.625)		(0.817)		(0.210)		(0.882)		(0.912)		(0.856)		(0.656)		(0.114)	
R-squared	0.591		0.833		0.747		0.809		0.666		0.884		0.723		0.907	
Adjusted R-squared	0.393		0.785		0.694		0.739		0.471		0.846		0.517		0.892	
S.E. of regression	0.292		0.140		0.111		0.128		0.229		0.065		0.221		0.095	
Log likelihood	1.530		70.260		91.323		74.818		27.753		150.557		35.296		110.635	
Durbin-Watson stat	1.942		1.803		1.726		2.425		2.064		2.184		2.026		2.065	
Heteroskedasticity	10.892		18.382		23.559		33.544		28.568		64.383		25.868		11.053	
Test:	[0.999]		[0.736]		[0.170]		[0.118]		[0.771]		[0.000]		[0.959]		[0.749]	
Ramsey RESET test:	1.545		1.914		0.035		1.626		1.019		0.354		0.969		0.879	
	[0.200]		[0.154]		[0.851]		[0.179]		[0.367]		[0.841]		[0.432]		[0.510]	
ARCH Test:	0.109		1.153		0.764		16.016		2.833		1.966		0.166		1.069	
	[0.999]		[0.886]		[0.943]		[0.141]		[0.586]		[0.742]		[0.997]		[0.899]	
Jarque-Bera	4467.219		759.330		36.817		20.782		62.599		6.751		2542.707		48.949	
	[0.000]		[0.000]		[0.000]		[0.000]		[0.000]		[0.034]		[0.000]		[0.000]	
Breusch-Godfrey LM	0.463		0.843		12.101		21.917		6.685		9.884		3.044		1.623	
test:	[0.496]		[0.358]		[0.017]		[0.000]		[0.154]		[0.042]		[0.551]		[0.805]	
Akaike info criterion	0.635		-0.889		-1.195		-1.039		0.172		-2.419		0.120		-1.736	
Schwarz criterion	1.489		-0.279		1.726		-0.335		1.133		-1.754		1.222		-1.341	
F-statistic	2.985		17.383		13.959		11.509		3.418		23.421		3.516		60.718	
Prob(F-statistic)	0.000		0.000		0.000		0.000		0.000		0.000		0.000		0.000	

Notes: The adjusted sample period is 1995-2006. *, **, and *** denotes statistical significance at the 10%, 5% and 1% levels respectively. ( ), [ ], and < > are t −statistic, probability, and lag order, respectively.

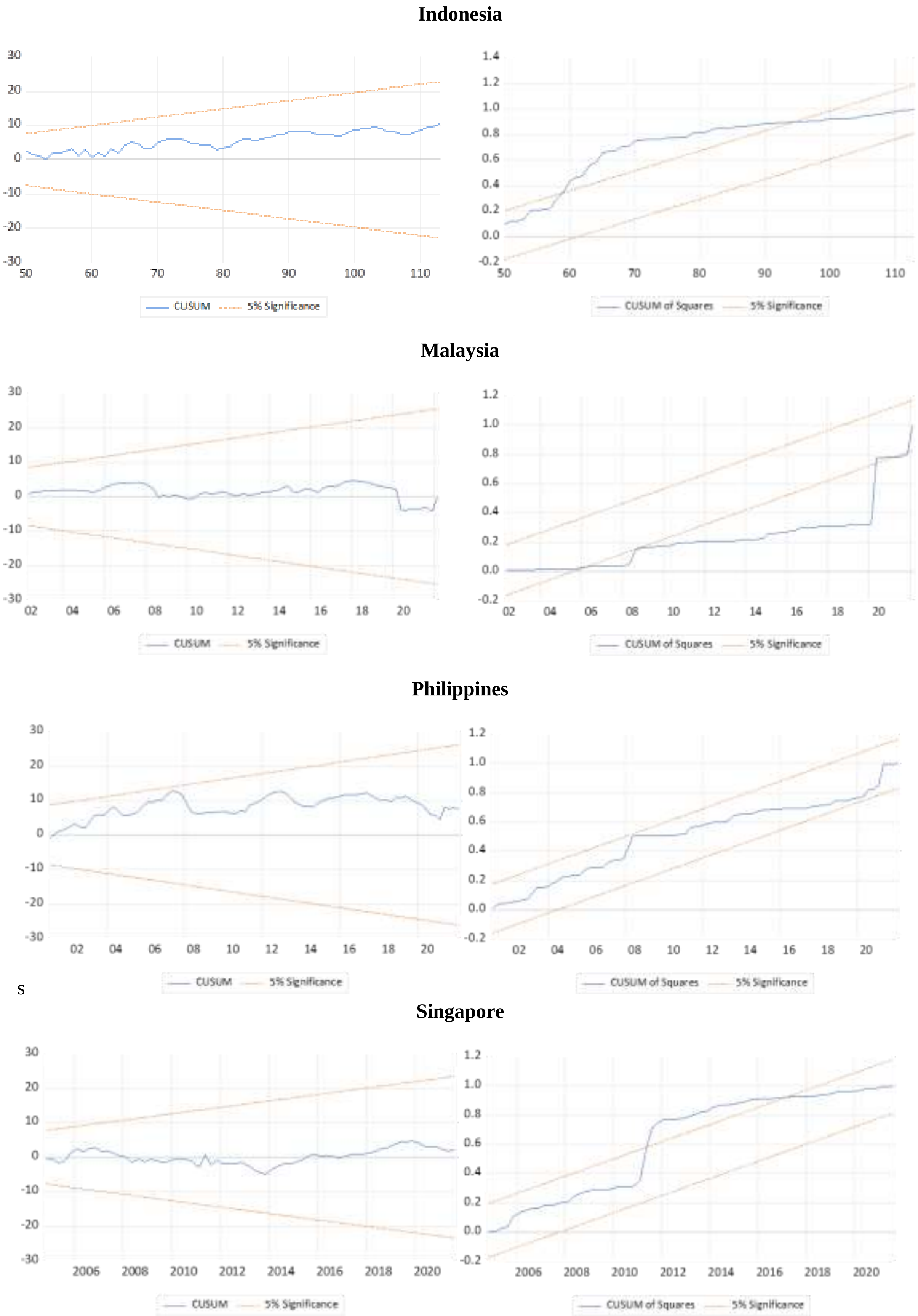

Figure 1: Plot of CUSUM and CUSUMSQ of recursive residuals. Dotted line and continuous line represent CUSUM and CUSUMSQ of recursive residuals and critical bounds at 5% significance level, respectively

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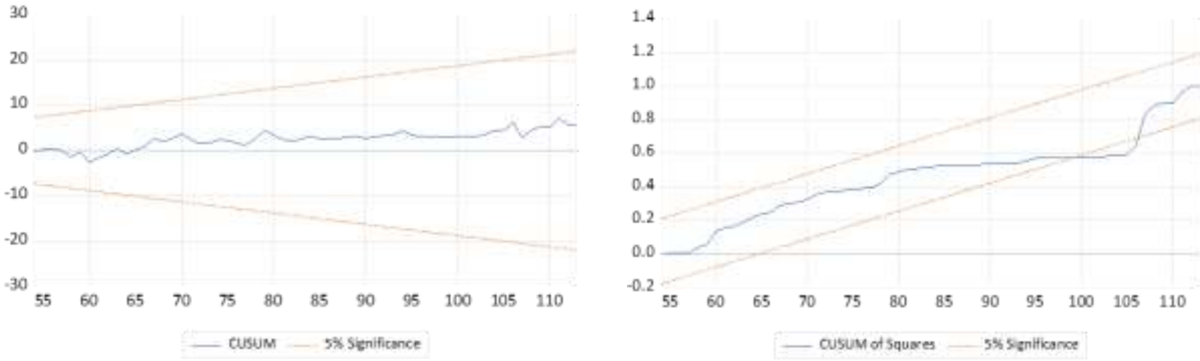
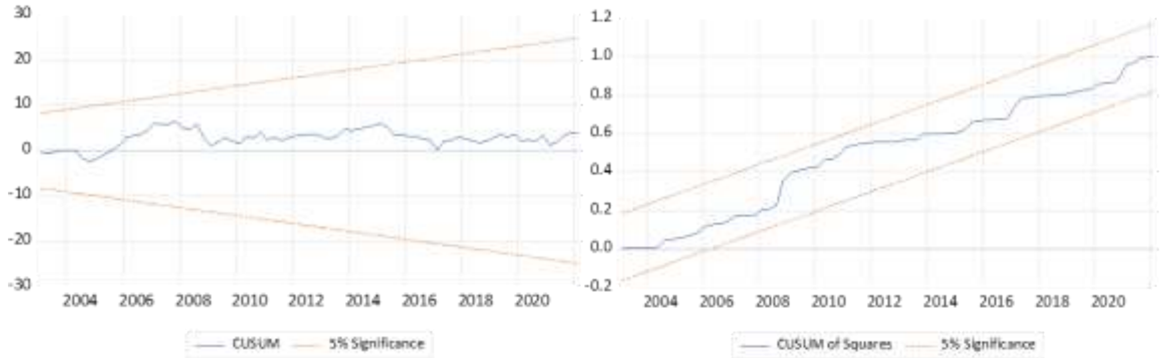
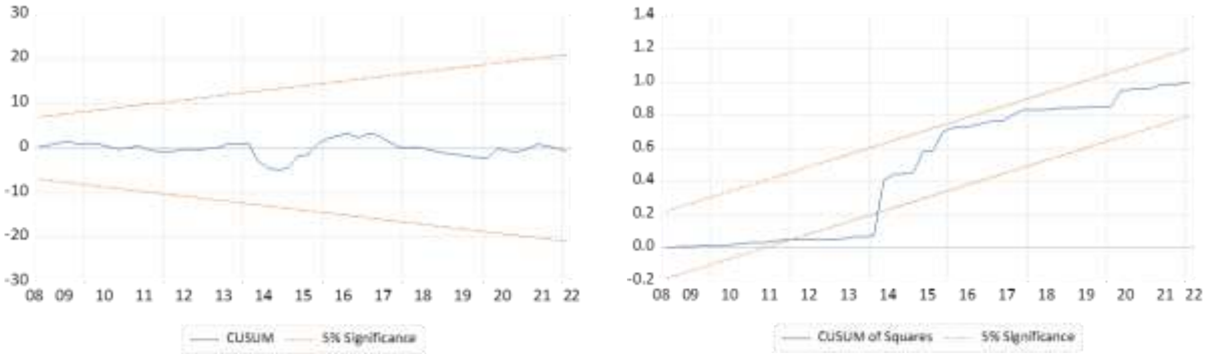
Thailand



Korea



Japan



China

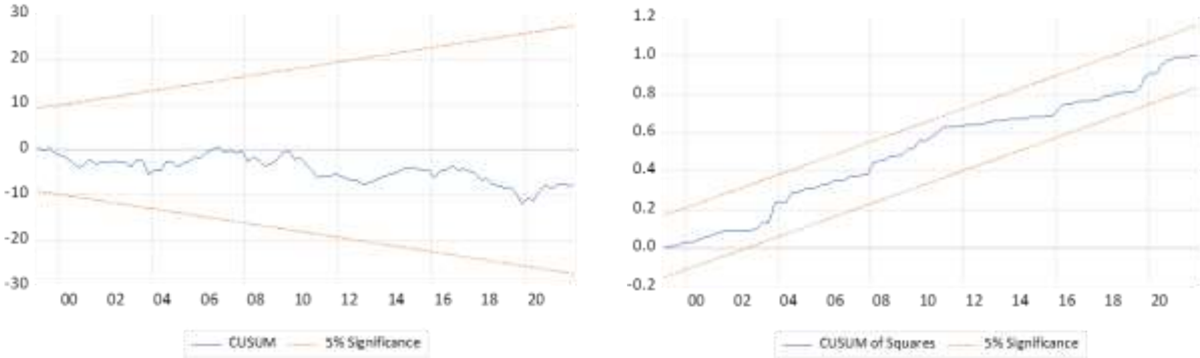


Figure 1: (continued)

Table 3. Robustness tests assess the responsiveness of the policy interest rate to different weights across adjustment factors based on the Wald statistic

Countries	Size of weights								
	β_y		Decision on policy response	β_π		Decision on policy response	β_e		Decision on policy response
	0.5	1.0		0.5	1.0		0.5	1.0	
Indonesia	[1408.4]***	[5494.8]***	AP	[10.778]	[46.646]***	FMP	[36422]***	[146203]***	AP
Malaysia	[26677]***	[107123]***	AP	[322.36]***	[685.27]***	AP	[27308]***	[110737]***	AP
Philippines	[131736]***	[528557]***	AP	[426.85]***	[1066.8]***	AP	[12494]***	[49216]***	AP
Singapore	[25016]***	[101606]***	AP	[472.77]***	[1099.1]***	AP	[7123.9]***	[28554]***	AP
Thailand	[2503.5]***	[10178.9]***	AP	[20.323]	[55.933]***	FMP	[7077.3]***	[28798]***	AP
South Korea	[7242.5]***	[28997.6]***	AP	[719.34]***	[1935.5]***	AP	[336995]***	[1346130]***	AP
Japan	[1021.1]***	[4174.7]***	AP	[5.841]	[20.120]***	FMP	[24479]***	[97924]***	AP
China	[14974]***	[61083]***	AP	[536.73]***	[1324.4]***	AP	[7906.6]***	[31393]***	AP

Source: Author's calculation using software package EViews 12

Notes: The symbols *, **, and *** denotes statistical significance at the 10%, 5% and 1% levels respectively. Two different null hypotheses of the responsiveness of the policy interest rate are examined, i.e. fairly modest policy response is the expectation that the weight on the adjustment factor is 0.5, and more aggressive policy response is the expectation that the weight on the adjustment factor is 1.0; [] is the chi-squared statistic; FMP and MAP denote fairly modest policy response and more aggressive policy response, respectively. (Note that rejecting the null hypothesis of fairly modest policy response and the null hypothesis of more aggressive policy response imply active policy response; AP denotes active policy response). Active policy response also means that the responsiveness of the interest rate to the respective adjustment factor is rejected by the weight with larger magnitudes (1.5 and 2.0); however, this table presents only a short summary of the results because the complete results require more space than is allowed here.