



Vaasan yliopisto
UNIVERSITY OF VAASA

OSUVA Open
Science

This is a self-archived – parallel published version of this article in the publication archive of the University of Vaasa. It might differ from the original.

Did mega-regional trade agreements reshuffle the financial influence of the US, China, and Japan in ASEAN? Evidence from the volatility-spillover effects

Author(s): Cao, Li; Jiang, Junhua; Piljak, Vanja

Title: Did mega-regional trade agreements reshuffle the financial influence of the US, China, and Japan in ASEAN? Evidence from the volatility-spillover effects

Year: 2023

Version: Accepted manuscript

Copyright ©2023 Elsevier. This manuscript version is made available under the Creative Commons Attribution–NonCommercial–NoDerivatives 4.0 International (CC BY–NC–ND 4.0) license, <https://creativecommons.org/licenses/by-nc-nd/4.0/>

Please cite the original version:

Cao, L., Jiang, J. & Piljak, V. (2023). Did mega-regional trade agreements reshuffle the financial influence of the US, China, and Japan in ASEAN? Evidence from the volatility-spillover effects. *Research in International Business and Finance*, 65, 101937. <https://doi.org/10.1016/j.ribaf.2023.101937>

Did mega-regional trade agreements reshuffle the financial influence of the US, China, and Japan in ASEAN? Evidence from the volatility-spillover effects

Li Cao^a, Junhua Jiang^b, Vanja Piljak^c

^a *School of Finance, Nanjing University of Finance and Economics, Nanjing, China*

^b *School of Finance, Anhui University of Finance and Economics, Bengbu, China*

^c *School of Accounting and Finance, University of Vaasa, Vaasa, Finland*

5 February 2023

Abstract

The Trans-Pacific Partnership (TPP) and the succeeding Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) were widely viewed as trade agreements aiming at containing the influence of China and raising that of the US and Japan in Asia. This study utilizes the outward volatility-spillover effect of the equity market as a proxy for a country's financial influence and analyzes whether the signing of the TPP and CPTPP reshuffled the financial influence of the US, China, and Japan in the Association of Southeast Asian Nations (ASEAN). The study finds that the TPP and CPTPP did boost the financial influence of the US and Japan in some ASEAN countries; however, there is no evidence that they have reduced the financial influence of China in ASEAN.

Keywords: Financial Influence; Volatility spillover; TPP and CPTPP; ASEAN

JEL classification: F10, G15

Contact address:

Li Cao, School of Finance, Nanjing University of Finance and Economics, Nanjing, China, e-mail:

li-lucky@nufe.edu.cn

Junhua Jiang, School of Finance, Anhui University of Finance and Economics, Bengbu, China, e-mail:

jiang.junhua@hotmail.com

Vanja Piljak, School of Accounting and Finance, University of Vaasa, Vaasa, Finland, e-mail:

vanja.piljak@uwasa.fi

1. Introduction

This study investigates whether the signing of mega-regional trade agreements reshuffled the global (the US) and regional (China and Japan) financial influence in Asia. More specifically, the study focuses on the Trans-Pacific Partnership (TPP) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and examines whether the two trade agreements altered the financial influence of the US, China, and Japan on the Association of Southeast Asian Nations (ASEAN). The ASEAN comprises ten countries, but due to data availability this study selects six of the ten ASEAN countries: Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

The TPP was signed on 4 February 2016 between 12 countries: Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, Vietnam, and the United States. After the US withdrew from the TPP, the remaining 11 countries signed a succeeding trade agreement (i.e., CPTPP) on 8 March 2018. The leading promoter of the TPP was the Obama's Administration of the US, while Japan overtook the leading role for CPTPP. The CPTPP includes one of the largest free trade zones in the world that has profound impact on the world economy (Li and Li, 2021). The coverage of CPTPP accounted for 13.5% of the world economy in 2017, covering a market of about 500 million people (Li and Whalley, 2021). Although the main provisions of the CPTPP (also known as TPP11) are similar to those of the TPP, this study treats them as two trade agreements, since the US is not a member of the CPTPP and the two trade agreements have different leading promoters. The TPP was widely considered as a geopolitical competition tool aiming at containing the influence of China and raising that of the US and Japan in Asia (see, e.g. Wall Street Journal, 17 April 2015). After the US withdrew from the TPP, Japan became the leader in promoting the succeeding trade agreement CPTPP, with a similar goal of boosting its own power and reducing that of China in the region. Given the special objectives of the TPP and CPTPP in promoting economic growth and financial integration and their perception as geopolitical

tools, it is appealing to study how they have reshuffled the financial influence of the US, Japan, and China in Asia.

Our focus on the ASEAN countries is motivated by the following reasons. Firstly, ASEAN countries are becoming increasingly important part of the world economy due to their fast economic growth and stock market development (Vinayak et al., 2014; Chien et al., 2015; Kang et al., 2019). For instance, Vinayak et al. (2014) emphasize that ASEAN countries represent one of the largest economic zones and exporting regions in the world, characterized with a high level of foreign direct investments while maintaining macroeconomic stability and good indicators of government debt. ASEAN economic zone is the seventh-largest economy in the world based on the GDP and it is ranked as the fourth-largest exporting region in the world, following the European Union, North America, and China. The government debt is less than 50 percent of GDP, which is far less than many developed economies such as the US or the United Kingdom. Accelerated economic growth and increased cross-border capital flows contributed to the increase of regional and global integration of ASEAN financial markets (Batten et al., 2015; Boubakri and Guillaumin, 2015; Caporale et al., 2019).

Secondly, ASEAN countries play a distinctive role in terms of the geopolitical, economic, and financial competitions between the US, Japan, and China in Asia. Equity markets that are geographically and culturally close to each other tend to be more strongly connected (Flavin et al., 2002; Lucey and Zhang, 2010). As many of the ASEAN countries are geographically and culturally close to China, it is expected that ASEAN equity markets are more likely to be influenced by the Chinese equity market. Apart from the financial market connectedness, China also exerts large economic influence on the ASEAN countries. China's economic profile has significant impact on the ASEAN economies (see e.g., Fujiwara and Takahashi, 2012; Rafiq, 2016). In addition, China and ASEAN are important trading partners. For instance, trade in goods with China accounts for 18% of ASEAN's total value of trade in goods in 2019, which is almost the percentage accounted for by US and Japan combined (data source:

ASEANstats). Given ASEAN's financial and economic connections with China, if the TPP and CPTPP affected China's financial influence in Asia, the effect would be more likely to be observed in the ASEAN equity markets. Furthermore, because of ASEAN's important geographical location and fast-growing economies, both the US and Japan are competing for the political and economic influence in the region. Therefore, it is important to examine how the two free trade agreements that aim at redefining the distribution of economic influence in Asia have changed the relative equity market influence of the US, China, and Japan on the ASEAN countries.

To evaluate whether the TPP and CPTPP reshuffled the financial influence of the US, China, and Japan on ASEAN, we analyze how these trade agreements affected the equity market volatility-spillovers from the US, China, and Japan to ASEAN. The volatility-spillover and contagion effects have been used in the literature in the context of global and regional financial integration (e.g. Christiansen, 2007; Syriopoulos et al., 2015; Vo and Tran, 2020). We utilize methodological framework of volatility spillovers based on Bekaert et al. (2005) and Christiansen (2007), enhanced with the spillover/connectedness measures of Diebold and Yilmaz (2012, 2014) to further examine the robustness of the results. While extensive studies on the volatility transmission of international equity markets have been conducted (see e.g., Ng, 2000; Billio and Pelizzon, 2003; Baele, 2005; Singh et al., 2010; Gamba-Santamaria et al., 2017; Mensi et al., 2018), few studies (e.g., Li and Giles., 2015; Kang et al., 2019; Vo and Tran, 2020) investigate the volatility spillovers of the ASEAN equity markets. Li and Giles (2015) investigate volatility spillovers from the developed markets (the US and Japan) to six Asian emerging stock markets (China, India, Indonesia, Malaysia, the Philippines and Thailand) by using an asymmetric GARCH-BEKK model. They find that the volatility spillovers from the US to Asian emerging countries are strongly significant only for the Asian financial crisis period. However, the volatility spillovers between Japan and Asian emerging markets are significant in both the long run and the short run. Kang et al. (2019) examine dynamics of volatility spillovers between ASEAN-5 countries and world stock

markets utilizing a dynamic equicorrelation (DECO) model and the spillover index of Diebold and Yilmaz (2012). Their main finding regarding directional spillovers is that spillovers are much stronger from the world markets to the ASEAN markets than in the opposite direction. However, there is heterogeneity among the ASEAN markets in the degree of spillovers to the world markets over time. Furthermore, they document that spillovers (both return and volatility) increase during financial crises. Vo and Tran (2020) investigate spillover effects from the US stock market to ASEAN stock markets by using the augmented EGARCH model with the ICSS algorithm to control for the structural volatility break. They find a significant volatility spillover from the US to ASEAN stock markets in the period from 2001 to 2016.

Our study builds upon aforementioned studies by bringing up new insights in the context of the mechanisms behind the spillover, reflected in the distribution of economic and political influence following the free trade agreement evolution. Furthermore, our study differs from aforementioned studies by analyzing also COVID-19 time period, as literature provides evidence that volatility spillovers significantly increased during the COVID-19 period (Akhtaruzzaman et al., 2021, Choi, 2022; Li et al., 2021). Akhtaruzzaman et al. (2021) examine financial contagion between China and G7 countries and find that Chinese and Japanese stock markets were the net transmitters of spillovers during the COVID-19 period. Our study differs from Akhtaruzzaman et al. (2021) by providing the evidence that volatility spillovers from the US market rather than the Japanese market significantly changed during the COVID-19 pandemic period.

This study complements the relatively limited streams of the literature on the equity market volatility spillovers of the ASEAN countries and on mega-regional trade agreements. Thus, we contribute to the previous literature in the following aspect. Previous research on the effects of the TPP and CPTPP generally concentrates on their economic impact. For instance, Mukhopadhyay and Thomassin (2018) examine the impact of the TPP on the Canadian economy, while Petri and Plummer (2019) study the

effects of the CPTPP on the Australian economy. Li and Li (2021) investigate the trade effects of the CPTPP on the member states of the trade agreement. Li and Whalley (2014) explore the effects of the TPP on China and other countries, while Li and Whalley (2021) update the model structure (after the TPP has become the CPTPP) and re-simulate the possible economic impacts of the CPTPP. Rather than assessing the economic effects of the TPP and CPTPP, our study examines the financial effects reflected in the impact of these two trade agreements on the stock market. Hence, we fulfill a research gap in the literature on the intersection between volatility spillovers and the effects of the mega-regional trade agreements.

The financial impact of a free trade agreement is also important given that after a country signed the free trade agreement, its economic linkages (especially the trade linkages) with the other member states of the agreement could be stronger. Hence, policy makers of the country may need to assess how the risks of its equity market would be affected as a result of its stronger economic linkages with the external economies. Similarly, international investors could be interested in how their portfolio risks and compositions are likely to be influenced by the potential changes in the volatility spillover effects induced by the new trade agreement. Therefore, this study extends the previous research and analyzes the financial effects of the trade agreements TPP and CPTPP. Our study provides new evidence on the important issue of whether these two trade agreements accomplished the goal of containing the financial influence of China and raising that of the US and Japan in Asia. Furthermore, the study has important financial implications for international investors who traditionally have been attracted to the emerging markets due to their relatively higher average returns and lower correlations with the developed markets. The findings of this study suggest that international investors may need to adjust their international diversification strategies by accounting for the increase in the global and regional spillovers induced by mega-regional free trade agreements. Finally, the study has relevant implications for the policymakers in

the context of the volatility connectedness dynamics that are essential for alleviating contagion risk in the international stock markets.

The remainder of the paper is organized as follows. Section 2 provides a literature review. Section 3 describes the data and method. Section 4 presents the empirical results. Finally, Section 5 concludes.

2. Literature review

Our paper is closely connected to the streams of literature on global and regional equity market integration and on volatility spillovers in international equity markets. Hence, we provide a brief overview of the related literature.

The research on global and regional equity market integration is a part of extensive literature on international financial integration (see, e.g. Lucey et al., 2018). A large body of this literature is devoted to financial integration at the global level with the focus on either developed or emerging markets (Pukthuanthong and Roll, 2009; Kiviaho et al., 2014; Lehkonen, 2015; Bekaert and Mehli, 2019), while one subgroup of studies in this array examines regional integration (Yu et al., 2010; Donadelli and Paradiso, 2014; Wang, 2014; Batten et al., 2015; Boubakri and Guillaumin, 2015; Chien et al., 2015; Wu et al., 2015; Chevallier et al., 2018; Caporale et al., 2019). Since the focus of our study is on ASEAN markets, we limit discussion here to the studies on Asian region. Yu et al. (2010) examine the relative importance of regional (within Asia) vs. global (mainly US) factors in the context of equity market integration and find that for the Asian markets the regional factor is more important than the global factor. Wang (2014) investigates the degree of integration among six major stock markets in East Asia and their interactions with the US market. Boubakri and Guillaumin (2015) analyze the dynamics of regional financial integration in East Asia and provide evidence that despite partial segmentation within the region

until 2008, the stock markets of East Asia showed an upward trend in the regional integration after the 2008-2009 global financial crisis. Chien et al. (2015) investigate regional integration between China and ASEAN-5 (Malaysia, Singapore, Thailand, Indonesia, and the Philippines) and find that level of regional integration has been increasing. Batten et al. (2015) provide evidence that the degree of integration between Asian and international stock markets has been increasing, but they find very low level of integration with Japan.

Wu et al. (2015) study interdependence and contagion between the developed markets (US, Japan, and Hong Kong) and Asian emerging markets. They find significant overreaction of Asian emerging stock markets to shocks coming from Japan and Hong Kong, but no contagion effects from the US market. Chevallier et al. (2018) find that stock market integration of the ASEAN emerging markets is more affected by the exposure to shocks affecting stock markets in the United States, rather than to shocks affecting the East Asian developed markets. Caporale et al. (2019) document that Asian stock markets seem to be integrated both globally (with the US) and regionally (within Asia); however, in the period after the 2008-2009 global financial crisis the global integration was slightly stronger than the regional integration.

The literature on volatility transmission in international equity markets is extensive (see e.g., Ng, 2000; Billio and Pelizzon, 2003; Baele, 2005; Singh, Kumar, and Pandey, 2010; Gamba-Santamaria et al., 2017; Mensi et al., 2018, Jiang et al., 2020). The studies in this stream of literature have utilized methodological frameworks such as multivariate GARCH family modelling approaches (e.g. Clements et al., 2015; MacDonald et al., 2018), spillover measure by Diebold and Yilmaz (2009, 2012), and more recently frequency volatility connectedness measure by Barunik and Krehlik (2018). One specific part of the literature focuses on the volatility spillovers of the ASEAN equity markets. (e.g., Li and Giles, 2015; Kang et al., 2019; Vo and Tran, 2020, Wang and Xiao, 2023). Li and Giles find that the volatility spillovers between Japan and six Asian emerging markets are significant in both the long run and the

short run. Kang et al. (2019) show that spillovers are much stronger from the world markets to the ASEAN markets than in the opposite direction, although there is heterogeneity among the markets in the degree of spillovers over time. Vo and Tran (2020) find a significant volatility spillover from the US to ASEAN stock markets in the period from 2001 to 2016. Wang and Xiao (2023) document significant risk spillovers from the Chinese and the US stock markets to the East Asian countries (Japan, South Korea, and Hong Kong). Furthermore, the recent literature on volatility spillovers points out that volatility spillovers in international stock markets significantly increased during the COVID-19 period (Akhtaruzzaman et al., 2021, Choi, 2022; Li et al., 2021). In particular, Li et al. (2021) document that the total degree of volatility spillover in international stock markets was extremely high during the COVID-19 period, while Akhtaruzzaman et al. (2021) provide evidence that China and Japan seem to be net transmitters of spillover during the COVID-19 period. Choi et al. (2021) examine dynamic connectedness between Asian stock markets (South Korea, Japan, and China) with the US market and show that the US has been consistently a net transmitter of volatility shocks. However, China's volatility shock transmission to South Korea was stronger than that of the US until the COVID-19 outbreak, indicating strong dependence of South Korean market on the Chinese economy.

3. Data and method

The data of the study consist of daily stock price indexes in local currencies over the period from 2.4.2016 to 12.31.2019. Stock price indexes in local currencies were used to avoid the impact of the exchange rate fluctuations (see Mink, 2015). Similar to Zhang et al. (2020) and Rai and Garg (2021), we retrieved the data from investing.com. The retrieved data are the S&P500 index for the US market, Shanghai composite index for the Chinese market, Nikkei 225 index for the Japanese market, MSCI Indonesia index, MSCI Malaysia index, MSCI Philippines index, MSCI Singapore index, MSCI Thailand index, and VN30 index for the Vietnamese market.

To examine the impact of the TPP and CPTPP on the volatility spillovers, the overall sample period is divided into three sub-periods: "TPP period" (2.4.2016–1.22.2017), "withdrawn period" (1.23.2017–3.7.2018), and "CPTPP period" (3.8.2018–12.31.2019). To avoid the confounding effect of the Chinese stock market crash that occurred in 2015 and extended to January 2016, the sample period starts from 4 February 2016 when the TPP was officially signed. The sample period does not cover the time after 2019 due to the outbreak of the COVID-19 crisis that could have affected the spillover effects among the investigated markets. The US government withdrew from the TPP on 23 January 2017, and the CPTPP was officially signed on 8 March 2018. Hence, the sample period is separated into three sub-periods according to these two dates.

The method utilized in this study is similar to that of Bekaert et al. (2005) and Christiansen (2007). Christiansen (2007) employs a “euro spillover” model to examine the effect of the introduction of the euro on the volatility spillover dynamics of the European bond markets. This study applies an analogous method to evaluating the impact of the trade agreements (TPP and CPTPP) on the equity market volatility spillovers from the US, China, and Japan to six ASEAN countries.

The method involves a three-step estimation procedure, with the residuals of the earlier steps included as explanatory variables in the later steps. The first step of the estimation procedure assumes that the return on the US equity market follows an AR(1) process:

$$(1) R_{US,t} = c_{0,US} + c_{1,US}R_{US,t-1} + e_{US,t},$$

where $R_{US,t}$ is the US market return at time t ; $c_{0,US}$ and $c_{1,US}$ are the parameters; $e_{US,t}$ is the error term that is normally distributed and follows a GARCH(1,1) model:

$$(2) \sigma_{US,t}^2 = \omega_{US} + \alpha_{US}e_{US,t-1}^2 + \beta_{US}\sigma_{US,t-1}^2.$$

The second step of the estimation procedure specifies the model for the return on the regional Chinese and Japanese stock markets:

$$(3) R_{CN,t} = c_{0,CN} + c_{1,CN}R_{CN,t-1} + \gamma_{CN,t-1}R_{US,t-1} + \phi_{CN,t-1}e_{US,t} + e_{CN,t},$$

$$(4) R_{JP,t} = c_{0,JP} + c_{1,JP}R_{JP,t-1} + \gamma_{JP,t-1}R_{US,t-1} + \phi_{JP,t-1}e_{US,t} + e_{JP,t},$$

where $R_{CN,t}$ and $R_{JP,t}$ are respectively the Chinese and Japanese stock market return at time t ; $e_{US,t}$ is the residual estimated from the first step; $\gamma_{CN,t-1}$ and $\gamma_{JP,t-1}$ are the parameters measuring the mean spillover effect from the US market to the Chinese and Japanese market, respectively; $\phi_{CN,t-1}$ and $\phi_{JP,t-1}$ are the parameters that quantify the volatility spillover effect from the US market to the Chinese and Japanese market, respectively; $e_{CN,t}$ and $e_{JP,t}$ are the error term following a GARCH(1,1) model similar to Equation (2).

In the above regressions, we assume that there are two regional stock markets (China and Japan) that affect all the other stock markets in the Asian region, and there is only one way spillover effect from the US market to the two regional markets. Previous studies on Asian stock market spillovers emphasize the role of the global US market and the regional Japanese market (see e.g., Chevallier et al., 2018; Miyakoshi, 2003; Ng, 2000). Recent research (e.g., Arslanalp et al., 2016; Chow, 2017) further suggests that the influence of the Chinese market on the Asian markets has risen to a level comparable to that of the Japanese market. The assumption that there is only one way spillover effect from the US market to the two regional markets is supported by the Granger causality tests (see Table A1 in the appendix): over the investigated sample period, US market Granger causes the Chinese and the Japanese markets,

whereas the Chinese and Japanese markets do not Granger cause the US market; in addition, the Granger causality tests also indicate that market spillovers between China and Japan are not statistically significant over the sample period.

The third step of the method relates the global US and regional Chinese and Japanese market returns to the individual ASEAN market returns. The following regression is specified for each of the six ASEAN markets:

$$(5) R_{i,t} = c_{0,i} + c_{1,i}R_{i,t-1} + \gamma_{i,t-1}R_{US,t-1} + \delta_{i,t-1}R_{CN,t-1} + \mu_{i,t-1}R_{JP,t-1} + \phi_{i,t-1}e_{US,t} + \psi_{i,t-1}e_{CN,t} + \eta_{i,t-1}e_{JP,t} + e_{i,t},$$

where $R_{i,t}$ is the return on the individual ASEAN stock market i at time t ; $\gamma_{i,t-1}$, $\delta_{i,t-1}$, and $\mu_{i,t-1}$ are the parameters that determine the mean spillover effect of the US, Chinese, and Japanese market on ASEAN market i , respectively; $\phi_{i,t-1}$, $\psi_{i,t-1}$, and $\eta_{i,t-1}$ are the parameters measuring the volatility spillover effect of the US, Chinese, and Japanese market on ASEAN market i , respectively; $e_{US,t}$, $e_{CN,t}$, and $e_{JP,t}$ are the residuals estimated from the first two steps; $e_{i,t}$ is the error term that follows a GARCH(1,1) model.

The regression model specified in Equation (5) shows that the unexpected return on individual ASEAN market i is

$$(6) \varepsilon_{i,t} = \phi_{i,t-1}e_{US,t} + \psi_{i,t-1}e_{CN,t} + \eta_{i,t-1}e_{JP,t} + e_{i,t}.$$

Analogously, Equations (1), (3), and (4) show that the unexpected return on the US market, Chinese market, and Japanese market are respectively

$$(7) \varepsilon_{US,t} = e_{US,t}$$

$$(8) \varepsilon_{CN,t} = \phi_{CN,t-1}e_{US,t} + e_{CN,t}$$

$$(9) \varepsilon_{JP,t} = \phi_{JP,t-1}e_{US,t} + e_{JP,t}$$

Define the conditional variance of the unexpected return on individual ASEAN market i as $h_{i,t}$. Then, under the assumption that the idiosyncratic errors ($e_{US,t}$, $e_{CN,t}$, $e_{JP,t}$, and $e_{i,t}$) are independent of each other, Equation (6) suggests that

$$(10) h_{i,t} = E(\varepsilon_{i,t}^2 | f_{t-1}) = \phi_{i,t-1}^2 \sigma_{US,t}^2 + \psi_{i,t-1}^2 \sigma_{CN,t}^2 + \eta_{i,t-1}^2 \sigma_{JP,t}^2 + \sigma_{i,t}^2,$$

where f_{t-1} is the information set available at time $t-1$. Therefore, the conditional variance of the unexpected return for ASEAN market i depends on the variance of the US, Chinese, Japanese, and own idiosyncratic shocks; in other words, the conditional variance of ASEAN market i has four sources: the effects from the US market, Chinese market, Japanese market, and the local market itself. When $\phi_{i,t-1}$ is statistically significant, larger value of US idiosyncratic volatility ($\sigma_{US,t}$) leads to higher $h_{i,t}$. Hence, $\phi_{i,t-1}$ gauges the volatility spillover effect from the US market to market i . Similarly, $\psi_{i,t-1}$ and $\eta_{i,t-1}$ represent the volatility spillover effect from the Chinese and Japanese markets to market i , respectively. Consequently, for ASEAN market i , the variance ratios (VR) accounted for by the US market, Chinese market, Japanese market, and the local market itself are respectively

$$(11) VR_{i,t}^{US} = \phi_{i,t-1}^2 \sigma_{US,t}^2 / h_{i,t},$$

$$(12) VR_{i,t}^{CN} = \psi_{i,t-1}^2 \sigma_{CN,t}^2 / h_{i,t},$$

$$(13) VR_{i,t}^{JP} = \eta_{i,t-1}^2 \sigma_{JP,t}^2 / h_{i,t},$$

$$(14) VR_{i,t}^i = 1 - VR_{i,t}^{US} - VR_{i,t}^{CN} - VR_{i,t}^{JP}.$$

To assess the impact of the two trade agreements on the mean and volatility spillover effects from the US, China, and Japan to the ASEAN countries, we specify the mean and volatility spillover parameters as

$$(15) \gamma_{i,t-1} = \gamma_{0,i} + \gamma_{1,i}D_{1,t-1} + \gamma_{2,i}D_{2,t-1},$$

$$(16) \delta_{i,t-1} = \delta_{0,i} + \delta_{1,i}D_{1,t-1} + \delta_{2,i}D_{2,t-1},$$

$$(17) \mu_{i,t-1} = \mu_{0,i} + \mu_{1,i}D_{1,t-1} + \mu_{2,i}D_{2,t-1},$$

$$(18) \phi_{i,t-1} = \phi_{0,i} + \phi_{1,i}D_{1,t-1} + \phi_{2,i}D_{2,t-1},$$

$$(19) \psi_{i,t-1} = \psi_{0,i} + \psi_{1,i}D_{1,t-1} + \psi_{2,i}D_{2,t-1},$$

$$(20) \eta_{i,t-1} = \eta_{0,i} + \eta_{1,i}D_{1,t-1} + \eta_{2,i}D_{2,t-1},$$

where $D_{1,t}$ and $D_{2,t}$ are respectively the dummy variables for the TPP and CPTPP: $D_{1,t}$ equals to 1 for the "TPP period" (2.4.2016–1.22.2017) and 0 otherwise; $D_{2,t}$ equals to 1 for the "CPTPP period" (3.8.2018–12.31.2019) and 0 otherwise; the base time period is the "withdrawn period" from 1.23.2017 to 3.7.2018. The impacts of the two trade agreements are captured by the parameters for $D_{1,t}$ and $D_{2,t}$, which denotes the changes in the spillover effect relative to the base time period (i.e., the "withdrawn period"). For instance, a positive and statistically significant $\phi_{1,i}$ would suggest that volatility spillovers from the US market to market i were stronger over the TPP period than the withdrawn period. In other words, the TPP strengthened the volatility spillovers from the US market to market i (or when the US withdrew from the TPP, its volatility spillovers to ASEAN market i weakened). Analogously, a positive and statistically significant $\phi_{2,i}$ would indicate that volatility spillovers from the US market to market i

were stronger over the CTPP period than the withdrawn period, or CPTPP raised the volatility spillovers from the US market to ASEAN market i .

Investigating volatility-spillover effects in the European bond markets, Christiansen (2007) proposes a constant spillover model, an euro spillover model, and a trend spillover model. The constant spillover model assumes the spillover parameters to be constant throughout the entire sample period; the euro spillover model, which is used to examine the effect of the introduction of the euro on the spillover dynamics of the European bond markets, assumes the spillover parameters to be constant before and after the introduction of the euro; the trend spillover model postulates that the spillover parameters take on different values each year during the sample period. Our specification for the spillover parameters in Equations (15)-(20) is similar to the euro spillover model and is employed to analyze the impact of the two trade agreements on the spillover dynamics of the ASEAN markets. Our model assumes the spillover parameters to take on different values over the three sub-periods (TPP period, withdrawn period, and CPTPP period), but within each sub-period the spillover parameters are assumed to be constant. The changes of the spillover parameters during the TPP and CPTPP periods relative to the withdrawn period are captured by the parameters of the dummy variables for the TPP and CPTPP.

4. Empirical results

4.1. Mean and volatility spillovers

Table 1 reports the descriptive statistics of the equity market returns for the nine countries analyzed in this study. All the market return series are skewed to the left, show excess kurtosis, and are stationary. Some of the return series and the squared return series have statistically significant autocorrelation coefficient, which supports the AR and GARCH specifications in our spillover models.

Insert Table 1 here

Table 2 shows the parameter estimates for the influence of the two trade agreements on the mean and volatility spillovers from the US, China, and Japan to the ASEAN countries. For the two regional stock markets, volatility spillovers from the US to Japan decreased following the signing of the CPTPP. For the six ASEAN markets, the signing of the TPP raised the mean spillovers from the US to Singapore and reduced that from the US to Vietnam. Over the CPTPP period, the mean spillovers from the US to Malaysia and Vietnam weakened. In contrast, mean spillovers from the Chinese market to the Vietnamese market strengthened during the TPP period.

For the volatility spillover effect of the trade agreements on the ASEAN equity markets, Table 2 shows that TPP raised the volatility spillovers from the US to Indonesia and Thailand. Similarly, volatility spillovers from the US to Indonesia and Malaysia also seem to be stronger after the signing of the CPTPP. Interestingly, at the 5% significance level, neither the TPP nor the CPTPP had statistically significant impact on the volatility transmissions from the Chinese market to the ASEAN markets. Following the signing of the CPTPP, volatility spillovers from Japan to Malaysia and Vietnam became stronger, which is consistent with the finding of Li and Whalley (2021) that as a result of the CPTPP, the exports of Japan will increase moderately and the GDP of Malaysia and Vietnam will raise considerably. Unexpectedly, Singapore received lower volatility transmissions from Japan over the TPP period than the withdrawn period, which may be because Singapore is the only developed country among the ASEAN and hence is more exposed to the external economic and financial shocks. In summary, the results in Table 2 suggest that the TPP increased the financial influence of the US on Indonesia and Thailand, but decreased that of Japan on Singapore; the CPTPP raised the financial impact of the US on Indonesia and Malaysia and that of Japan on Malaysia and Vietnam; however, neither the TPP nor the CPTPP changed the financial influence of China on the ASEAN countries.

Insert Table 2 here

Table 3 reports the results for testing the joint significance of the impacts of the two trade agreements. Wald test statistics further support the findings in Table 2: TPP and CPTPP jointly did not have significant impact on the volatility spillovers from China to the ASEAN countries; TPP and CPTPP jointly altered the volatility transmissions from the US to Indonesia, Malaysia, and Thailand; TPP and CPTPP jointly affected the volatility spillovers from Japan to Malaysia, Singapore, and Vietnam.

Insert Table 3 here

Cross-market volatility spillovers measure the financial market linkages and risk transmissions across countries. The results in this section suggest that although the emerging ASEAN countries could benefit from the trade agreements in terms of exports and GDP growth, their financial linkages and risk transmissions with the member states also tend to be stronger due to the trade agreements.

4.2. Variance ratios

Figure 1 displays the dynamic variance ratios of the ASEAN equity markets accounted for by the US, Chinese, and Japanese markets. Shocks to the US market explained a large proportion of the variance of the unexpected returns on most of the ASEAN markets, which is in line with the finding of Chow (2017) that the US stock market had relatively dominating influence on the Asian markets. Over the sample period, the Japanese market exhibited high impacts on the Malaysian, Singaporean, and Vietnamese markets. The Chinese market had relatively strong influence on the Philippine market over the CPTPP period and on the Vietnamese market over the withdrawn period.

Concerning the impacts of the two trade agreements, Figure 1 shows that compared with the withdrawn period in the middle, volatility spillovers from the US to Indonesia and Thailand over the TPP period were stronger. Analogously, volatility spillovers from the US to Indonesia and Malaysia and those from Japan to Malaysia and Vietnam were generally stronger over the CPTPP period than the withdrawn period. Therefore, for the financial effects of the TPP and CPTPP, the dynamic variance ratios in Figure 1 and the parameter estimates in Table 2 provide similar conclusions.

Insert Figure 1 here

Table 4 presents the mean and standard deviation of the variance ratios of the ASEAN equity markets accounted for by the US, Chinese, and Japanese markets over the three sub-periods. With the largest proportions of the variance of the unexpected returns explained by shocks from the US, China, and Japan, Singaporean market is the one with the highest exposure to external influences among the six ASEAN markets. In line with the regression results in Table 2, Table 4 shows that compared with the withdrawn period, the mean value of the variance ratios of the Indonesian and Thai markets explained by the US shocks was significantly larger over the TPP period; that of the Singaporean market accounted for by the Japanese shocks over the TPP period was considerably smaller than the withdrawn period; relative to the withdrawn period, the average value of the variance ratios of the Indonesian and Malaysian markets due to US shocks and that of the Malaysian and Vietnamese markets due to Japanese shocks over the CPTPP period were significantly higher. Although the average variance ratios of Thailand and Vietnam accounted for by China were lower over the TPP and CPTPP periods than the withdrawn period, the impact of the TPP and CPTPP on China's financial influence on Thailand and Vietnam is not statistically significant at the 5% significance level based on the regression results in Table 2.

Insert Table 4 here

4.3. Specification tests and robustness checks

The spillover models applied in this study are appropriate and adequate based on the properties of the standardized residuals. We analyze the properties of the standardized residuals of all the nine markets (US, Chinese, Japanese, and the six ASEAN markets). We test for no autocorrelation and no ARCH effects in the standardized residuals by the Ljung and Box (1978) Q-statistics and the Engle (1982) Lagrange Multiplier test, respectively. At the 1% significance level, all the nine series of standardized residuals are serially uncorrelated at order 1 and up to order 5; except for the Singaporean market, all the series of the squared standardized residuals have no remaining ARCH(1) effect and are serially uncorrelated at order 1 and up to order 5. As a robustness check, we estimate a GARCH(2,2) model (instead of a GARCH(1,1) model) for the variance equation of the Singaporean market; the resulting series of the squared standardized residuals of the Singaporean market has no remaining ARCH(1) effect and is serially uncorrelated at order 1 and up to order 5; the estimated effects of the TPP and CPTPP for the Singaporean market are qualitatively unchanged.

In order to alleviate the problem that the nine markets in our analysis have nonsynchronous trading hours, we follow Forbes and Rigobon (2002) and explore the robustness of the results by using the average two-day returns. Except that there is some evidence that the volatility spillovers from the Chinese market to the Philippine market were stronger during the CPTPP period, the main findings for the financial impacts of the TPP and CPTPP remain unchanged (see Table A3 in the appendix).

In this study we employ a spillover method similar to that of Bekaert et al. (2005) and Christiansen (2007). We also utilize the spillover/connectedness measures of Diebold and Yilmaz (2012, 2014) to further examine the robustness of the results. Since our study focuses on the global US and regional Chinese and Japanese volatility-spillover effects in the ASEAN countries, we consider the volatility

spillovers from the US, China, and Japan to each of the six ASEAN countries. As in Diebold and Yilmaz (2016), we use the daily range-based volatility estimate of Garman and Klass (1980) and transform the volatility estimate into log volatility.

Table A4 in the appendix reports the pairwise and net pairwise directional volatility spillovers from the US, China, and Japan to each of the six ASEAN countries. The table shows that among the six ASEAN markets, Singaporean market exhibited the largest volatility transmissions with the world markets, which is in line with the results of Kang et al. (2019) and Vo and Tran (2020). The pairwise directional spillovers from the US to Malaysia and Thailand were stronger over the TPP period than the withdrawn period. The TPP also appeared to have increased the volatility spillovers from Japan to some ASEAN countries. For instance, the pairwise directional spillovers from Japan to Indonesia increased from 0.3% over the withdrawn period to 8.84% over the TPP period. Unexpectedly, the spillovers from Japan to Singapore over the TPP period were stronger than the withdrawn period. For the impact of the CPTPP, the table indicates that relative to the withdrawn period, the pairwise directional spillovers from the US to Indonesia and Malaysia strengthened during the CPTPP period; the CPTPP also raised the net pairwise directional spillovers from Japan to Malaysia and Vietnam. The spillovers from China to the ASEAN countries over the TPP and CPTPP periods either witnessed small changes or increased. Overall, our main conclusion remains unchanged: the TPP and CPTPP did boost the financial influence of the US and Japan in some ASEAN countries, but they did not appear to have reduced the financial influence of China in ASEAN.

The outbreak of the COVID-19 pandemic significantly affected the global stock markets. Therefore, we also conduct a robustness check to investigate the impact of the COVID-19 pandemic on the volatility spillovers from the US, Chinese, and Japanese stock markets to the ASEAN markets. We extend the sample period to the December 31, 2021 (since many countries lifted the COVID restrictions in 2022, the effect of the pandemic on the volatility spillovers is more likely to be observed before 2022).

We divide the full sample period into a pre-pandemic period (2.4.2016-12.31.2019) and a pandemic period (1.1.2020-12.31.2021). Defining a pandemic dummy variable which is set to 1 during the pandemic period and 0 otherwise, we apply a similar three-step estimation procedure to examine the impact of the COVID-19 pandemic. Table A5 in the appendix presents the estimation results. The table shows that the COVID-19 pandemic raised the volatility transmissions from the US and Chinese markets to the ASEAN markets ($\phi_{1,i}>0$; $\psi_{1,i}>0$). The effect is statistically significant (at the 5% level) for the volatility spillovers from the US (China) to Vietnam (Indonesia and Vietnam). Akhtaruzzaman et al. (2021) study the financial contagion between China and G7 countries and find that Chinese and Japanese stock markets were the net transmitters of spillovers during the COVID-19 period. Our finding that the Chinese market had stronger volatility spillovers to the ASEAN markets over the pandemic period is in line with that of Akhtaruzzaman et al. (2021). However, in contrast to Akhtaruzzaman et al. (2021), we find that volatility spillovers from the US market rather than the Japanese market significantly changed during the COVID-19 pandemic period. This could be because the investors in the ASEAN countries paid more attention to the highly volatile US stock market during the pandemic period.

5. Conclusions

Mega-regional trade agreements have been used as geopolitical competition tools. The TPP and CPTPP, for instance, were widely viewed as trade agreements aiming at containing the influence of China and raising that of the US and Japan in Asia. Using the volatility-spillover effect of a country's equity market as a proxy for its financial influence, this study examines whether the signing of the TPP and CPTPP reshuffled the financial influence of the US, China, and Japan in ASEAN. The main findings of the study are that the TPP increased the financial influence of the US on Indonesia and Thailand, but also decreased that of Japan on Singapore; the CPTPP raised the financial impact of the US on Indonesia and

Malaysia and that of Japan on two member states of the trade agreements (Malaysia and Vietnam); however, neither the TPP nor the CPTPP changed the financial influence of China on the ASEAN countries. Hence, the overall findings of the study indicate that the TPP and CPTPP did boost the financial influence of the US and Japan in some ASEAN countries; however, there is no evidence that they have reduced the financial influence of China in ASEAN.

Although the emerging ASEAN countries could benefit from free trade agreements in terms of exports and GDP growth, their equity markets may also have to endure larger external financial influences. Policy makers in the corresponding countries thus need to monitor the financial market linkages and risk transmissions more closely, design measures to mitigate the impact of the stronger external financial influences, and take into account the greater financial linkages and risk spillovers when making economic and financial policies. The study also has important practical implications for international investors dealing with emerging markets in general and the ASEAN equity markets in particular, as the analysis of volatility spillovers is essential for reducing portfolio risk from an asset allocation perspective. International investors have traditionally identified the emerging markets as the potential source of diversification benefits due to relatively higher average returns and lower correlations with the developed markets. The findings of this study might imply that international investors should modify their international diversification strategies to reflect for the increase in the global and regional spillovers induced by mega-regional free trade agreements. In this study, we have only focused on the equity market volatility-spillover effects of the TPP and CPTPP. Future research could include extension of our analysis to the bond and currency market volatility-spillover effects of these two trade agreements or the more recently signed RCEP. Another avenue for the further research might be focusing on the industry-specific relationships and connectedness between analyzed countries.

References

- Akhtaruzzaman, M., Boubaker, S. and Sensoy, A. (2021). Financial contagion during COVID-19 crisis. *Finance Research Letters* 38, 101604.
- Arslanalp, S., Liao, W., Piao, S. and Seneviratne, D. (2016). China's growing influence on Asian financial markets. IMF Working Paper, WP/16/173.
- Baele, L. (2005). Volatility spillover effects in European equity markets. *Journal of Financial and Quantitative Analysis* 40, 373–401.
- Batten, J.A., Morgan, P. and Szilagyi, P.G. (2015). Time varying Asian stock market integration. *Singapore Economic Review* 60, 1550006.
- Barunik, J. and Krehlik, T. (2018). Measuring the frequency dynamics of financial connectedness and systemic risk. *Journal of Financial Econometrics* 16, 271–296.
- Bekaert, G., Harvey, C. R. and Ng, A. (2005). Market integration and contagion. *Journal of Business* 78, 39 – 69.
- Bekaert, G. and Mehli, A. (2019). On the global financial market integration “swoosh” and the trilemma, *Journal of International Money and Finance* 94, 227-245.
- Billio, M. and Pelizzon, L. (2003). Volatility and shocks spillover before and after EMU in European stock markets. *Journal of Multinational Financial Management* 13, 323–340.
- Bollerslev, T. and Wooldridge, J. M. (1992). Quasi-maximum likelihood estimation and inference in dynamic models with time-varying covariances. *Econometric Reviews* 11, 143–172.
- Boubakri, S. and Guillaumin, C. (2015). Regional integration of the East Asian stock markets: an empirical assessment. *Journal of International Money and Finance* 57, 136–160.
- Caporale, G. M, You, K. and Chen, L. (2019). Global and regional stock market integration in Asia: A panel convergence approach. *International Review of Financial Analysis* 65, 101381.

- Chevallier, J., Nguyen, D. K., Siverskog, J. and Uddin, G. S. (2018). Market integration and financial linkages among stock markets in Pacific Basin countries. *Journal of Empirical Finance* 46, 77–92.
- Chien, M.-S., Lee, C.-C., Hu, T.-C. and Hu, H.-T. (2015). Dynamic Asian stock market convergence: evidence from dynamic cointegration analysis among China and ASEAN-5. *Economic Modelling* 51, 84–98.
- Choi, S. Y. (2022). Volatility spillovers among Northeast Asia and the US: Evidence from the global financial crisis and the COVID-19 pandemic. *Economic Analysis and Policy*, 73, 179-193.
- Chow, H. K. (2017). Volatility spillovers and linkages in Asian stock markets. *Emerging Markets Finance and Trade* 53, 2770–2781.
- Christiansen, C. (2007). Volatility-spillover effects in European bond markets. *European Financial Management* 13, 923–948.
- Clements, A.E., Hurn, A.S., and Volkov, V.V. (2015). Volatility transmission in global financial markets. *Journal of Empirical Finance* 32, 3-18.
- Dickey, D. A. and Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association* 74, 427–431.
- Diebold, F.X. and Yilmaz, K. (2009). Measuring financial asset return and volatility spillovers, with application to global equity markets. *Economic Journal* 119, 158–171.
- Diebold, F.X. and Yilmaz, K. (2012). Better to give than to receive: predictive directional measurement of volatility spillovers. *International Journal of Forecasting* 28, 57–66.
- Diebold, F.X. and Yilmaz, K. (2014). On the network topology of variance decompositions: measuring the connectedness of financial firms. *Journal of Econometrics* 182, 119–134.
- Diebold, F.X. and Yilmaz, K. (2016). Trans-Atlantic equity volatility connectedness: U.S. and European financial institutions, 2004–2014. *Journal of Financial Econometrics* 14, 81–127.

- Donadelli, M. and Paradiso, M. (2014). Is there heterogeneity in financial integration dynamics? Evidence from country and industry emerging market equity indexes. *Journal of International Financial Markets Institutions and Money*, 32, 184–218.
- Engle, R. F. (1982). Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation. *Econometrica* 50, 987–1007.
- Flavin, T.J., Hurley, M.J. and Rousseau, F. (2002). Explaining stock market correlation: a gravity model approach. *Manchester School* 70, 87–106.
- Forbes, K. J. and Rigobon, R. (2002). No contagion, only interdependence: measuring stock market comovements. *Journal of Finance* 57, 2223–2261.
- Fujiwara, I. and Takahashi, K. (2012). Asian financial linkage: macro-finance dissonance. *Pacific Economic Review* 17, 136–159.
- Gamba-Santamaria, S., Gomez-Gonzalez, J.E., Hurtado-Guarin, J. L. and Melo-Velandia, L.F. (2017). Stock market volatility spillovers: Evidence for Latin America. *Finance Research Letters* 20, 207–216.
- Garman, M.B. and Klass, M.J. (1980). On the estimation of security price volatilities from historical data. *Journal of Business* 53, 67–78.
- Jiang, J., Piljak, V., Tiwari, A.K. and Äijö, J. (2020). Frequency volatility connectedness across different industries in China. *Finance Research Letters* 37, 101376.
- Kang, S.H., Uddin, G.S., Troster, V. and Yoon, S.M. (2019). Directional spillover effects between ASEAN and world stock markets. *Journal of Multinational Financial Management* 52–53, 100592.
- Kiviaho, J., Nikkinen, J., Piljak, V. and Rothovius, T. (2014). The Co-movement Dynamics of European Frontier Stock Markets. *European Financial Management* 20, 574-595.
- Koenker, R. and Machado, J. A. F. (1999). Goodness of fit and related inference processes for quantile regression. *Journal of the American Statistical Association* 94, 1296-1310.

- Lehkonen, H. (2015). Stock Market Integration and the Global Financial Crisis. *Review of Finance* 19, 2039–2094.
- Li, W. (2021). COVID-19 and asymmetric volatility spillovers across global stock markets. *The North American Journal of Economics and Finance*, 58, 101474.
- Li, Y. and Giles, D.E. (2015). Modelling volatility spillover effects between developed stock markets and Asian emerging stock markets. *International Journal of Finance and Economics* 20, 155–177.
- Li, C. and Li, D. (2021). When Regional Comprehensive Economic Partnership Agreement (RCEP) meets Comprehensive and Progressive Trans-Pacific Partnership Agreement (CPTPP): Considering the "Spaghetti Bowl" effect. *Emerging Markets Finance and Trade*, DOI: 10.1080/1540496X.2021.1949284.
- Li, C., and Whalley, J. (2014). China and the Trans-Pacific Partnership: A numerical simulation assessment of the effects involved. *World Economy* 37, 169–192.
- Li, C. and Whalley, J. (2021). Effects of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership. *World Economy* 44, 1312–1337.
- Ljung, G. M. and Box, G. E. P. (1978). On a measure of lack of fit in time series models. *Biometrika* 65, 297–303.
- Lucey, B.M. and Zhang, Q. (2010). Does cultural distance matter in international stock market comovement? Evidence from emerging economies around the world. *Emerging Markets Review* 11, 62–78.
- Lucey, B.M, Vigne, S. A., Ballester, L., Barbopoulos, L., Brzezczynski, J., Carchano, O., Dimic, N., Fernandez, V., Gogolin, F., González-Urteaga, A., Goodell, J.W., Helbing, Marinč, M., McGee, R.J., McGroarty, F., Neville, C., O’Hagan-Luff, M., Piljak, V., Sevic, A., Sheng, X., Stafylas, D., Urquhart, A., Versteeg, R., Vu, A.N., Wolfe, S., Yarovaya, L. and Zaghini, A. (2018). Future

- directions in international financial integration research - A crowdsourced perspective. *International Review of Financial Analysis* 55, 35–49. <https://doi.org/10.1016/j.irfa.2017.10.008>
- MacDonald, R., Sogiakas, V. and Tsopanakis, A. (2018). Volatility co-movements and spillover effects within the Eurozone economies: A multivariate GARCH approach using the financial stress index. *Journal of International Financial Markets, Institutions and Money*, 52, 17-36.
- Mensi, W., Boubaker, F.Z., Al-Yahyaee, K.H. and Kang, S.H. (2018). Dynamic volatility spillovers and connectedness between global, regional, and GIPSI stock markets. *Finance Research Letters* 25, 230–238.
- Mink, M. (2015). Measuring stock market contagion: Local or common currency returns? *Emerging Markets Review* 22, 18–24.
- Miyakoshi, T. (2003). Spillovers of stock return volatility to Asian equity markets from Japan and the US. *Journal of International Financial Markets, Institutions and Money* 13, 383–399.
- Mukhopadhyay, K. and Thomassin, P.J. (2018). The impact of Trans-Pacific Partnership agreement on the Canadian economy. *Journal of Economic Structures* 7, DOI: 10.1186/s40008-017-0102-y.
- Ng, A. (2000). Volatility spillover effects from Japan and the US to the Pacific-Basin. *Journal of International Money and Finance* 19, 207 – 233.
- Petri, P.A. and Plummer, M.G. (2019). Mega-regional agreements and their impact on Australia. *Australian Economic Review* 52, 468– 475.
- Pukthuanthong, K. and Roll, R. (2009). Global market integration: an alternative measure and its application. *Journal of Financial Economics* 94, 214–232.
- Rafiq, S. (2016). When China sneezes does ASEAN catch a cold? IMF Working Paper, WP/16/214.

- Rai, K. and Garg, B. (2021). Dynamic correlations and volatility spillovers between stock price and exchange rate in BRIICS economies: evidence from the COVID-19 outbreak period. *Applied Economics Letters*, DOI: 10.1080/13504851.2021.1884835.
- Singh, P., Kumar, B. and Pandey, A. (2010). Price and volatility spillovers across North American, European and Asian stock markets. *International Review of Financial Analysis* 19, 55–64.
- Syriopoulos, T., Makram, B. and Boubaker, A. (2015). Stock market volatility spillovers and portfolio hedging: BRICS and the financial crisis. *International Review of Financial Analysis* 39, 7-18.
- Troster, V. (2018). Testing for Granger-causality in quantiles. *Econometric Reviews* 37, 850-866.
- Vinayak, H.V., Thompson, F. and Tonby, O. (2014). *Understanding ASEAN: Seven Things You Need to Know*. McKinsey & Company Insights & Publications.
<https://www.mckinsey.com/industries/public-sector/our-insights/understanding-asean-seven-things-you-need-to-know>.
- Vo, X.V. and Tran, T.T. A. (2020). Modelling volatility spillovers from the US equity market to ASEAN stock markets. *Pacific-Basin Finance Journal* 59, 101246.
- Wall Street Journal (17 April, 2015). TPP: Momentum on Trade Deal Bolsters U.S., Japan Efforts to Counter China. <https://www.wsj.com/articles/tpp-momentum-on-trade-deal-bolsters-u-s-japan-efforts-to-counter-china-1429249448>
- Wang, L. (2014). Who moves East Asian stock markets? The role of the 2007–2009 global financial crisis. *Journal of International Financial Markets, Institutions and Money* 28, 182-203.
- Wang, B. and Xiao, Y. (2023). Risk spillovers from China's and the US stock markets during high-volatility periods: Evidence from East Asian stock markets. *International Review of Financial Analysis*, 102538.
- Wu, L., Meng, Q. and Xu, K. (2015). ‘Slow-burn’ spillover and ‘fast and furious’ contagion: a study of international stock markets. *Quantitative Finance* 15:6, 933-958.

Yu, I., Fung, L. and Tam, C. (2010). Assessing financial market integration in Asia-equity markets.
Journal of Banking and Finance 34, 2874–2885.

Zhang, D., Hu, M. and Ji, Q. (2020). Financial markets under the global pandemic of COVID-19.
Finance Research Letters 36, 101528.

Table 1. Descriptive statistics of the equity market returns.

	US	CN	JP	ID	MY	PH	SG	TH	VN
Mean	0.07	0.01	0.05	0.04	-0.01	0.02	0.04	0.03	0.06
Std.	0.86	1.19	1.24	1.25	0.63	1.18	0.92	0.89	1.14
Skew.	-0.73	-0.50	-0.64	-0.51	-1.04	-0.08	-0.03	-0.20	-0.48
Kurt.	7.50	6.48	8.90	5.92	10.00	5.30	6.58	5.14	6.99
AC(1)	0.01	0.02	-0.05	-0.01	0.02	-0.03	0.04	0.02	0.06
AC(5)	-0.02	-0.02	-0.06	0.00	-0.07*	-0.07***	-0.04*	-0.03	-0.11***
AC ² (1)	0.16***	0.07*	0.12***	0.08**	0.12***	0.02	0.02	0.06*	0.10***
AC ² (5)	0.13***	0.06***	0.07***	0.00***	0.00***	0.03	0.03	0.07**	0.29***
ADF	-26.71	-26.32	-28.10	-27.19	-26.18	-27.62	-25.84	-26.37	-25.20

Notes: the table reports some descriptive statistics of the daily equity market returns (in %) for the following nine countries: US, China (CN), Japan (JP), Indonesia (ID), Malaysia (MY), Philippines (PH), Singapore (SG), Thailand (TH), and Vietnam (VN). The reported statistics are the mean, standard deviation, skewness, kurtosis, autocorrelation coefficient of the return series (order 1 and 5), autocorrelation coefficient of the squared return series (order 1 and 5), and the augmented Dickey-Fuller (ADF) unit root test statistics (Dickey and Fuller, 1979). All the ADF test statistics are statistically significant at the 1% significance level. *, **, and *** denote statistical significance of the autocorrelation coefficient (up to the given order) at the 10%, 5%, and 1% significance level, respectively.

Table 2. Parameter estimates for the impact of the TPP and CPTPP.

		CN	JP	ID	MY	PH	SG	TH	VN
Mean spillovers from US:	$\gamma_{0,i}$	0.25*	0.62***	0.31***	0.30***	0.37***	0.28***	0.18***	0.52***
		(0.15)	(0.16)	(0.07)	(0.04)	(0.09)	(0.05)	(0.06)	(0.11)
	$\gamma_{1,i}$	-0.09	0.25	0.21	-0.06	0.03	0.19**	0.03	-0.44***
		(0.19)	(0.34)	(0.13)	(0.07)	(0.13)	(0.09)	(0.12)	(0.13)
	$\gamma_{2,i}$	0.03	-0.06	0.02	-0.14**	-0.07	0.03	-0.04	-0.31***
		(0.16)	(0.17)	(0.11)	(0.06)	(0.11)	(0.06)	(0.08)	(0.12)
Mean spillovers from CN:	$\delta_{0,i}$			-0.17***	0.01	-0.09	0.05	0.08	-0.20**
				(0.06)	(0.04)	(0.06)	(0.07)	(0.06)	(0.10)
	$\delta_{1,i}$			0.14*	-0.01	0.14	-0.10	-0.13	0.22**
				(0.08)	(0.05)	(0.10)	(0.09)	(0.08)	(0.11)
	$\delta_{2,i}$			0.09	0.04	0.10	-0.01	-0.06	0.20*
				(0.10)	(0.05)	(0.09)	(0.07)	(0.07)	(0.10)
Mean spillovers from JP:	$\mu_{0,i}$			-0.06	-0.07**	-0.06	-0.02	-0.07	-0.02
				(0.06)	(0.03)	(0.06)	(0.04)	(0.04)	(0.08)
	$\mu_{1,i}$			-0.10	0.04	-0.07	0.03	-0.02	-0.02
				(0.12)	(0.05)	(0.07)	(0.06)	(0.07)	(0.08)
	$\mu_{2,i}$			-0.01	-0.01	-0.02	-0.03	0.01	-0.04
				(0.09)	(0.05)	(0.08)	(0.05)	(0.07)	(0.09)
Volatility spillovers from US:	$\phi_{0,i}$	0.14	0.71***	-0.02	0.04	0.27***	0.41***	0.21***	0.31**
		(0.12)	(0.13)	(0.07)	(0.04)	(0.09)	(0.08)	(0.06)	(0.14)
	$\phi_{1,i}$	0.06	-0.18	0.42***	0.08	-0.15	-0.01	0.34***	-0.15
		(0.18)	(0.26)	(0.13)	(0.06)	(0.14)	(0.11)	(0.12)	(0.16)
	$\phi_{2,i}$	0.16	-0.38***	0.26**	0.13**	-0.20	-0.10	0.03	-0.10
		(0.15)	(0.15)	(0.11)	(0.05)	(0.12)	(0.08)	(0.08)	(0.15)
Volatility spillovers from CN:	$\psi_{0,i}$			0.09	0.03	-0.09	0.10	0.15**	0.34***
				(0.08)	(0.04)	(0.12)	(0.07)	(0.07)	(0.11)
	$\psi_{1,i}$			-0.17	0.06	0.17	0.07	-0.10	-0.22*
				(0.12)	(0.06)	(0.14)	(0.11)	(0.09)	(0.12)
	$\psi_{2,i}$			0.02	0.00	0.27*	0.04	-0.05	-0.19
				(0.11)	(0.05)	(0.14)	(0.07)	(0.08)	(0.12)
Volatility spillovers from JP:	$\eta_{0,i}$			0.07	0.08**	0.26***	0.40***	0.11**	0.07
				(0.07)	(0.03)	(0.09)	(0.07)	(0.05)	(0.09)
	$\eta_{1,i}$			0.06	0.00	-0.10	-0.22***	0.05	0.03
				(0.08)	(0.04)	(0.11)	(0.08)	(0.07)	(0.10)
	$\eta_{2,i}$			0.07	0.14**	-0.13	-0.08	0.11	0.22**
				(0.12)	(0.06)	(0.13)	(0.08)	(0.09)	(0.11)

Notes: to conserve space, the table only reports the estimated parameters involving the spillover effects in the mean equations (the estimated parameters of the conditional variance equations are reported in Panel A of Table A2 in the appendix). Bollerslev and Wooldridge (1992) robust standard errors are shown in the parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance level, respectively.

Table 3. Wald test for the joint significance of the impacts of the TPP and CPTPP.

	ID	MY	PH	SG	TH	VN
H ₀ : US volatility spillovers unaltered	6.06*** (0.00)	2.97** (0.05)	1.38 (0.25)	0.97 (0.38)	4.38*** (0.01)	0.42 (0.66)
H ₀ : CN volatility spillovers unaltered	1.55 (0.21)	0.83 (0.44)	1.71 (0.18)	0.21 (0.81)	0.58 (0.56)	1.62 (0.20)
H ₀ : JP volatility spillovers unaltered	0.29 (0.75)	3.71** (0.02)	0.63 (0.53)	4.57*** (0.01)	0.76 (0.47)	3.69** (0.03)

Notes: p-values are shown in the parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance level, respectively.

Table 4. Mean and standard deviation of the variance ratios over the three sub-periods.

	TPP period			Withdrawn period			CPTPP period		
	<i>VR_US</i>	<i>VR_CN</i>	<i>VR_JP</i>	<i>VR_US</i>	<i>VR_CN</i>	<i>VR_JP</i>	<i>VR_US</i>	<i>VR_CN</i>	<i>VR_JP</i>
Indonesia:									
Mean	7.88	0.80	2.50	0.05	0.57	0.47	3.34	1.32	1.12
Std.	6.18	0.69	2.24	0.27	0.23	0.36	2.85	0.69	0.63
Malaysia:									
Mean	3.76	4.40	4.34	0.57	0.27	3.07	6.03	0.30	9.94
Std.	2.87	3.32	3.66	0.58	0.17	1.53	5.04	0.15	4.27
Philippines:									
Mean	0.90	1.05	5.35	4.11	0.49	5.83	0.43	3.19	1.17
Std.	0.81	1.21	5.89	4.44	0.17	3.37	0.43	1.39	0.77
Singapore:									
Mean	10.68	3.58	7.39	15.26	0.96	24.53	13.77	4.52	15.71
Std.	6.86	0.95	5.97	8.23	0.28	7.17	9.67	2.25	5.71
Thailand:									
Mean	17.74	0.46	4.96	5.10	2.97	2.45	6.62	2.17	6.37
Std.	9.52	0.22	3.23	5.23	1.09	1.40	5.27	1.03	2.26
Vietnam:									
Mean	2.48	3.47	2.94	5.53	7.65	0.42	3.94	3.27	7.46
Std.	2.22	3.95	3.08	3.23	2.44	0.21	3.73	1.72	3.91

Notes: the table presents the mean and standard deviation of the variance ratios of the ASEAN equity markets accounted for by the US (*VR_US*), Chinese (*VR_CN*), and Japanese (*VR_JP*) markets over the three sub-periods.

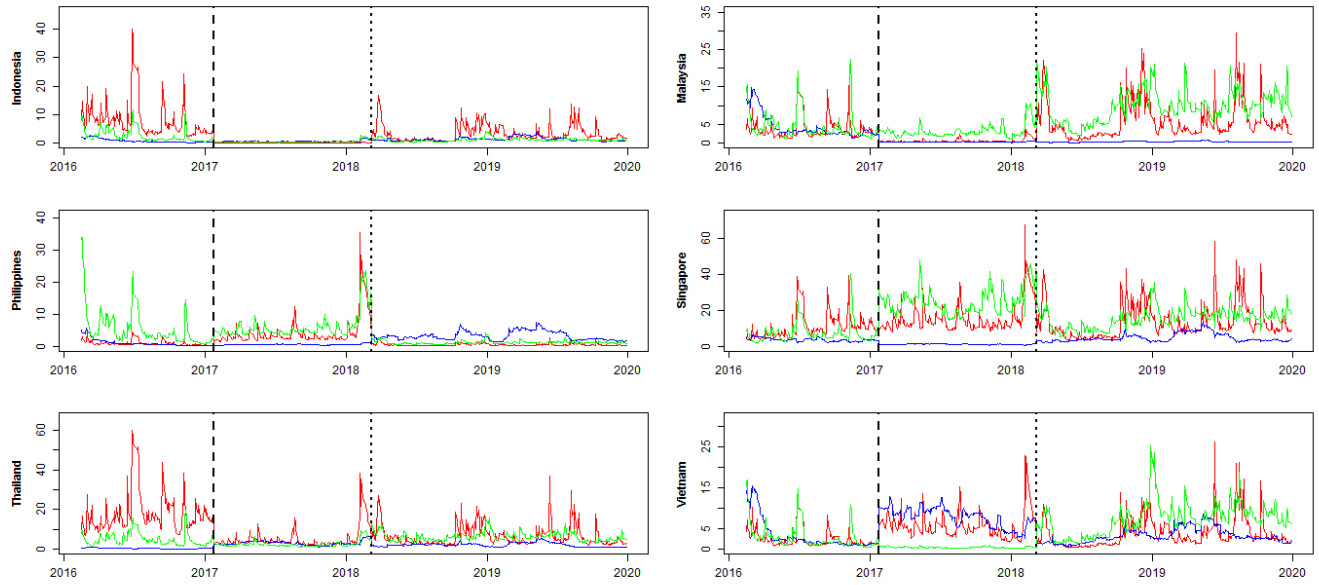


Figure 1. Evolutions of the variance ratios accounted for by the US market (red line), Chinese market (blue line), and Japanese market (green line). The first dashed vertical line corresponds to the date when the US withdrew from the TPP (23 January 2017); the second dotted vertical line denotes the date when the CPTPP was official signed (8 March 2018).

Appendix

Table A1. Pairwise Granger causality tests.

Null Hypothesis	F-statistic	p-value
CN does not Granger cause US	1.33	0.21
US does not Granger cause CN	6.28	0.00
JP does not Granger cause US	1.39	0.18
US does not Granger cause JP	14.56	0.00
JP does not Granger cause CN	0.91	0.53
CN does not Granger cause JP	0.75	0.69

Notes: Except for the test for Granger causality between China and Japan, the pairwise Granger causality test results are based on VAR models of order 10. The test for Granger causality between China and Japan are based on a VAR model of order 11. Breusch-Godfrey serial correlation LM tests indicate that each one of the VAR residuals is serially uncorrelated. The table shows the results of tests for the Granger-causality in mean between the return series. We also conduct tests for the Granger-causality-in-quantile between the return series (for Granger-causality-in-quantile tests, see e.g., Koenker and Machado, 1999; Troster, 2018). The tests indicate that the results of the above table still hold for the quantiles in the 30th-70th percentiles, except for the causality from China and Japan to the US in the 70th percentile.

Table A2. Parameter estimates for the conditional variance equations.

	US	CN	JP	ID	MY	PH	SG	TH	VN
Panel A:									
ω	0.092** (0.040)	0.014 (0.009)	0.097** (0.038)	0.040 (0.026)	0.004* (0.002)	0.036 (0.026)	0.005 (0.003)	0.017 (0.013)	0.020* (0.011)
α	0.286*** (0.095)	0.052** (0.021)	0.174*** (0.059)	0.058** (0.023)	0.065** (0.029)	0.041** (0.018)	0.034 (0.021)	0.034** (0.017)	0.062*** (0.020)
β	0.617*** (0.105)	0.934*** (0.022)	0.751*** (0.058)	0.913*** (0.036)	0.926*** (0.026)	0.930*** (0.035)	0.952*** (0.023)	0.937*** (0.029)	0.918*** (0.026)
Panel B:									
ω	0.031*** (0.010)	0.012** (0.006)	0.044*** (0.017)	0.058*** (0.018)	0.008*** (0.003)	0.024* (0.015)	0.002* (0.001)	0.067*** (0.020)	0.014** (0.007)
α	0.409*** (0.089)	0.135*** (0.042)	0.200*** (0.050)	0.265*** (0.060)	0.211*** (0.047)	0.107*** (0.029)	0.037* (0.020)	0.239*** (0.057)	0.097*** (0.029)
β	0.518*** (0.086)	0.843*** (0.042)	0.700*** (0.062)	0.642*** (0.068)	0.731*** (0.059)	0.848*** (0.054)	0.946*** (0.023)	0.473*** (0.110)	0.865*** (0.038)

Notes: the table shows the estimated parameters of the conditional variance equation (GARCH(1,1) model) for each of the nine markets. Panel A reports the parameter estimates for the case when daily returns are analyzed (parameter estimates for the corresponding mean equations are reported in Table 2); Panel B reports the parameter estimates for the case when the average two-day returns are analyzed (parameter estimates for the corresponding mean equations are reported in Table A3 in the appendix). Bollerslev and Wooldridge (1992) robust standard errors are shown in the parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance level, respectively.

Table A3. Parameter estimates for the impact of the TPP and CPTPP based on the average two-day returns.

		CN	JP	ID	MY	PH	SG	TH	VN
Mean spillovers from US:	$\gamma_{0,i}$	0.12 (0.09)	0.55*** (0.10)	0.17** (0.07)	0.27*** (0.05)	0.36*** (0.08)	0.26*** (0.07)	0.18*** (0.05)	0.37*** (0.12)
	$\gamma_{1,i}$	-0.02 (0.13)	-0.16 (0.21)	0.24* (0.13)	-0.09 (0.06)	-0.05 (0.12)	0.03 (0.11)	0.00 (0.09)	-0.28** (0.14)
	$\gamma_{2,i}$	0.15 (0.11)	-0.08 (0.11)	-0.02 (0.11)	-0.14** (0.06)	-0.16 (0.11)	0.05 (0.08)	-0.10 (0.07)	-0.19 (0.13)
Mean spillovers from CN:	$\delta_{0,i}$			-0.15*** (0.05)	-0.01 (0.03)	-0.06 (0.07)	0.01 (0.05)	0.02 (0.04)	-0.15** (0.07)
	$\delta_{1,i}$			0.12* (0.07)	-0.01 (0.03)	0.06 (0.09)	0.00 (0.07)	-0.06 (0.05)	0.19** (0.08)
	$\delta_{2,i}$			0.08 (0.07)	0.05 (0.03)	0.07 (0.09)	-0.01 (0.05)	-0.03 (0.05)	0.13 (0.08)
Mean spillovers from JP:	$\mu_{0,i}$			-0.01 (0.05)	-0.06** (0.03)	-0.05 (0.07)	-0.03 (0.04)	-0.08** (0.04)	-0.03 (0.07)
	$\mu_{1,i}$			-0.11 (0.08)	0.04 (0.04)	-0.08 (0.08)	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.08)
	$\mu_{2,i}$			-0.01 (0.08)	0.01 (0.04)	0.05 (0.10)	-0.03 (0.05)	0.13** (0.06)	0.00 (0.09)
Volatility spillovers from US:	$\phi_{0,i}$	0.23** (0.12)	0.73*** (0.11)	0.05 (0.08)	0.08** (0.03)	0.22*** (0.08)	0.41*** (0.06)	0.23*** (0.06)	0.38*** (0.13)
	$\phi_{1,i}$	0.04 (0.17)	-0.50 (0.36)	0.35*** (0.12)	0.05 (0.05)	-0.16 (0.12)	-0.03 (0.09)	0.24** (0.11)	-0.27* (0.14)
	$\phi_{2,i}$	0.06 (0.13)	-0.34*** (0.12)	0.21** (0.10)	0.11** (0.05)	-0.12 (0.11)	-0.10 (0.07)	0.02 (0.08)	-0.16 (0.14)
Volatility spillovers from CN:	$\psi_{0,i}$			0.07 (0.06)	0.04 (0.03)	-0.13 (0.11)	0.11* (0.06)	0.17*** (0.06)	0.22** (0.11)
	$\psi_{1,i}$			-0.11 (0.09)	0.05 (0.04)	0.22* (0.12)	-0.04 (0.09)	-0.07 (0.08)	-0.09 (0.11)
	$\psi_{2,i}$			0.08 (0.09)	-0.04 (0.05)	0.26** (0.13)	0.05 (0.07)	-0.07 (0.07)	-0.06 (0.12)
Volatility spillovers from JP:	$\eta_{0,i}$			0.05 (0.06)	0.08** (0.03)	0.19*** (0.07)	0.38*** (0.05)	0.11** (0.05)	0.01 (0.09)
	$\eta_{1,i}$			0.05 (0.09)	0.00 (0.04)	0.01 (0.09)	-0.16** (0.07)	0.09 (0.07)	0.13 (0.10)
	$\eta_{2,i}$			0.08 (0.10)	0.18*** (0.05)	-0.13 (0.11)	-0.10 (0.07)	0.05 (0.08)	0.25** (0.11)

Notes: to conserve space, the table only reports the estimated parameters involving the spillover effects in the mean equations (the estimated parameters of the conditional variance equations are reported in Panel B of Table A2). Bollerslev and Wooldridge (1992) robust standard errors are shown in the parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance level, respectively.

Table A4. Volatility spillovers from the global and regional markets to the ASEAN markets.

Panel A: Pairwise directional volatility spillovers from US, CN, and JP to ASEAN markets									
	TPP period			Withdrawn period			CPTPP period		
	From US	From CN	From JP	From US	From CN	From JP	From US	From CN	From JP
ID	1.67	4.89	8.84	4.90	1.02	0.30	5.58	1.17	2.39
M Y	9.38	9.77	7.63	2.12	1.85	3.91	4.49	1.69	2.31
PH	2.10	0.82	2.25	3.20	2.58	0.44	2.87	1.49	0.56
SG	6.94	7.40	10.00	14.16	1.97	2.31	7.39	2.28	4.10
TH	4.38	1.73	2.25	2.29	1.72	0.72	3.01	2.25	3.02
VN	2.04	4.12	7.08	11.21	1.49	9.10	6.53	5.96	6.06

Panel B: Net pairwise directional volatility spillovers from US, CN, and JP to ASEAN markets									
	TPP period			Withdrawn period			CPTPP period		
	From US	From CN	From JP	From US	From CN	From JP	From US	From CN	From JP
ID	-0.59	1.06	3.81	3.08	-6.95	-1.49	4.64	-1.23	0.37
M Y	4.05	6.36	2.77	-7.28	-2.33	-3.34	3.59	1.56	1.40
PH	-0.06	-0.32	1.00	0.05	0.62	-1.78	1.84	-0.61	-0.57
SG	1.76	3.99	1.91	10.51	0.41	0.98	5.55	-1.00	-0.33
TH	-0.51	-0.13	-1.80	-5.75	-0.65	-7.09	2.75	0.63	1.43
VN	0.11	3.68	2.33	3.52	-11.83	-2.07	5.73	0.40	3.24

Notes: the table reports the Diebold and Yilmaz (2012, 2014) volatility spillovers from the global (the US) and regional (China and Japan) markets to the ASEAN markets.

Table A5. Parameter estimates for the impact of the COVID-19 pandemic.

		CN	JP	ID	MY	PH	SG	TH	VN
Mean spillovers from US:	$\gamma_{0,i}$	0.27*** (0.06)	0.59*** (0.06)	0.35*** (0.05)	0.22*** (0.02)	0.33*** (0.04)	0.31*** (0.03)	0.16*** (0.04)	0.20*** (0.04)
	$\gamma_{1,i}$	-0.18** (0.08)	-0.09 (0.09)	0.05 (0.16)	-0.05 (0.06)	0.05 (0.13)	0.00 (0.07)	0.06 (0.08)	-0.03 (0.07)
Mean spillovers from CN:	$\delta_{0,i}$			-0.09** (0.04)	0.02 (0.02)	0.02 (0.04)	0.02 (0.02)	0.03 (0.03)	-0.02 (0.03)
	$\delta_{1,i}$			0.00 (0.07)	-0.02 (0.05)	-0.02 (0.09)	-0.08* (0.04)	-0.07 (0.06)	0.13* (0.07)
Mean spillovers from JP:	$\mu_{0,i}$			-0.10 (0.06)	-0.04* (0.02)	-0.08** (0.03)	0.00 (0.03)	-0.05* (0.03)	-0.02 (0.03)
	$\mu_{1,i}$			0.01 (0.10)	0.08* (0.05)	0.16* (0.09)	-0.01 (0.06)	0.14** (0.06)	0.00 (0.06)
Volatility spillovers from US:	$\phi_{0,i}$	0.22*** (0.06)	0.41*** (0.06)	0.18*** (0.06)	0.10*** (0.03)	0.12** (0.05)	0.32*** (0.03)	0.26*** (0.04)	0.20*** (0.04)
	$\phi_{1,i}$	0.05 (0.09)	-0.01 (0.08)	0.16 (0.13)	0.05 (0.06)	0.16 (0.11)	0.05 (0.06)	0.12 (0.08)	0.15** (0.08)
Volatility spillovers from CN:	$\psi_{0,i}$			0.10** (0.05)	0.04** (0.02)	0.10** (0.05)	0.12*** (0.03)	0.11*** (0.03)	0.18*** (0.03)
	$\psi_{1,i}$			0.18** (0.09)	0.10* (0.06)	0.02 (0.10)	0.02 (0.06)	0.08 (0.08)	0.27** (0.11)
Volatility spillovers from JP:	$\eta_{0,i}$			0.13*** (0.03)	0.10*** (0.02)	0.18*** (0.04)	0.31*** (0.03)	0.18*** (0.03)	0.13*** (0.03)
	$\eta_{1,i}$			0.07 (0.08)	0.06 (0.05)	0.08 (0.10)	-0.05 (0.06)	-0.06 (0.08)	-0.09 (0.09)

Notes: to conserve space, the table only reports the estimated parameters involving the spillover effects in the mean equations. Bollerslev and Wooldridge (1992) robust standard errors are shown in the parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% significance level, respectively.