In Search of Common Currency Anchor for ASEAN+3+3 Countries

Jamshaid ur Rehman[1], Tasneem Zafar[2], Shabbir Ahmad[3], Aftab Anwar[4]

Abstract
This study examines the monetary credibility of ASEAN+3+3 countries (APSCs) against three potential anchors i.e. China, Japan and USA. The time-varying credibility index is based on Capital Assets Price Model (CAPM) methodology which is estimated with Kalman Filter Algorithm (KFA). In multivariate Markov regime switching (MRS) models, the credibility index is made dependent on macro-fundamentals with asymmetric effects in two regimes. In other multivariate MRS models the time-varying transition probabilities (TVTPs) are influenced by macro-fundamentals and cause switching between the two credibility regimes (high and low). The noteworthy results are found against USA vis-à-vis against China and Japan. We conclude that USA could relatively be an ideal choice of anchor for APSCs.
Key Words: Credibility, CAPM, Kalman Filter, Markov Regime Switching

1. Introduction

The ASEAN is a group of 10 nations with five core members called *pentagon* [5] (Sun and Simons, 2011). It formed to achieve "*economic progress and social and cultural development in the region*" (Ng, 2002). However, the move toward economic cooperation started after the 1973 oil crisis, further boosted after 1977 summit[6] that focused on trade and industrial policies harmonization and established the ASEAN Swap Arrangement (ASA). In 1976 Bali summit, it was decided to use ASEAN currencies[7] in the payment of intra-ASEAN trade (Sussangkarn and Manupipatpong, 2015). However, there was a sheer lack of supranational/transnational or intergovernmental goals (Eichengreen 2007, Glick 2005), hence the structure of ASEAN "*consciously kept diffuse, decentralized, and under national control*" (Palmer and Reckford 1987). However, some of ASEAN core members have shown remarkable economic performance in labour intensive industries i.e. automobile and electronics during 1980s and became the prime destination of FDI (Saglio et al. 2005). The "Asian factory" phenomenon has made extensively known by the ASEAN countries (Langhammer, 2007). During this phase ASEAN focused on the export promotion strategies and eventually developed AFTA in 1992 (Ng, 2002).

The Asian Financial Crisis (AFC) of 1997-98 severely affected East Asian countries (EACs). Thereby ASEAN members favoured the larger regionalism strategy to seriously look into the self-governing financial cooperation to manage globalized capital flows during financial crisis (Pomfret, 2005). In this regard, the ASEAN Central Bank Forum was established in November 1997. The region has also established "*one-stop investment centres*" and the "ASEAN Investment Area (AIA) in 1998". It was also decided to study the viability of common currency in the region as per the 1998 "Hanoi Plan of Action" (Shirono, 2008). This debated a model of ASEAN10 plus X (Becker 2008, Plummer 2006). Therefore, ASEAN leaders called the i.e. China, Japan and Korea to join ASEAN for broader regional agendas of economic cooperation and fostering mutual trust for the free flow of goods, services, capital among ASEAN+3 (Angresano 2004, Pasadilla 2008). The joining of +3 nations has enhanced economic and political weight of the region and made it a clout in the international monetary and political arenas (Becker 2008, Drysdale 2002, Lee et al. 2004). In 2005 during the "East Asia Summit" meeting it was decided to include Australia, India, and New Zealand in ASEAN+3 (APTCs) bloc to further boost economic cooperation (Park and Wyplosz, 2010). In this regard new institutional pillars established in the region such as CMIM, AMRO etc. (Hill and Menon 2014, Kawai 2015, Kawai and Park 2015). Moreover, APTCs are willing to loss their monetary autonomy in response to greater credibility of regional policy to escalate the intra-regional integration (Kawai, 2015). The discussion to form a monetary union among ASEAN+3+3 had also been the main topic of industrial, governmental and academic forums (Sato et al. 2009) to guard against future crises and also to boost economic integration (Becker 2008, Binner et al. 2011, Huang and Guo 2006, Nasution 2005, Sun and Simons 2011, Swofford 2008). Qin and Tan (2009) estimated that ASEAN economies by and large could gain from monetary union. Many studies empirically analyzed the impact and effectiveness of an optimal currency area (OCA) criteria for APSCs (Quah 2012, Lee and Koh 2012, Sato et al. 2009, Lee and Azali 2010, Nusair 2012).

This study endeavours to find whether or not there exists monetary credibility among the ASEAN+3+3 as a prospect OCA. In literature, few studies have analyzed the monetary credibility[8]. However, there is dearth of detailed credibility analysis of ASEAN+3+3 with State Space models (SSMs) e.g. Kalman Filter Algorithm (KFA) and Markov Regime Switching (MRS) model. The objectives of the study are three folds: First, to find time-

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[5] These are Indonesia, Malaysia, the Philippines, Singapore and Thailand which founded it in 1967. In 1984 Brunei also joined them followed by Vietnam (1995), Laos (1997), Myanmar (1997) and Cambodia (1999).
[6] The first "Regional Trade Arrangements" among ASEAN members is named as the "Preferential Trading Arrangements".
[7] Such as Singapore dollar and Malaysian ringgit, Lamberte (1991) noted their usage in Philippines during 1986-9.
[8] All related to EU countries, for instance, Gómez-Puig and Montalvo (1997), Tillmann (2003), Tronzano (2001), Arestis and Mouratidis (2002), Sarantis and Piard (2004), Bonasia and Napolitano (2007) and Lanzafame and Nogueira (2011).

varying credibility of ASEAN+3+3 with Capital Assets Price Model (CAPM) estimated by KFA; Second, to find the association between credibility and macro-fundamentals of ASEAN+3+3 against three potential anchors i.e. China, Japan and USA[9] (as considered by Hefeker and Nabor 2005, Katada 2008, Kwan 2001, Mundell 2003, Shirono 2009, Nusair 2012, Quah 2012, Quah and Crowley 2012); Third, to find an appropriate anchor economy for ASEAN+3+3. Our empirical findings reveal that high credibility (CAPM beta < 1) is present in most of the countries against China, Japan and USA. Further, we find that China and Japan do not seem to be a suitable monetary anchor for the region thus left the room for the USA.

The rest of study is organised as following: Section-II explains brief literature review. Section-III explains the methodology of time-varying CAPM estimation with KFA and modelling with Markov Regime Switching model. Section-IV provides estimates of CAPM and multivariate Markov Regime Switching models. Conclusion and policy implications are drawn in Section-V.

2. Literature Review

We here discuss the theoretical and empirical literature to select the several potential macro-fundamentals that may influence the monetary policy credibility. This study uses the short term interest rate as an indicator of the conduct of monetary policy (Dahlquist and Gray 2000, Ng 2002). For instance, when monetary authorities change interest rate, the economy may likely to change because public begin to change their conduct in response to the changed interest rate. The increasing (falling) deviation from declared policy requires higher (lower) interest rate which makes the monetary policy less (more) credible (Lanzafame and Nogueira 2011). In Figure-1, for instance, if money supply declines its immediate impact will be on real interest rate, hence it increases. This increases the cost of investment, thus depress firms spending and investment, finally a decrease in AD, real GDP, inflation, and employment. Moreover, if policymakers follow tough monetary policies, it may increase credibility of their promises of controlling inflation and achieving the exchange rate parity. But at the same time they may experience the adverse circumstances (i.e. increasing unemployment, decreasing output, falling trade commitments, rising exchange rate). Thus, increasing unemployment make the future policies less credible due to the high cost associated with it. The financial crisis weaken trade commitments and put pressure on the policymaker to renege their policies (Sarantis and Piard 2004). The increase in GDP growth rate enhances the country's credibility, hence positive association with credibility (Tronzano et al. 2003). The increase in inflation and unemployment put the negative effect on credibility due to growing inflationary and unemployment pressures (Sarantis and Piard 2004). De Grauwe (1994) found positive association among the unemployment and the exchange rate credibility for EMS countries. Likewise Knot et al. (1998) noted that higher unemployment significantly deteriorate the credibility. Bernhardsen (2000) reported the positive effect of unemployment on the interest rate spread. The real exchange rate is used as a measure of *external competitiveness* by Knot et al. (1998), Tronzano et al. (2003) and Sarantis and Piard (2004).

Figure-1: Monetary Policy Effects on Economy
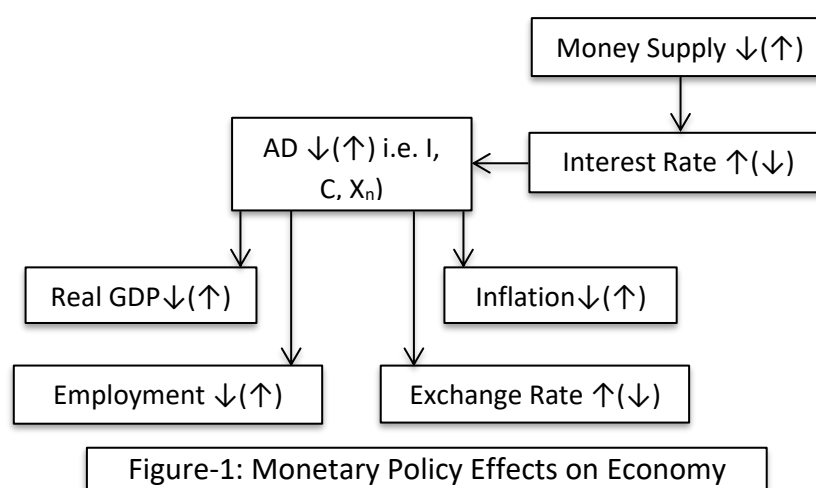
It is considered that the loss of *external competitiveness* might put pressure on the government to adopt expansionary policies, thus reducing credibility. All APSCs are highly open as their share of traded goods in total demand is high (a larger demand effect) that depreciate the domestic currency and reduced their credibility.

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[9] Nusair (2012) has given reasons why USD can be used as anchor, (i) a leading reserve currency (ii) a vehicle currency for world-wide transactions (iii) a 'safe-haven' currency in case of financial crises (iv) a currency which is used as soft dollar pegs in East Asia and elsewhere.

3. Methodology
3.1. Variables and Data Sources
The GDP is taken from NUS[10] and IFS. The exchange rate is REER but for India, Indonesia and Thailand we used US\$/NC. Inflation is CPI in percentages. The unemployment rate is available in IFS for all countries except India and Indonesia. The trade openness is calculated as ratio of import plus export to GDP. The money market rate is interest rate. The time period of every country is different[11]. All variables are used in first difference to avoid nonstationary behaviour.

3.2. Time-varying CAPM model for Estimating Credibility
Dahlquist and Gray (2000) argued that short term interest rate has two important characteristics: (1) it has mean-reversion behaviour; (2) the changes in it are leptokurtic. These characteristics can easily be captured if it is estimated with the models that endogenously determine the time varying behaviour or regime shifts in the data. Thus we used non-linear KFA to estimate the time-varying CAPM model [following Bonasia and Napolitano (2007), Lanzafame and Nogueira (2011), Sarantis and Piard, (2004)] as

$$\left(r_{it} - r_{it}^f\right) = \alpha_{it} + \beta_{it}\left(r_{it}^m - r_{it}^f\right) + \varepsilon_{it} \qquad \varepsilon_{it} \sim N(0, \sigma_i^2) \tag{1}$$

where r_{it} is the interest rates of every country, r_{it}^f is Chinese, Japanese and USA risk free interest rates and r_{it}^m is weighted average market interest rate[12]. If the estimated *beta* is greater than 1 (lower than 1) it indicates lower (higher) credibility of a country's monetary policy vis-à-vis the weighted average of APSCs. The state space specification of CAPM model assuming both α_t and β_t are time-varying is (3), for ease we drop the subscript i. The *measurement equation* develops the dynamic nexus among the observed variables and unobserved state or latent factors/variables (Kim and Nelson 1999). In more compact form:

$$y_t = [1 \quad x_t]\begin{bmatrix} \alpha_t \\ \beta_t \end{bmatrix} + \varepsilon_t \tag{2}$$

$$y_t = Z_t S_t + \varepsilon_t \qquad \varepsilon_t \sim N(0, H_t) \tag{3}$$

where y_t is an $1 \times n$ vector of variables observed at time t; S_t is a $k \times 1$ vector of unobserved state variables; Z_t is a $n \times k$ vector that makes connection between the observed y_t and unobserved state vector S_t; H_t is a $(n \times n)$ covariance matrix. The *transition equation* develops the dynamic association in state variable as:

$$S_t = T_t S_{t-1} + e_t \qquad e_t \sim N(0, Q_t) \tag{4}$$

where $\qquad S_t = \begin{bmatrix} \alpha_t \\ \beta_t \end{bmatrix}, \qquad T_t = \begin{bmatrix} \gamma_{11} & 0 \\ 0 & \gamma_{21} \end{bmatrix}_{(k \times k)}$ and $e_t = \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix}_{(k \times 1)}$

The T_t is a stationary diagonal $k \times k$ matrix known as a transition matrix. $E(e_t) = 0$ and $Q_t = cov(e_t)$ matrix. In case if both $\gamma_{11} = \gamma_{21} = 1$ then the time varying coefficients CAPM α and β moves over time as random walk. The KFA find the maximum likelihood estimates of parameters through prediction error decomposition i.e. the prediction error ($\eta_{t|t-1}$) and its variance ($f_{t|t-1}$) (Kim and Nelson, 1999). The sample log likelihood function based on prediction error decomposition is represented by

$$\ln L = -\frac{1}{2}\sum_{t=1}^T ln\left(2\pi f_{t|t-1}\right) - \frac{1}{2}\sum_{t=1}^T \eta'_{t|t-1} f_{t|t-1}^{-1} \eta_{t|t-1} \tag{5}$$

which can be maximized with respect to unknown parameters of the model.

3.3. Multivariate MRS Model
Here β_{it} not only depends on S_t but also on Z_{t-j} a vector of macro-fundamentals (Sarantis & Piard, 2004). Specifically,

$$\beta_{it} = \theta_{0,S_t} + \theta_{i,S_t}\beta_{i,t-p} + \delta_{r,S_t} Z_{i,t-j} + \varepsilon_{it} \tag{6}$$

where S_t is an unobservable, two states, first-order Markov chain, the $\theta_0 S_t$ is intercept, the θ_{i,S_t} are the coefficients of AR(p) term, $\delta_{S_t} = \left(\delta_{1,S_t}, \dots, \delta_{5,S_t}\right)$ is a vector of macro-fundamentals parameters and $\varepsilon_t \sim i.i.d.\, N(0, \sigma_{st}^2)$. The equation (6) allows the effects of macro-fundamentals on credibility whether symmetric or asymmetric. The transition probabilities (p and q) are described as:

$$Pr[S_t = 2|S_{t-1} = 2, Z_t] = p_t = exp(p_0 + Z_t' p_1)/\left(1 + exp(p_0 + Z_t' p_1)\right) \tag{7}$$

$$Pr[S_t = 1|S_{t-1} = 2, Z_t] = (1 - p_t) = \left(1 - exp(p_0 + Z_t' p_1)\right)/\left(1 + exp(p_0 + Z_t' p_1)\right) \tag{8}$$

The S_t depends on its own past values and also on Z_t. The log likelihood function will maximized with respect to $\theta_{0,1}$, $\theta_{i,1}$, $\delta_{1,1}$, $\delta_{2,1}$, $\delta_{3,1}$, $\delta_{4,1}$, $\delta_{5,1}$, σ_1^2 and p_1 under regime 1, and $\phi_{0,2}$, $\phi_{i,2}$, $\delta_{1,2}$, $\delta_{2,2}$, $\delta_{3,2}$, $\delta_{4,2}$, $\delta_{5,2}$, σ_2^2 and p_2 under regime 2. Hence, the MLE iterative procedure is used to estimate the model (6).

3.4 TVTPs of Multivariate MRS Model
The TVTPs are expected to dependent on the macro-fundamentals (Sarantis and Piard 2004). The TVTPs of M-state Markov switching process S_t can be written as:

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[10] National University of Singapore, data available at this link http://www.fas.nus.edu.sg/ecs/esu/data.html

[11] AUS(1982Q1-2015Q1), CHN(1986Q4-2015Q1), IND(1984Q4-2015Q1), IDN(1985Q1-2015Q1), JPN(1985Q1-2015Q1), KOR (1985Q1-2015Q1), MYS(1982Q1-2015Q1), NZL(1985Q1-2015Q1), PHL(1986Q1-2015Q1), SGP(1984Q1-2015Q1), and THA(1985Q1-2015Q1).

[12] The weights are AUS (0.0839), BRN (0.0037), CHN (2.8175), KHM (7.2274), IDN (480.9787), IND (5.0625), JPN (17.4863), KOR (93.2500), LAO (9.6235), MYS (0.1563), MMR (0.0217), NZL (0.0142), PHL (0.7009), SGP (0.0911), THA (1.6609), and VNM (287.1027). These weights are the 10th version of the Asian Monetary unit, updated in October, 2014 by Japanese "Research Institute of Economy, Trade and Industry".

$$P_{ij}, (Z) = Pr[S_t = j | S_{t-1} = i, Z_{t-1}] = \left(exp(\lambda_{ij,0} + Z'_{t-1}\lambda_{ij,1}) \right) / \left(1 + exp(\lambda_{ij,0} + Z'_{t-1}\lambda_{ij,1}) \right)$$

$$i = 1,2,\dots,M; \qquad j = 1,2,\dots,M-1 \tag{7}$$

The Z_{t-1} affect the likelihood of regime switches, the TVTPs follow the logistic function. The variables Z_t help in inferencing the sign of the parameters characterizing the transition probability. If $\lambda_{ij,1} > 0$, then $\partial p_{ij}/\partial Z_t > 0$ which means that the larger Z_t, the greater the probability of staying in state i – *the high credibility state*.

4. Empirical Results
4.1 Movements of Time-varying Credibility[13]

Figure-1 to 31 display time-varying fluctuations of beta coefficients against China, Japan and USA. These figures describe certain features: (a) a threshold line at the value of 1.0 split credibility indices in two regimes (low and high); (b) inverted y-axis scale show that high credibility regime is above the threshold line; (c) the variations in beta coefficients, wane at, or close to the time of financial crises[14]. ASEAN5 enjoyed high credibility against selected anchors except Indonesia. Against China, Japan and Korea reveal high credibility and high volatility, respectively. Against Japan, China and Korea depict high credibility. The countries lost high credibility against Japan due to its zero interest rate policy started after AFC as well as due to bubble burst of 2000-2001. Against Japan and USA: Australia, India and New Zealand while against China only Australia and New Zealand show high credibility.
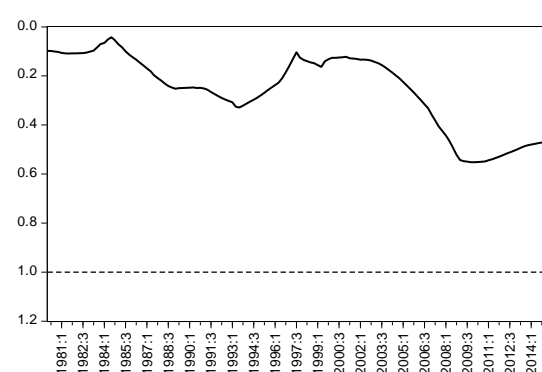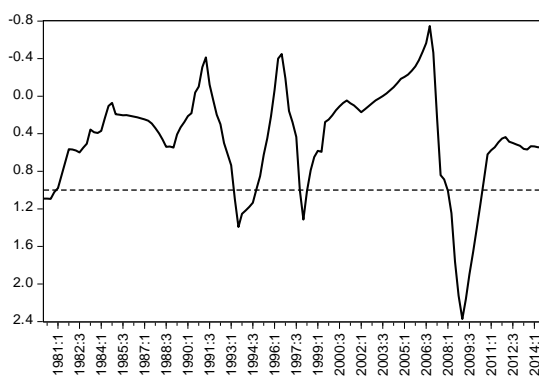

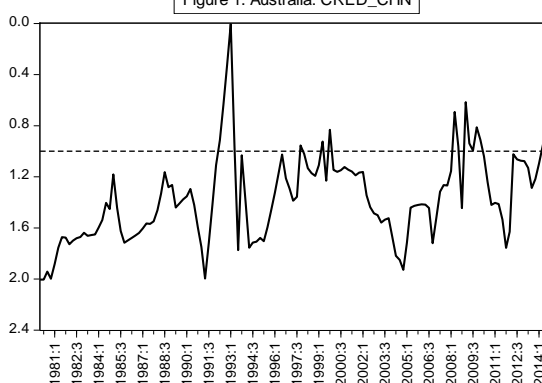Figure 1. Australia: CRED_CHN

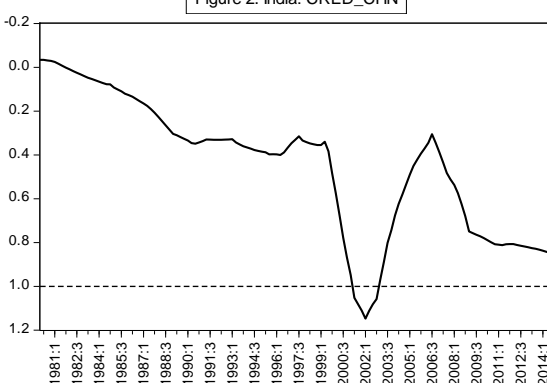Figure 2. India: CRED_CHN

Figure 3. Indonesia: CRED_CHN

Figure 4. Japan: CRED_CHN

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[13] We have not reported the results of Brunei, Cambodia, Laos, Myanmar, and Vietnam (BCLMV) to curtail the length of paper.
[14] i.e. plaza accord (1985:4), AFC (1997-98), 2001-02 bubble burst, and GFC (2008-09)
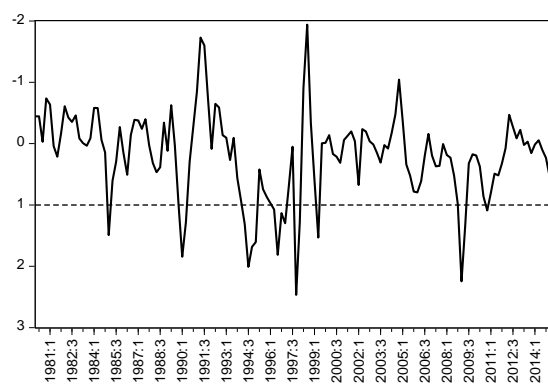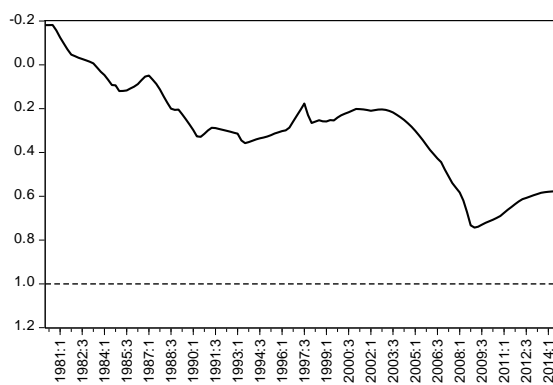
Figure 5. Korea: CRED_CHN

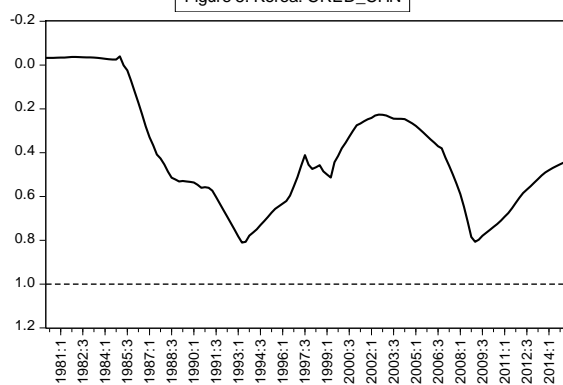
Figure 6. Malaysia: CRED_CHN
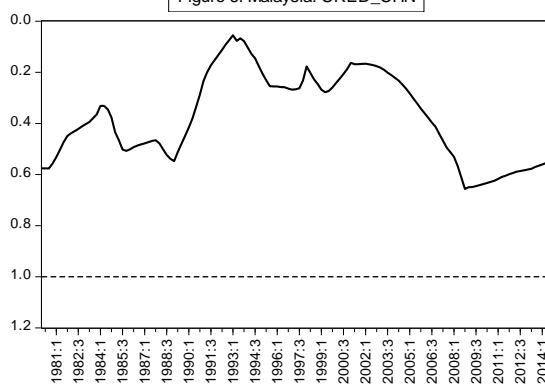

Figure 7. New Zealand: CRED_CHN
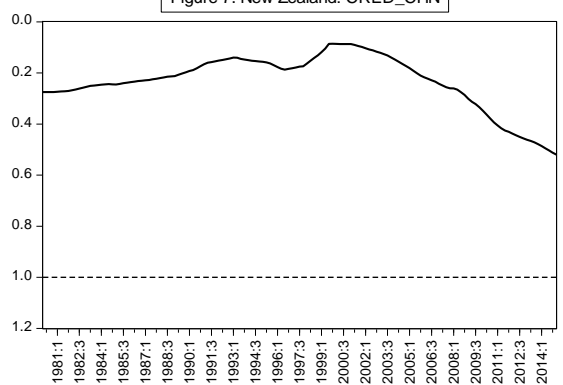

Figure 8. Philippines: CRED_CHN
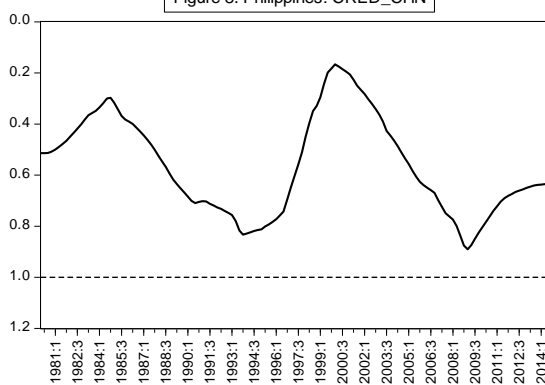

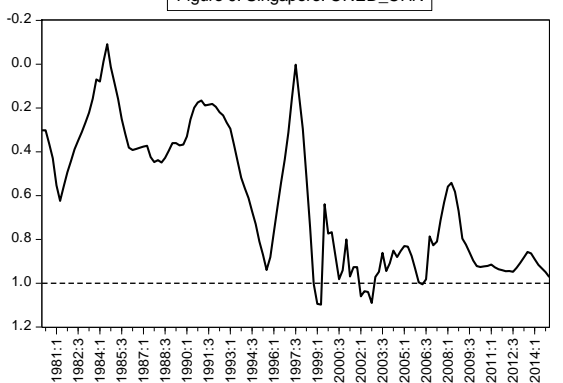Figure 9. Singapore: CRED_CHN

Figure 10. Thailand: CRED_CHN

Figure 11. Australia: CRED_JPN
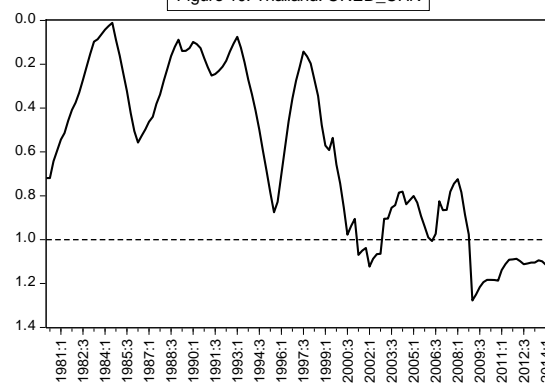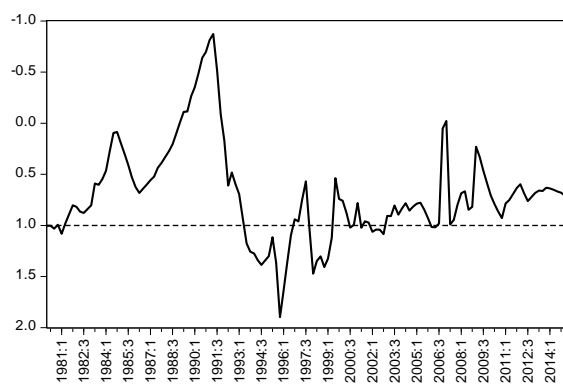

Figure 12. China: CRED_JPN

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Figure 13. India: CRED_JPN

Figure 14. Indonesia: CRED_JPN

Figure 15. Korea: CRED_JPN

Figure 16. Malaysia: CRED_JPN

Figure 17. New Zealand: CRED_JPN

Figure 18. Philippines: CRED_JPN

Figure 19. Singapore: CRED_JPN

Figure 20. Thailand: CRED_JPN

Figure 21. Australia: CRED_US
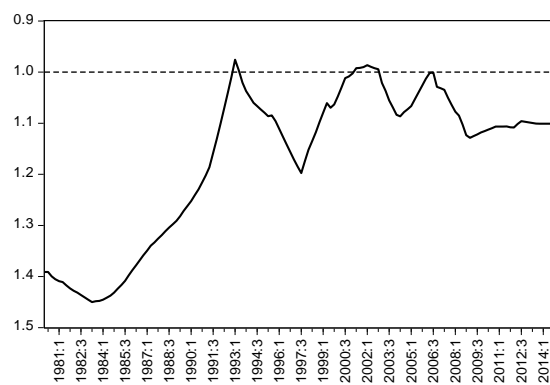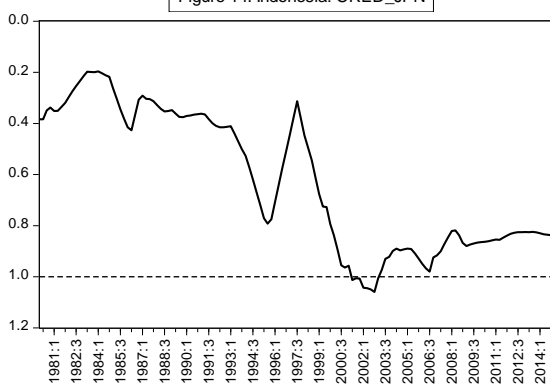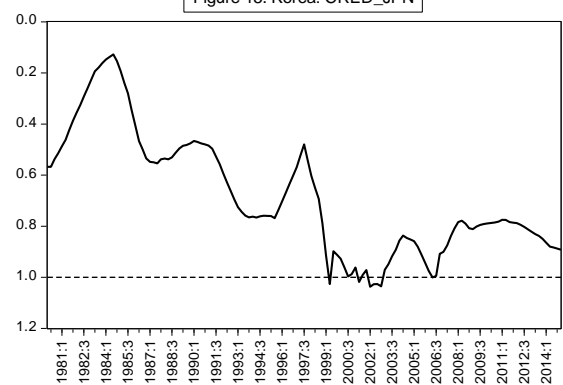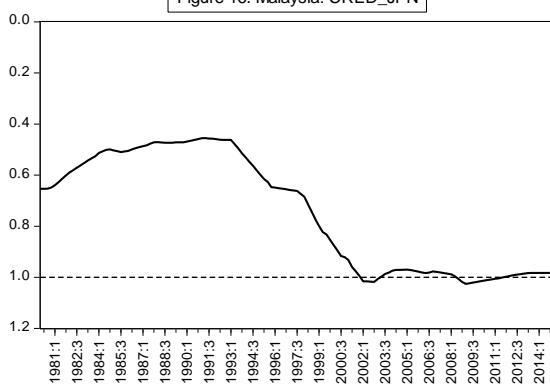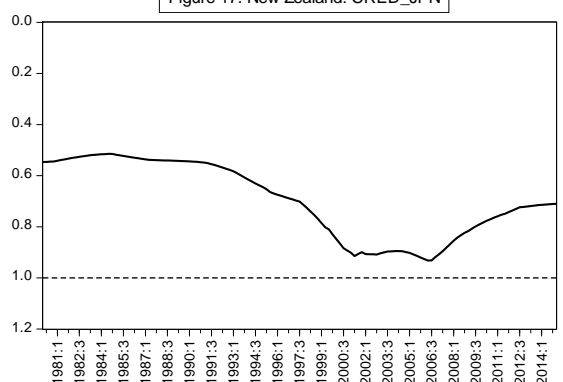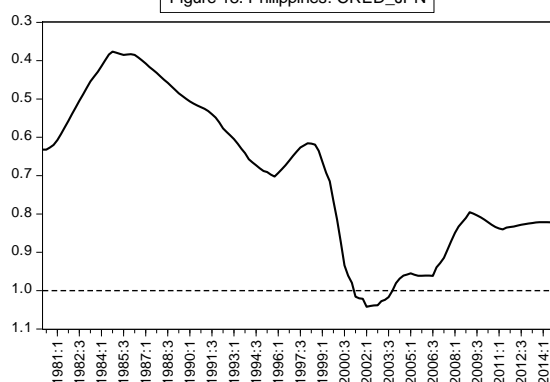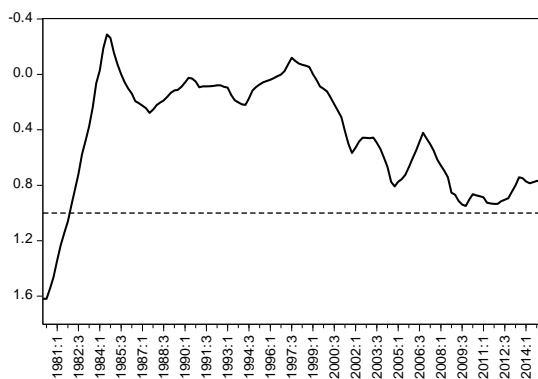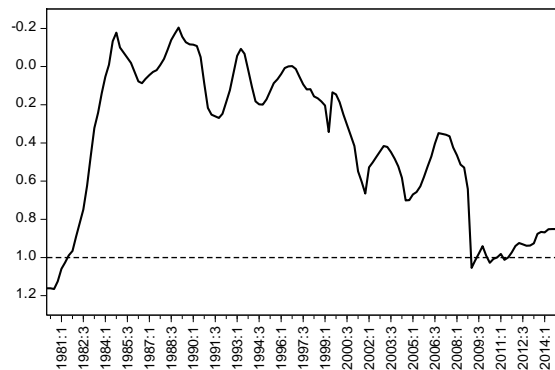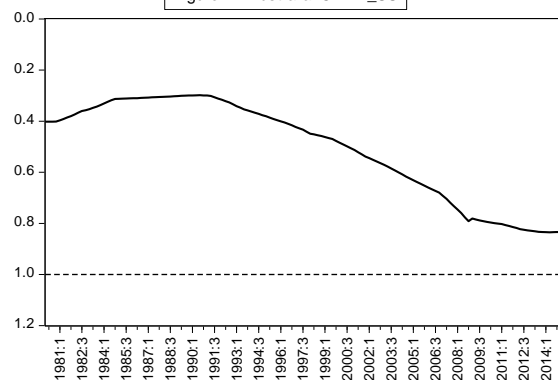

Figure 22. China: CRED_US
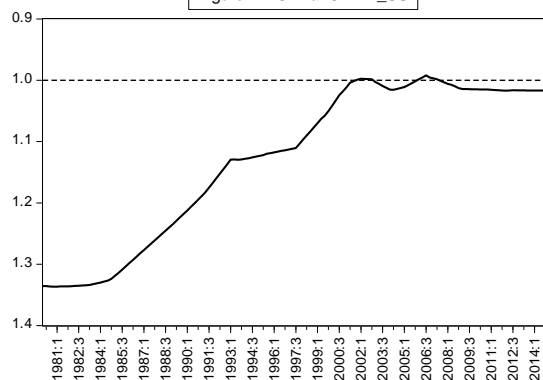

Figure 23. India: CRED_US
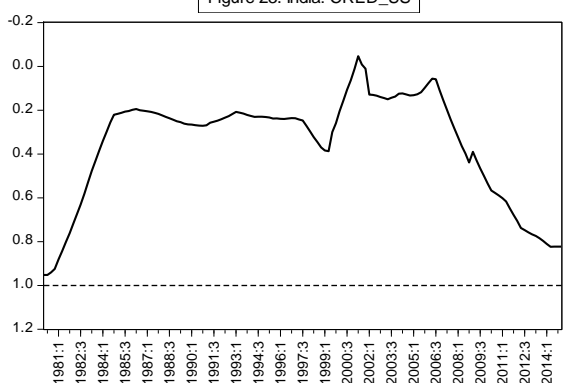

Figure 24. Indonesia: CRED_US
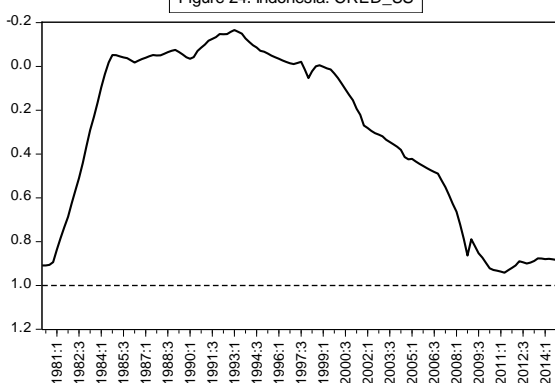

Figure 25. Japan: CRED_US
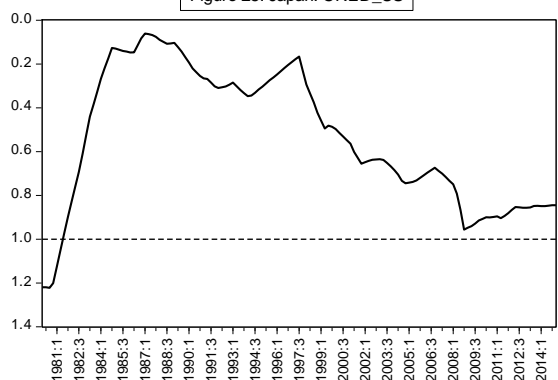

Figure 26. Korea: CRED_US
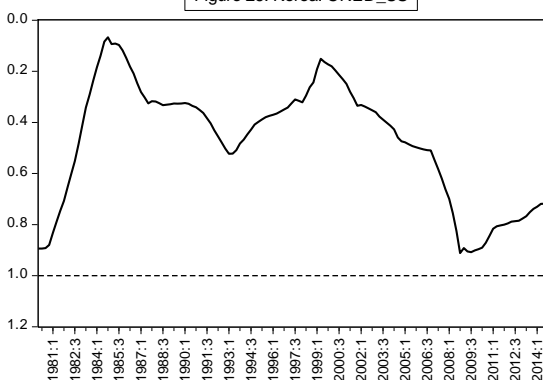

Figure 27. Malaysia: CRED_US

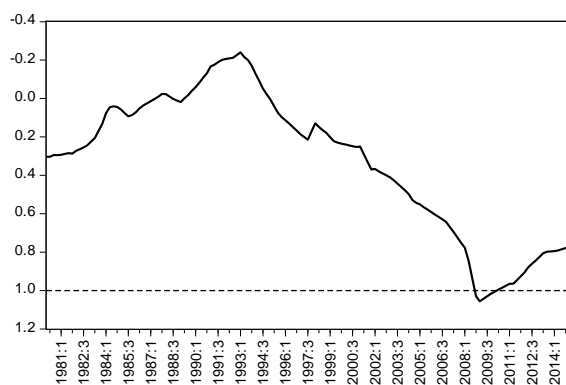

Figure 28. New Zealand: CRED_US
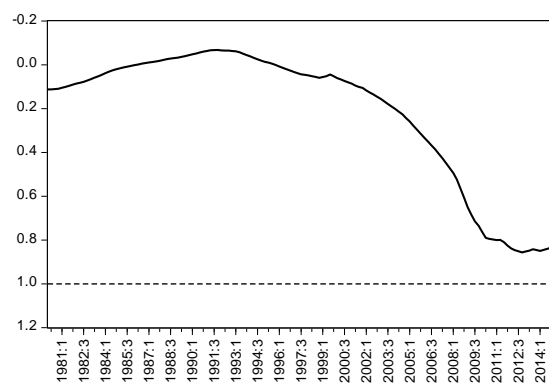
Figure 29. Philippines: CRED_US
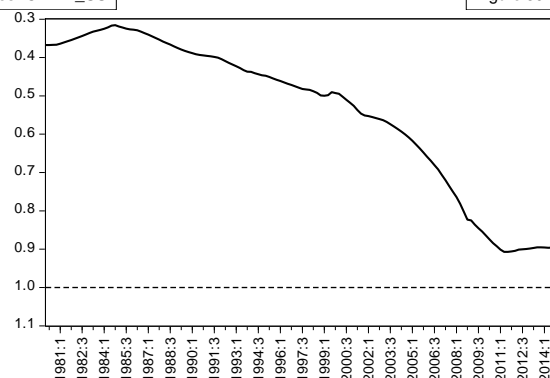

Figure 30. Singapore: CRED_US

Figure 31. Thailand: CRED_US

4.2. Idiosyncratic Monetary Policy Divergence of APSCs against Anchors

This section shows mix results against three potential anchor countries. However, we still cannot explicitly recommend any anchor for the region. To overcome this dilemma, the first difference of every β index is calculated ($\Delta\beta_i = \beta_{i,t-2} - \beta_{i,t-1}$) to compute the idiosyncratic monetary policy divergence[15] against all three countries[16]. The first difference explains us the successive in time changes that are attributed and deduced in the region against these three countries. The smaller regional divergence signifies greater acceptability of a country as a regional anchor. Figure-32 to 43 show the plots of the first difference of credibility index – regional divergence against China, Japan and USA. The regional idiosyncratic monetary policy divergence of ASEAN5 and Korea are high against China, while low against Japan and USA. Japan shows high divergence against China. The divergence of all +3 countries is lowest against the USA. The divergence of Australia, India and New Zealand are a bit high against China as compare to Japan, however, lowest against the USA. The divergence of ASEAN (with the inclusion of BCLMV) become high against Japan and USA vis-à-vis China. It indicates that ASEAN5 have more divergence against China than with the inclusion of relatively poor ASEAN countries. The choice of the unequivocal internal anchor is not clear. However, the optimal choice of anchor country could be the USA. However, the APSCs by no mean accept the external anchor especially both the China and Japan due to more political (power rivalry and disagreements) than economic issues (Park and Wyplosz 2010, Katada 2008).

4.3 Multivariate Asymmetric Effects (MAEs) of Macro-fundamentals on Credibility

It is observed with given features: (a) all macro-fundamentals are expected to influence the level of credibility asymmetrically; (b) the heteroscedasticity is considered in both states; (c) the AR terms are included to obtain white noise residuals; (d) the models are estimated with diverse lag combinations of all variables. We here explain only the results of significant estimates[17].

Against China, the mean estimates show that regime 1 (see Table-1) is highly credible for Indonesia, Korea, and New Zealand while regime 2 is highly credible for other countries. The transitions probabilities (p_{11} and p_{22}) of being in high credibility regime are persistent for most countries (between 0.57 for New Zealand to 0.95 for Philippine).

The *GDP growth* rate is significant for Indonesia, Japan, and Korea in high regime while for Indonesia, Malaysia, New Zealand, and Thailand in low regime. The positive value show increasing effect on credibility due to growing output effect. The *difference in inflation* is significant for Australia, Indonesia, Japan, Korea, Philippine and Singapore in high regime while for India, and Indonesia in low regime. The positive sign put negative effect on

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[15] Likewise Bonasia and Napolitano (2007) calculated the first difference of credibility index to find the market sentiments of pension reform in Australia and Iceland.

[16] We here mentioned only the average of different countries instead of individual countries just to save space because it takes many pages.

[17] We have not reported p/*t*-values to save space, however, the symbols *, †, ‡ show level of significance at 1%, 5% and 10% respectively.

credibility due to growing inflationary pressures. The effect of *unemployment* rate on credibility is significant for Australia, Japan, Korea, Philippine and Thailand in high regime while for Korea, New Zealand and Singapore in low regime. The positive sign of unemployment deteriorates the credibility. The *real exchange rate* effect on credibility is significant for Australia, Japan, Korea, Malaysia, Singapore and Thailand in high regime, while for Indonesia, Malaysia, and Philippines in low regime. The positive sign indicates a loss of external competitiveness. The *trade openness* effect on credibility is significant for Indonesia, Japan, Korea, Malaysia and Singapore in high regime, while for Indonesia, Malaysia, New Zealand and Singapore in low regime. The positive value enhances credibility.
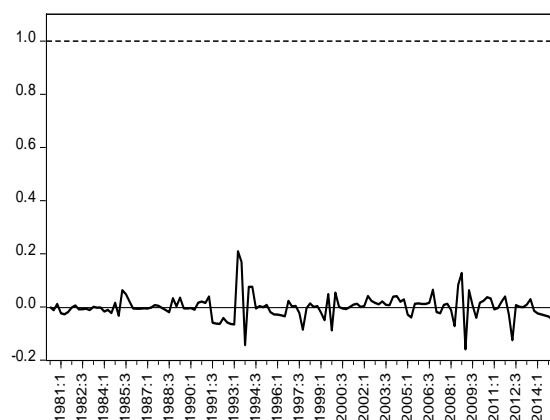
Figure 32: Idiosyncratic Divergence of ASEAN5_AMUW_CHN
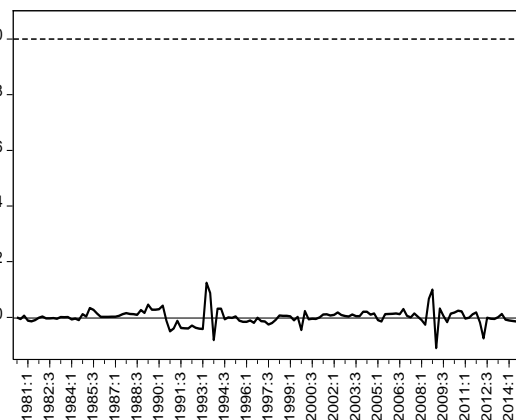
Figure 33: Idiosyncratic Divergence of ASEAN_AMUW_CHN
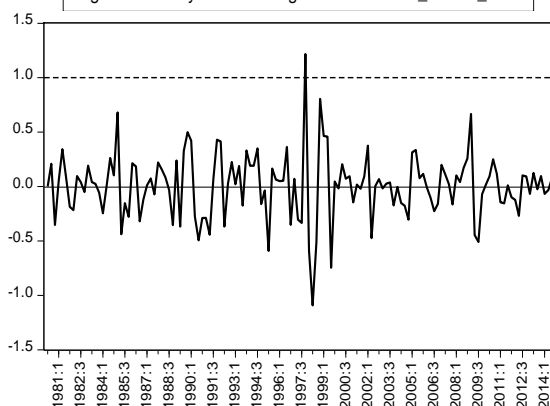
Figure 34: Idiosyncratic Divergence of JPN_KOR_AMUW_CHN
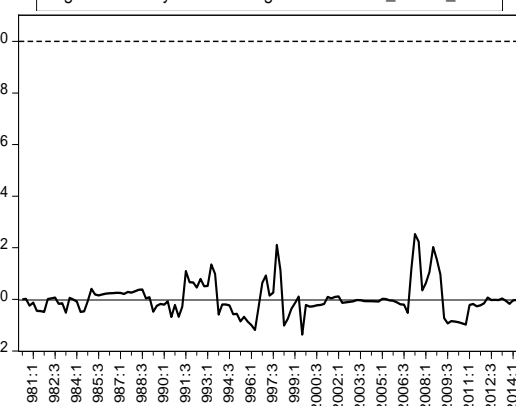
Fig 35: Idiosyncratic Divergence of AUS_NZL_IND_AMUW_CHN
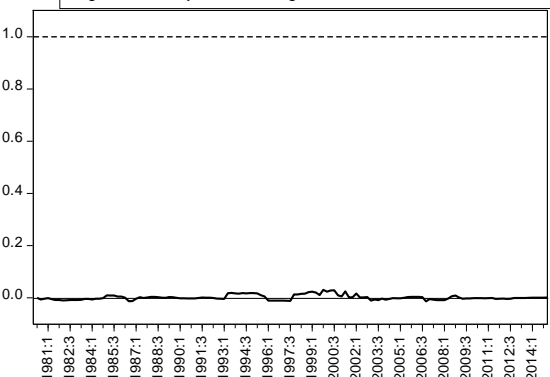
Figure 36: Idiosyncratic Divergence of ASEAN5_AMUW_JPN
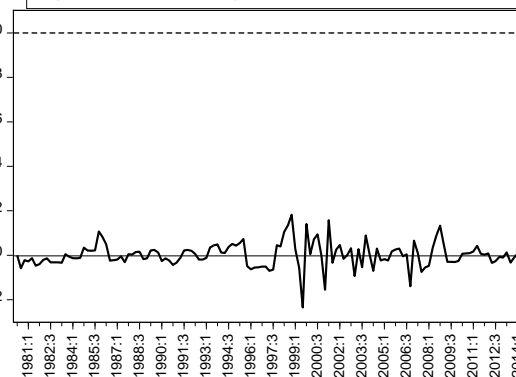
Figure 37: Idiosyncratic Divergence of ASEAN_AMUW_JPN

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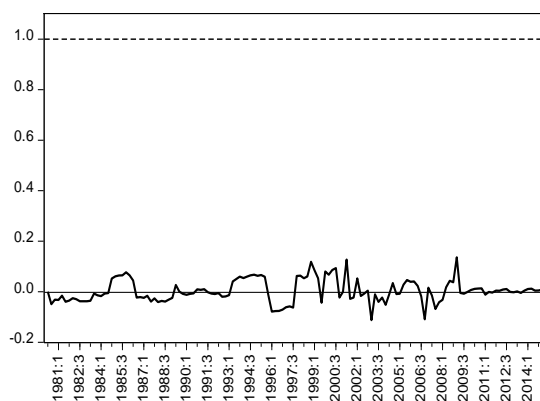
Figure 38: Idiosyncratic Divergence of CHN_KOR_AMUW_JPN
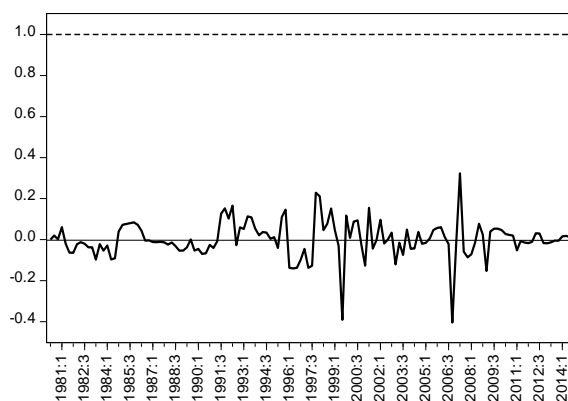
Figure 39: Idiosyncratic Divergence of AUS_NZL_IND_AMUW_JPN
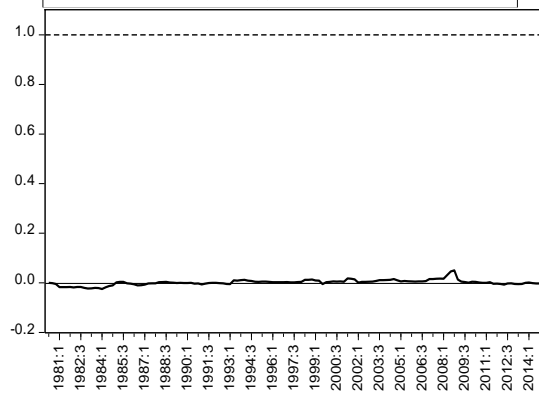
Figure 40: Idiosyncratic Divergence of ASEAN5_AMUW_US
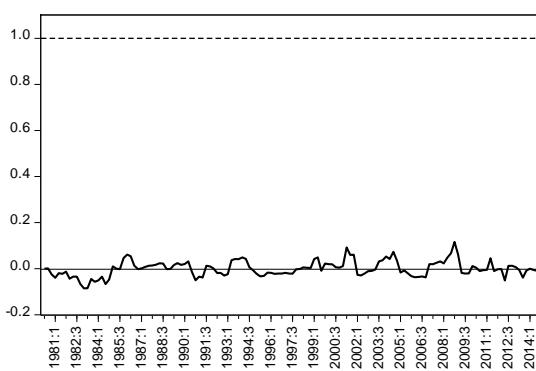
Figure 41: Idiosyncratic Divergence of ASEAN_AMUW_US
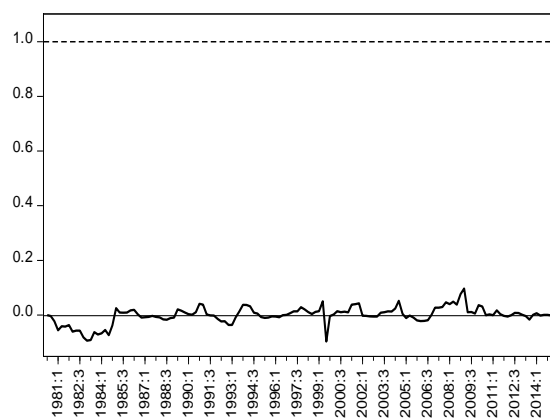
Figure 42: Idiosyncratic Divergence of CHN_JPN_KOR_AMUW_US
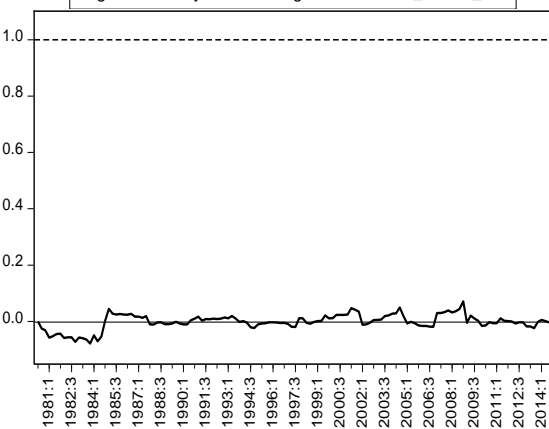
Figure 43: Idiosyncratic Divergence of AUS_NZL_IND_AMUW_US

Against Japan, the mean estimates of regime 1 (Table-2) is highly credible for India, Indonesia, Korea, and Malaysia while regime 2 is credible for other countries. The transitions probabilities are ranging from 0.59 for Korea to 0.95 for Malaysia. The effect of *GDP growth rate* on credibility is significant for Indonesia and China in high regime while Australia, China, India and New Zealand in low regime. GDP is mostly significant in low regime. The *difference in inflation* is significant for Australia, Indonesia, Korea, Philippines and Thailand in high regime, while for Malaysia, and Philippines in low regime. The positive sign reduce credibility due to growing inflationary pressures. The effect of *unemployment rate* on credibility is significant only for Malaysia in both regimes. The positive sign indicates that Malaysia is experiencing tough monetary policies to enhance credibility against Japan. The *real exchange rate* is significant for Korea in high regime, while for Australia, Korea, New Zealand, Singapore and Thailand in low regime. The positive value indicates a loss of external competitiveness. *Trade openness* is significant for Korea, Malaysia, New Zealand and Thailand in high regime, while for China, India, and Thailand in low regime. The positive value enhances credibility.

Table-1: MAEs of MRS Results against China

Parameters	ASEAN5					+ 3		+ 3		
	IDN	MYS	PHL	SGP	THA	JPN	KOR	AUS	IND	NZL
β_{t-1}	1.873*	1.988*	1.872*	2.010*	1.923*	1.884*	0.869*	1.987*	1.672*	1.985*
β_{t-2}	-0.883*	-0.991*	-0.881*	-1.011*	-0.931*	-0.896*	-0.302*	-0.999*	-0.682*	-0.978*
Regime 1										
$\phi_{0,1}$	0.023	0.005*	0.045*	0.004	0.004‡	0.008†	0.039*	0.003	0.044	0.002
ΔGDPg						0.025	0.053*			
$\Delta GDPg_{t-1}$								-0.014	0.004	-0.002
$\Delta GDPg_{t-2}$	0.002*	0.003†		0.505						
$\Delta GDPg_{t-3}$			0.245		0.018†					
ΔP						0.002		-0.966	-0.003‡	
ΔP_{t-1}			0.003							
ΔP_{t-2}		0.002			0.017		-0.109*			0.008
ΔP_{t-3}	0.011*			-0.395						
ΔREER	-40.89		0.019‡					-0.003	1.516	0.002
$\Delta REER_{t-1}$							0.011*			
$\Delta REER_{t-2}$		-0.002‡			1.531					
$\Delta REER_{t-3}$				-0.003		0.950				
Δtopen		-0.555			-0.001	0.019	0.040*		0.052	
$\Delta topen_{t-1}$	0.007*							0.004		0.004
$\Delta topen_{t-2}$			0.226	0.655‡						
ΔUN			-0.845				-0.251*			
ΔUN_{t-1}		-0.00			0.00	-0.00		0.014		-0.031
ΔUN_{t-3}				-0.008†						
σ_1^2	0.098*	0.906*	1.806*	1.105*	1.504*	0.506*	0.025*	1.504*	2.204*	1.504*
P11	0.929	0.805	0.953	0.687	0.699	0.826	0.454	0.688	0.888	0.567
Regime 2										
$\phi_{0,2}$	0.076‡	0.006‡	0.022‡	5.106	0.006*	0.007‡	0.155†	0.005‡	0.014*	0.027†
ΔGDPg						-0.071‡	-0.034			
$\Delta GDPg_{t-1}$								-0.002	-0.019	0.004*
$\Delta GDPg_{t-2}$	-0.029†	0.013		-3.005						
$\Delta GDPg_{t-3}$			-0.022		-6.105					
ΔP						-0.027*		-0.007*	0.009	
ΔP_{t-1}			0.025*							
ΔP_{t-2}		0.008			-0.005		0.066			-0.002
ΔP_{t-3}	-0.007‡			-0.002†						
ΔREER	1783.3‡		0.061					0.012†	-6.820	0.014
$\Delta REER_{t-1}$							-0.014			
$\Delta REER_{t-2}$		0.012‡			0.361*					
$\Delta REER_{t-3}$				-0.805†		0.016‡				
Δtopen		0.096†			-1.905	0.026‡	0.057		0.004	
$\Delta topen_{t-1}$	-0.099‡							4.015		-0.002†
$\Delta topen_{t-2}$			-0.024	-0.876‡						
$\Delta topen_{t-3}$										
ΔUN			0.026†				0.253‡			

	IDN	MYS	PHL	SGP	THA	CHN	KOR	AUS	IND	NZL
ΔUN_{t-1}		0.013			0.017*	-0.033‡		-0.007‡		0.024†
ΔUN_{t-3}				1.905						
σ_2^2	0.008*	0.003*	0.002*	1.107*	1.506*	0.804*	0.292*	1.906*	0.042*	2.906*
P22	0.582	0.708	0.952	0.627	0.843	0.672	0.801	0.872	0.860	0.744
Diagnostics										
DW-stat	2.297	2.052	2.237	2.034	1.933	2.100	2.121	2.260	1.731	2.283
Q(2)	9.353*	4.491	0.337	1.168	2.896	1.930	1.736	2.969	0.440	2.601
Q(4)	11.57†	5.256	1.773	5.986	7.437	9.3665‡	2.043	3.328	0.786	9.341†

Table-2: MAEs of MRS Results against Japan

Parameters	ASEAN5					+3		+3		
	IDN	MYS	PHL	SGP	THA	CHN	KOR	AUS	IND	NZL
β_{t-1}	1.663*	1.749*	1.832*	1.837*	1.902*	1.841*	1.849*	1.638*	1.416*	1.855*
β_{t-2}	-0.676*	-0.751*	-0.842*	-0.841*	-0.906*	-0.851*	-0.850*	-0.642*	-0.426*	-0.868*
Regime 1										
$\phi_{0,1}$	0.016*	0.005	0.014	0.028†	0.014	0.012†	-0.027‡	0.065	0.023	0.004
$\Delta GDPg$										-0.008*
$\Delta GDPg_{t-1}$						-0.052†	-0.063	0.056†	0.016	
$\Delta GDPg_{t-2}$		-0.009		-7.06	2.405					
$\Delta GDPg_{t-3}$	-0.003†		0.016							
ΔP						0.006	0.078*	0.007†	0.024	
ΔP_{t-1}		0.013	0.012	-0.002	0.004*					
ΔP_{t-2}										-0.001
ΔP_{t-3}	0.004*									
$\Delta REER$		-0.001	2.106			0.008			-32.626‡	
$\Delta REER_{t-1}$	-11.83						0.064†	-0.008		-0.006‡
$\Delta REER_{t-3}$				-0.011‡	-0.233*					
$\Delta topen$		0.019*						0.004	0.0209	
$\Delta topen_{t-1}$					8.905†	0.012‡				
$\Delta topen_{t-2}$	2.305		-5.206	0.001			0.021†			0.028
ΔUN						-0.048	-0.023	-0.024		-0.012
ΔUN_{t-2}		-0.026†	0.005	-0.003						
ΔUN_{t-3}					-0.005					
σ_1^2	1.406	0.007	5.005	2.105	2.206	5.204	0.0018	0.0004	0.0906	6.005
P11	0.914	0.923	0.8718	0.090	0.850	0.934	0.594	0.961	0.909	0.901
Regime 2										
$\phi_{0,2}$	0.016*	0.019	5.105	0.024*	0.001	0.069	0.002	0.048	0.013	0.015
$\Delta GDPg$										0.055
$\Delta GDPg_{t-1}$						0.0347‡	0.008	0.039	0.0047‡	
$\Delta GDPg_{t-2}$		0.019		-1.105	0.005					
$\Delta GDPg_{t-3}$	0.001		-1.905							
ΔP						0.016	-0.001	0.068	0.043	
ΔP_{t-1}		0.025*	8.305‡	-0.705	-0.0013					
ΔP_{t-2}										0.006
ΔP_{t-3}	-5.505									

Parameters	IDN	MYS	PHL	SGP	THA	CHN	JPN	KOR	AUS	IND	NZL
$\Delta REER$		0.205	0.305			0.082				6.8216†	
$\Delta REER_{t-1}$	93.832							0.087*	-0.013†		-0.004
$\Delta REER_{t-3}$				0.105	-0.176						
$\Delta topen$		0.505						0.0142	-0.069†		
$\Delta topen_{t-1}$					-0.005‡	0.039					
$\Delta topen_{t-2}$	0.002		-0.650	0.76			0.002				0.098‡
ΔUN							0.182	0.034	0.015		-0.015
ΔUN_{t-2}		0.009*	-0.001	5.205							
ΔUN_{t-3}					-0.005						
σ_2^2	0.905	0.705	0.007	0.007	0.204	0.091	0.002	0.014	0.025		0.045
P22	0.932	0.946	0.904	0.909	0.743	0.852	0.939	0.936	0.939		0.587
Diagnostics											
DW-stat	2.064	2.174	2.197	2.279	2.331	2.494	2.176	2.734	2.215		2.492
Q(2)	0.254	0.355	0.475	0.517	1.071	3.384	3.049	2.876	4.490		5.787‡
Q(4)	3.141	0.369	0.942	4.402	1.204	5.902	4.369	5.158	4.564		6.291

Against USA, the mean estimates show that regime 1 (Table-3) is highly credible for Australia, Korea, and Thailand while regime 2 is credible for other countries. The transitions probabilities are ranging from 0.57 for China to 0.94 for Korea. The effect of *GDP growth rate* on credibility is significant for Australia, Japan, Malaysia, Philippine and Singapore in high regime, while China, India, Japan, Korea, Malaysia, New Zealand and Thailand in low regime. The GDP growth rate has significant impact on credibility in low regime for most countries. The *difference in inflation* is significant for China, Japan, and Philippine in high regime while for India, Korea, Malaysia and New Zealand in low regime. The positive value indicates inflationary pressures. The effect of *unemployment rate* on credibility is for Australia, Philippine and Singapore in high regime while for China, Korea, and Malaysia in low regime. The positive value indicates weakening credibility. The *real exchange rate* effect on credibility is significant for Philippine and Thailand in high regime, while for Japan, Korea, and Thailand in low regime. The positive sign indicates a loss of external competitiveness. The effect of openness on credibility is for Australia, China, Indonesia, Japan, New Zealand, Philippine, and Singapore in high regime, while for India, Korea, and Malaysia in low regime. It is mostly significant in high regime.

Table-3: MAEs of MRS Results against USA

Parameters	ASEAN5					+ 3			+ 3		
	IDN	MYS	PHL	SGP	THA	CHN	JPN	KOR	AUS	IND	NZL
β_{t-1}	1.915*	1.985*	1.939*	2.013*	1.885*	1.664*	1.937*	1.645*	1.809*	1.965*	1.855*
β_{t-2}	-0.924*	-0.996*	-0.948*	-1.024*	-0.895*	-0.672*	-0.945*	-0.657*	-0.818*	-0.975*	-0.865*
Regime 1											
$\phi_{0,1}$	0.008	0.035*	0.005	0.001	0.205	0.037	0.004	0.002‡	0.003	0.002	0.006*
$\Delta GDPg$		0.028*				0.031			0.003‡		
ΔGDP_{t-2}	-0.013	-0.006*		-2.405			0.003‡	0.004			0.005†
ΔGDP_{t-3}					0.004					-0.014‡	
ΔP		0.010†	0.005†			0.007	0.205	0.006	-0.008		
ΔP_{t-1}				0.002	0.009						-0.008‡
ΔP_{t-2}	-0.026										

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
ΔP_{t-3}										0.035*	
ΔREER			0.035†			-0.002					
$\Delta REER_{t-1}$								0.005*	-0.003		-0.003
$\Delta REER_{t-2}$		0.023		-0.001	0.915*					1.262	
$\Delta REER_{t-3}$	1713.7						0.014†				
Δtopen_t			-0.038*			-0.905	-0.024†	0.002	-0.027*		-0.002
$\Delta topen_{t-1}$	0.003		-3.15*	-0.002							
$\Delta topen_{t-2}$		0.092*									
$\Delta topen_{t-3}$										-0.029*	
ΔUN		-0.133*	0.012*			0.142†		-0.006	-0.006†		
ΔUN_{t-1}			0.605								0.015
ΔUN_{t-2}					0.006		-0.002				
σ_1^2	0.086*	0.003*	0.304*	0.207*	1.305*	0.009*	0.606*	0.905*	0.005*	0.605*	0.405*
P11	0.655	0.095	0.325	0.872	0.715	0.959	0.836	0.939	0.649	0.194	0.929
Regime 2											
$\phi_{0,2}$	0.003	0.002	0.044	-0.003	0.005	0.054†	-0.013‡	0.012†	0.078	0.004	0.035
ΔGDPg			0.366			-0.137*			-0.014		
ΔGDP_{t-2}	-0.006	0.007		-0.008*			-0.075†	-0.016*			-0.205
ΔGDP_{t-3}						-0.805†			-1.505		
ΔP		-0.009	0.053			-0.074*	-0.057*	-0.010†	0.043		
ΔP_{t-1}			0.405	0.940							0.059
ΔP_{t-2}	-0.004										
ΔP_{t-3}									-0.405		
ΔREER			0.016			0.016					
$\Delta REER_{t-1}$								0.012†	0.005		0.021
$\Delta REER_{t-2}$		0.003		0.007	-0.066‡					0.022	
$\Delta REER_{t-3}$	34.51						-0.018				
Δtopen			0.705			-0.024*	0.058*	0.008*	0.044‡		0.071*

$\Delta topen_{t-1}$	-0.005‡			0.002†	-0.106						
$\Delta topen_{t-2}$		-0.905									
$\Delta topen_{t-3}$											-0.605
ΔUN		-0.008	0.042			0.018				-0.016*	0.0113
ΔUN_{t-1}				-0.022†							0.025
ΔUN_{t-2}					0.013		-0.013				
σ_2^2	0.905*	0.105**	0.405**	0.205**	0.407**	0.022*	0.011*	0.001*	0.014*	0.707*	0.005*
P22	0.900	0.882	0.878	0.756	0.904	0.566	0.474	0.609	0.749	0.929	0.604
Diagnostics											
DW-stat	2.267	1.816	1.966	2.097	2.442	2.169	2.741	2.432	1.967	2.589	2.249
Q(2)	0.342	2.045	5.777‡	0.137	2.285	2.156	7.669†	4.506	0.947	18.03†	0.707
Q(4)	13.016†	2.950	9.501‡	5.361	6.648	3.495	10.78†	7.168	3.646	18.04‡	1.931

4.4. Asymmetric Effects of Macro-fundamentals on TVTPs

It is considered that when an economy is in a low credibility regime, it indicates worsening of macroeconomic fundamentals which may possibly lengthen the probability of staying in the low credibility regime. In contrast when an economy is in a high credibility regime, the deterioration of macroeconomic fundamentals perhaps lowers the probability of remaining in the high credibility regime (Sarantis and Piard 2004). The given explanation is only of significant variables.

Against China, the mean estimates (Table-4) show that regime 1 is highly credible for Australia, India, Indonesia, Japan, Malaysia, New Zealand, Philippine, and Thailand while regime 2 is credible other countries. The *GDP growth* rate effect on TVTPs is significant for Australia, India, Korea, Malaysia and New Zealand in high regime whereas it is significant for Japan, Korea and Thailand in low regime. In comparison with the multivariate MRS model, GDP of Japan, New Zealand and Thailand impacts the level of credibility while of Australia, India, Korea, and Malaysia it causes switching between the two regimes. The negative GDP decrease the probability of remaining in high credibility regime.

The *changes in inflation* effect TVTPs significantly in Australia, India, Indonesia, Malaysia and Philippine in high regime, whereas in low regime it is significant for Australia, India, and Japan. In Indonesia, and Philippine inflation effects level of credibility while in Australia, India, Japan, and Malaysia, it causes shifts in both regimes. The negative sign shows that increase of inflation reduce the probability of remaining in a regime. The *unemployment* impact on TVTPs is significant only in New Zealand in high credibility regime and influence on the level of credibility. The *exchange rate* effects on TVTPs are significant for Korea and New Zealand in the high credibility regime, while for Japan, Korea, Malaysia, and Singapore in low credibility regime. The exchange rate of Japan, Malaysia, New Zealand and Singapore cause switching in two regimes, while of Korea it depends on the level of credibility. The *trade openness* influence the TVTPs significantly in Indonesia, Philippine, and Thailand in high regime, while Australia, Japan, Korea, Malaysia, Singapore, Thailand, in low regime. In comparison with the multivariate MRS model, the openness causes the switching in the regimes of the credibility of all countries except Japan. The positive sign of openness increase the probability of remaining in high credibility regime.

Table-4: Multivariate TVTPs Results against China

Parameters						+3			+3	
	IDN	MYS	PHL	SGP	THA	JPN	KOR	AUS	IND	NZL
β_{t-1}	1.912*	1.953**	1.928**	1.976**	1.945**	1.908**	0.767**	1.986**	1.724**	2.019**

β_{t-2}	-0.921*	-0.957**	-0.934*	-0.986*	-0.951*	-0.919*	-0.265*	-0.989*	-0.740*	-1.122*
Regime 1										
$\phi_{0,1}$	0.033†	0.405†	0.015†	0.002‡	0.018	0.011‡	0.212‡	0.002‡	0.059†	0.029†
σ_1^2	0.001*	0.004*	0.003*	0.505*	0.002*	0.206*	0.588*	0.906*	0.043*	0.008*
P11ΔGDP$_{t-1}$		0.435‡		0.032						
P11ΔGDP$_{t-2}$			1.705		0.071		-2.025†	0.998†	-1.189‡	
P11ΔGDP$_{t-3}$	0.447				0.114	-0.628‡				
P11ΔP					-0.147					
P11ΔP$_{t-1}$		1.071†								-0.234
P11ΔP$_{t-2}$	1.104‡	1.274‡				-0.546			0.863‡	
P11ΔP$_{t-3}$							-0.978	-3.470*		
P11ΔREER		-0.280				0.171	0.285			
P11ΔREER$_{t-1}$	31286.7			-0.767†						
P11ΔREER$_{t-2}$							0.331†			-0.803‡
P11Δtopen				0.155‡					-0.241	
P11Δtopen$_{t-1}$		0.203‡				1.405				
P11Δtopen$_{t-2}$	-0.714†	-0.173					0.626†	0.422		
P11Δtopen$_{t-3}$				-0.124‡						
P11ΔUN$_{t-1}$				-0.423		-3.884				
P11ΔUN$_{t-2}$										-8.628‡
Regime 2										
$\phi_{0,2}$	0.034†	0.018*	0.032*	0.806	0.045*	0.013†	0.069†	0.006	0.053†	0.020‡
σ_2^2	0.014*	0.506*	0.106*	0.307*	0.606*	0.008*	0.046*	0.002*	0.004*	0.106*
P21-C	-0.151	-2.173*	-22.72	-134.01	-1.558†	-2.185†	-5.376‡	-0.4786	-10.72†	-1.875*
P21ΔGDP$_{t-1}$		0.113		-36.59						
P21ΔGDP$_{t-2}$			2.815			-1.493†		0.391	1.353‡	0.277
P21ΔGDP$_{t-3}$	-0.473				-0.852†	2.107‡				

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
P21ΔP					0.818					
P21ΔP$_{t-1}$			6.405							0.609
P21ΔP$_{t-2}$	-0.068	-1.988‡				-4.502‡			3.268†	
P21ΔP$_{t-3}$								3.424	2.443‡	
P21ΔREER		0.472†				-0.325†			0.343	
P21ΔREER$_{t-1}$	76511.9		116.19							
P21ΔREER$_{t-2}$								-0.841‡		-0.198
P21Δtopen					-0.177‡				-0.343	
P21Δtopen$_{t-1}$			-1.694			5.832†				
P21Δtopen$_{t-2}$	0.044	0.092‡						-0.2670	-0.834‡	
P21Δtopen$_{t-3}$			13.81							
P21ΔUN$_{t-1}$			33.83			-1.344				
P21ΔUN$_{t-2}$										1.369
Diagnostics										
DW-stat	2.527	2.103	2.289	2.031	1.769	2.156	1.878	2.294	1.767	2.265
Q(2)	7.621†	0.755	0.271	1.259	0.327	2.192	0.382	1.031	2.461	1.007
Q 4)	9.973†	6.500	2.604	6.936	3.688	8.089	0.929	1.164	2.489	1.725

Figure-44 to 53 show the high credibility state TVTPs of all ASEAN+3+3 countries against China. It is apparent that the macroeconomic variables bring many veers in the TVTPs. Indian TVTPs of high credible state are mostly stable but wane due to slump in late 1980s and early 1990s as well as during Southern Europe crises. Indonesia and Japan show volatility clustering in TVTPs during AFC and GFC, while Korea shows it in late 1980s and early 1990s as well as during AFC and GFC. The TVTPs of Malaysia, New Zealand, Philippine, Singapore and Thailand also show many veers in the high credible state, it indicates that likelihood of switching is high from tranquil regime to a crisis regime and vice versa.
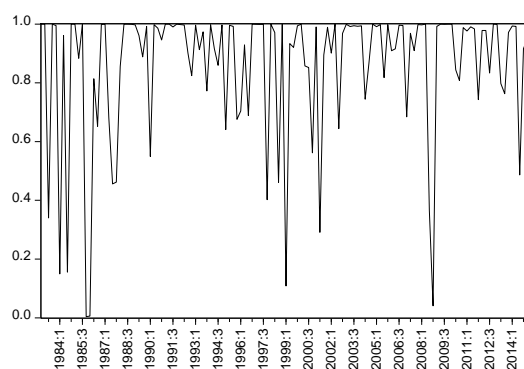

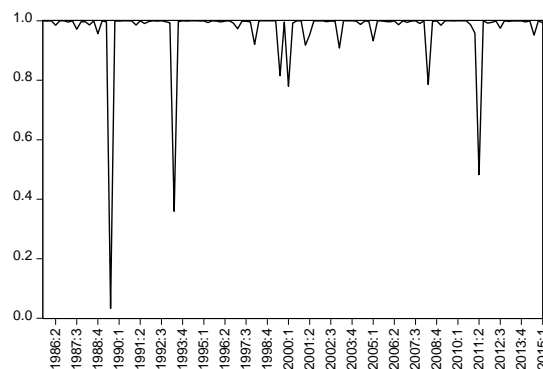Fig 44: Multivariate TVTPs of the High Credible State: Australia_CHN

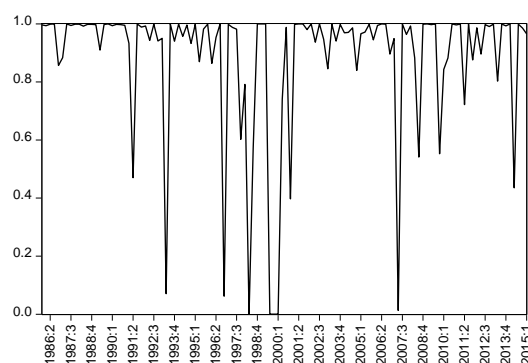Fig 45: Multivariate TVTPs of the High Credible State: India_CHN

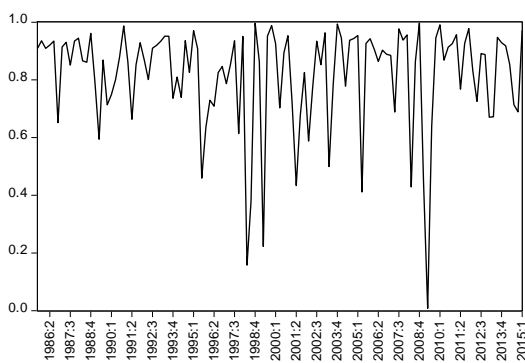Fig 46: Multivariate TVTPs of the High Credible State: Indonesia_CHN

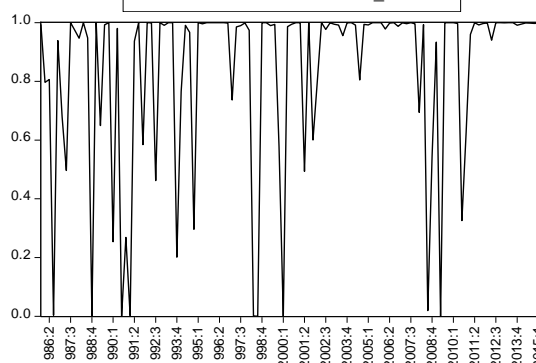Fig 47: Multivariate TVTPs of the High Credible State: Japan_CHN

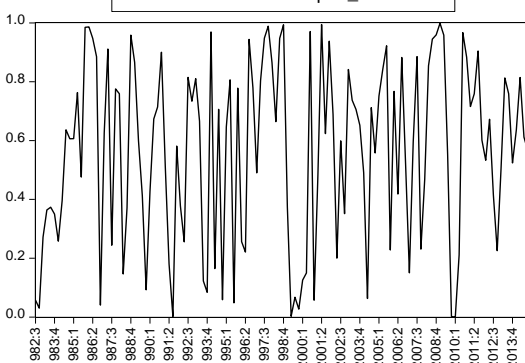Fig 48: Multivariate TVTPs of the High Credible State: Korea_CHN

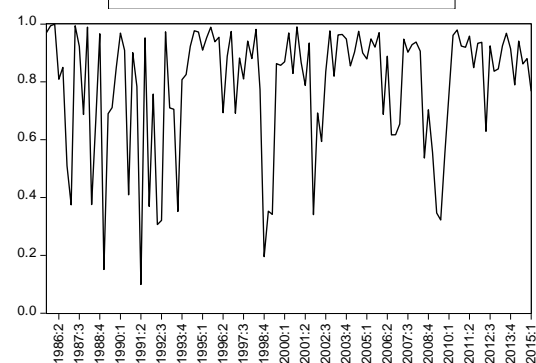Fig 49. Multivariate TVTPs of the High Credible State: Malaysia_CHN

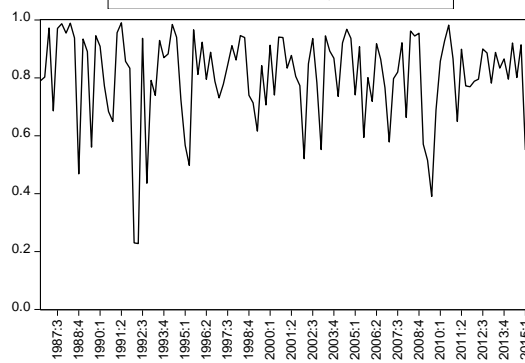Fig 50: Multivariate TVTPs of the High Credible State: New Zealand_CHN

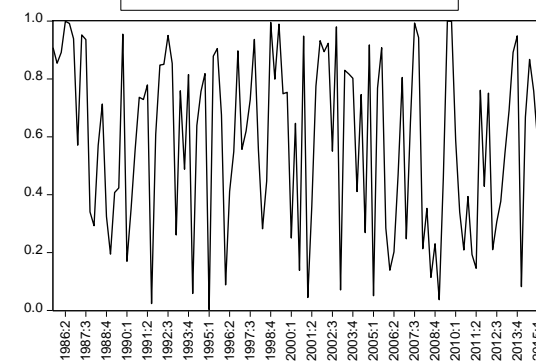Fig 51: Multivariate TVTPs of the High Credible State: Philippines_CHN

Fig 52. Multivariate TVTP of the High Credible State: Singapore_CHN
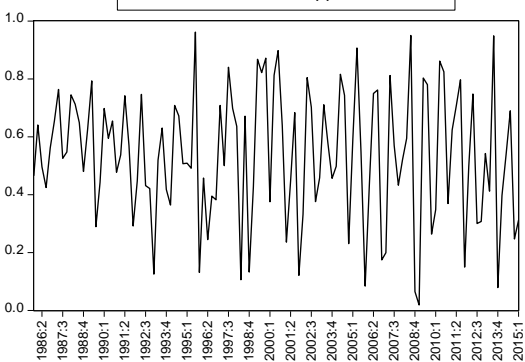
Fig 53. Multivariate TVTPs of the High Credible State: Thailand_CHN

Against Japan, the mean estimates (Table-5) show that regime 1 is highly credible for India, Indonesia, Malaysia, and Singapore while regime 2 is credible for other countries. The *GDP growth* rate effect on TVTPs is only significant for Korea (-3.2925, 5%) in low regime and depends on the level of credibility. The *change in inflation* is significant for Australia, China, India, and New Zealand in high regime, while for Australia, China, and Philippine in low regime. The inflation in all these countries causes switching between two regimes. The negative sign shows that increase of inflation reduce the probability of remaining in a regime. The *unemployment* effect on

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TVTPs is significant for Singapore in high regime while for Korea in low regime. Singapore unemployment causes shifts between two credibility regimes, while for Korea it affects just level of credibility. The *real exchange rate* effect on TVTPs is significant for Malaysia and Philippine in high regime while for Australia, China, Korea, New Zealand, and Philippine in low regime. The exchange rate of Australia, Malaysia, New Zealand and Philippine cause the switching in the regimes of the credibility, while for China, and Korea it depends on the level of credibility. The effect of *trade openness* on TVTPs is significant for India, Malaysia, and Thailand in high regime while for China, Korea and Philippine in low regime. The openness causes the switching in the regimes of the credibility of all countries. The positive sign of openness increase the probability of remaining in high credibility regime.

Table-5: Multivariate TVTPs Results against Japan

Parameters	ASEAN5					+3		+3		
	IDN	MYS	PHL	SGP	THA	CHN	KOR	AUS	IND	NZL
β_{t-1}	1.707*	1.674*	1.972*	1.982*	1.868*	1.872*	1.835*	1.909*	1.255*	1.876*
β_{t-2}	-0.719*	-0.689**	-0.982*	-0.992*	-0.872*	-0.880*	-0.839*	-0.984*	-0.265*	-0.884*
Regime 1										
$\phi_{0,1}$	0.013*	0.062†	0.003	-0.605†	0.025*	0.013†	0.004†	0.007‡	0.031†	0.009
σ_1^2	0.001*	-3.559*	0.107*	0.805*	0.002*	0.010*	0.805*	0.504*	0.045*	0.305*
P11-C	3.239†	4.708*	6.863†	-0.287	2.586†	2.866†	5.054†	3.344*	4.783*	3.773*
P11ΔGDPg							-3.293†			
P11ΔGDP$_{t-1}$		-0.496*						0.063	-0.168	
P11ΔGDP$_{t-2}$			0.501	0.239						-0.097
P11ΔGDP$_{t-3}$	0.472				0.374					
P11ΔP										
P11ΔP$_{t-1}$	0.038		-1.602†			1.343‡				
P11ΔP$_{t-2}$					-0.334			1.599†	-0.911‡	0.589
P11ΔP$_{t-3}$		-2.295*		3.539			1.695			
P11ΔREER	-21484.6	0.136*								
P11ΔREER$_{t-1}$				-0.592		0.407			209.8	0.575†
P11ΔREER$_{t-2}$								0.293‡		
P11ΔREER$_{t-3}$			-0.606‡				0.562†			
P11Δtopen								-0.386		
P11Δtopen$_{t-1}$	-0.196	0.104	-0.809†	-0.129						

P11Δtopen$_{t-2}$					0.046	-0.023				
P11Δtopen$_{t-3}$							-0.718‡		-0.524‡	
P11ΔUN$_{t-1}$					1.429	15.98				
P11ΔUN$_{t-2}$				1.495‡			-4.399‡			
Regime 2										
$\phi_{0,2}$	0.013*	0.003‡	0.106†	0.002	0.022†	0.065‡	0.014*	0.058†	0.011†	0.026†
σ_2^2	0.706	0.213*	0.105*	0.607*	0.406*	0.004*	0.018*	0.026*	0.116*	0.045*
P21-C	-3.832‡	-12.55*	-1.632‡	-1.279*	-5.628*	-5.244†	-131.3	2.557†	-11.43	-1.063
P21ΔGDPg							88.101			
P21ΔGDP$_{t-1}$		2.957*					-0.789	2.404		
P21ΔGDP$_{t-2}$			-0.826	-0.115						0.405
P21ΔGDP$_{t-3}$	-0.859				0.117					
P21ΔP										
P21ΔP$_{t-1}$	0.782		-0.191			-0.754‡				
P21ΔP$_{t-2}$					-0.220			-4.316†	2.194	-0.838‡
P21ΔP$_{t-3}$		2.369*		0.638			-8.589			
P21ΔREER	7685.5	-1.484*								-0.2188 (0.3956)
P21ΔREER$_{t-1}$				-0.053		0.543‡			266.62	
P21ΔREER$_{t-2}$								-0.401		
P21ΔREER$_{t-3}$			0.373‡				11.026			
P21Δtopen								-0.523		
P21Δtopen$_{t-1}$	0.364	-1.116*	0.220	0.041						
P21Δtopen$_{t-2}$					0.388†	-0.349‡				
P21Δtopen$_{t-3}$							14.585		4.9148	
P21ΔUN$_{t-1}$					1.828	27.131				
P21ΔUN$_{t-2}$				0.331			50.829			
Diagnostics										
DW-stat	1.997	1.964	2.434	2.386	2.3187	2.695	2.437	2.834	2.124	2.675
Q (2)	0.182	0.121	0.507	1.976	1.422	0.467	0.878	1.761	0.054	4.691
Q (4)	1.751	0.216	1.219	6.504	4.656	0.925	1.585	4.699	5.523	4.693

Figure-54 to 63 show the high credibility state TVTPs all ASEAN+3+3 countries against Japan. The movement of Australian TVTPs are disturbed by crises (Plaza, dot cum, GFC). The movement of Chinese TVTPs show that AFC effect is not severe vis-à-vis GFC. Similarly other countries for which the TVTPs waned by crises are India (AFC, GFC, and SE), Indonesia (AFC), Malaysia (all four crises), New Zealand (all four crises) and Thailand (during all four crises). Korea also experiences high volatility in high credibility TVTPs.
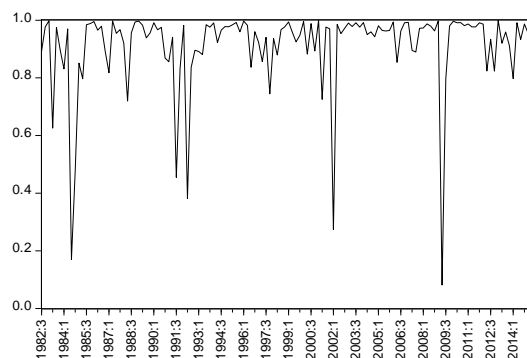

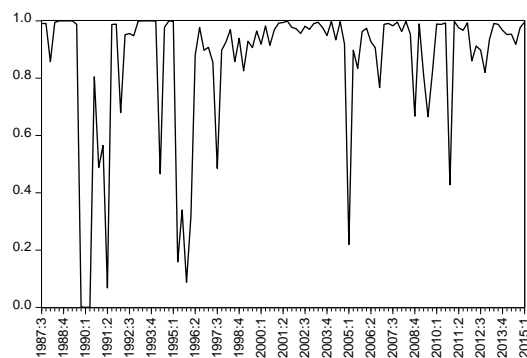Fig 54. Multivariate TVTPs of the High Credible State: Australia_JPN

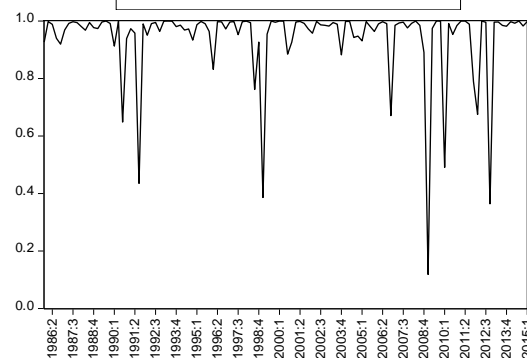Fig 55. Multivariate TVTPs of the High Credible State: China_JPN

Fig 56. Multivariate TVTPs of the High Credible State: India_JPN
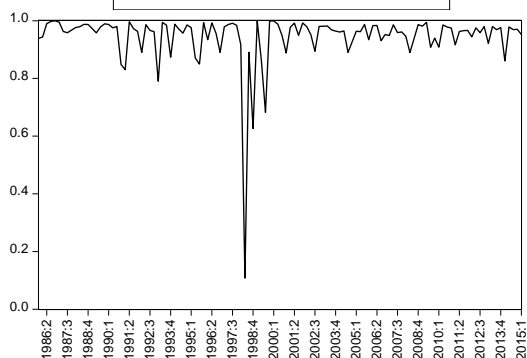

Fig 57. Multivariate TVTPs of the High Credible State: Indonesia_JPN
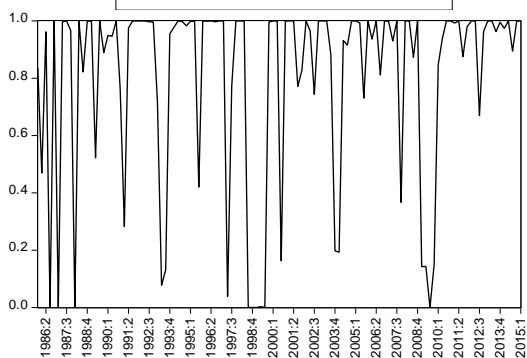

Fig 58. Multivariate TVTPs of the High Credible State: Korea_JPN
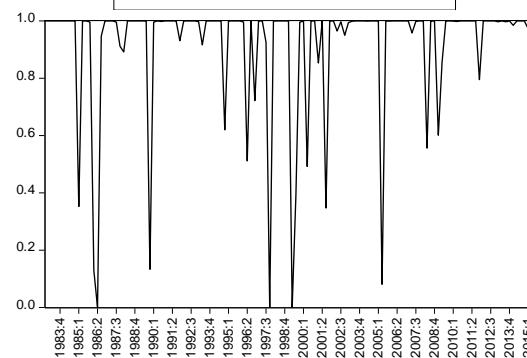

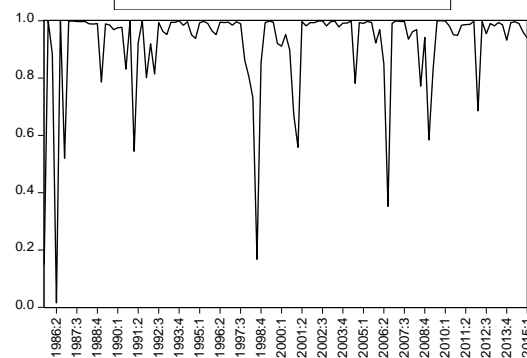Fig 59. Multivariate TVTPs of the High Credible State: Malaysia_JPN

Fig 60. Multivariate TVTPs of the High Credible State: New Zealand_JPN
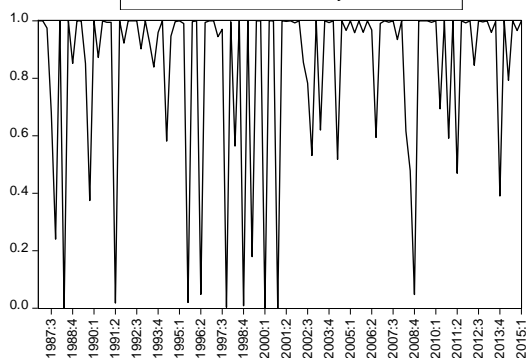

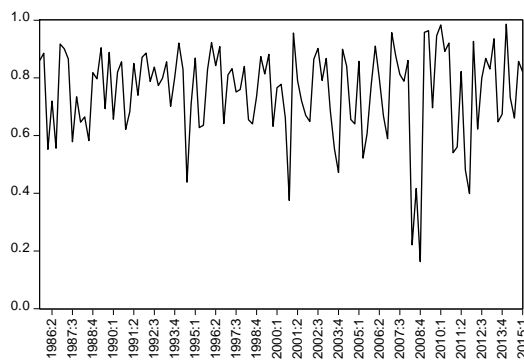Fig 61. Multivariate TVTPs of the High Credible State: Philippines_JPN

Fig 62. Multivariate TVTPs of the High
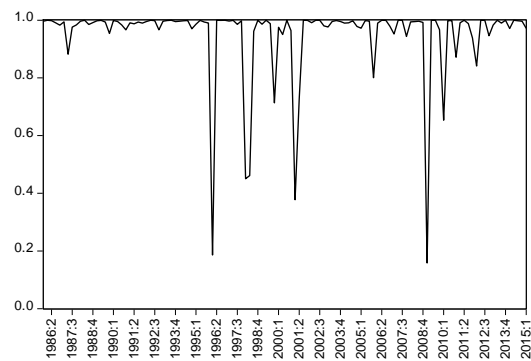Credible State: Singapore_JPN

Fig 63. Multivariate TVTPs of the High
Credible State: Thailand_JPN

Against USA, the mean estimates (Table-6) show that regime 1 is highly credible for India, Indonesia, Japan, New Zealand and Thailand while regime 2 is credible for other countries. The *GDP growth* rate effect on TVTPs is significant for Indonesia, Japan, Philippine, and Singapore in high regime while for Malaysia in low regime. In Indonesia, Japan, Malaysia, and Philippines GDP growth rate impact the level of credibility while in Singapore it causes switching between the two regimes. The positive value of GDP increases the probability of remaining in high credibility regime. The *inflation* affects the TVTPs significantly in China, Indonesia, Japan, and Korea, Philippine, and Singapore in high credibility regime while for Australia, New Zealand and Thailand in low regime. In Australia and Indonesia inflation effects level of credibility while in China, Japan, Korea, New Zealand, Philippine, Singapore and Thailand it causes the shifting between two credibility regimes. The *unemployment* effect on TVTPs is significant only for Japan and Singapore in high regime while for Australia and Singapore in low regime. In Australia, Japan and Singapore unemployment causes shifts between two credibility regimes. The *real exchange rate* effects on TVTPs are significant for China, Korea, Malaysia, New Zealand, Philippine and Singapore in high regime while for Malaysia in low regime. In comparison with the multivariate MRS model, the exchange rate of China, Korea, Malaysia, Philippine and Singapore causes the switching in both regimes of the credibility, while of New Zealand it depends on the level of credibility. The negative value exchange rate decreases the probability of staying in high credibility. The *trade openness* effects on TVTPs are significant for Australia, Indonesia, Philippine and Singapore in high regime while for Australia and Thailand in low regime. Trade openness causes the switching in the regimes of the credibility.

Table-6: Multivariate TVTPs Results against USA

Parameters	ASEAN5					+ 3			+ 3		
	IDN	MYS	PHL	SGP	THA	CHN	JPN	KOR	AUS	IND	NZL
β_{t-1}	0.960*	1.981*	1.927*	2.006*	1.914*	1.752*	1.935*	1.722*	1.815*	2.007*	1.813*
β_{t-2}	-0.152†	-0.984*	-0.936*	-1.016*	-0.924*	-0.762*	-0.944*	-0.733*	-0.822*	-1.017*	-0.825*
Regime 1											
$\phi_{0,1}$	0.189†	0.002*	0.023*	0.305*	0.705*	0.015†	0.006†	0.035‡	0.054‡	0.705‡	0.064*
σ_1^2	0.127*	0.006*	0.009*	0.306*	0.705*	0.021*	0.806*	0.023*	0.018*	0.707*	0.006*
P11ΔGDPg							0.558‡				
P11ΔGDP$_{t-1}$		-0.731‡			0.173				0.818		
P11ΔGDP$_{t-2}$	-0.972‡		0.378							0.083	
P11ΔGDP$_{t-3}$				0.250				8.178			-0.113
P11ΔP		-0.297		-0.677			1.820‡	110.43			
P11ΔP$_{t-1}$	-0.538‡										

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P11ΔP$_{t-2}$			-0.286		-0.015					0.077	0.278
P11ΔP$_{t-3}$					-0.605				-2.736‡		
P11ΔREER		0.092				-0.185					-0.335
P11 ΔREER$_{t-1}$	26810.7	-0.975†									
P11ΔREER$_{t-2}$			-0.387		0.513						
P11ΔREER$_{t-3}$								4.842	0.065		
P11Δtopen		0.023				-2.117				0.031	
P11Δtopen$_{t-1}$			0.034								
P11Δtopen$_{t-2}$	0.464‡				-0.056			119.33	1.587†		0.264
P11Δtopen$_{t-3}$		0.079		0.086							
P11ΔUN		-2.438		-1.350‡		11.148†					
P11ΔUN$_{t-2}$					-5.905						
P11ΔUN$_{t-3}$								6.137*			
Regime 2											
$\phi_{0,2}$	0.266*	0.305**	0.004†	0.003*	0.005*	0.033*	0.009†	0.023†	0.001‡	0.003‡	0.066*
σ_2^2	0.007*	0.405**	0.605**	0.405*	0.907**	0.005*	0.022*	0.705**	0.405**	0.425**	0.235**
P21ΔGDPg							-0.417				
P21ΔGDP$_{t-1}$		0.241			0.142				0.307		
P21ΔGDP$_{t-2}$	-1.867	0.911‡								0.607	
P21ΔGDP$_{t-3}$			96.47*					-1.121			-0.192
P21ΔP		0.585		-643.7*			0.294	3.912‡			
P21ΔP$_{t-1}$	-2.806										
P21ΔP$_{t-2}$		1.219‡			-1.859‡					-0.563	1.733
P21ΔP$_{t-3}$						0.915‡			0.967		
P21ΔREER		1.486*	-0.759‡				0.165				1.039‡
P21 ΔREER$_{t-1}$	-7978										
P21ΔREER$_{t-2}$				-71.84*	-0.597†						
P21ΔREER$_{t-3}$								-1.604†	0.109		
P21Δtopen		0.114					1.551			0.117	
P21Δtopen$_{t-1}$				-54.90*							
P21Δtopen$_{t-2}$	1.626					0.011		0.079	-0.616‡		-0.203

P21Δtopen$_{t-}$:		0.239 ‡		0.203 ‡						
P21ΔUN	2.578		121.23 *			-3.182				
P21ΔUN$_{t-2}$				7.335						
P21ΔUN$_{t-3}$						- 1.458				
Diagnostics										
DW-stat	2.305	2.065	1.853	1.981	2.412	2.724	2.837	2.649	1.979	2.721	2.354
Q (2)	3.980	0.261	2.697	2.274	0.128	6.322	6.323	0.336	2.276	5.596	0.112
Q (4)	6.448	1.074	4.165	8.085‡	3.077	9.865 †	8.000	3.127	3.191	6.125	4.712

Figure-64 to 74 show the high credibility state TVTPs of all ASEAN+3+3 against USA. The TVTPs of Australia are highly instable against USA vis-à-vis against China and Japan. The Chinese high credibility TVTPs show sharp decay in early 1990s and moderate decays during the periods of AFC and GFC. Indonesian TVTPs are highly instable and show many veer. The Indian movements of TVTPs are more stable against USA. Japan also has numerous declines in the TVTPs but sharper are at the time of crises (AFC, dot-com bubble in 2000-01, GFC and Southern Europe), Korea also shows similar pattern. Singapore, Philippine and Thailand show movements of TVTPs with clear impact of crises. Malaysia shows many veer in TVTPs without any clear pattern. New Zealand show many veer in TVTPs with clear decays at AFC and GFC.
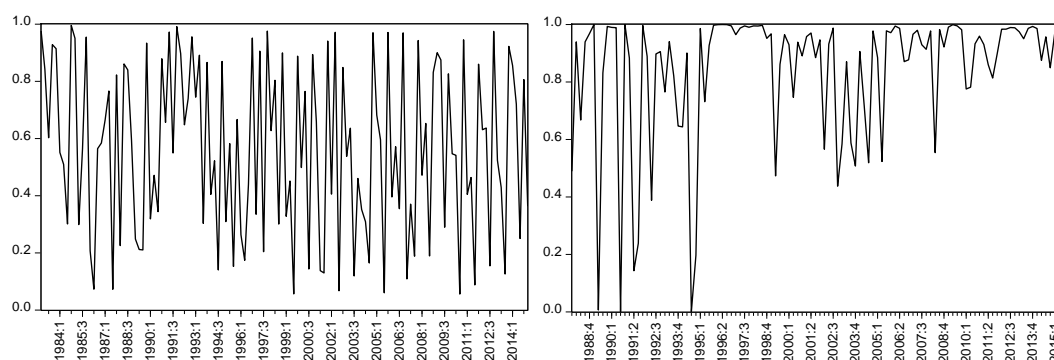

Fig 64. Multivariate TVTPs of the High Credible State: Australia_US
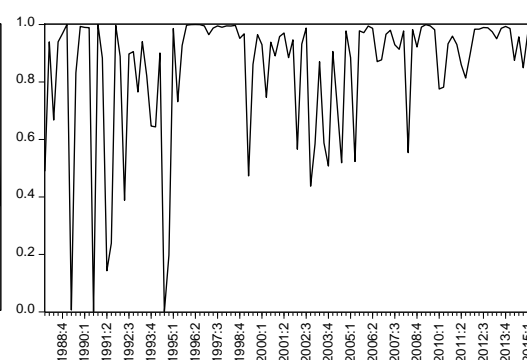

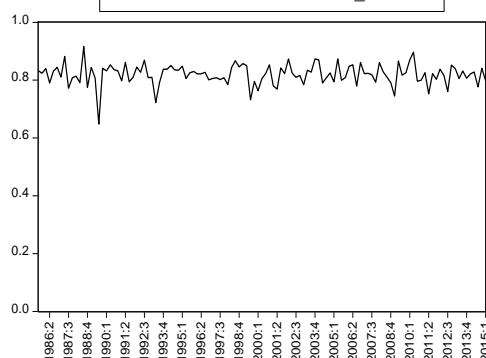Fig 65. Multivariate TVTPs of the High Credible State: China_US

Fig 66. Multivariate TVTPs of the High Credible State: India_US
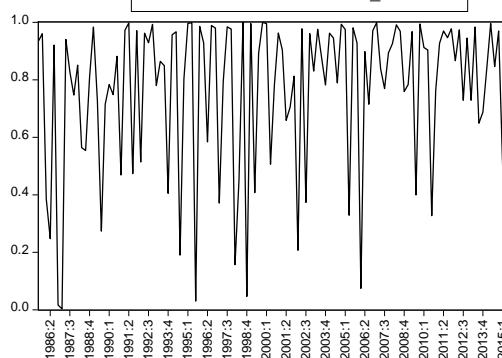

Fig 67. Multivariate TVTPs of the High Credible State: Indonesia_US

Fig 68. Multivariate TVTPs of the High
Credible State: Japan_US

Fig 69. Multivariate TVTPs of the High
Credible State: Korea_US

Fig 70. Multivariate TVTPs of the High
Credible State: Malaysia_US

Fig 71: Multivariate TVTPs of the High
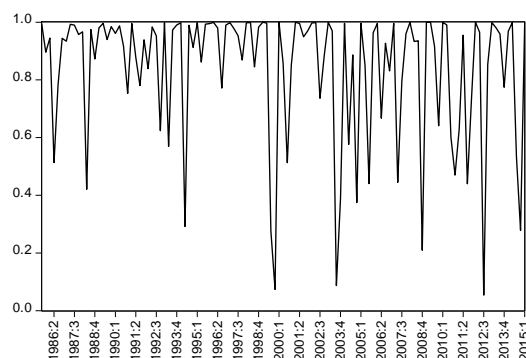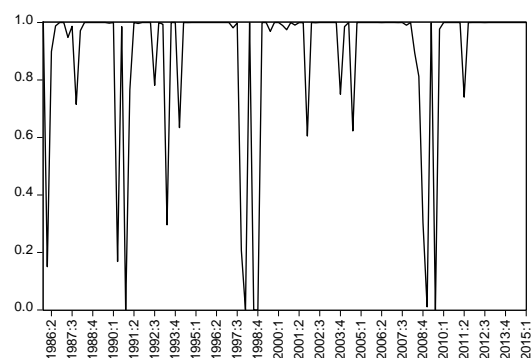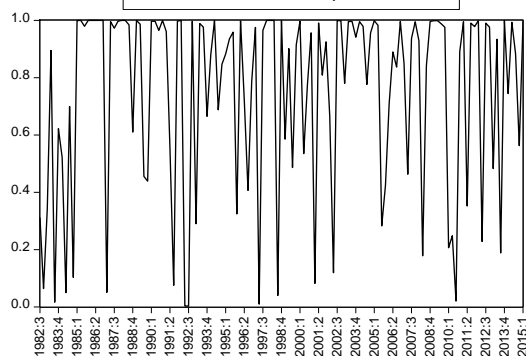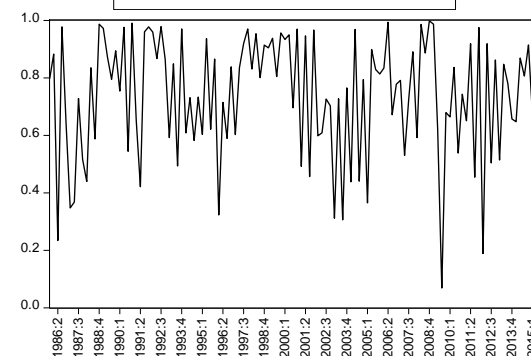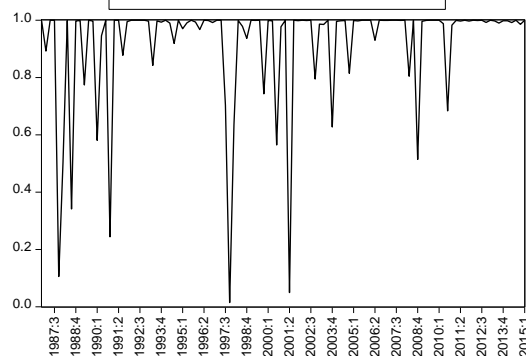Credible State: New Zealand_US

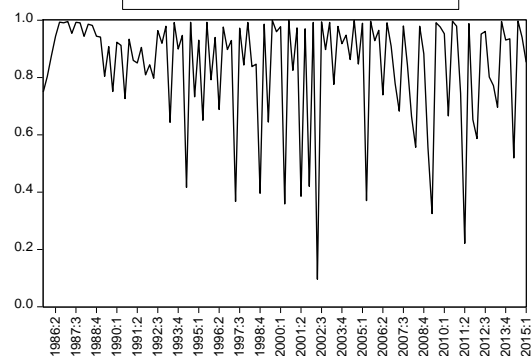Fig 72. Multivariate TVTPs of the High
Credible State: Philippines_US

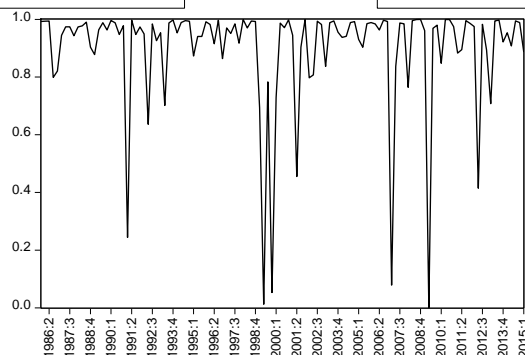Fig 73. Multivariate TVTPs of the High
Credible State: Singapore_US

Fig 74. Multivariate TVTPs of the High
Credible State: Thailand_US

Table-7: ASEAN+3+3 Effect of Macro-fundamentals on Credibility

Countries		China					Japan					USA				
		GDP	INF	UN	ER	TO	GDP	INF	UN	ER	TO	GDP	INF	UN	ER	TO
ASEAN5	IDN	H/L	H/L		L	H/L	H	H			L		L			H/L
	MYS	L			H/L	H/L		L	H/L		H	H/L	L	L		L
	PHL		H	H	L			H/L				H	H	H	H	H
	SGP		H	L	H	H/L				L		H		H		H
	THA	L		H	H			H		L	H				H/L	
+3	CHN						H/L				L	L	H	L		H
	JPN	H	H	H	H	H						H/L	H		L	H
	KOR	H	H	H/L	H	H		H		H/L	H	L	L	L	H/L	L
+3	AUS		H	H	H		L	H		L		H		H		H
	IND		L				L					L				
	NZL	L		L		L	L			L	H/L	L	L			H

Table-8: ASEAN+3+3 Effect of Macro-fundamentals on TVTPs

Countries		China					Japan					USA				
		GDP	INF	UN	ER	TO	GDP	INF	UN	ER	TO	GDP	INF	UN	ER	TO
ASEAN5	IDN		H			H*						H	H			H*
	MYS	H*	H*		L*	L*				H*	H*	L			H/L*	
	PHL		H			H*		L*		H/L*	L*	H	H*		H*	H*
	SGP				L*	L*			H*			H*	H*	H/L*	H*	H*
	THA	L				H/L*					H*		L*			L*
+3	CHN							H/L*		L	L*		H*		H*	
	JPN	L	L*		L*	L						H	H*	H*		
	KOR	H/L*			H/L	L*	H		L	L	L*		H*		H*	
+3	AUS	H*	H/L*			L*	H/L*			L*			L	L*		H/L*
	IND	H*	H/L*				H*			H*						
	NZL	H		H	H*			H*		L*			L*		H	

Note: * means that a particular variable cause switching in the regimes of the credibility

5. Concluding Remarks

This study examined association between credibility and macro-fundamentals of APSCs against potential anchor economies e.g. China, Japan and USA. The empirics suggest that macro-fundamentals impact the level of credibility as well as cause switching between states. Moreover, the macro-fundamentals mostly influence regime of credibility asymmetrically (see Table-7 and 8). The empirical evidence describes that GDP growth rate is mostly significant in low regime against all anchors. It is mostly significant against USA. Inflation is significant mostly in high credibility regime whose effects on TVTPs are more significant against USA in high regime. Unemployment association of APSCs are more with China and USA in high regime. Exchange rate association

of most of APSCs are with China in high regime followed by USA. Trade openness is mostly significant in high regime against China and USA, however, it is robust against USA. The macro-fundamentals are mostly significant driving factor of TVTPs evidenced in case of inflation, trade openness, exchange rate, and GDP growth rate. The macro-fundamentals influence the monetary credibility and TVTPs so there is strong justification for a monetary unification among ASEAN5+3+3. In short, the unequivocal internal anchor among China and Japan is less appealing. So USA could relatively be an ideal choice of external anchor for APSCs, as supported by Sun and Simons (2011) and Nusair (2012). However, economic situation in the region is changing rapidly due to Chinese high growth performance and its emerging trade linkages with APSCs. Hence, the emphasis has been put to internal anchor economy which is a future policy theme of region.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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