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Keywords	Shadow short rate; Quantitative Easing; Spillover Effect; Unconventional Monetary Policy
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Abstract

This study aims to investigate the spillover effects of the US unconventional monetary policy (UMP) on macroeconomic and financial conditions in Asian emerging countries. In this study, I employed a panel VAR (Vector Autoregression) model and panel Fixed-Effect model to analyze the impact of this unconventional monetary shock on Asian emerging markets (AEMs). The data covers the period from December 2003 to April 2018. The unconventional monetary policy in the US is measured by the Shadow Short Rate (SSR), which is not commonly used in previous studies. The empirical findings from this study are summarized as follows. First, the expansionary monetary shocks not only spill over into Asian stock market but also affects the currency markets. The excess liquidity from the US resulted in an increase in equity prices and an appreciation pressure for local currencies in AEMs. Empirical evidence also points to the significant impacts of QE shocks on AEMs in post-crisis periods compared to the pre-crisis period. Third, this study also sheds light on the heterogeneous responses among AEMs to the US excessive liquidity by examining the degree of trade and financial linkages between each country and the US. While the level of trade openness strengthens the impact of quantitative easing (QE) shocks on asset prices, a high openness degree in global financial activities lessens the responses of AEMs to the external shocks. Moreover, countries with flexible exchange rate are likely to respond more to QE shocks.

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JEL classifications: E44, E52, F41

1. Introduction

The global financial crisis (GFC) has been one of the most significant shocks in the post-war period, leaving credit conditions markedly tightened and international financial markets dysfunctional. Thus, most of the advanced economies needed to drastically cut the traditional monetary policy instrument (i.e., interest rate), which meant it became stuck at the zero-lower bound (ZLB). In response to the near-zero interest rate, the US Federal Reserve initiated an alternative monetary policy tool termed as 'quantitative easing' (QE) in which a central bank purchases government securities, aiming at altering the global conditions (Rafiq, 2015). The main purposes of this program are to ease financial conditions and support a sustained economic recovery by putting downward pressure on long-term interest rates. According to Wright (2012), a Large Scale Asset Purchases (LSAP) program is conceived as an instrument that prevails over the periods when unconventional monetary policy was being deployed in the US. Specifically, QE policy involves purchasing safe assets such as Treasury debt, federal agency bonds, mortgage-backed securities and high-grade corporate bonds that aim to serve the purpose of keeping the federal funds rate at a low level.

Notably, as well as impacting domestically, the QE policy impacts internationally upon other nations. Expanding monetary policy associated with an increasing degree of capital mobility will result in an investing environment with a lower interest rate, hence increasing global liquidity and stimulating carry-trade opportunities of investors. In other words, investors will have the incentive to invest in higher yields, encouraging capital in the US flows to emerging countries. Brana, Djigbenou, and Prat (2012) suggested that excess global liquidity will be able to boost the economic prospect in developing nations. On the other hand, Bianchi (2011) and Lorenzoni (2008) both argue that large capital inflows can result in credit boom, thus leaving asset price collapse and further causing economic and financial instability the recipient countries. Tillmann (2015) refers to the argument of Brazil's President Dilma Rousseff to describe QE shocks as 'sudden floods' of liquidity to emerging countries, which might lead to severe consequences on economic fundamentals of one country. More important, a continuing currency war is likely to fuel a trade war among countries.

The focus of this research will be on investigating the impact of the expansion of monetary aggregates in the US on asset prices in Asian emerging markets. Most of the literature tends to focus on large emerging nations (i.e., Bhattarai, Chatterjee, and Park, 2018; Tillmann, 2015) with fewer research focusing comprehensively only on Asian nations. According to Park, Ramayandi and Shin (2013), global instability is likely to substantially threaten the growth and prospect of Asian nations. Additionally, Southeast Asian nations have a long history of economic ties with the US because of its dominant role as their trading partner. Notably, after the GFC, Indonesia and the Philippines witnessed fragile economies, awkward policies, and a great loss of investor confidence. Miyakoshi, Shimada, and Li (2017) specify that Korean and

Singaporean stock markets play the leading role in Asia, which are characterized by a similar structure with advanced markets.

Additionally, this study investigates the channels through which QE shocks will affect financial and macroeconomic conditions in Asian countries. Based on the findings of this investigation, this research will offer some helpful recommendations for AEMs key-decision makers, by which they can mitigate the adverse effects from external shocks in their countries.

This study will ask the following four questions with the aim of answering them:

1. Is there the presence of spillover effect of the US QE shocks on Asian emerging nations?
2. Are there different spillovers effects between conventional monetary policy and unconventional monetary policy?
3. How could QE shock from the US affect other economies?
4. Why do different markets respond differently to QE shock?

2. Literature Review

2.1 Theoretical framework

Using the Mundell–Fleming (MF) model initiated by Mundell (1963) and Fleming (1962), Joyce, Tong, and Woods (2011) comprehensively studied five transmission channels: money, policy signaling, portfolio rebalancing, market liquidity and confidence effects. What follows details how each channel operates.

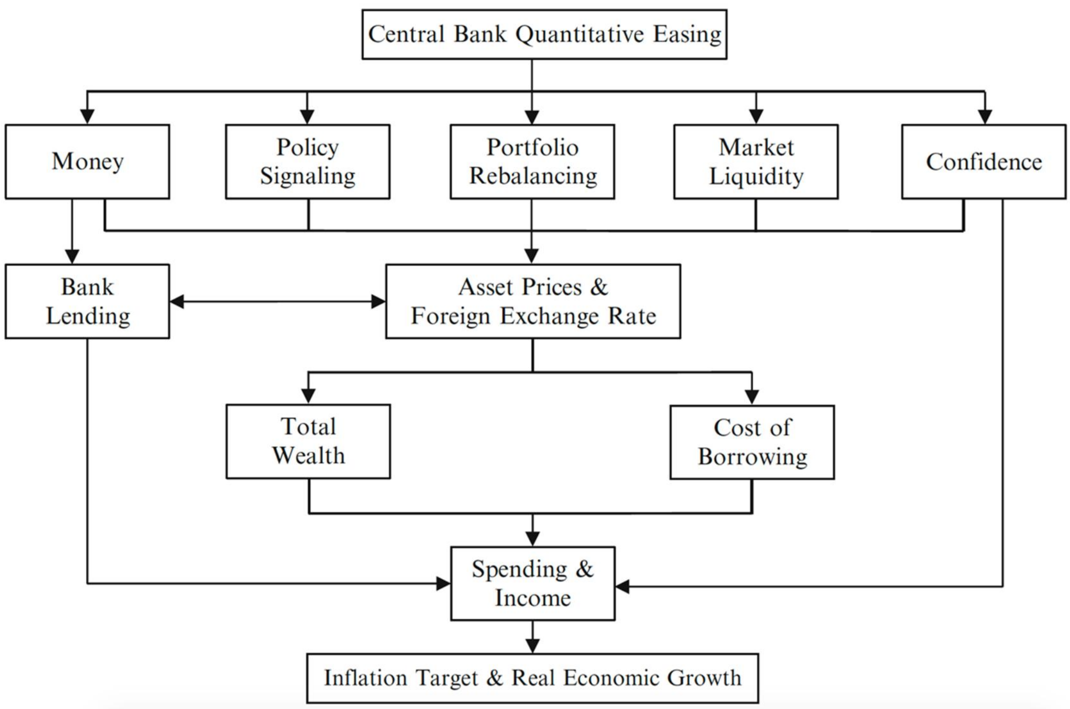

Figure 1. Transmission channels of quantitative easing

(Source: Adopted from Joyce et al., 2011)

Signaling channel

Regarding the signalling channels, the announcements of non-traditional expansionary monetary policy aim to signal that the future course of short-term interest rates will continue to experience a decline. By implementing LSAPs, the Federal Reserve would like to indicate to investors that it would sustain an expansionary monetary policy for a longer time than expected previously. Having said that, the signaling effect refers to the perceptions of central banks about future economic conditions. For example, because an expectation of worse conditions will increase the demand for T-bills from investors, such a signal will immediately lower the average, expected short-term yield, which is a crucial component of a bond yield over longer terms.

Portfolio rebalance channel

Concerning the portfolio balance channel, it is crucial to comprehend the 'preferred habitat theory' for investors, which has significantly influenced the yields of securities being purchased and their close substitutes. Generally, investors would like to place their capital in long-term safe investments (Krishnamurthy & Vissing-Jorgensen, 2011). However, once the Federal Reserve purchases securities, the portfolio rebalancing channel will produce its effect so that the amount of assets held by private sectors reduces. Therefore, they are inclined to invest in international securities which closely substitute for US assets being purchased (Hausman & Wongswan, 2011). Consequently, this purchase program bids up the price of the assets being bought under the LSAPs as well as their substitutes, thus lowering yields and term premium of these assets, until the new equilibrium is reached.

Liquidity channel

The greater participation of the central bank in the market is expected to increase market functioning and also reduce the liquidity premium required (Joyce et al., 2011). When a monetary policy is expansionary, this channel would assist market participants to liquidate their positions when required, as the large asset purchased by a central bank will reduce their costs. Furthermore, an increasing liquidity flow following QE policy would help to boost equity and property prices. Through this channel, QE policy is expected to stimulate more investments in riskier assets. Consequently, by boosting wealth and the level of spending, the expansionary policy will significantly contribute to greater consumption, production and employment.

Other channels also mentioned by in Joyce et al. (2011) were the confidence and bank lending effects. Once the economic outlook improves, market participants will be more confident purchasing assets, resulting in increased prices and declined risk premiums. Relevant to the bank lending channel, UMP policy would benefit the banking sector by increasing broad money held by people after they purchase large assets.

In general, these transmission channels indicate that QE shocks will cause interest rate to decline and stock prices to increase. Additionally, the channels are not mutually exclusive but could happen at the same time. Adding to this, commodity prices tend to decline in response to the announcements of LSAPs. Nevertheless, according to Glick and Leduc (2012), LSAPs could also raise the security yields and commodity prices given future expectations of lower risk. Therefore, it is important to consider not only the state of economic conditions but also the sentiment of investors about investment risks.

2.2 Empirical Research

Generally, two strands of the literature explore the mechanism of unconventional monetary policy shock. The first explores the determinants of QE shocks to developing countries (e.g., Fratzscher, 2012; Forbes & Warnock, 2012). Second are studies investigating the impact of non-traditional monetary policy shock on real and financial variables in Emerging Market Economies (Aizenman & Noy, 2006; Bowman, Londono, & Sapriza, 2015). Additionally, concerning the measurement of the Fed's policy stance applied after the GFC, earlier studies used two primary categories of analysis, namely event study and balance sheets' assets changes. This part will mainly focus on the measurement of policy stance in literature.

These event studies generally follow two research courses: first, the announcements of the Federal Open Market Committee (FOMC) meetings and speeches by Chairman Bernanke; and second, they assess changes of term structure of interest rates. Much research uses event-study analysis, starting with Gagnon et al. (2011), then Krishnamurthy and Vissing-Jorgensen (2011), Glick and Leduc (2012), Wright (2012) and Neely (2015). Some focus on the domestic financial markets (i.e., Gagnon et al., 2011; Glick & Leduc, 2012), while some also consider international financial markets (i.e., Hausman & Wongswan, 2011; Neely, 2015). However, less research investigates the impact of QE on the real economy, as do Dahlhaus, Hess, and Reza (2018).

The high-frequency event-study analysis of Wright (2012) considers the total effect of QE shocks on intraday changes of asset prices. Such analyses point to a negative relation between three periods of QE shocks and the interest rates that were reserved over the following periods. In a model-based event study, Bauer and Rudebusch (2011) suggest that around 30% to 65% of the total impact on term structure is attributable to the signaling effect while Gagnon et al. (2011) document that this channel only accounts for 30% of the changes in interest rates. Bauer and Neely (2014) measured three rounds of asset purchases including QE1, QE2, QE3[1] by estimating the importance of signaling and portfolio balance channels with the focus on the

[1] QE1, QE2, QE3 are used to refer to quantitative easing programs that occurred in the first, second and third phases of implementation respectively.

term structure of interest rates.

Hausman and Wongswan (2011) employed current rates (target surprise) and expected rates (path surprise) as two proxies for US unconventional monetary shocks upon the announcement days. Notably, they found that nations with rigid exchange rate regimes would have greater reaction in the equity market and larger interest-rate response. Hancock and Passmore (2011) find that QE surprises create substantial downward pressure on mortgage rates through the portfolio rebalancing channel. Aizenman, Binici and Hutchison (2014) conduct a 'quasi-event' study to assess the impacts of the US QE tapering announcements on the financial conditions of developing countries, showing that country characterised by a strong fundamental will respond more to the tapering statements compared to the weak country.

Concerning the studies on central bank balance sheet, researchers used to base their approach on the changes of components on the balance sheet as per QE policy. Bhattarai et al. (2018) argue that securities held outright are the main components of QE policy in the US, especially after ZLB started binding. They argue that other assets such as gold stock, SDRs, or loans accounted for a very small portion and stayed constant during the QE phases. Bhattarai et al. (2018) also evidence a stronger impact of QE shocks on financial variables compared to that on real macroeconomic variables. Additionally, Dahlhaus et al. (2018) proxied the unconventional monetary stance by the long-term assets on the US Federal Reserve's balance sheet.

Macdonald (2017) measures the policy stance of the Fed during the aftermath period by five different types of assets balance sheets, standing out by an application of gravity-in-international-finance model by which a significant differences in responses of EMEs to the monetary shocks from the US was documented. Macdonald (2017) also emphasises on the magnitude and signs of coefficients associated with asset prices, indicates that each type of assets exposed differently to the excess liquidity from advanced countries. Macdonald (2017) eventually points to a salient suggestion, recommending policymakers in emerging countries to orientate their monetary policies earlier by cautiously bearing in mind the level of market friction and trade integration in global market earlier.

Fratzscher, Lo Duca, and Straub (2018) provide two reasons for measuring policy stance based on the actual asset purchased rather than on FOMC announcements. First, asset purchases could capture the liquidity of actual market operations by the Federal Reserve during the aftermath. Second, it is inaccurate to measure the effectiveness of non-standard monetary policy by market expectations following the announcements (Fratzscher et al., 2018).

Although the previous studies addressed the issue quite comprehensively, there are still considerable gaps. Few studies either compare the different impacts between conventional and unconventional monetary policies or indicate whether the impact of financial variables outweighs that of macroeconomic variables. To the best of my knowledge, only Bhattarai et al. (2018) take account of this matter. Also, there is no consensus on which is the most appropriate measure of policy stances of the US Federal Reserve during the aftermath. While event studies cannot reflect the impacts of QE surprises on macroeconomic variables, measuring by the changes on a central bank balance sheet also fails to comprehensively capture policies related to QE programs, for example, the forward guidance (Macdonald & Popiel, 2016). Notably, little research addresses the spillover effect of UMP on both macroeconomic and financial conditions in Asian emerging markets. Of that, Miyakoshi et al. (2017) focus on the changes in stock price, Xu and La (2017) on bank lending, and Ogawa and Wang (2016) on how QE affects interest rates, exchange rates and capital outflows in the East Asian nations.

While Morgan (2011) analyses the East-Asian market using visual inspection on data rather than an econometric approach, Miyajima, Mohanty, and Yetman (2014) employ a monetary transmissions model to study the impacts of the US long-term yield on Asian economies. The latter study indicates that low bond yields in Asian countries are significantly associated with a low US term premium under QE programs. However, Miyajima et al. (2014) only focus on the direct role of interest rate channel but not investigate in other channels, for instance portfolio rebalancing or market liquidity channels. Cho and Rhee (2014) investigate how loosening monetary policy from the US can influence capital inflows and financial condition in Asia. Nonetheless, Cho and Rhee (2014) do not address how stock markets in Asia are influenced by QE surprises and do not account for potential spill-over effect of QE programs from the US. Generally, these studies do not essentially show whether heterogeneity exists in the responses of asset prices to the UMP by the US Federal Reserve aftermath.

After noting these gaps and varying empirical results, I study the spill-over effect of QE programs on Asian nations to an extent that could complement previous studies. To the best of my knowledge, this is one of the first studies that focuses on AEMs using various channels and linkages including trade and financial nexuses. Additionally, different from previous research in Asian countries, I measure the policy stance based on the shadow short rate (SSR) estimated by Krippner (2016) as it can capture the overall policy stances which comprise LSAPs and forward guidance by Fed. With these distinctions, I aim to contribute meaningfully to the literature.

3. Methodology

This study takes a VAR-based approach in analysing the impact of QE policy, which also accords with the method in Wright (2012) and Gambacorta et al. (2014). The research will be implemented in two steps:

1. Identifying shocks from unconventional monetary policy.

2. Tracing out the spillovers effect of unconventional monetary policy in the US on AEMs through trade linkage and financial linkage.

3.1 Identify shocks from unconventional monetary policy

When monetary policy reacts to the effect of other macroeconomic variables, it is challenging to measure the pure impact of the policy on the economy. Therefore, identifying only the exogenous shocks would help to ascertain the dynamic effects of the unconventional monetary policy. Sims (1980a) indicates that structural VAR (SVAR) is one of the most practical classes of models for empirical macroeconomics and finance. Specifically, Stock and Watson (2001) emphasize that SVAR can importantly identify the causal links in the econometric model, thus allowing simultaneous interactions among variables. Additionally, to delay the transmission of monetary policy, its effects should be restricted. To impose such restrictions, structural VAR is thus the most suitable approach in this research. Regarding the US economy, I adopt a SVAR model as follows:

$$A_0 y_t = A_1^* y_{t-1} + A_2^* y_{t-2} + \cdots + A_k^* y_{t-k} + B\varepsilon_t \quad (2)$$

In which, y_t is a vector of endogenous variables, which will be later detailed in this paper. Also, ε_t follows the normal distribution $\mathbb{N}(0, I_{my})$. Moreover, E $(\varepsilon_t | y_{t-j}: i \geq 1) = 0$. In this model, I assume that the structural shocks are orthogonal and can thus ascertain the relationship between the errors of the reduced and structural forms, as follows:

$$Au_t = B\varepsilon_t$$

Breitung, Brüggemann, and Lütkepohl (2004) explain the setting of linear restrictions of A and B matrices, and specify the additional restrictions needed for identification: $n^2 - \frac{n^2+n}{2} = \frac{n^2-n}{2}$. Therefore, the system becomes exactly identified. It is important to note that a proper identified structural model would help lessen the probability of endogeneity problems.

This research then employs a theory-based restrictions SVAR approach to identify monetary policy shocks when the economy gets stuck at zero lower bound (ZLB). The identification of structural shocks in this model will use exact restrictions implied by the empirical models, based on the beliefs of the relationship between variables. Because the QE shocks can be understood as unanticipated deviation from the QE policy, this deviation is exogenous to the US economic condition. Macdonald and Popiel (2016) adopt an upper triangular matrix with the order {*policy rate, VIX index, commodity export price, price, output*} to identify the unconventional monetary policy shocks. Gambacorta et al. (2014) assumed that stock market volatility would not respond to the QE shocks. Output and prices would not be expected to react to the changes of monetary policy within a month, which accords with Leeper, Sims, and Zha (1996) and Macdonald and Popiel (2016). Gambacorta et al. (2014) also assert that monetary shocks only affect macroeconomic variables with lags. In other words, because the growth rate and price level would not change in the short-term, the contemporaneous impacts of QE shocks on these variables are restrained to zero.

This research thereby follows Macdonald and Popiel (2016) by ordering the variables. Table 1 summarizes the restrictions considered for the benchmark model, as follows.

[Table 1 near here]

3.2 Trace out the international effect of non-standard monetary policy from the US on the Asian emerging countries

3.2.1 Panel Fixed-Effect Model

This section examines the impact of QE shock on asset prices in AEMs by adopting a panel data of 10 nations in Asia with fixed effects. Its purpose is to measure the average spillover effect of unconventional monetary policy shocks from the US on the AEMs. It is important to note that a crucial assumption of the panel fixed effect is the time-invariant characteristics are unique to each individual, which are uncorrelated with the characteristics of other individuals. The estimation equation is presented as below:

$$\Delta y_{it} = \alpha + c_i^y + \sum_{j=0}^{q} \beta_{i,j}\,.\,eta_{t-j} + \theta^y.\,X_{it} + \sum_{j=0}^{q} \rho_{i,j}\,.\,eta_{t-j}\,.\,Linkages + \varepsilon_{it}$$

In which, y_{it} denotes the percentage change in asset prices (stock prices, long-term yield, exchange rate) of country *i* at month *t*. α is the intercept whereas c_i^y is the country-fixed effects, reflecting country-specific characteristics. Eta_t captures the shocks to SSR in the US which is obtained previously. X_{it} is a row vector of control variables that accounts for domestic conditions, defined as growth rate. This vector includes three variables: market capitalization, monetary bases and real output for each country *i*. Market capitalization reflects the investment ability of foreign investors on each AEMs. I also include the interaction terms between QE shocks and the indicator of Trade/Financial Linkages to explore the heterogeneity impacts of QE programs on Asian economies.

3.2.2 Panel VAR for the Asian emerging markets

After identifying QE shocks from the US, I adopt a Panel VAR model to explore its dynamic effects on asset prices for a group of emerging countries in Asia, solely focusing on the short-run effects. The Panel VAR was introduced by Holtz-Eakin, Newey, and Rosen (1988), afterwards adopted in various research of international transmission of monetary policy such as Brana et al. (2012), Bhattarai et al. (2018). Panel VAR is considered as a pair of extensions based on panel data analysis and vector autoregression models (VAR). This model has a feature of enabling individual heterogeneity by adopting the fixed effect in the levels of variables, thus improving the asymptotic results (Holtz-Eakin et al., 1988). Peter (2013) also emphasizes the advantage of this method of suitability for unbalanced panels, allowing researchers to process the panel data with different timespan among individuals. I then apply a block exclusion restriction in the panel VAR, assuming that AEMs do not affect the economic condition of the US, as do Bhattarai et al. (2018). The Panel VAR model can be expressed as:

$$X_{it} = \mu_i + \Phi(L).X_{it} + \varepsilon_{it}$$

The sample includes 10 countries which are indexed as i=1,2,3, …10 and $\Phi(L)$ represents for the lag operator. μ_i and ε_{it} represent for individual effects and idiosyncratic error terms, respectively. $\Phi(L)$ is a matrix polynomial in the lag operator L. X_{it} is a vector of including shocks to SSR of the US, macroeconomic and financial conditions in AEMs. UMP shock is considered as an exogenous shock which has contemporaneous impact on asset prices in AEMs. Therefore, exogenous shocks such as QE surprises should be placed first, which is similar to the study of Brana et al. (2012). Belke, Orth, and Setzer (2010) suggest placing macroeconomic variables before financial variables, implying output and inflation should be placed before asset prices. In addition, Darius (2010) propose that the domestic variables should lag behind the international influences. The order in this analysis will be put as follows: *{SSR, Growth, M2, Market Capitalization, Asset prices}*. The lagged regressor will be used as the instrumental variables in Panel VAR (Abrigo & Love, 2016).

Based on previous discussion, I propose the following hypotheses which also recap the research questions.

Hypothesis 1: The QE shocks have a significant impact on asset prices which are equity price, long-term bond yields and exchange rates in AEMs.

In the regard of this hypothesis, I expect that QE shocks from the US will increase stock price, lower long-term yields and appreciate currency values in AEMs.

Hypothesis 2: There is heterogeneity degree in the responses between high degree of trade openness group and low degree of trade openness group.

Hypothesis 3: There is heterogeneity degree in the responses between high degree of financial openness group and low degree of financial openness group.

Hypothesis 4: The impacts of unconventional monetary policy from the US on AEMs are different with the conventional monetary policy.

4. Result and Discussion

4.1 Data

Based on data availability, my sample contains 10 Asian emerging countries: China, India, Indonesia, Malaysia, South Korea, Singapore, Sri Lanka, Thailand, Philippines and Vietnam. The monthly data covers the period from December 2003 to April 2018 with the primary sources being *Bloomberg* and IMF databases. For the output of all economies, I employed the real GDP, extracted from IMF; the export and import volumes for each country were also collected from IMF. As real GDP is not available at monthly frequency, I employ the Chow-Lin procedure for temporal disaggregation. In addition, because GDP was not sufficiently collected from *Bloomberg* and IMF, I later updated the data using the national resources. The growth rate of broad money in each country was retrieved from the CEIC database and the US data were retrieved from FRED. Capital flowing between the US and Asian nations was obtained from the US Bureau of Economic Analysis. This table below depicts data statistics in this research. Other details are presented in appendix 1.

[Table 2 near here]

4.2 Data Analysis

4.2.1 The US economy

First, based on the common selection criteria named the Akaike information criteria (AIC) (Akaike, 1969), the optimal lag selected is 2 (see Appendix 2). The SVAR estimation is then proceeded with the constraints introduced previously. This section continues to discuss the impact of the US non-traditional monetary policy in its macroeconomy.

[Figure 2 near here]

The IRFs of US macroeconomic variables to one standard deviation of QE shocks is depicted in figure 2 above. As commonly evidenced in previous studies (i.e., Anaya et al., 2017; Gambacorta et al., 2014), the US UMP shocks are associated with a positive response of real GDP growth which peaks at around 0.04%. This finding is in line with the visual inspection data earlier, implying that the expansionary monetary policy in the US during the aftermath helps to boost economic growth in this country. Likewise, the response of inflation the Fed's enlargement of balance sheet is positive. The response of price level reaches its peak of 0.05% and lasts up to 5 months. Figure 2 also shows a negative response of VIX Index to QE shocks after 2 months, which is analogous to Gambacorta et al. (2014). As a prime gauge of stock market volatility, a negative response of VIX Index implies that QE policy mitigates the fear of financial turmoil and economic instability. As expected, following a loosening monetary policy, long-term interest rate gradually decreases, indicating that market participants' expectation of a lower interest rate. Afterwards, the first series of structural shocks was retrieved as the measure of UMP shocks for subsequent analysis in the international context.

4.2.2 Average spillovers effect of the US QE shocks

The panel fixed-effect model for each asset price is described as:

$$y_{it} = \alpha_0 + c_i + . \sum_{p=0}^{4} \beta_p eta_{t-p} + \gamma_i X_{it} + \vartheta_i Trade_{it} + \sum_{p=0}^{4} \tau_p . eta_{t-p} . Trade_{it-p} + e_{it}$$

In which, y_{it} is a vector representing for three asset prices, which capture the growth rates of stock price index, exchange rates and the change of long-term bond yields for country *i* at the time *t*. *eta* represents for the UMP shocks which were retained from previous step. As it might take time for the shocks to have an impact on asset prices, I then used the lags of *eta*. Also, c_i aims to capture individual-specific effect, is constant over time. X_{it} is still a vector of control variables including the economic growth rate, growth rate of broad money and the growth rate of market capitalization. The results are reported in Table 3. To account for the contemporaneous correlation across panels, I also use Panel-Corrected Standard Errors (PCSE).

[Table 3 near here]

Table 3 shows that on average, the US Federal Reserve's QE programs were linked to a statistically significant rise in stock prices, a decline in sovereign yields, and currency appreciation by the shock itself or through the link. The empirical result in this part indicates a trivial impact of QE shocks on foreign long-term bond yields. Considerably, the Fed monetary shocks significantly influenced other asset prices in emerging markets in Asia after four months (see columns 1, 2 and 6). One standard deviation increases in QE surprises led to a rise in stock prices by around 0.45% and currency appreciation by 0.17%, on average.

On average, the trade linkage seems to exert an important role in transmitting QE shocks to stock prices in Asian countries during the given period and a higher level of integration strengthens specifically the influence of shock on equity prices. In addition, the trade linkage stimulates a negative impact of QE shocks on long-term interest rates, which is similar to the country-specific estimation and literature. However, the magnitude of the impact is quite negligible.

The next section will discuss how the financial integration can influence the impacts of QE shocks on AEMs. I estimate a panel regression, which also considers the level of financial integration between AEMs and the US. This panel fixed-effect model is given as follows, in which *Finm* represents for financial linkage:

$$y_{it} = \alpha_0 + c_i + . \sum_{p=0}^{4} \beta_p eta_{t-p} + \gamma_i X_{it} + \vartheta_i Finm_{it} + \sum_{p=0}^{4} \tau_p . eta_{t-p} . Finm_{it} + e_{it}$$

[Table 4 near here]

It has been shown from the table 4 that an expansionary monetary policy in the US is accompanied by appreciation of currencies, increases in stock prices, and decline in long-term interest rates in Asian countries. The QE shocks particularly seem to affect foreign equity prices more strongly and sooner than other asset prices, which could increase average stock prices in AEMs by 0.56%. In addition, the R-squared values imply that monetary surprises from the US exert the highest explanatory power for equity prices and the lowest for foreign sovereign yield. Specifically, the equity markets that have more financial integration with the US will respond less to QE shocks. This result is consistent with Macdonald (2017) who finds that nations with strong market frictions experienced a smaller increase in stock prices. Moreover, the financial integration slightly lessens the impact of QE shocks in nations with a high degree of integration.

Overall, related to two linkages, the R-squared values suggest that monetary surprises from the US explain more for the fluctuation in equity prices than other asset prices. In other words, the QE programs seem to support growth in AEMs by providing liquidity for their financial systems.

4.2.3 Sub-groups analysis

The sub-groups analysis in the following sections will help to explain the pattern of heterogeneous spillover effects from the US Federal Reserve's large-scale purchases. It will be shown that the degree of market friction explains the cross-country heterogeneity in the responses of asset prices to external monetary shocks.

High degree and low degree of trade integration

H_0: The US monetary shock has a homogeneous impact across sub-groups

H_1: The US monetary shock has a heterogeneous impact across sub-groups

[Table 5 near here]

Table 5's analysis is consistent with the previous section investigating the average spillover effects of QE shocks. At 5% level of significance, the results show that equity markets that have more trade integration will more actively respond to QE shocks than the equity markets in countries with low degree of integration. This is in line with the positive value of the proxy for trade links that we found previously in the panel fixed-effect analysis. Through trade linkages, QE shocks notably increased long-term interest rates in countries that were less integrated into global business cycles (0.0135%), but this was almost offset after one month (-0.0123%). Generally, QE surprises slightly affect long-term bond yields in AEMs. Nations with high-integrated levels in global trade saw a strong appreciation in currencies.

While Macdonald (2017) indicates that market frictions were less able to explain the heterogeneity across countries in responses to interest rates, this study finds that bilateral frictions in trade linkages are unable to explain the heterogeneity in currencies' reaction to the

US Federal Reserve's purchasing programs. The difference might stem from the different sample and different time frame.

High degree and low degree of financial integration

H_0: The US monetary shock has a homogeneous impact across sub-groups

H_1: The US monetary shock has a heterogeneous impact across sub-groups

[Table 6 near here]

Table 6 shows that, unsurprisingly, financial linkages lessen the effect of QE shocks on the countries which integrated more in global financial market.[2] This parallels the outcomes from average spillover effects on AEMs earlier. This finding somehow confirms the study of Miyajima et al. (2014) on five Asian economies, implying that some Asian countries can limit the rising in price level and mitigate external shocks by implementing macro-prudential policies over the last few years. Furthermore, the purchasing liquid assets of the US Federal Reserve is likely to decline in the markets with a higher degree of integration sooner than the low degree ones. The sub-group analysis for exchange rate is essentially in line with the panel fixed-effect analysis previously mentioned, meaning that nations with a higher degree of financial integration witnessed greater currency appreciation.

Conventional and unconventional monetary shocks

H_0: Conventional shocks on AEMs are similar to unconventional shocks

H_1: Conventional shocks on AEMs are different to unconventional shocks

In this part, we split the data into two periods before and after October 2008 to find whether there is a substantial change the QE impacts on asset prices in AEMs between two phases.

[Table 7 near here]

It is important to note that the SSR before crisis reflects the traditional monetary policy stances. Thus, this result allows to draw inferences about the differences between the traditional and non-traditional monetary shocks. Table 7 again demonstrates the significant impacts of QE policies of stock prices in AEMs. While QE shocks seem not to impact upon stock prices during the pre-crisis period, they caused a positive response on equity prices in AEMs after four months during the aftermath. The result does not demonstrate any considerable difference in long-term bond yields between two periods, a not unsurprising outcome because my preceding analysis also did not indicate the significant impact of QE programs on long-term interest rates. Contrary to the pre-crisis period, QE shocks exert a negative impact on exchange rates after October 2008, implying that the currency values of AEMs strongly appreciated against US dollars after the crisis.

Overall, the empirical findings support for all hypotheses, except hypothesis 1b.

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[2] In which, the US is the dominant player.

4.2.4 Impulse responses of asset prices in Asian countries to the US QE shocks

I estimate the response of asset prices in Asia to unconventional monetary policy shocks by the '*pvar*' routine introduced by Love and Zicchino (2006). Gambacorta et al. (2014) suggest that in a dynamic panel, fixed effects can be correlated with lagged values of dependent variables, causing inconsistent estimators. Therefore, to remove the panel-specific fixed-effects, the first-differencing technique is applied. Also, the cointegration test[3] does not show any significant long-run relationship among the non-stationary variables (see Appendix 3). Thus, the first differences of asset prices and market capitalization will be used in estimating Panel VAR.

The stability conditions of panel VAR estimated have been checked prior to the IRFs. The Eigen-values stability condition is satisfied, implying that the estimate is stable. With a horizon of 10 months for the IRFs, I use a Cholesky identification scheme with 100 Monte Carlo draws for standard errors. The option '*byopt(yrescale)*' is also adopted to fix the annoying scaling problems when graphing impulse response functions. Afterwards, the lag length of one was chosen based on the criteria named MAIC, MBIC, MHQIC.

[Figure 3 near here]

Figure 3 depicts the average response asset prices in AEMs to the US monetary shocks. Similar to the results from Panel Fixed-Effects, in response to an expansionary monetary policy from the US, stock prices in AEMs significantly increase after two months. Regarding the response of exchange rate, the peak effect occurs after two months, it is shown from the graph that there is a slight decrease in long-term bond yields in response to external monetary shocks. However, responses of average long-term bond yields in AEMs is somehow trivial, which confirms the findings from the Panel Fixed-Effect approach earlier.

[Figure 4 near here]

The real GDP growth rate in AEMs respond positively to QE surprises, which peaks after 3 months. This finding is in line with Brana et al. (2012), pointing that excess liquidity from the US contributes to a rise in GDP in recipient countries. However, the QE policy only has a positive impact on growth rate in AEMs in short-run and gradually disappears in the long-run. This finding is associated with the expectation from a monetary shock, which temporarily boosts output growth. In addition, monetary growth in AEMs decrease in response to an excess liquidity from the US. Furthermore, the money base growth rates in AEMs respond negatively to monetary shocks from US, signaling that capital might flight back to the home country. This supports Miyakoshi et al. (2017), implying that capital repatriation is 'a sign of the desperation of central bankers'.

[Figure 5 near here]

This result confirms that equity prices in AEMs respond positively to US unconventional monetary shocks. In addition, there is evidence that QE shocks modestly influence long-term

[3] I performed the Kao panel-data cointegration test

bond yield in the short-run, but this effect seems to be persistent in the long-run. Although the panel fixed-effect approach did not find a significant impact of excess liquidity from the US to long-term interest rates, the signs of coefficients indicate a negative relationship.

4.2.5 Robustness check

To identify the QE shocks from the US, Bowman et al. (2015) employ an event-study approach to compare with their initial approach using SVAR. Gambacorta et al. (2014) use different lengths of lagged variables in the robustness analysis. Punzi and Chantapacdepong (2017) and Bhattarai et al. (2018) employed shadow short rates estimated by different methods. In this section, I test the robustness of my research by using another SSR (see Wu & Xia, 2016) over different time (from Decemeber 2003 to November 2015). The SSR measured by Wu and Xia (2016) is less volatile compared to that of Krippner (2016).

The QE shocks estimated by the SSR of Wu and Xia (2016) also significantly affect asset prices in AEMs after four months. Similar to previous analysis using SSR estimated by Krippner (2016), non-standard monetary policy from the US lead to increases in stock prices and appreciation of local currency in AEMs (Appendix 4). These QE shocks also exert subdued impacts on long-term bond yields in Asian economies. However, employing the SSR by Wu and Xia (2016), the level of trade integration does not strengthen the impacts of external shocks on AEMs.

4.3 Discussion

Closest to my research work into the spillover effect of QE shocks from the US to foreign countries through trade and financial linkages are Hausman and Wongswan (2011). These authors and Macdonald (2017) both confirm that the US QE shocks affect asset prices in foreign nations. Hausman and Wongswan (2011) specify that the QE programs by the US Federal Reserve play a crucial role in the decline of foreign long-term bond yields. However, I find rather that monetary surprises from the US show the least explanatory power for long-term interest rates in AEMs. The variation may be that the US QE surprises are measured differently. Upon the R-squared values, my analysis indicates that equity markets in AEMs are the most affected by the external monetary surprise, while Hausman and Wongswan (2011) find that interest rates markets suffered the greatest impact of QE shocks.

This research shares the view with Hausman and Wongswan (2011) and Macdonald (2017) that market friction could determine the magnitude and direction of QE impacts on asset prices in foreign countries. Having said that, the variation among countries in response to QE shocks can be partly explained by the degree of trade and financial integration. This study also found that the sign and size of QE shocks on asset prices varied between different types of linkages. The results show that countries characterized by a low degree of financial openness seem to be more influenced by the UMP shocks from the US.

This study is consistent with previous papers (i.e, Glick & Leduc, 2012; Punzi & Chantapacdepong, 2017) that suggest external monetary shocks put upward pressure on currency values in Asian countries. Additionally, this research agrees with Tillmann (2015) that excess liquidity from the US contribute to increasing foreign equity prices in emerging economies. Similar to Claus, Claus, and Krippner (2018), my study also shows that the US unconventional monetary policy shocks exert more significant impacts on asset price in recipient countries than the effects under conventional period. The sign of correlations between monetary shocks and asset prices are also relatively similar under two periods, thus agreeing with Claus et al. (2018). However, the magnitude of QE shocks on Asian markets is relatively small, which accords with Rafiq (2015). This result somehow supports the finding of Chudik and Fratzscher (2011) that the liquidity shocks from the US tend to influence other developed countries rather more strongly than EMEs. Generally, my study only addressed the impacts of QE programs on asset prices in AEMs through trade and financial linkages. Capital controls and exchange rate regimes are among the potential control variables awaiting future research.

5. Concluding remarks

The global financial crisis of 2007 to 2008 triggered financial turmoil across countries. In response to the crisis, large central banks around the globe cut the policy rates closed to zero. The low interest rate prompted the US Federal Reserve to subsequently find an alternative solution, that is, the Quantitative Easing policy, to provide an economic stimulus and assist credit markets. The main findings from this research fall broadly in line with research that indicates an existence of spillover effect from the US to foreign countries under QE implementation. This supports the idea that "When the U.S. sneezes, emerging markets catch a cold" (Maćkowiak, 2007). Specifically, this study consistently found that QE shocks was effective in increasing stock prices in AEMs. In addition, AEMs also experienced an appreciation of currency against the US dollars under the implementation of QE programs. However, the impact of unconventional monetary policy from the US on long-term yields in AEMs is less significant.

Importantly, trade and financial linkage explained for the heterogeneity in response to the QE shocks. Countries that have strong trade linkages with the US are more influenced by the QE shocks. Furthermore, countries in Asia seem to react to external monetary shock differently, depending on the choice of exchange rate regime and capital control techniques. In short, to some extent, UMP shocks from the US drive the financial and macroeconomic conditions in AEMs.

To avoid adverse effects from advanced countries, policy makers in AEMs should focus on strengthening macro-prudential policies for cross-border transactions. Well-prepared policy will help the development of developing countries to be more sustainable. Furthermore, macroprudential policies will be more effective if they can be combined with fiscal policies. After investigating the property sector, Loh (2014) also agreed that the macroprudential instrument cannot lead to stable financial markets by itself. A liability-based policy is also an appropriate macroprudential tool for central banks in AEMs. This policy can be implemented by imposing a tax on non-core bank liabilities. Such a levy has advantages in diminishing the procyclicality of financial systems in developing countries. This program can also specifically reduce the risks of unfavourable effects on emerging countries if external capital suddenly stops. For instance, a macroprudential levy that is subject to banks' non-deposit foreign currency liabilities has been used in Korea since 2010. As this program was successful in structuring the external debt, it has considerably reduced the short-term foreign borrowing of Korea (Miyajima et al., 2014)

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Appendices

Appendix 1: Data description and sources

Variable	Description	Source
For US		
SSR	Shadow short rates – Measure monetary policy stances	Krippner (2016), monthly frequency, end of period data.
Real GDP (Billions of Chained 2012 dollars)		Fred, Bloomberg, IMF
VIX Index	Measure of volatility of stock market	Bloomberg
Long-term interest rate (%)		Fred, Bloomberg
CPI	Consumer Price Index	Fred
For AEMs		
Stock price index	Measure of equity price	Bloomberg, last price
Real exchange rate	Expressed as the bilateral exchange rate vis-à-vis the US dollars, in real term	Bloomberg, last price
Long-term yield (%)		Bloomberg, national sources
Trade Linkage (%)	Exports plus imports divided by GDP of each country	Bloomberg, IMF
Financial Linkage (%)	Expressed as the ratio of FDI from US to one country over GDP of each country	US Bureau of Economic Analysis
Real GDP (Billion USD)	Control variable for macroeconomic conditions	Fred, Bloomberg, IMF
Monetary growth	Control variable for domestic policies	CEIC database
Stock market capitalisation	Control variable for fluctuations in investors' sentiment	Bloomberg

Appendix 2: Lag selection order in SVAR model for US economy

```
. varsoc SSR VIXIndex INF Growth Longtermrate, maxlag(8)

   Selection-order criteria
   Sample:  2004m6 - 2018m4                     Number of obs      =       167
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	115.774				1.8e-07	-1.32664	-1.28875	-1.23329
1	871.558	1511.6	25	0.000	2.9e-11	-10.0785	-9.85119*	-9.51842*
2	908.703	74.29	25	0.000	2.5e-11*	-10.224*	-9.80719	-9.1971
3	926.811	36.216	25	0.068	2.7e-11	-10.1414	-9.53521	-8.6478
4	946.343	39.065	25	0.036	2.9e-11	-10.076	-9.28028	-8.11555
5	966.748	40.81*	25	0.024	3.1e-11	-10.0209	-9.0358	-7.59376
6	980.142	26.788	25	0.367	3.6e-11	-9.88194	-8.70735	-6.98799
7	993.718	27.152	25	0.348	4.2e-11	-9.74513	-8.38109	-6.38442
8	1009.18	30.93	25	0.191	4.8e-11	-9.63093	-8.07744	-5.80346

```
   Endogenous:  SSR VIXIndex INF Growth Longtermrate
    Exogenous:  _cons
```

Appendix 3: Cointegration test for non-stationary variables in Panel VAR model

```
.  xtcointtest kao MCap Equity EXRate

Kao test for cointegration
--------------------------
Ho: No cointegration                          Number of panels       =     10
Ha: All panels are cointegrated               Avg. number of periods =  173.4

Cointegrating vector: Same
Panel means:          Included                Kernel:            Bartlett
Time trend:           Not included            Lags:              3.70  (Newey-West)
AR parameter:         Same                    Augmented lags:    1
```

	Statistic	p-value
Modified Dickey-Fuller t	0.2020	0.4199
Dickey-Fuller t	-0.0518	0.4793
Augmented Dickey-Fuller t	-0.6801	0.2482
Unadjusted modified Dickey-Fuller t	0.8590	0.1952
Unadjusted Dickey-Fuller t	0.4806	0.3154

Appendix 4

Table 4.1 Average impact of QE shocks on asset price in AEMs through trade linkages

Method	**Fixed-effect**	**PCSE**	**Fixed-effect**	**PCSE**	**Fixed-effect**	**PCSE**
Dependent variable	**Equity price**	**Equity price**	**Long-term interest rate**	**Long-term interest rate**	**Exchange rate**	**Exchange rate**
eta2	0.123	0.102	0.0293	0.0285	0.110	0.115
	(0.139)	(0.258)	(0.0169)	(0.0181)	(0.0741)	(0.0949)
eta2_1	0.252	0.239	0.0123	0.0118	0.0134	0.0186

	(0.195)	(0.260)	(0.00715)	(0.0182)	(0.112)	(0.0959)
eta2_2	-0.0184	-0.0300	0.0239	0.0239	0.113	0.117
	(0.126)	(0.260)	(0.0185)	(0.0182)	(0.122)	(0.0957)
eta2_3	0.0186	0.0154	-0.00234	-0.00196	0.0698	0.0746
	(0.142)	(0.262)	(0.0207)	(0.0183)	(0.0606)	(0.0967)
eta2_4	**0.998*****	**0.994*****	-0.0124	-0.0120	-0.244	**-0.240****
	(0.170)	(0.265)	(0.0175)	(0.0184)	(0.144)	(0.0976)
M2	0.0436*	0.00280	0.00598	0.00333	0.00483	0.00825
	(0.0223)	(0.0291)	(0.00735)	(0.00335)	(0.00954)	(0.00702)
Growth	0.00506	0.00503	-0.000964	-0.000926	-0.00229	-0.00187
	(0.00477)	(0.00814)	(0.000969)	(0.000949)	(0.00192)	(0.00337)
Trade	-0.0366	-0.0337**	-0.000197	0.000817	-0.0252**	-0.0122*
	(0.0255)	(0.0171)	(0.00189)	(0.00155)	(0.0102)	(0.00658)
Channelw2	0.00830	0.00857	-0.00253	**-0.00256***	0.00395	0.00333
	(0.00653)	(0.0167)	(0.00206)	(0.00131)	(0.00320)	(0.00689)
Channelw2_1	0.00795	0.00795	0.000135	8.99e-05	-0.000967	-0.00168
	(0.0150)	(0.0168)	(0.00101)	(0.00130)	(0.00977)	(0.00694)
Channelw2_2	0.000921	0.00102	0.00107	0.00103	0.00633	0.00575
	(0.00734)	(0.0167)	(0.00137)	(0.00130)	(0.00725)	(0.00691)
Channelw2_3	-0.000969	-0.000996	0.000955	0.000901	-0.00611	-0.00683
	(0.00717)	(0.0168)	(0.00169)	(0.00130)	(0.00345)	(0.00695)
Channelw2_4	-0.00307	-0.00256	-0.000954	-0.000992	-0.00998	-0.0108
	(0.0115)	(0.0167)	(0.000828)	(0.00127)	(0.0113)	(0.00701)
Mcapn	2.57e-05***	2.53e-05***	7.14e-08	7.13e-08	-3.22e-06	-3.29e-06***
	(7.06e-06)	(1.51e-06)	(5.30e-08)	(5.50e-08)	(3.28e-06)	(3.54e-07)
Constant	0.609	1.116**	-0.0903	-0.0671	0.346	0.145
	(0.374)	(0.507)	(0.0959)	(0.0545)	(0.210)	(0.148)
Observations	1,317	1,317	1,253	1,253	1,317	1,317
Number of ID	10	10	10	10	10	10
R-squared	0.250	0.247	0.013	0.012	0.081	0.083

Standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

Table 4.2 Average impact of QE shocks on asset price in AEMs through financial linkages

Method	Fixed-effect	PCSE	Fixed-effect	PCSE	Fixed-effect	PCSE
Dependent variable	**Equity price**	**Equity price**	**Long-term interest rate**	**Long-term interest rate**	**Exchange rate**	**Exchange rate**
eta2	0.315**	0.297	-0.00208	-0.00334	0.130**	0.107
	(0.0980)	(0.341)	(0.0189)	(0.0127)	(0.0487)	(0.112)
eta2_1	0.420**	0.404	0.0182	0.0171	-0.0350	-0.0231
	(0.150)	(0.344)	(0.0185)	(0.0128)	(0.0638)	(0.116)
eta2_2	-0.0225	-0.0353	0.0405*	0.0400***	0.190***	0.174
	(0.0872)	(0.344)	(0.0205)	(0.0128)	(0.0558)	(0.115)
eta2_3	0.000150	-0.00407	0.00936	0.00928	0.0107	0.00212
	(0.0802)	(0.347)	(0.0216)	(0.0129)	(0.0420)	(0.117)
eta2_4	**0.960*** **	**0.963*** **	**-0.0206***	-0.0203	**-0.352*** **	**-0.338*** **
	(0.125)	(0.351)	(0.0112)	(0.0131)	(0.0947)	(0.115)
M2	0.0553**	0.0173	0.00645	0.00363	0.00719	0.0126
	(0.0207)	(0.0297)	(0.00774)	(0.00230)	(0.0116)	(0.00983)
Growth	0.00626	0.00616	-0.000976	-0.000976	-0.00123	-0.00138
	(0.00490)	(0.00818)	(0.000945)	(0.000768)	(0.00202)	(0.00346)
Finm	0.0152**	-0.00336	0.00286	0.000649**	0.0132	-0.00284
	(0.00633)	(0.00517)	(0.00186)	(0.000328)	(0.00830)	(0.00188)
Channelw4	**-0.0115*** **	**-0.0109** **	0.000321	0.000385	**0.00306*** **	**0.00472*** **
	(0.00232)	(0.00504)	(0.000343)	(0.000371)	(0.000895)	(0.00172)
Channelw4_1	**-0.00850** **	-0.00789	-0.000620	-0.000562	0.00327**	0.00333*
	(0.00354)	(0.00511)	(0.000413)	(0.000373)	(0.00114)	(0.00186)
Channelw4_2	-0.000893	-0.000492	-0.000481	-0.000454	-0.00108	-0.000555
	(0.00151)	(0.00508)	(0.000428)	(0.000371)	(0.00120)	(0.00185)
Channelw4_3	0.000635	0.000890	-4.84e-05	-3.67e-05	-0.00222**	-0.00202
	(0.00164)	(0.00517)	(0.000395)	(0.000378)	(0.000804)	(0.00188)
Channelw4_4	1.50e-05	0.000238	-0.000315	-0.000316	-0.00228	-0.00318
	(0.00310)	(0.00529)	(0.000176)	(0.000389)	(0.00215)	(0.00198)
Mcapn	2.57e-05***	2.53e-05***	6.82e-08	6.72e-08	-3.17e-06	-3.60e-06***
	(7.06e-06)	(1.57e-06)	(5.58e-08)	(4.28e-08)	(3.25e-06)	(4.95e-07)
Constant	-0.108	0.545	-0.122	-0.0661**	-0.106	-0.0406
	(0.301)	(0.493)	(0.117)	(0.0304)	(0.189)	(0.240)
Observations	1,296	1,296	1,232	1,232	1,296	1,296
Number of ID	10	10	10	10	10	10
R-squared	0.255	0.250	0.012	0.011	0.079	0.085

Standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

Tables and Figures

Table 1. Identifying restrictions-benchmark identification

	Response to				
Variables	**QE shock**	**VIX shock**	**Inflation shock**	**Output shock**	**Long-term rate shock**
SSR	a_{11}	a_{12}	a_{13}	a_{14}	a_{15}
VIX Index	*0*	a_{22}	a_{23}	a_{24}	a_{25}
Inflation	*0*	*0*	a_{33}	a_{34}	a_{35}
Growth rate	*0*	*0*	*0*	a_{44}	a_{45}
Long-term rate	*0*	*0*	*0*	*0*	a_{55}

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Eta1 (QE shocks)	1,730	3.08E-09	1.000	-3.317	4.211
Equity	2,140	3523.932	5212.998	101.55	35965.02
Longtermrate	1,882	5.154	2.661	1.3	15.6
EXRate	2,140	3014.234	6067.345	1.204	1108.3
GDP (Billion USD)	1,730	98.272	193.692	1.87	50.501
M2 (%)	2,062	12.575	7.162	-1.94	46.769
TradeLinkage (%)	1,730	11.655	8.5661	0.807	46.769
FinmLinkage (5)	2,052	8.046	17.328	0.137	84.674
Real GDP Growth (%)	1,720	0.775	13.891	-228.729	231.022
MarketCap (Milliion USD)	1,754	644363.2	11900762	18.67	8831841

Table 3. Average impact of QE shocks on asset price in AEMs with trade linkages

Method	Fixed-effect	PCSE	Fixed-effect	PCSE	Fixed-effect	PCSE
Dependent variables	Equity price		Long-term interest rate		Exchange rate	
	(1)	(2)	(3)	(4)	(5)	(6)
eta1	0.0866	0.180	-0.0159	-0.0150	0.133	0.0999
	(0.186)	(0.222)	(0.0158)	(0.0134)	(0.145)	(0.0840)
eta1_1	0.129	0.112	-0.00761	-0.00672	0.0264	0.0340
	(0.141)	(0.222)	(0.0144)	(0.0133)	(0.0830)	(0.0838)
eta1_2	-0.115	-0.0870	0.00451	0.00360	0.115	0.0951
	(0.129)	(0.221)	(0.00878)	(0.0133)	(0.0715)	(0.0835)
eta1_3	0.180	0.163	-0.00395	-0.00414	-0.0545	-0.0716
	(0.251)	(0.222)	(0.00858)	(0.0134)	(0.0998)	(0.0840)
eta1_4	**0.438*** **	**0.449** **	0.00709	0.00546	-0.128	**-0.167** **
	(0.0901)	(0.222)	(0.0268)	(0.0135)	(0.0953)	(0.0842)
M2	0.0343	0.0154	0.00399	0.00199	0.00882	0.0128**
	(0.0286)	(0.0281)	(0.00591)	(0.00189)	(0.00764)	(0.00642)
Growth	0.00536	0.00538	-0.000888	-0.000995	-0.00164	-0.00146

	(0.00390)	(0.00731)	(0.000986)	(0.000683)	(0.00148)	(0.00325)
Trade	-5.63e-05	-0.0179	-0.000518	0.000405	**-0.0217****	**-0.0113***
	(0.0236)	(0.0173)	(0.00155)	(0.000996)	(0.00740)	(0.00598)
Channel2	**0.0183***	0.0120	0.000615	0.000558	-0.000604	0.00119
	(0.00997)	(0.0155)	(0.00215)	(0.000935)	(0.00813)	(0.00673)
Channel2_1	0.00198	0.00328	0.000844	0.000722	-0.00277	-0.00354
	(0.00752)	(0.0154)	(0.000973)	(0.000928)	(0.00761)	(0.00671)
Channel2_2	0.00147	-0.000966	0.000747	0.000705	0.00207	0.00276
	(0.00788)	(0.0153)	(0.000710)	(0.000921)	(0.00449)	(0.00665)
Channel2_3	-0.00355	-0.00411	-0.000249	-0.000309	-0.00503	-0.00466
	(0.0149)	(0.0154)	(0.000675)	(0.000931)	(0.00815)	(0.00672)
Channel2_4	0.0125	0.0104	-0.00165	**-0.00168***	-0.00727	-0.00518
	(0.00743)	(0.0153)	(0.00142)	(0.000927)	(0.00689)	(0.00667)
Mcapn	**2.26e-05*****	**2.33e-05*****	4.24e-08	4.12e-08	-2.98e-06	**-3.18e-06*****
	(6.09e-06)	(1.23e-06)	(3.80e-08)	(3.30e-08)	(2.87e-06)	(2.96e-07)
Constant	0.265	0.743	-0.0552	-0.0409	0.231	0.0750
	(0.259)	(0.468)	(0.0734)	(0.0296)	(0.145)	(0.134)
Observations	1,607	1,607	1,543	1,543	1,607	1,607
R-squared	0.230	0.237	0.006	0.005	0.062	0.067

Standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

Table 4. Average impact of QE shocks on asset price in AEMs with financial linkages

Method	**Fixed-effect**	**PCSE**	**Fixed-effect**	**PCSE**	**Fixed-effect**	**PCSE**
Dependent variable	**Equity price**		**Long-term interest rate**		**Exchange rate**	
eta1	**0.330*****	**0.359****	-0.0215	**-0.0212***	0.130	0.107
	(0.0963)	(0.148)	(0.0144)	(0.0108)	(0.0719)	(0.102)
eta1_1	0.194	0.198	0.00444	0.00377	-0.0269	-0.0264
	(0.156)	(0.147)	(0.00945)	(0.0107)	(0.0500)	(0.102)
eta1_2	-0.120	-0.120	**0.0150***	0.0137	**0.144*****	0.117
	(0.114)	(0.147)	(0.00683)	(0.0106)	(0.0379)	(0.102)
eta1_3	0.135	0.108	-0.00581	-0.00615	**-0.114***	-0.128
	(0.123)	(0.147)	(0.00782)	(0.0107)	(0.0564)	(0.102)
eta1_4	**0.564*****	**0.558*****	-0.00888	-0.0106	**-0.199*****	**-0.224****
	(0.121)	(0.148)	(0.0163)	(0.0108)	(0.0552)	(0.102)
M2	0.0428	0.0241	0.00433	0.00250	0.00949	0.0143

	(0.0288)	(0.0279)	(0.00630)	(0.00200)	(0.00983)	(0.00917)
Growth	0.00484	0.00557	-0.000858	-0.000991	-0.000764	-0.000999
	(0.00406)	(0.00734)	(0.000985)	(0.000735)	(0.00145)	(0.00346)
Finm	0.00485	-0.00250	0.00143	0.000404	0.00941*	-0.00202
	(0.00404)	(0.00753)	(0.00106)	(0.000295)	(0.00459)	(0.00149)
Channel4	**-0.004****	-0.00424	**0.0015*****	**0.0016*****	-0.000198	0.000872
	(0.00171)	(0.00663)	(0.000328)	(0.000303)	(0.00132)	(0.00159)
Channel4_1	-0.00268	-0.00269	**-0.0005*****	-0.000471	0.00175	0.00225
	(0.00337)	(0.00661)	(0.000139)	(0.000300)	(0.000962)	(0.00160)
Channel4_2	-0.000726	-0.000669	**-0.0003****	-0.000255	**-0.0016***	-0.000530
	(0.00209)	(0.00655)	(0.000124)	(0.000297)	(0.000754)	(0.00159)
Channel4_3	0.00346	0.00397	**-0.0002****	-0.000251	-4.25e-05	0.000575
	(0.00237)	(0.00646)	(0.000103)	(0.000293)	(0.00104)	(0.00158)
Channel4_4	0.00317	0.00350	-0.000422	-0.000433	-0.00161	-0.000548
	(0.00283)	(0.00634)	(0.000332)	(0.000289)	(0.00121)	(0.00157)
Mcapn	2.28e-05***	2.36e-05***	4.56e-08	4.43e-08	-2.92e-06	-3.11e-06***
	(6.13e-06)	(1.26e-06)	(3.65e-08)	(3.49e-08)	(2.93e-06)	(3.73e-07)
Constant	0.125	0.457	-0.0790	-0.0478*	-0.115	-0.0799
	(0.373)	(0.361)	(0.0879)	(0.0266)	(0.142)	(0.212)
Observations	1,546	1,546	1,482	1,482	1,546	1,546
R-squared	0.234	0.242	0.009	0.008	0.058	0.063

Standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

Table 5. Sub-group analysis the US monetary policy impacts through trade integration

Dependent variables	**Equity price**		**Long-term yield**		**Exchange rate**	
Level of integration	**High integrated**	**Low integrated**	**High integrated**	**Low integrated**	**High integrated**	**Low integrated**
eta1	-0.648*	0.0642	-0.0482	-0.0117	0.201	0.0759
	(0.263)	(0.313)	(0.0499)	(0.0166)	(0.181)	(0.174)
eta1_1	-0.0944	0.252	-0.00870	0.0118	0.0527	-0.0255
	(0.624)	(0.480)	(0.0116)	(0.0291)	(0.179)	(0.171)
eta1_2	-0.104	-0.450**	0.000411	-0.0512	-0.0229	**0.281***
	(0.259)	(0.134)	(0.00668)	(0.0249)	(0.177)	(0.168)
eta1_3	**0.765****	0.0648	0.00517	0.0465	-0.212	-0.130
	(0.207)	(0.759)	(0.0219)	(0.0227)	(0.180)	(0.171)
eta1_4	0.433	**0.827***	-0.0176	0.0452	**-0.358****	-0.281
	(0.340)	(0.369)	(0.0504)	(0.0511)	(0.179)	(0.171)
Growth	-0.00117	0.0119	0.00133	-0.000825	-0.00107	-0.00329

	(0.00178)	(0.00771)	(0.0117)	(0.00105)	(0.00658)	(0.00414)
Trade	-0.0407	0.0120	-0.000934	0.00273	-0.00937	**-0.0573*****
	(0.0303)	(0.0535)	(0.00365)	(0.00145)	(0.00869)	(0.0218)
M2	0.0512	0.0289	0.00929**	-0.00374	0.0121**	0.00596
	(0.0334)	(0.0325)	(0.00315)	(0.00541)	(0.00577)	(0.0126)
Channel2	**0.0543****	0.0256	0.00244	0.000793	-0.00489	0.0112
	(0.0119)	(0.0467)	(0.00312)	(0.00229)	(0.0107)	(0.0291)
Channel2_1	0.0127	-0.0543	0.00111	-0.00405	-0.00448	0.0140
	(0.0263)	(0.148)	(0.00100)	(0.00485)	(0.0106)	(0.0284)
Channel2_2	-7.31e-05	0.0861	0.000831	**0.0135***	0.00932	-0.0341
	(0.0103)	(0.0575)	(0.000501)	(0.00533)	(0.0105)	(0.0277)
Channel2_3	-0.0298	0.0650	-0.000375	**-0.0123****	0.00223	0.0115
	(0.0142)	(0.117)	(0.00120)	(0.00309)	(0.0107)	(0.0285)
Channel2_4	0.0187	0.0132	-0.000131	-0.00943	0.00242	0.0257
	(0.0121)	(0.0859)	(0.00238)	(0.00599)	(0.0106)	(0.0281)
Constant	0.900	0.640	-0.101	0.0304	0.0346	0.349
	(0.650)	(0.698)	(0.0981)	(0.0841)	(0.187)	(0.259)
Observations	843	845	809	771	843	845
R-squared	0.027	0.026	0.011	0.025	0.044	0.030

Standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

Table 6. Sub-group analysis the US monetary policy impacts through financial integration

Dependent variables	**Equity price**		**Long-term yield**		**Exchange rate**	
Level of integration	**High integrated**	**Low integrated**	**High integrated**	**Low integrated**	**High integrated**	**Low integrated**
eta1	0.257	-0.108	-0.0136	-0.0480	0.128	**0.407***
	(0.216)	(0.216)	(0.0120)	(0.0642)	(0.0833)	(0.159)
eta1_1	0.0464	0.478	0.000244	-0.00837	-0.0615	0.0339
	(0.206)	(0.458)	(0.0130)	(0.0155)	(0.0858)	(0.0752)
eta1_2	-0.0393	-0.555	0.0163	0.0382	**0.155*****	0.0213
	(0.108)	(0.334)	(0.00918)	(0.0217)	(0.0324)	(0.0844)
eta1_3	**0.344****	0.253	**-0.0166***	0.0115	**-0.236****	-0.0660
	(0.113)	(0.484)	(0.00771)	(0.0135)	(0.0675)	(0.0739)
eta1_4	**0.512****	**1.667****	**-0.0383****	0.0859	**-0.351****	-0.0864
	(0.124)	(0.401)	(0.0129)	(0.0427)	(0.0942)	(0.223)
Growth	-0.000706	0.0225**	-6.59e-05	-0.00166	0.000772	-0.00380
	(0.00142)	(0.00521)	(0.000189)	(0.00182)	(0.00105)	(0.00211)
Finm	0.00334	-0.739**	6.65e-05	-0.0238	0.0101	0.0924
	(0.00495)	(0.180)	(0.00107)	(0.0191)	(0.00603)	(0.101)
M2	0.0414	0.0418	-0.00440	0.00944**	0.0110	0.00902
	(0.0395)	(0.0219)	(0.00590)	(0.00337)	(0.0241)	(0.00928)
Channel4	-0.00329	**0.427***	**0.00123*****	0.0267	4.10e-05	-0.287
	(0.00408)	(0.181)	(0.000197)	(0.0408)	(0.00174)	(0.234)
Channel4_1	0.000437	-0.370	**-0.000515***	0.0160	0.00251	-0.00982

	(0.00394)	(0.221)	(0.000196)	(0.0125)	(0.00174)	(0.109)
Channel4_2	**-0.00297***	**0.443****	-0.000399*	-0.0227	**-0.00175****	0.0845
	(0.00120)	(0.128)	(0.000179)	(0.0151)	(0.000493)	(0.126)
Channel4_3	-0.000237	0.0711	-0.000100	-0.00647	0.00226	0.0112
	(0.00169)	(0.340)	(9.79e-05)	(0.00793)	(0.00135)	(0.119)
Channel4_4	**0.00659****	-0.594	0.000130	**-0.0686***	0.00107	-0.0524
	(0.00205)	(0.394)	(0.000229)	(0.0303)	(0.00168)	(0.199)
Constant	0.342	1.179***	0.0197	-0.146	-0.298	-0.0647
	(0.420)	(0.213)	(0.0687)	(0.0776)	(0.291)	(0.250)
Observations	825	802	791	728	825	802
R-squared	0.025	0.034	0.018	0.024	0.044	0.029

Standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

Table 7. Response of asset prices to QE shocks during pre-crisis and post-crisis periods

Variables	**Equity prices**		**Long-term yields**		**Exchange rates**	
Periods	**Before**	**After**	**Before**	**After**	**Before**	**After**
eta1	0.643	-0.0190	-0.00478	-0.00755	0.189	0.137
	(0.696)	(0.239)	(0.0354)	(0.0103)	(0.275)	(0.110)
eta1_1	0.256	0.155	0.0456	-0.00638	0.263	-0.0604
	(0.680)	(0.233)	(0.0346)	(0.00999)	(0.273)	(0.107)
eta1_2	0.796	-0.353	0.0426	0.00849	-0.0803	0.175
	(0.670)	(0.233)	(0.0338)	(0.0100)	(0.269)	(0.107)
eta1_3	0.157	0.270	-0.0337	-0.00323	-0.0301	-0.143
	(0.687)	(0.234)	(0.0348)	(0.0101)	(0.273)	(0.108)
eta1_4	0.221	**0.630*****	-0.0392	-0.00571	-0.206	**-0.229****
	(0.678)	(0.240)	(0.0341)	(0.0103)	(0.268)	(0.110)
M2	-0.0175	0.0476**	0.00741	-0.000377	0.00716	0.0211*
	(0.0738)	(0.0234)	(0.00926)	(0.00203)	(0.0142)	(0.0112)
Growth	-0.000344	0.00740	-0.00811	-0.000841	-0.000429	-0.000815
	(0.0130)	(0.00924)	(0.00964)	(0.000648)	(0.00545)	(0.00393)
Mcapn	4.70e-05***	1.73e-05***	4.12e-08	2.04e-08	-3.45e-06**	-2.72e-06***
	(3.99e-06)	(1.01e-06)	(1.95e-07)	(3.49e-08)	(1.46e-06)	(3.40e-07)
Constant	0.771	0.366	-0.0582	-0.0243	-0.183	-0.140
	(1.100)	(0.362)	(0.120)	(0.0243)	(0.319)	(0.232)
Observations	459	1,138	405	1,129	459	1,138
R-squared	0.352	0.245	0.024	0.003	0.053	0.077
Number of Country	10	10	9	10	10	10

Standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

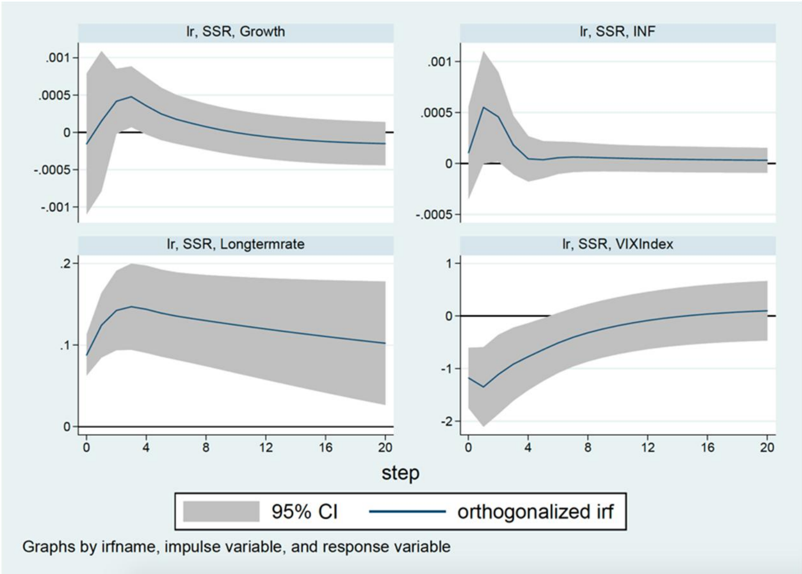

Figure 2. Report of Impulses Responses to Unconventional Monetary Policy shock in the US

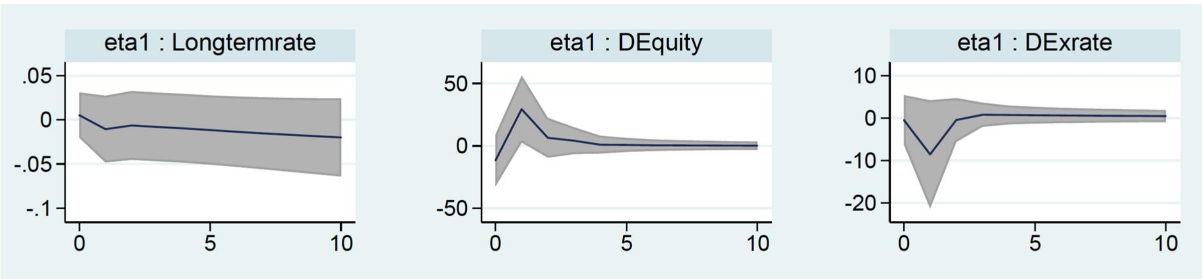

Figure 3. Report of impulse responses of average asset prices in AEMs to the US monetary shocks

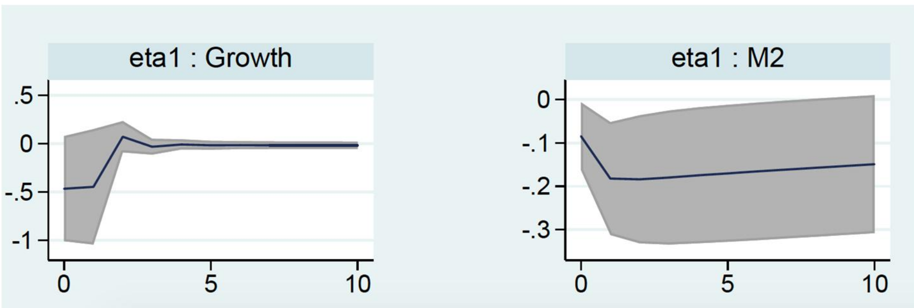

Figure 4. Report of impulse responses of macroeconomic variables in AEMs to the US QE shocks

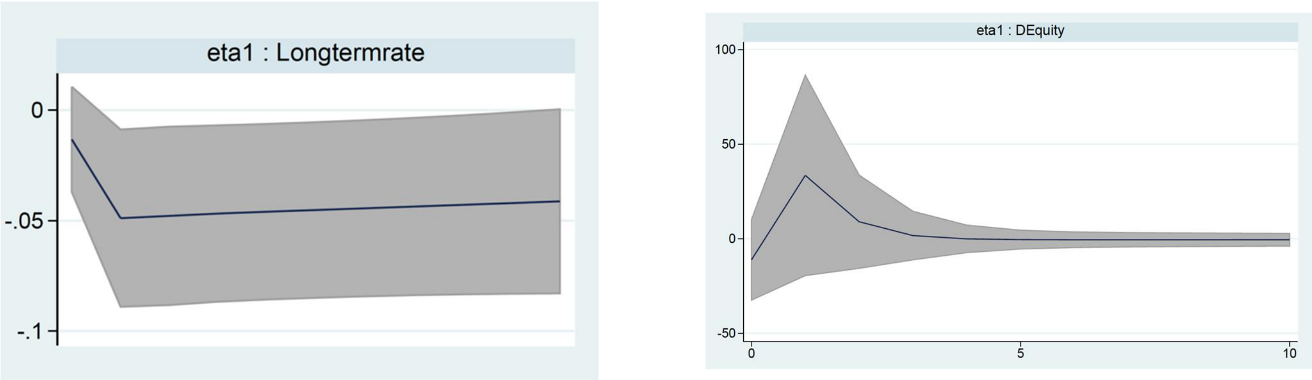

Figure 5. Report of impulse responses of asset prices to QE shocks after global financial crisis

INFORMATION

Title of Study: **The spillover effect of the US unconventional monetary policy on Asian Emerging Markets**

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To whom it may concern,

My name is Pham Hoang Cam Huong, currently working at Hue College of Economics, Hue University. I have just submitted my paper named ***“The spillover effect of the US unconventional monetary policy on Asian Emerging Markets”*** to your Journal, including a Manuscript, an Information File and this letter. My case is, as per the policy of ESM-AEF 2019 (International Conference on Econometrics and Statistical Methods – Applications in Economics and Finance) which was held early this year, the accepted paper would be automatically sent to JABES. However, due to the misunderstanding of the coordinator and me, my paper has not been directly sent to the Journal, which I only knew after a long time. This situation hence affects the time of publishing as I expected initially. To be honest, this is the research that I put a lot of enthusiasm into, during the time I was studying in Australia. Thus, right after revising my paper, I decided to submit my study to JABES directly. I truly wish that this paper would be processed as soon as possible this time.

Please accept my deepest thanks!

Huong Pham