Stability in ASEAN+3 exchange markets: An EGARCH-M approach

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Abstract: - This paper empirically investigates the advancement of exchange markets' stability and comovement after the ASEAN+3 financial cooperation agreement. The study employs EGARCH-in-mean approach and uses daily exchange rates. The findings indicate that: 1) the exchange market volatility is resulted from regional markets' shocks during both of pre and post-agreement periods, 2) the ASEAN+3 exchange markets progressed substantial development during post-agreement, 3) both of high and low income economies are improving the exchange market stability in a cooperative way regardless of income level, and 4) the overall impact of ASEAN+3 financial cooperation leads to stabilize the regional exchange markets.

Key-Words: - ASEAN+3, financial integration, Exchange market, E-GARCH, exchange markets, market stability

1 Introduction

The strong ties of regional financial markets require stable exchange markets which follow the comovement among the regional economies. When, the exchange markets of regional economies are stable, the intra-regional economic activities such as intra-investments and intra-trades develop positively and influence on regional macroeconomic strength. The regional investors become more motivated to invest their savings once the exchange markets confirm the stability in regional exchange rates. The member economies of ASEAN+3 formed a financial cooperation group, i.e Chiang Mai Initiatives in May 2000 for stabilizing the exchange markets and strengthening the regional macroeconomics.

The progress of exchange market stability is documented through the bilateral swap fund agreements and intra-regional trades (shown in Figure 1) and investments (shown in Figure 2). The statistics of current swap agreements (16 swap agreements), intra-investments and intra-trades (0.34% growth by 21 years) indicate that CMI do not support the ASEAN+3 economies in stabilizing the exchange markets and strengthening the macroeconomics. This study empirically examines the current advancement of exchange-market stability and explores whether the current international finance transactions are low due to the lack of exchange-market comovement. The findings of the investigation process answer the following questions: 1) whether the regional exchange markets are stable and maintain the market comovement regardless of economic position of high and low income economies; 2) whether the regional exchange markets are influenced by country-specific risks, policy actions and negatives shocks; 3) whether the financial cooperation agreement improves the exchange market comovement during post-agreement period. The arrangement of this paper is as follows. A brief discussion of relevant literature is in section two. Details of data and variables are discussed in section three, while the methodology part is discussed in section four

following analysis of findings in section five. Concluding remarks along with suggestions and implications of the study are described in section six.

2 Past literature

The past literatures did not focus on the exchange markets stability in ASEAN+3 rather, they cover the area of stock markets integration in different parts of the world. The whole previous studies can be segmented into five categories.

The first group of studies investigates the stock market integration in developed countries, Guillaumin (2009), Morelli (2010). They found the stock markets in developed economies are organized and highly regulated that leads the markets to be integrated. The second group of studies (Beiney and Candelon, 2011), (Chambet and Gibson, 2008) examined the degree of stock market integration in the region of emerging economies in which the stock markets are weakly integrated in contrast with that of developed economies.

The third group of studies (Yu et al, 2010), (Oh et al, 2010) found the stock markets in east Asian region are segmented before the financial crisis but the stock market are getting integrated after the Asian financial crisis according to forth group of studies, (Guidi and Gupta, 2013), (Mukherjee and Mishra, 2010). The final group of studies compared the stock market integration between developed and developing economies where Horvath and Poldauf (2012) and Syriopoulos (2011) found the stock markets of developed economies are in long-run relationship while in developing economies are in weakly integrated.

3 Data and variables

This study uses daily exchange rate against US $ that has been transformed into exchange return using the formula $\ln(Exch_t/Exch_{t-1})$. The data covers from 6th November, 1991 to 24th May 2013 which are segmented into two dimensions; agreement based between pre (6 November, 1991 to 30 June, 1997) and post (3 May, 2000 to 21 May 24, 2013) agreement periods and gross national income (GNP) based between high income (Japan, South Korea and Singapore) and low income (Malaysia, Singapore, Philippines, Thailand and China) economies. The descriptive statistics indicates that the currencies of Korea, China and Indonesian depreciate while the currencies of Japan, Malaysia, Singapore, Philippines and Thailand appreciate during pre-agreement period. The average exchange returns of Korea, China and Indonesia are positive while the remaining are negative. The correlation of coefficients of exchange returns between Korea and Philippines is positive (0.362), between Japan and Singapore is positive (0.241) while between Malaysia and Japan is negative (-0.037) during pre-agreement period. The overall descriptive statistics indicate the lack of stability in the regional exchange markets.

4 Model Specification

This study employs GARCH (1,1) models incorporated with mean equation and asymmetric term.

$$r_{i,t} = \gamma_{i,0} + \gamma_{i,j,1}\sum_{i=1}^{8} r_{i,j,t} + \gamma_{i,2} r_{i,t-1} + \varepsilon_{i,t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.1)$$

$$h_{i,t} = \omega_{i,0} + \omega_i \varepsilon^2{}_{i,t-1} + \beta_i\, h_{i,t-1} + \phi_{i,j,1}\sum_{i=1}^{8} r_{i,j,t} + \phi_{i,2} r_{i,t-1} \quad \ldots\ldots (4.2)$$

Where, $r_{i,t}$ indicates the exchange return of individual ("i[th]" country) economy at time t. $r_{i,j,t}$ is the average return of member economies at time t while $r_{i,t-1}$ is the exchange return at time t-1. $\varepsilon_{i,t}$ (error term) is the unexpected contemporary and idiosyncratic shocks. The mean equation is the function of exogenous variables where the individual market return ($r_{i,t}$) is influenced by the average current exchange return ($\gamma_{i,j,1}$) of member economies, average previous return ($r_{i,t-1}$) of own economies and unexpected idiosyncratic shocks. $h_{i,t}$ is the conditional variance reflects the ARCH effects of innovations and volatility of spillover effects. The variance equation is determined by five factors; mean ($\omega_{i,0}$), ARCH term ($\varepsilon^2{}_{i,t-1}$) that indicates the news-based markets shocks in previous periods, GARCH term ($h_{i,t-1}$) that indicates the persistence of previous variance, current exchange returns ($r_{i,j,t}$) of member countries and previous market return ($r_{i,t-1}$) own return. In addition, we used the variance factor in the mean equation of

GARCH (1,1) model that is considered as GARCH-in-mean model which can be formed as follows:

$$r_{i,t} = \gamma_{i,0} + \eta_i h_{i,t} + \gamma_{i,j,1}\sum_{i=1}^{8} r_{i,j,t} + \gamma_{i,2} r_{i,t-1,2} + \varepsilon_{i,t} \quad \ldots\ldots\ldots (4.3)$$

The equation (4.3) is known as GARCH(1,1)-in-mean that includes variance term ($h_{i,t}$) in the mean equation. The variance term ($h_{i,t}$) confirms whether the individual exchange return responds to the market risk in determining the return. The EGARCH (1,1)-in-mean models is used to captures the asymmetric terms in which the mean equation would be the same like equation (4.3) while the variance equation would be as follows:

$$h_{i,t} = \exp\{\ \omega_{i,0} + \xi_i \ln(h_{i,t-1}) + f_{i,j}(z_{i,j,t-1}) + \phi_{i,j,1}\sum_{i=1}^{8} r_{i,j,t} + \phi_{i,2} r_{i,t-1}\ \} \quad \ldots\ldots (4.4)$$

Where, $h_{i,t}$ is the conditional variance, $z_i = \left(\frac{\varepsilon_{i,t}}{\sigma_{i,t}}\right)$ is the standard innovations. ξ_i is the volatility persistence where the value of $\xi_i < 1$ indicates the unconditional variance, the value of $\xi_i = 1$ indicates the absence of unconditional variance and indicates that conditional variance follows an integrated process of order one. The asymmetric transmission of shocks from one market to another is given by the following equation:

$$f_{i,j}(z_{i,j,t-1}) = (|\ z_{i,j,t-1}\ | - E(|\ z_{i,j,t-1}\ |) + \delta_{i,j} z_{i,j,t-1}) \quad \text{for } i, j = 1,2,.....,8 \quad \ldots\ldots (4.5)$$

The relative asymmetry is measured by:

$$\sigma_{i,j,t} = \rho_{i,j}\ \sigma_{i,j}\sigma_{j,t} \quad \text{for } i, j = 1,2,.....,8 \text{ and } i \neq j$$

Where, $f_{i,j}(z_{i,j,t-1})$ with $i \neq j$ indicates the asymmetric shocks from member economies to individual market i. $(|\ z_{i,j,t-1}\ | - E(|\ z_{i,j,t-1}\ |)$ indicates the size effect, $\delta_{i,j} z_{i,j,t-1}$ indicates the sign effect if $\delta_{i,j}$ is negative and accompany by $z_{i,j,t}$ will tend to reinforce the size effect and a positive $z_{i,j,t}$ will partially offset it, where, $E(|\ z_{it}\ |) = (2/\pi)^{1/2}(\tau(v-1)/2/\tau(v/2)$. They asymmetry is estimated by partial derivatives of equation (5) is given below:

$$\partial f_i(z_{i,t}) / \partial z_{i,j,t} = 1 + \delta_i \quad \text{for } z_j > 0$$
$$\partial f_i(z_{i,t}) / \partial z_{i,j,t} = 1 - \delta_i \quad \text{for } z_j < 0$$

The relative asymmetry is measured as $|-1+\delta_{i,j}\ |/(1+\delta_{i,j})$. Assume, all of the exchange returns are normal, the log likelihood for the EGARCH methods would be:

$$L(\Psi) = -1(1/2)(NT)In(2\pi) - (1/2)\sum_{i=1}^{T}(In\ |\ S_t\ |) + \varepsilon_t^{'} S_t^{-1}\varepsilon_t \quad \ldots\ldots\ldots (4.6)$$

5 Empirical Analyses

The exchange return series are examined to see the ARCH effect, serial correlation in errors and non-normality before employing the econometric techniques. The LM test indicates the presence of ARCH effect, Ljung-Box test indicates the autocorrelation and Jarque-Bera test statistics indicate the non-normality in the residuals of exchange return series (the results are available on request). Since, these statistical tests indicate the presence of ARCH effect in the series, the time-varying conditional GARCH approach would be the best estimation technique.

The exchange returns of individual economies are influenced by their own lagged returns at 1% significant level, except Singapore at 5% during pre-agreement period, shown in Table-1 (all of the result tables are provided at the appendix). The exchange markets of Singapore and Malaysia positively influence by each other at 1% significant level due to geographical location and close economic relation. The exchange rate of Philippines is important for Singapore at 5%, Thailand for Malaysia at 5%, China for Philippines and Malaysia for Indonesia are important at 1% level of significance in influencing the exchange returns. On the other hand, the mean returns of majority countries are influenced by other member countries during post-agreement period. The number of bidirectional influencing countries increased during this period. The unidirectional influencing power and positive comovement in exchange rate increased as well during this period. The comovement of regional exchange markets among member economies improved regardless income level of the member economies in contrasting the findings of Guillaumin (2009). The stability of ASEAN+3

exchange markets significantly improved during post-agreement period complying with the findings of Guidi and Gupta (2013).

The findings in Table-2 indicate that the volatility of regional exchange markets resulted from own lagged volatility and exogenous shocks. Most of the paired exchange markets have bidirectional influences on market volatility at 1% level of significance except at 5% in the case of Malaysia-China. Malaysian and Singaporean currencies are the most influential in the regional economies due to their regional trade surplus, while Chinese currency is experiencing high volatility due to its regional trade-deficit. On the other hand, most of the exchange markets achieved better stability during post-agreement period in comparison with that of pre-agreement period, Majid (2009). Thirteen couples of exchange markets respond to the regional spillover effects. This result is supported by the mean findings where the cross-linkage among exchange markets of ASEAN+3 increased during this period. Besides, even though, the high income countries have more influences on the volatility of low income countries' exchange markets, the overall markets have improved the comovement.

Furthermore, the significant error terms (ε_{t-1}^2) and variance terms (σ_{t-1}^2) in Table-3 support the progress of exchange market comovement among member economies. The significant and negative values of asymmetric terms indicate that exchange markets of Singapore, China and Thailand immediately respond to the possible negative shocks caused by economic downturn and unfavourable policy actions of regional economies. It indicates that the market participants of these countries are risk-averse and therefore, the negative shocks lead the exchange markets towards high volatility. The remaining exchange markets do not respond to the asymmetric shocks due to the presence of short-term spikes in exchange returns. The findings of half-life indicate that these countries are not efficient in adjusting the market shocks. Singapore and Thailand are comparatively more efficient than China in adjusting the shocks. The findings of relative asymmetric ratio indicate that impact of volatility of negative shocks had 1.423 times than that of positive shocks on average during pre-agreement period. The influences of negative shocks reduced to 1.122 times which means the exchange markets of member economies became efficient in adjusting the negative shocks during post agreement period. Finally, different lag levels (1,8 and 10) referring Gee (2010) are used to check robustness of model specification that indicates that the findings (result is available on request) are free from autocorrelation and heteroskedasticity.

6 Conclusion

This study presents several conclusions; firstly) member economies respond more to the exchange market volatility compared to the exchange market returns, secondly) majority of the exchange rates do not respond to the negative shocks of country specific policies of member economies, thirdly) the exchange markets of ASEAN+3 have developed their intra-regional cross-linkage during post-agreement agreement period, and finally) the comovement among ASEAN+3 exchange markets do not respond completely but the degree of intra-regional linkage improved in both of high and low income economies during post-agreement period compared to pre-agreement period.

The regional exchange markets are not completely stabilized and hence the findings remind the policy makers to adopt further initiatives in order to stabilize the regional economies. As remedial actions, the member countries have to further develop their intra-regional cooperation and impose policy enforcement in developing the intra-regional transactions such as trades, investment, etc in order to stabilize the domestic exchange markets. Currently, the countries of this regional bloc are involved with multiple agreements along with different commitments. In order to achieve the objectives of financial cooperation and protect the regional economies from future crisis, they have to prioritize ASEAN+3 economies. Finally, they have to identify the country-specific barriers and remove them through policy implementation in order to stabilize the ASEAN+3 exchange markets.

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Table-1: Mean equation of GARCH-in-mean and E-GARCH-in-mean

Mean Equation: $r_{i,t} = \gamma_{i,0} + \eta_i h_{i,t} + \gamma_{i,j,1} \sum_{i=1}^{8} r_{i,j,t} + \gamma_{i,2} r_{i,t-1,2} + \varepsilon_{i,t}$

	Pre-agreement period								Post-agreement period							
	High-income Economies			Low-income Economies					High-income Economies			Low-income Economies				
	Jp	Kr	Sg	My	Ph	Th	Id	Ch	Jp	Kr	Sg	My	Ph	Th	Id	Ch
η	-206.342 (0.000)	-6.008 (0.815)	12.614 (0.581)	13.115 (0.409)	0.651 (0.918)		0.820 (0.982)	0.958 (0.975)	-511.205 (0.000)	9.594 (0.019)	-18.505 (0.046)	27.707 (0.000)		20.165 (0.014)	-5.604 (0.016)	-135.199 (0.000)
$\gamma_{i,0}$	0.009 (0.000)	1.16E-05 (0.792)	-0.0001 (0.125)	2.38E-05 (0.731)	5.37E-05 (0.615)	3.73E-05 (0.34)	0.0001 (0.123)	-1.88E-05 (0.000)	0.016 (0.000)	-0.0003 (0.000)	6.39e-05 (0.305)	-9.19E-07 (0.077)	8.90E-05 (0.401)	-0.0002 (0.0001)	0.0004 (0.016)	6.06E-07 (0.179)
$\gamma_{i,1}$	-0.204 (0.000)	0.223 (0.000)	-0.067 (0.008)		0.127 (0.000)		-0.167 (0.000)	0.232 (0.000)	-0.267 (0.000)	0.0948 (0.000)	-0.104 (0.000)	-0.0172 (0.190)	0.019 (0.473)	0.022 (0.139)		-0.171 (0.000)
$\gamma_{i,1}$Jp	---	0.0008 (0.848)	0.1004 (0.000)	0.042 (0.000)	0.015 (0.069)	0.031 (0.000)	-0.002 (0.6992)	0.0013 (0.110)	--	0.012 (0.193)	0.137 (0.000)	-0.001 (0.000)	-0.0003 (0.983)	0.038 (0.000)	-0.0902 (0.000)	-0.0002 (0.036)
$\gamma_{i,1}$Kr	-0.023 (0.874)	---	0.014 (0.641)	-0.026 (0.289)	-0.051 (0.151)	-0.014 (0.589)	0.0301 (0.267)	-0.0017 (0.168)	0.108 (0.000)	--	-0.006 (0.461)	3.71E-05 (0.850)	0.235 (0.000)	-0.013 (0.078)	0.064 (0.0002)	0.0003 (0.016)
$\gamma_{i,1}$Sg	0.914 (0.000)	0.013 (0.282)	---	0.24 (0.000)	-0.068 (0.005)	0.108 (0.000)	0.018 (0.233)	-0.0014 (0.536)	-0.049 (0.225)	-0.071 (0.000)	--	0.004 (0.000)	-0.0304 (0.232)	0.248 (0.000)	0.123 (0.000)	0.001 (0.000)
$\gamma_{i,1}$My	0.447 (0.000)	-0.013 (0.307)	0.171 (0.000)	---	-0.0556 (0.018)	0.048 (0.001)	-0.002 (0.901)	0.0003 (0.865)	-0.060 (0.246)	0.041 (0.088)	0.308 (0.000)	---	0.032 (0.238)	0.0301 (0.013)	0.427 (0.000)	0.028 (0.000)
$\gamma_{i,1}$Ph	0.166 (0.003)	-0.005 (0.462)	-0.112 (0.309)	0.018 (0.086)	---	-0.005 (0.533)	0.009 (0.224)	0.017 (0.000)	0.233 (0.000)	0.415 (0.000)	-0.003 (0.752)	0.0003 (0.12)	---	0.0071 (0.523)	-0.018 (0.544)	-0.0004 (0.012)
$\gamma_{i,1}$Th	0.282 (0.000)	-0.001 (0.917)	-0.152 (0.086)	0.004 (0.684)	-0.119 (0.000)	---	0.005 (0.638)	-0.002 (0.317)	0.903 (0.000)	0.016 (0.423)	0.292 (0.000)	-0.002 (0.000)	0.006 (0.815)	---	0.406 (0.000)	0.0004 (0.035)
$\gamma_{i,1}$Id	-0.022 (0.894)	0.037 (0.127)	0.019 (0.604)	0.106 (0.000)	0.006 (0.863)	0.05 (0.061)	---	-5.91E-05 (0.983)	0.093 (0.000)	-0.002 (0.849)	0.031 (0.000)	-3.44E-05 (0.747)	0.014 (0.170)	0.0697 (0.000)	---	-0.0002 (0.006)
$\gamma_{i,1}$Ch	0.421 (0.127)	0.017 (0.605)	0.068 (0.207)	0.101 (0.056)	0.536 (0.000)	0.004 (0.915)	0.024 (0.422)	---	-0.648 (0.0317)	-0.074 (0.403)	0.095 (0.0856)	0.681 (0.000)	0.136 (0.064)	0.028 (0.467)	-0.083 (0.463)	---

*The hypotheses are based on p-values that are presented in the parenthesis.

Table-2: Result of variance equation of GARCH-in-Mean and EGARCH-in-mean

Variance equation: $h_{i,t} = \omega_{i,0} + \omega_i \varepsilon^2_{i,t-1} + \beta_i h_{i,t-1} + \phi_{i,j,1} \sum_{i=1}^{8} r_{i,j,t} + \phi_{i,2} r_{i,t-1} \quad h_{i,t} = \exp\{ \omega_{i,0} + \xi_i \ln(h_{i,t-1}) - f_{i,j}(z_{i,j,t-1}) + \phi_{i,j,1} \sum_{i=1}^{8} r_{i,j,t} + \phi_{i,2} r_{i,t-1} \}$

	Pre-agreement period								Post-agreement period							
	High-income Economies			Low-income Economies					High-income Economies			Low-income Economies				
	Jp	Kr	Sg	My	Ph	Th	Id	Ch	Jp	Kr	Sg	My	Ph	Th	Id	Ch
ω_0	1.77E-05 (0.000)	1.66E-07 (0.000)	-1.554 (0.000)	2.97E-07 (0.000)	1.79E-06 (0.000)	3.53E-07 (0.000)	3.81E-07 (0.000)	-0.162 (0.000)	3.47e-05 (0.000)	3.97e-07 (0.000)	2.13e-07 (0.000)	2.38E-11 (0.000)	6.11E-06 (0.000)	-0.527 (0.000)	1.48E-05 (0.000)	-0.191 (0.000)
$\Phi_{i,2}$	-0.0001 (0.319)	0.0001 (0.0006)		0.0002 (0.000)	0.0004 (0.009)		0.0004 (0.000)		-0.0004 (0.000)	-2.81e-05 (0.523)	4.55e-05 (0.056)		0.0001 (0.17)			
$\Phi_{i,1}$Jp	-0.0018 (0.000)	-5.54E-06 (0.174)	-1.164 (0.719)	3.67E-06 (0.697)	-0.0002 (0.000)	-5.46E-05 (0.000)	-5.88E-06 (0.255)	-38.356 (0.000)	-0.001 (0.000)	-6.19e-05 (0.000)	-4.68e-05 (0.000)	-5.21E-10 (0.636)	-3.02E-05 (0.348)	-8.753 (0.000)	-3.12E-05 (0.611)	-2.676 (0.025)
$\Phi_{i,1}$Kr	0.0004 (0.204)	7.99E-05 (0.000)	0.271 (0.976)	-6.40E-06 (0.743)	-0.0002 (0.000)	-1.18E-05 (0.649)	0.0001 (0.000)	-6.085 (0.217)	0.0001 (0.016)	0.0001 (0.000)	5.22e-05 (0.000)	1.47E-09 (0.45)	0.0001 (0.000)	1.991 (0.163)	-0.0002 (0.007)	8.862 (0.000)
$\Phi_{i,1}$Sg	0.0018 (0.000)	5.31E-05 (0.000)	-13.119 (0.002)	2.30E-05 (0.29)	0.0004 (0.000)	7.90E-05 (0.000)	1.22E-05 (0.27)	61.826 (0.000)	-0.0005 (0.000)	8.01e-05 (0.088)	-1.63e-05 (0.104)	-1.40E-08 (0.000)	0.0003 (0.000)	12.569 (0.001)	0.0004 (0.026)	-45.988 (0.000)
$\Phi_{i,1}$My	0.0011 (0.000)	-1.00E-05 (0.333)	12.103 (0.071)	-9.92E-05 (0.000)	1.33E-05 (0.367)	-3.29E-05 (0.025)	1.05E-05 (0.039)	3.521 (0.048)	0.0001 (0.139)	-6.15e-05 (0.127)	-6.61e-06 (0.631)	2.05E-06 (0.000)	0.0001 (0.000)	-14.515 (0.001)	0.0003 (0.012)	22.585 (0.000)
$\Phi_{i,1}$Ph	0.0006 (0.0001)	7.34E-06 (0.082)	9.132 (0.115)	-8.99E-06 (0.357)	-9.27E-05 (0.000)	-4.00E-05 (0.000)	2.03E-05 (0.000)	-16.241 (0.000)	0.0004 (0.000)	8.53e-05 (0.000)	-3.63e-05 (0.000)	5.93E-09 (0.0002)	0.0001 (0.002)	6.777 (0.009)	0.0005 (0.000)	-10.829 (0.000)
$\Phi_{i,1}$Th	0.0005 (0.037)	-1.51E-05 (0.081)	34.115 (0.000)	-8.79E-05 (0.000)	1.34E-05 (0.553)	1.31E-05 (0.019)	-1.52E-05 (0.066)	19.922 (0.003)	0.002 (0.000)	-1.35e-05 (0.653)	2.34e-05 (0.046)	6.11E-09 (0.0006)	0.0003 (0.000)	12.633 (0.000)	0.0004 (0.000)	22.429 (0.000)
$\Phi_{i,1}$Id	-0.0005 (0.473)	-5.24E-06 (0.761)	29.55 (0.130)	-0.0001 (0.0003)	-0.0003 (0.000)	0.0001 (0.000)	5.47E-05 (0.000)	-76.263 (0.000)	0.0002 (0.000)	-4.60e-05 (0.000)	-5.78e-06 (0.223)	2.45E-09 (0.1001)	-2.73E-05 (0.3778)	-2.449 (0.026)	-0.0002 (0.000)	3.519 (0.001)
$\Phi_{i,1}$Ch	0.001 (0.15)	-4.85E-05 (0.025)	-13.83 (0.325)	0.0002 (0.000)	0.0002 (0.061)	1.34E-05 (0.571)	-9.36E-05 (0.000)	179.106 (0.000)	-0.002 0.0501	0.0002 (0.279)	-5.44e-05 (0.398)	-1.01E-06 (0.000)	0.002 (0.000)	-6.3602 (0.539)	0.005 (0.000)	-87.332 (0.000)

*The hypotheses are based on p-values that are presented in the parenthesis.

Table-3 Other parameters and test statistics of GARCH-in-mean and EGARCH-in-mean

	Pre-agreement period								Post-agreement period							
	Jp	Kr	Sg	My	Ph	Th	Id	Ch	Jp	Kr	Sg	My	Ph	Th	Ic	Ch
ω	0.0097 (0.648)	0.234 (0.000)		0.215 (0.000)	0.364 (0.000)	0.209 (0.000)	0.157 (0.000)		0.014 (0.378)	0966 (0000)	0.070 (0.000)	0.274 (0.000)	0.1496 (0.000)		0.396 (0.000)	
β	0.513 (0.000)	0.684 (0.000)		0.752 (0.000)	0.487 (0.000)	0.696 (0.000)	0.611 (0.000)		0.056 (0.233)	0886 (0000)	0.899 (0.000)	0.733 (0.000)	0.5927 (0.000)		0.451 (0.000)	
ξ_i			0.894 (0.000)					0.996 (0.000)						0.971 (0.000)		0.998 (0.000)
Half-life			6.186					172.94						23.553		346.227
Asymmetric(δ_i)			-0.174 (0.000)					-0.176 (0.019)						-0.0496 (0.007)		-0.067 (0.000)
Relative (δ_i)			1.421					1.427						1.104		1.144
Adj. R^2	0.596	0.063	0.169	0.077	0.006	0.016	0.023	0.026	0.844	0139	0.288	0.039	0.1325	0.222	0.092	0.085
Max LH	5843.83	7832.778	7097.949	7145.007	6646.218	7514.159	7893.706	9610.527	14958.3	11106.1	16918.6	22380.82	15617.45	16932.59	13739.87	26599.68
Min AIC	-7.905	-10.605	-9.606	-9.678	-8.993	-10.17	-10.688	-13.018	-8.142	-8.222	-9.210	-12.189	-8.502	-9.218	-7.477	-14.487

* Note: The half-life and relative asymmetric ratios are calculated on the country that responds on leverage effects. The formua of calculating the half-life is $i_{hl} = \frac{\ln(0.5)}{\ln(\xi_i)}$.

*The relative asymmetric is calculated through $i_{ar} = \frac{|-1+\delta_{i,j}|}{(1+\delta_{i,j})}$. The value of $i_{ar} > 1$ indicates the negative symmetry, i_{ar}= indicates symmetry and $i_{ar} < 1$ indicates