Propagation of economic shocks from the United States, China, the European Union, and Japan to selected Asian economies: Does the global value chain matters?

by Miguel Miguel

Submission date: 02-Nov-2022 12:14PM (UTC+0800)
Submission ID: 1942123211
File name: edited2_Draft_Growth_Shocks.pdf (745.2K)
Word count: 8410
Character count: 44407

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ABSTRACT

A panel vector autoregression (VAR) model is employed to estimate whether growth shocks from the United States (US), China, Japan, and the European Union (EU) can be transferred to selected Asian countries. We examine 1) the effect of shocks through five channels: international trade, monetary policy, finance, global uncertainty, and oil prices; 2) whether a country's deeper integration with the global value chain (GVC) enhances or decreases the effect of growth shocks from major economies more intensively than trade openness. We found evidence of the shock transfer from major economies to Asia through the five channels. The impact differs across countries depending on their participation in GVC; for example, the impact is high in Indonesia and low in South Korea. Moreover, Asian countries are more exposed to trade shocks through China's trade channel than other major economies. Zooming in on the channels' impacts, global uncertainty affects countries' growth (e.g., Indonesia) more significantly than other channels (i.e., GVC); and Asian countries respond positively to oil prices in the short run but negatively in the long run.

Keywords: *Foreign spillovers, global uncertainty, oil prices, global value chain, monetary policy, trade openness, international business cycles, globalization*

JEL Classification: F44, F62, O53

I. INTRODUCTION

In this paper, we examine the responses of selected Asian countries to growth shocks from major global economies: China, the United States (US), Japan, and the European Union (EU). The aim is to understand the extent to which international trade, monetary policy, oil prices, finance, and global uncertainty channel growth shocks from large economies. We look at six economies in Asia with different levels of participation in the global value chain (GVC) and oil consumption: Indonesia, India, Malaysia, Thailand, South Korea, and the Philippines. Specifically, we compare conventional trade openness and GVC involvement as a measure of global trade participation in testing the economic shocks across countries. Also, the effects of growth shocks on countries' economic growth could be different in the short and long terms.

Literature on shock transmission is mixed. For example, shocks originating from the US and China (e.g., due to a trade war) did not shake Southeast Asian countries much but adversely impacted Korea (Lee, 2019), East Asian countries (Moeller, 2018), and Europe (Huidrom et al., 2019; Vandenbussche et al., 2019). However, Raghavan and Devadason (2020), using a structural

vector autoregression (VAR) model, found that there were indirect linkages between China and the US shocks to Southeast Asian (ASEAN) countries' economies. Employing a multi-sector Computable General Equilibrium (CGE), Caceres (2019) and Li et al. (2020) found that a decrease in global demand due to trade tensions could indirectly harm exports from ASEAN to the US. Although, in a possible scenario, ASEAN countries may substitute Chinese exports to the US. Iacoviello and Navarro (2019) noted that monetary shocks from the US impact countries to different degrees depending on the exchange rate regimes, trade openness, and global uncertainty. It should also be noted that the impact of monetary shocks on economic growth in advanced countries is amplified through the trade channel, while in developing countries, through vulnerability (risk). Harahap and Bary (2017) noted that economic growth in Asian countries, including Indonesia, is exposed to growth shocks from China and monetary shocks from the US, transmitted through financial channels. The increasing vulnerability of Asian countries to global superpowers has raised policymakers' awareness about the gravity of foreign policies, i.e., their risks and potential impacts.

Evidence suggests that fragmented GVCs influence global demand, altering the impact transmission mechanism (Tan et al., 2019; Xiao et al., 2020). Meanwhile, measuring global openness to trade in gross terms may not capture indirect export flows, hence underestimating the impact of growth shocks in third countries (Huidrom et al., 2019; Simola, 2019; Vandenbussche et al., 2019). Demand could be more responsive to growth shocks depending on the country's exposure to trade under the GVC (direct and indirect trade), the country's position within the GVC, and the kind of goods traded (Vandenbussche et al., 2019). For example, Asian countries may be less vulnerable to shocks from the EU because their linkages are not intense, but this may not be the case for countries linked to the EU via GVC. Likewise, the vulnerability of Asian countries to shocks from China is high, but this may not be the case for those not closely linked to China via GVC (Dizioli et al., 2016).

We extract data on economic growth shocks from four large economies (China, the US, Japan, and the EU) using quarterly data between 2000 and 2014. With this, we estimate the impact of a country's shocks on other countries' economic growth (growth spillover) after isolating the common shocks, i.e., exogenous movements. We isolate common shocks because business cycle co-movement can be originated from common shocks and spillover (IMF, 2013). With the isolation, we could identify the impact of specific shocks, i.e., the residual growth from each of the four economies. We then trace the spillover impact across selected Asian economies. Additionally, using a variable for conventional trade openness and a variable of GVC participation, the model allows for interaction between growth shocks and bilateral trade. As such, the model can identify whether trade links with major economies can transfer growth shocks.

After estimating the growth shocks, we apply a panel vector autoregression (VAR) model to examine the extent to which economic growth in selected Asian countries is affected by the shocks and how global integration and trade modulate the impact. Additionally, we integrate into the model the roles of 1) monetary policy, i.e., interest rates; 2) financial position, i.e., current account; 3) energy prices, i.e., oil prices); 4) and global uncertainty to examine the vulnerability levels to

shocks originating from major economies. Past research has shown that emerging economies can be vulnerable to economic shocks originating from advanced countries (Dungey et al., 2018), changes in oil prices (da Silva Souza & de Mattos, 2022), rising interest rates under inflationary pressure (Hoek et al., 2022), and pressure on the current account and from global uncertainty (Iacoviello & Navarro, 2019).

This study is contextual and timely for two reasons. First, the worst-case scenarios of the global economy in 2022 and 2023 include the tightening of monetary policy by the US, a decrease in global demand (economic slowdown), the rise of energy prices, and major global uncertainty. Understanding shock transmission mechanisms is highly relevant. Second, Asian countries are strongly linked to China via GVC, and to a lesser extent, to the US and Japan. Close linkages via GVC indicate potential vulnerability to the Chinese economy's downturn (Xiao et al., 2020), the US monetary policy, global energy prices (Chen et al., 2022), and uncertainty. The US-China trade war suggests that negative impacts can be transmitted to US-China partners or third countries (Chong & Li, 2019; Iqbal et al., 2019; C. Li et al., 2018). The impact of growth shocks from China through the international trade channel is often estimated to be larger than that from the US (Itakura, 2020; Kumagai et al., 2019; M. Li et al., 2020). The extent to which economic shocks are transferred to Asian partners remains an empirical question.

The selection of the Asian countries for this study, i.e., India, Indonesia, Malaysia, Thailand, the Philippines, and South Korea, is based on their participation in global trade, albeit the different roles in GVC. Some Asian countries, like Indonesia and Japan, export raw and intermediate goods, while others focus on final products, such as Malaysia, Thailand, and Vietnam (Padilla et al., 2019). Countries like Indonesia have taken more central roles in Asian GVC (Padilla et al., 2017)—increasing their market concentration, becoming specialized, and progressively fragmented—which means more vulnerability to global shocks (Purwono et al., 2020). Moreover, Asian countries are strongly linked to China, the US, Japan, and, to a lesser extent, the EU, suggesting varying degrees of exposure to growth shocks from each superpower.

This paper aims to discover the extent to which growth shocks in China, the US, and the EU have impacted selected Asian countries. Our study is limited to a timeframe where data on GVC from the World Input-Output Dataset (WIOD) is available. Purwono et al. (2022) noted that changes in GVC patterns take a long time, suggesting data lag is not a major obstacle to obtaining accurate empirical results.

We contribute to the literature three-fold. First, we provide evidence on whether GDP growth shocks from large economies impact growth rates in Asian countries and whether GVC participation modulates the effects. Oil prices are also likely to be impacted by growth shocks via GVC (Chen et al., 2022), suggesting the need to estimate the impact of oil price variations on economic growth in Asia. The fluctuations tend to impact developing countries' macroeconomy more significantly than the supply (da Silva Souza & de Mattos, 2022).

II. LITERATURE REVIEW

Business cycles' interconnectedness between countries increases as their trade ties become closer (Dizioli et al., 2016). Co-movements and exposure to volatility increase along with tighter bilateral ties (Raghavan & Devadason, 2020). Such connectivity amplifies the effects of changes in global demand, be it contraction, expansion, or substitution of products and services (Purwono et al., 2022). In global production networks, common global shocks can be transmitted indirectly through changes in domestic production, intermediate input trade, or indirect trade (Xing, 2022). It is worth noting that the US-China trade war may have realigned GVCs in Asia (Dizioli et al., 2016). In this case, global shocks could easily be transferred to the connected economies in the network. In Asia, China (Xiao et al., 2020) and Japan are major hubs in production, linking players across the continent and the world. At the same time, Asian countries continue trading indirectly with the US, connected through the GVC.

Literature on co-movements or interdependence is often based on formal approaches like CGE, as it facilitates the creation and simulation of scenarios of potential shocks (Caceres et al., 2019; Itakura, 2020). Other approaches employ impulse response functions (IRFs) to analyze the impact of shocks on economic growth (Harahap & Bary, 2017), monetary policies (Barnichon & Brownlees, 2019), financial positions, and energy prices (Punzi, 2019), exports (Aslan & Acikgoz, 2021), and demand for labor (Vandenbussche et al., 2019). Common approaches to estimating impacts from shocks are the structural VAR (Dungey et al., 2018), the global VAR (Raghavan & Devadason, 2020b), the panel VAR (Punzi, 2019), and Bayesian BVAR (da Silva Souza & de Mattos, 2022). Aside from VAR, non-linear models' local projections have also been applied to similar cases (Barnichon & Brownlees, 2019; Iacoviello & Navarro, 2019).

Previous studies in GVC have also noted that increasing interconnectedness increases countries' exposure to shocks (Huidrom et al., 2019). An empirical study in South Korea suggests that higher participation in GVC propagates shocks across internal and external activities (Lee, 2019). More importantly, having superpowers as trading partners can lead countries to economic swings that could damage the labor market (Vandenbussche et al., 2019).

Other studies explored the role of international trade in shock transfers, generally agreeing that higher integration in GVC increases exposure (Lee, 2019; Mattoo et al., 2017; Simola, 2019). However, some findings state that the impact of global trade as a channel of transmission or propagation of shocks is minimal (Berkmen et al., 2012). For ASEAN countries, trade relations have changed, and so has the propagation mechanism of shocks through global trade (Dungey et al., 2018). The increasing participation of Asian countries in indirect trades in highly concentrated and interconnected networks like the US, China, and the EU, seems to have increased the exposure to foreign shocks.

Trade shock effects differences are evident when employing value-added instead of gross exports, which have been researched in a European case (Huidrom et al., 2019). Countries engaged in indirect trade through GVC are more vulnerable to growth shocks (Dungey et al., 2018). This impact can be examined using various approaches (Huidrom et al., 2019; Shrestha, 2015). In CGE, Caceres et al. (2019) found that overall impacts resulting from trade tension on GDP tend to be minor. However, the results in specific sectors and locations exposed through direct-indirect

spillovers could be disruptive. Huidrom et al. (2019) estimate that economic shocks' effects are more substantial in highly integrated economies (more value-added across GVC). For example, a 1 percent negative growth in the US impacted -0.6 percent growth in the EU in two years. For the countries more engaged in GVC, the impact could rise to -1.4 percentage growth.

Another set of studies employs the input-output framework to analyze the impact of growth shocks. Ma et al. (2016) examined the effects of the Chinese economy's rebalancing from investment to consumption. The results show that the negative impact transmitted to foreign players exporting to China was estimated to fall. Vandenbussche et al. (2019) apply the I-O framework to evaluate the effects of Brexit, showing that the strong linkages across European countries increase the negative impacts, especially among the upstream players.

Another issue affecting Asian countries is their increasing dependence on China and Japan in the trade and production networks (Purwono et al., 2020). Meanwhile, their linkages to the US and EU are not as strong as before. With the Chinese economy rebalancing (Ma et al., 2016), shocks in demand are probable. This will affect Asian countries to a large extent because China is the largest trade partner. Similarly, the trade tensions (US-China), global energy prices, disruption in production, supply shortages, and a potential global slowdown could have significant direct and indirect effects on Asian economies.

Previous research on the spillover effects from the four major economies in this study (China, the US, Japan, and the EU) in Asian countries has confirmed their vulnerability to trade and growth shocks. Dungey et al. (2018) found that, prior to 1998, ASEAN countries responded strongly to a unit of growth shock from the US and, to a lesser extent, from the EU. Their responses to a growth shock from China were low before 1998 and increased substantially by 2015. At the country level, the study also found that Indonesia, Malaysia, Thailand, and the Philippines' cumulative response to China's growth shock increased at least twice from 1998 to 2015, while the response to the US growth shock decreased by nearly 25%. Dizioli et al. (2016) assess the potential spillover effects of China's economic slowdown on the ASEAN-5, finding that a 1% fall in China's GDP will translate into a 0.2% to 0.5% fall in the largest ASEAN countries' GDP. In other words, China's economic slowdown, rebalancing, and high uncertainty will have compound impacts.

Building on a global VAR model, Harahap and Bary (2017) show that a 1% shock (decline) in China's real GDP will be followed by a 0.52% decrease in Indonesia's real GDP. Caceres et al. (2019) investigate the impact of bilateral tariff escalation between China and the US using a multi-sector CGE model, showing that ASEAN countries are vulnerable to the impact of the trade war. Still, under particular scenarios, Indonesia's GDP could increase by 0.01-0.04% because its goods may replace Chinese exports to the US. Using the structural VAR model, Raghavan and Devadason (2020) also reveal increasing exposure to growth shocks from China and the US for ASEAN countries due to the growing connectivity. They also found that due to the growth multiplier effect, the US has a more dominant growth driver in some Asian countries, including Indonesia, than China, even though Indonesia's export shares to China are larger than the US. Such disputing evidence suggests the need to assess the transmission mechanism of growth shocks from superpower countries to Asia.

III. METHODOLOGY

A. *Growth Shocks*

E.1 Identification of shocks in China, the EU, Japan, and the US

We first estimate growth shocks in the source countries—the US, China, Japan, and the EU—by identifying the share of country-specific growth and removing common growth shocks (commonalities) to obtain the residual growth. We follow approaches by Morgan et al. (2004) applied in previous studies (Iacoviello & Navarro, 2019; IMF, 2013). We employ a series of quarterly GDP data measuring the four source economies' growth, covering 2000Q1 to 2014Q4 (Iacoviello & Navarro, 2019). Residual growth is closer to orthogonal when commonalities affecting growth across countries are removed. For instance, the correlation between country-specific growth shocks from the four major economies is close to zero, suggesting that the model can generate independent exogenous differences in growth shocks.

We regress the log GDP on a set of controls and use the residuals as the identified shocks. The determination of the residual shocks u_t in the regression is as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 Z_t + u_t$$

where Δy_t is the log real GDP for China, the EU, Japan, and the US. The set of controls Z_t includes contemporaneous, and GDP lagged in China, the EU, Japan, and the US, oil prices, stock market index volatility, current account, discount rate, and a quadratic time trend. We use quarterly data from 2000Q1 to 2014Q4.

E.2 Panel VAR model

We employ a panel VAR model to estimate how growth shocks affect economic activities via GVC and transfer to trade partners. We build on the co-movement theory, where economic growth is considered to have synchronized effects around the world, although the growth rate remains specific to each economy. The factors that slow growth are protectionism, retaliatory responses, uncertainty, policies, and economic shocks. If an economy has greater value-added exports to a trading hub country, its growth correlation with the hub country is more significant (Huidrom et al., 2019). Therefore, this study aims to examine how large hub countries' growth shocks (unexpected growth movements) are transmitted to their trading partners via GVC.

After estimating residual growth, we evaluate the effect transferred to selected Asian countries. We model the growth as a function of the growth shock's exogenous effect, an interaction term between growth shocks and GVC participation, and a set of control variables. We follow Huidrom et al. (2019), proposing oil prices and global uncertainty (proxied by stock market volatility) as key exogenous variables. Finally, we add current account and discount rates as standard control variables (Iacoviello & Navarro, 2018).

The model measures the effects of shocks in large hubs to other countries, with spillovers varying based on each country's exposure to value-added trade (Iacoviello & Navarro, 2018).

Local projections models, VAR, GVARs, and panel regressions are common approaches. Although panel VAR imposes restrictions and mainly captures linear relations, it fits our data better than the other alternatives.

We employ the same quarterly GDP data to estimate the panel VAR while incorporating quarterly shocks in the economy. Next, we create an interaction between the growth shock variable and GVC participation to capture whether GVC is a shock channel. The panel VAR is represented as follows:

$$Y_{it} = Y_{it-1}A_1 + Y_{it-2}A_2 + \cdots + Y_{it-h+1}A_{h-1} + Y_{it-h}A_h + X_{it}B + u_i + e_{it}, \qquad (1)$$

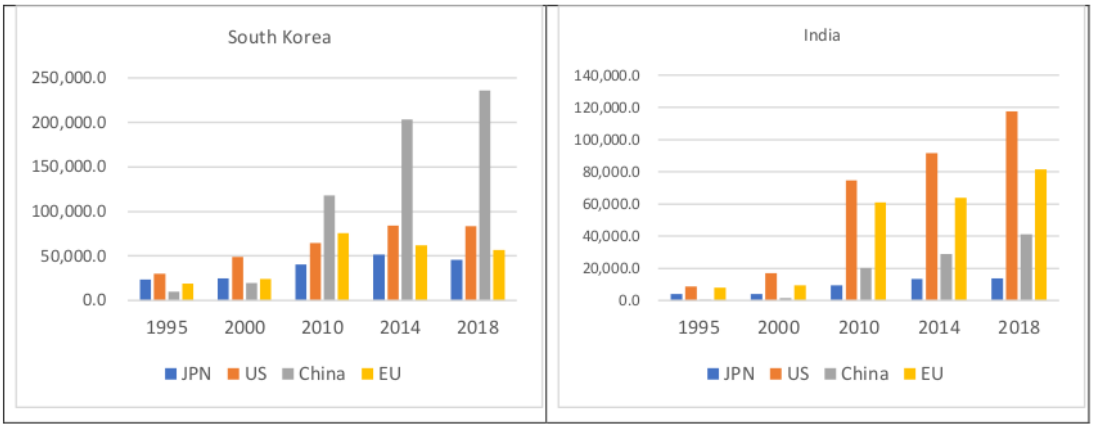
where Y_{it} is $(1xk)$ vector of dependent variables, X_{it} is a $(1xl)$ vector of exogenous covariates, u_i, and e_{it} is $(1xk)$ vector of dependent variables and idiosyncratic errors. $A_1, A_2, \ldots, A_{h-1}, A_h$, and matrix B are parameters to be estimated. The adaptation of the panel VAR to our model is as follows:

$$y_{it} = y_{i,h-1}A_1 + U_tA_2 + U_t x GVC_{i,t-1}A_3 + y_{i,t-1}A_4 + X_{it}B + u_i + e_{it}, \qquad (2)$$

where y_{it} is real GDP growth for selected Asian countries, i.e., Indonesia, India, South Korea, Malaysia, Thailand, and the Philippines; U_t is the growth shock estimated for the US, China, Japan, and the EU.

The shock variable is estimated as the residuals of growth (IMF, 2013 in Equation 3.5). The U_t x $GVC_{i,t}$ is an interaction term between Ut and the share of GVC, the value-added exports from each Asian country to the US, China, Japan, and the EU. The $y_{i,t-1}$ is the lag real GDP growth for Indonesia, India, South Korea, Malaysia, Thailand, and the Philippines. The matrix X_{it} includes control variables such as oil price, global uncertainty, discount rates, and current account. Oil price is estimated as oil rent, i.e., the difference between the value of crude oil production at world prices and the total production costs obtained from the World Bank for the US, China, Japan, and the EU. Global uncertainty is the stock market volatility index for the US (www.cboe.com/vix). Meanwhile, discount rates and current accounts are extracted from the International Financial Statistics - IMF Data.

Trade Patterns in Asian countries



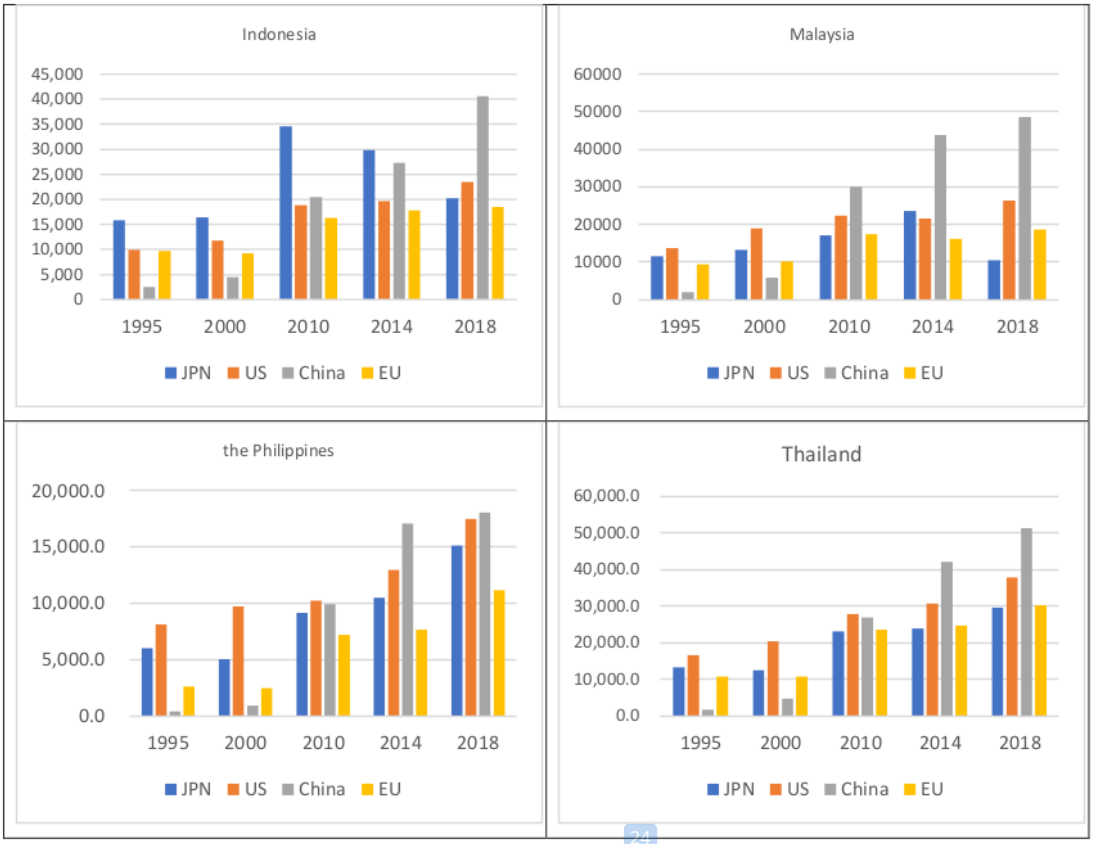


Figure 1 Gross Trade Exports from South Korea, India, Indonesia, Malaysia, The Philippines, and Singapore to Japan, the US, China, and the EU, 1995 - 2018

Note: Gross exports in million USD, data extracted on 22 Oct 2022 at 02:19 UTC (GMT) from OECD Stat

Figure 1 shows four noticeable changes in the pattern of trade between Asian countries and four superpowers. First, all selected Asian countries increased their share of exports to China, making it the largest trade partner, except for India. Second, the United States, except for India, is no longer the main trade partner for Asian countries. Third, Japan lost market share from Indonesia and Malaysia. Its rank declined to the second-largest trade partner with the Philippines, Thailand, South Korea, and India. Fourth, the value of trade increase substantially for the selected countries,

Regarding the value-added export patterns (see **Figure 2**), Korea, India, and Thailand reduced their shares. By contrast, Indonesia, the Philippines, and Malaysia increased their shares. Malaysia and Thailand had the lowest share of value-added exports among ASEAN countries as they produce final goods in GVC. Meanwhile, their intermediate parts and components needed to produce export goods are largely imported. Indonesia, by contrast, exports more raw materials, high in domestic value-added.

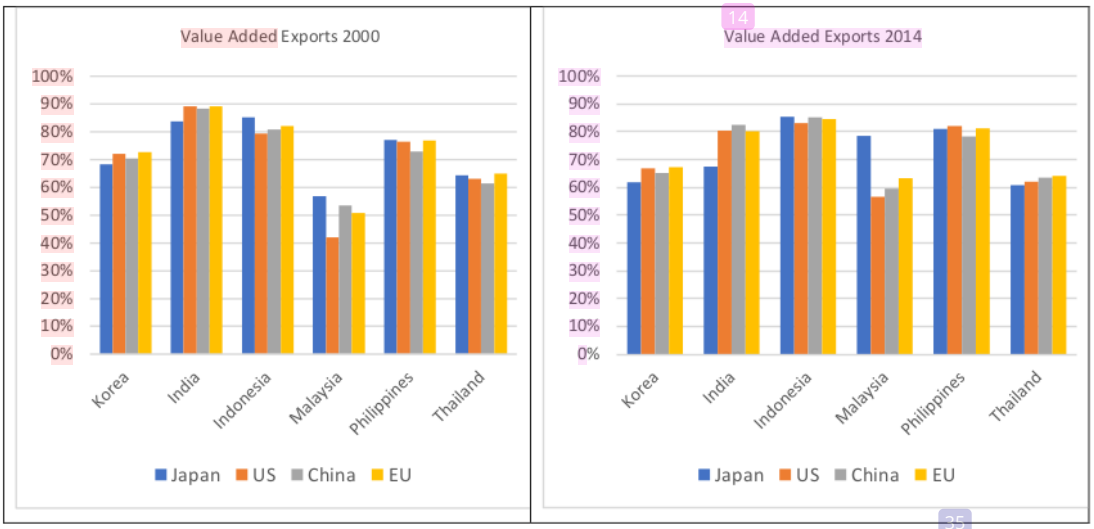


Figure 2. Value-Added exports share from gross exports from South Korea, India, Indonesia, Malaysia, the Philippines, and Thailand to Japan, the US, China, and the EU 2000 - 2014

Note: Value-added exports as a percentage of gross exports, data extracted on 22 Oct 2022 at 02:19 UTC (GMT) from OECD Stat

The variable on oil rents reflects the difference between the value of crude oil production and the production cost, which captures changes in prices and, to some degree, volatility. A fall in rents indicates low prices. Spikes in oil prices occurred in some quarters in 2004, 2008, 2011, and 2014. As noted in **Figure 3**, price changes affect oil rents across countries differently. Variations in oil prices are found to significantly impact GDP growth in ASEAN counties (Punzi, 2019). Besides, an increase in growth uncertainty (shocks) impacts energy prices, potentially magnifying the effects of oil prices on GDP growth.

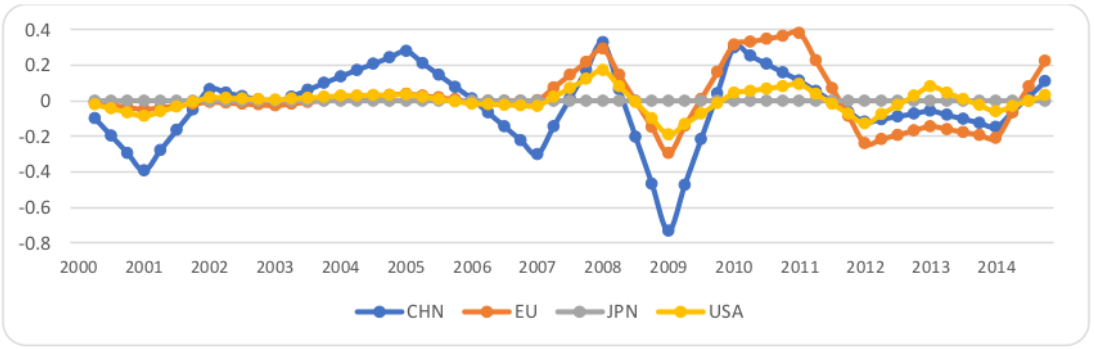


Figure 3. Changes in Oil Prices in China, the EU, Japan, and the US, 2000-2014

Note: Oil rents for China, the EU, Japan, and the US, data extracted from the World Bank and measured from the difference between the value of crude oil production at regional prices and total production costs

RESULTS

We incorporate a panel vector autoregression (VAR) model to analyze whether the economic growth rates in India, Indonesia, Malaysia, Thailand, South Korea, and the Philippines respond to the growth shocks from large trade hubs. We analyze whether 1) this shock is channeled by GVC, which spills the effect over Asian countries, and 2) whether Asian growth responds to oil prices, uncertainty, interest rate, and current account.

A. Growth Shocks

After confirming the VAR model's fitness, we estimate the companion matrix's moduli. The findings show that most models are stable with moduli of less than one (Appendix). Next, we estimate the impulse response (IRF), with confidence intervals (CI) calculated using the Monte Carlo iterations. Since the ordering of variables affects the orthogonalized IRF, we follow the sequence in the variables proposed by Huidrom et al. (2019) as it has been theoretically tested.

Before fitting the chosen model, we test the unit root to validate the stationarity in the data. We then estimate the selection-order statistics and evaluate different lag orders to identify the most appropriate model lag. We apply the moment and model selection criteria (MMSC) for each country under study to examine the GDP growth shocks (results available upon request). We also employ the GMM approach with its instrumental variables to generate the fit panel-VAR model. We use two models: 1) Model 1 counts GVC participation or share of trade under GVC to measure the linkage, and 2) Model 2 counts the conventional variable of trade openness or gross trade to GDP. We first report the model's results using the variable of GVC participation to measure the linkage between each country under study with the major hubs. The IRF of the stable models (three countries with stable results) is reported in **Figure 4**.

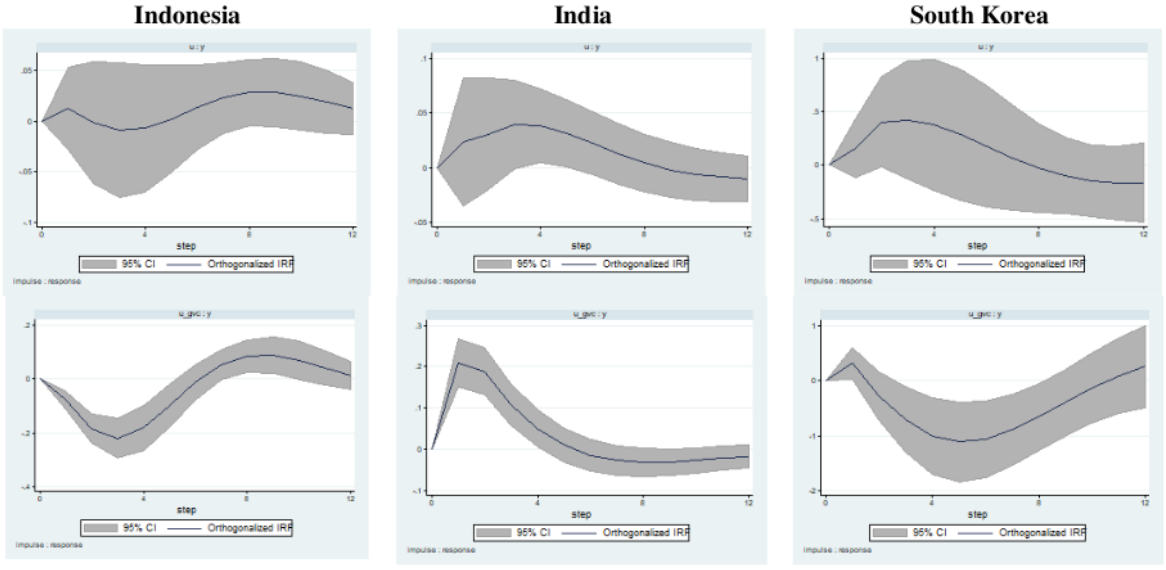


Figure 4. Impulse Response Function for Indonesia, India, and South Korea: The GVC Model

Note: Growth shocks (U), and interaction of growth shock and value-added export (u*gvc). Results from Malaysia, Thailand, and the Philippines are not displayed, as the moduli indicate borderline instability

The results show that the growth shocks from the advanced economies (captured by IRF on *u:y*) have a direct positive impact on Indonesia's growth rate in the short term, followed by GDP reverting to its equilibrium after 12 quarters. This positive effect may be due to Indonesia's expansionary fiscal and monetary policy responses in anticipation of the adverse changes in advanced economies' GDP. India and South Korea showed a similar effect, where growth shocks were responded to with expansionary macroeconomic policies so that GDP increased in the short term. Earlier studies have also found that the GDP growth of Indonesia and South Korea responded positively to growth shocks from advanced countries (Dungey et al., 2018).

However, if the GVC factor is included in the model (captured by IRF on *u_gvc:y*), Indonesia experiences negative impacts in the short term (or at least up to the third quarter). This shows that GVC amplifies the effects of growth shock in a negative direction, albeit temporarily since the GDP returns to its equilibrium after the shock abates (12 quarters). A 1% shock in GDP growth in global economies leads to a fall of 0.2 to 0.25 percent of GDP growth in Indonesia (lowest point). The same is true in South Korea. However, the impact is substantially larger than Indonesia's (nearly a 1% decrease in GDP growth following a 1% growth shock in major economies). This finding is in line with the scenarios proposed by Harahap and Bary (2017), revealing that GDP growth in ASEAN was responsive to shocks in China due to the close trade ties. Meanwhile, India shows a different pattern, where the effect of GVC goes in a positive direction akin to the growth shocks. Likewise, the impact is temporary as it starts to decline towards equilibrium after the second period. India's low participation in GVC and trade with China (see **Figure 1** and **Figure 2**) suggests that 1) the country is less vulnerable to China's growth shocks, 2) the growth shocks are not transferred to India via GVC.

We also estimate the impact of global uncertainty on the GDP of Indonesia, India, and South Korea in the model's framework (**Figure 5**). The global uncertainty is proxied by the stock market volatility index from the four advanced economies. The charts show that Indonesia's and South Korea's GDPs responded negatively to global uncertainty during the first year. Meanwhile, India's GDP responded positively during the first two quarters. In terms of magnitude, the most significant negative impact befell South Korea. Regarding timing, the negative impacts swept Indonesia and South Korea immediately after the shocks in developed countries. In all three countries, returning to equilibrium took approximately three years. These findings align with previous studies (Huidrom et al., 2019; Iacoviello & Navarro, 2019; World Bank, 2018).

It can be concluded that developing countries (e.g., Indonesia and India) are more exposed to uncertainty than to trade (Hoek et al., 2022; Iacoviello & Navarro, 2019). For more advanced economies like South Korea, the impact of uncertainty intensifies when interacting with global trade. Raghavan and Devadason (2020) noted that shocks from the China-US trade war are channeled not only directly via trade but also indirectly (external effects). Dizioli et al. (2016)

pointed out similar findings, arguing that if the rebalancing of China's growth coincides with global uncertainty, the negative impact on ASEAN markets will be more significant.

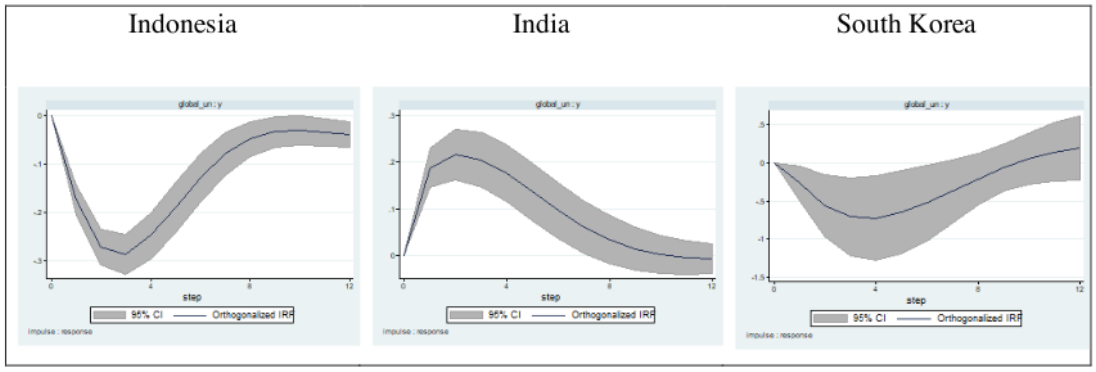
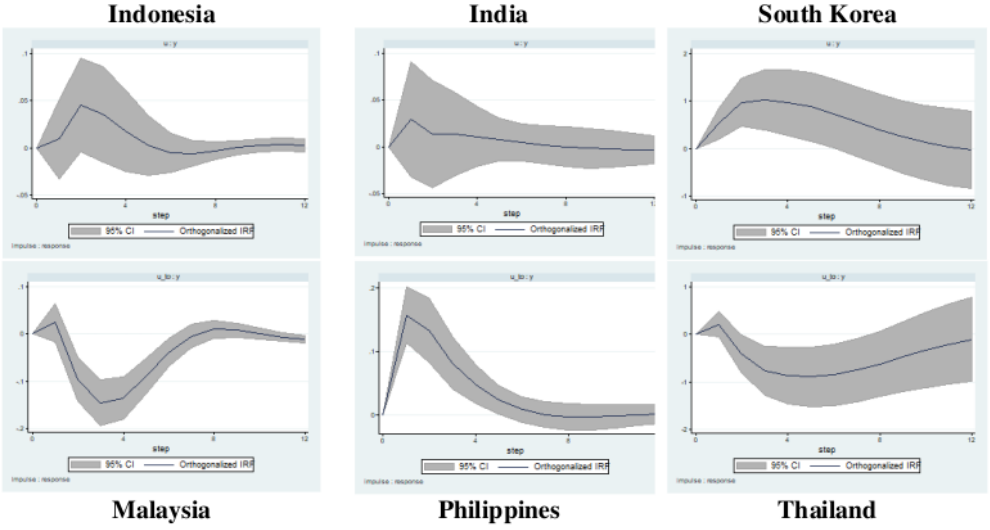


Figure 5. IRF of global uncertainty on Indonesia's, India's, and South Korea's GDP

Note: Global Uncertainty (Global_un)

We also formulate the trade linkage model using the gross trade variable (ratio of total trade to GDP) as a comparison for the GVC variable (value-added trade). After performing econometric procedures such as unit root tests and the convertibility of AR root, the following IRF results are obtained. We report in **Figure 6** (the results for the six stable countries).



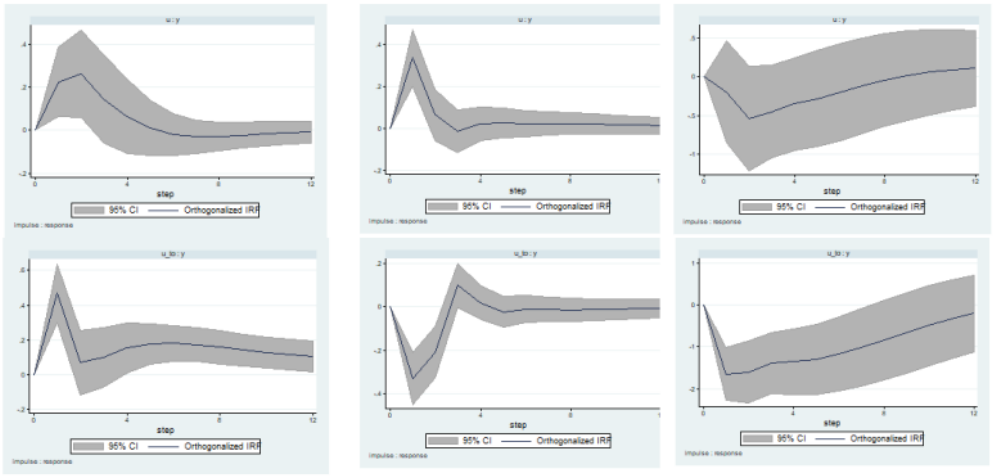


Figure 6. Impulse Response Function: Gross Trade Model

Note: Interaction of growth shocks (u) and trade openness (u_to:y)

The estimation results in the gross trade model also show that trade openness **(Figure 6)** intensifies the impact of growth shocks in Indonesia, India, and South Korea. In these three cases, the impact measured using the GVC variable was more significant than using total gross trade, suggesting that intense participation in GVC can moderate the impact of uncertainty on economic growth.

In Malaysia, the Philippines, and Thailand, the responses to growth shocks (*u: y*) vary. Thailand was impacted negatively following the growth shocks, while Malaysia and the Philippines saw positive changes only in the first three and four quarters. If the growth shocks interact with the total gross trade (*u.to: y*), the impact on the three countries will be greater. We also found that the growth shocks impacted Thailand more significantly and extensively than the Philippines, taking nearly three years to return to equilibrium.

The above result is in line with previous studies finding that the larger the share of value-added trade, the larger the exposure to shocks (Huidrom et al., 2019; IMF, 2013). Dizioli et al. (2016) found that trade linkages between ASEAN-5 and China are an essential channel of spillover transmission effects. Growth in ASEAN-5 is expected to fall between 0.2 and 0.5 percent, following a 1 percent decrease in China's growth. Harahap and Bary (2017) also noted that Indonesia's economic growth was exposed to shocks from China's real GDP growth. The country's vulnerability to growth shocks from China is more apparent (Dungey et al., 2018) than shocks from the US, although it remains exposed to the US monetary policy.

Country-specific shocks from China, Japan, the US, and the EU

Additionally, we explore how growth shocks from each advanced economy influence growth levels in the Asian economies as a group. Three models are displayed: 1) a model without trade

variable (baseline), 2) a model using trade under GVCs, and 3) a model using trade openness. Some results are unstable, so such cases' IRFs are not displayed.

The results indicate that growth shocks (*u : y*) from China and the US positively impact growth in Asian countries, suggesting they remain the most important sources of growth for Asian countries. By contrast, growth in Asian countries initially responds positively to the shocks from the EU before turning negative after the first quarter. The impact of growth shocks from Japan on Asian countries is positive for a few months before returning to equilibrium.

Regarding the interaction between trade openness and growth shocks (u_to : y), the results show that with the increasing intensity of trade between China and Asian countries (Indonesia, India, South Korea, Malaysia, Thailand, and the Philippines), growth shocks originating from China has the greatest impact on Asian economies when viewed from the trade openness perspective. As for the EU growth shocks, the compound effects (trade shocks and openness) are initially negative but turn positive over the medium term. However, the compound impacts from the US and Japan are negative, although it starts recovering after two quarters.

Interestingly, the impact of GVC in channeling shocks differs across countries. Asian countries' GDP growth in response to the interaction between growth shocks and trade variables (u_gvc: y and u_to: y) from Japan is negative for the first three quarters before moving towards equilibrium. It should be noted the negative impact of growth shocks and trade is magnified when observed in light of GVC, but mitigated when observed from the conventional gross trade. That suggests that Asian countries trade more with Japan under the GVC (indirect trade) than under gross trade. In other words, shocks are transmitted through production and distribution networks under GVC. In the case of the EU, the response to shocks and trade is larger under the trade openness variable (u_to: y) than GVC (u_gvc: y). Asian countries trade under GVC much less with the EU, suggesting they are not too vulnerable to the propagation of shocks through the EU value chains.

In the case of the US, the response to shocks through GVC is positive, while the response to shocks through trade openness is negative (opposite direction). In line with Purwono et al. (2022), Asian countries are more integrated with the US through indirect trade (under GVC) than through direct trade (gross trade). As such, policymakers in Asia need to assess the spillover effects on growth that can propagate from the US to the region through GVC (indirect linkages). From the perspective of total gross trade (u_to:y), Asian countries face the most significant impact when the shocks originate from the US, which tends to be immediate and permanent. This is different from the results of the GVC model (u_gvc: y). Among other reasons, Asian countries trade far more with the US under GVC than under gross trade, as Purwono et al. (2021) noted. Gross exports to the US from Asia are substantially lower than exports under GVC (the measurement includes indirect exports). Purwono et al. (2022) noted that the impact of tariffs under the US-China trade war was substantially bigger for Asian countries (i.e., Indonesia and South Korea) when accounting for GVC exports to the US than when employing gross trade. Asian countries trade substantially with the US via China, so indirect shipments are not measured using gross export

data. As for the nexus with China, negative impacts on economic activity in several Asian countries also occur due to shocks from China, which tend to be volatile and permanent.

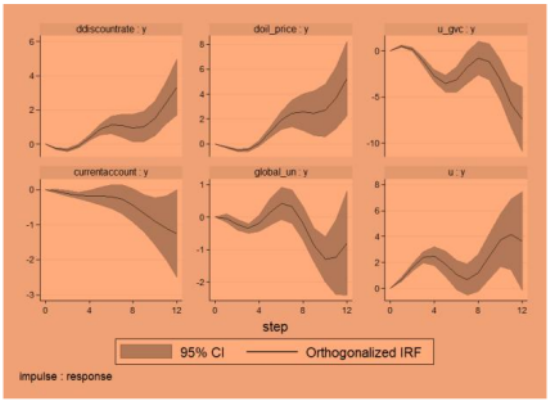
As for the other control variables, oil prices tend to negatively impact economic growth in the cases of shocks from China and the US (see IRF *doil price: y* for the model without trade variables). However, when gross trade is included, the impact of oil prices in the case of China has initial positive effects (first three periods), before turning negative (from the third quarter to the eighth), which is followed by a recovery. The impact of oil prices under the gross trade model is more immediately felt through the US (first two quarters) than in China (which turns negative after 1.5 years). However, in the medium term, oil prices negatively impact Asian countries through China more than the US (which starts recovering before the second quarter after the shocks). In the medium term, a change in oil prices can cause a decrease in nearly 1.5% growth for Asian countries after two years, while it causes 0.5% in the US model. In the case of the EU (GVC model), a change in oil prices causes an initial positive impact on economic growth for Asian countries for the first three quarters. Then, the impact turns negative, reaching -0.6% around the eighth quarter after the price change, before returning to equilibrium (the twelfth quarter). In the Japan model, oil prices cause a slight increase in GDP growth for Asian countries during the first two quarters before returning to equilibrium.

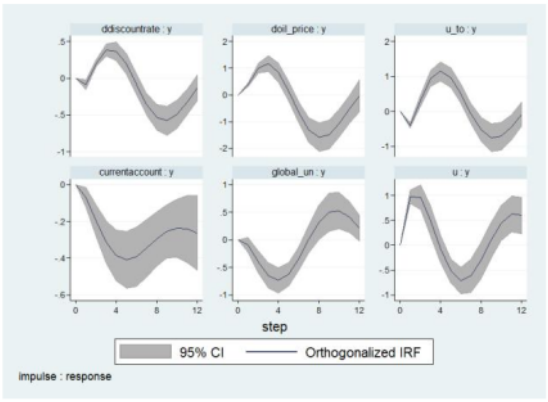
Regarding the response of GDP growth to monetary policy through the discount rate, the trend is similar in the four models, with an initial positive impact on growth for three to four quarters before turning negative until the eighth quarter, when recovery towards equilibrium starts. As for the current account (gross trade model), in China and the US models, growth in the Asian countries responds negatively to a change in the current account. In Japan and the EU models (gross trade), the response of economic growth to a change in the current account is positive. When we employ GVC, the response of GDP growth to the impact of the current account is less averse. The current account under GVC and gross trade differ as GVC captures indirect exports and imports. The use of a current account is particularly critical in the case of Asian countries with China, as most countries run trade deficits. A decrease in the current account is associated with growth for Asian economies when trading with China. By contrast, running a surplus in the current account with the US supports economic growth in Asia in the long run (see GVC model).

GVC Model

Total Gross Trade Model

China





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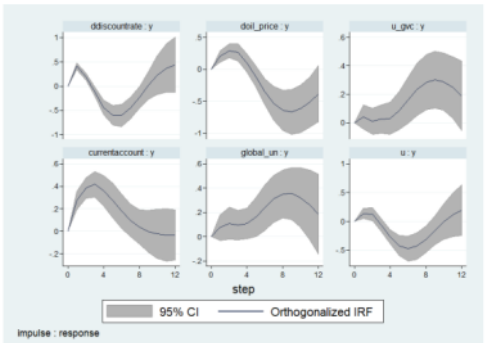
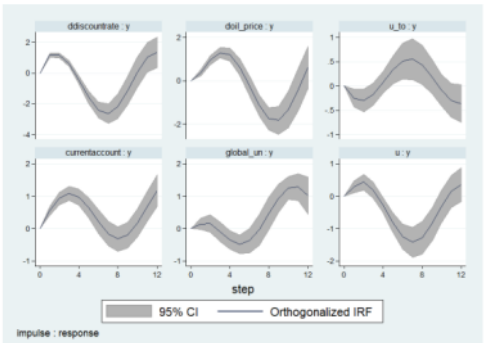
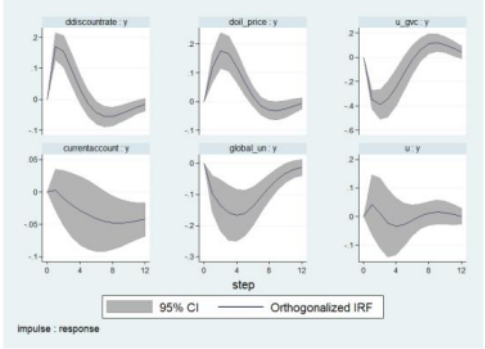
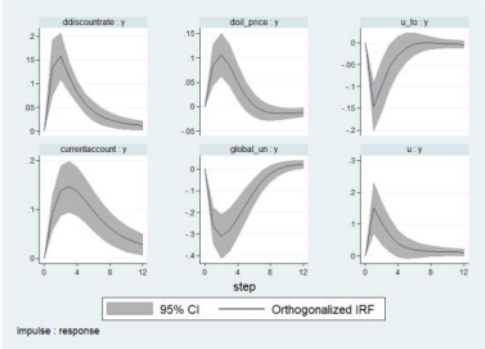


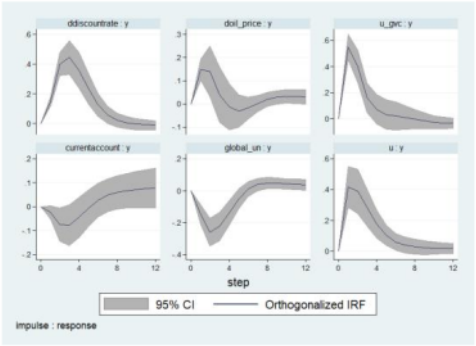


Japan





The US



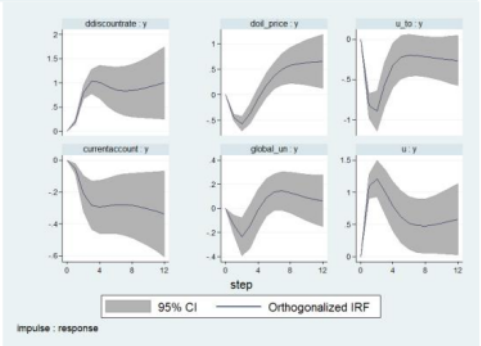


Figure 7. The impact of growth shocks from four large countries on Asian economies (as a group)

Note: Discount rate, oil price, current account, global uncertainty, growth shock (u), GDP growth (y), GVC (trade in value-added), trade openness (TO) (quarterly data)

V. CONCLUSION

We explore how growth shocks from large partner countries (the US, China, Japan, and the EU) affect emerging Asian countries' economic growth. Additionally, we examine whether GVC channels the growth shocks. We regress 1) selected Asian countries' growth on their GDP, 2) the growth shocks from partner countries (u), 3) an interaction of growth shocks with a trade indicator, 4) a variable capturing their own lagged growth rate, and 5) four control variables capturing exposure to external aspects, namely oil prices, global uncertainty, current account, and discount rate. The interaction between growth shocks and trade captures whether international trade channels the shocks. More importantly, we compare the conventional trade openness measures (total trade to GDP) with a measure of trade under GVC (value-added trade).

The participation of Asian countries in GVC has increased over time. Intermediate inputs increase the share of total value-added exports that travel through the GVC before reaching their endpoints. Most Asian countries created stronger linkages with production networks in China and Japan (although they are decreasing in importance). The considerable linkages that Asian countries hold with China and, to some degree, with the US, Japan, and EU hint that growth shocks can be propagated to Asian partners through GVC.

Our results suggest that Asian countries are exposed to growth shocks from the four largest economies (the US, China, Japan, and the EU), and the shocks transmitted via GVC tend to be larger for Indonesia. For South Korea, the impact of growth shocks is lower as the country participates more in GVC. However, the shocks' impact is positive for India, which has low participation in GVC. A larger share in GVC leads to more exposure to shocks for Indonesia, with nearly twice the impact of the shocks propagated through total gross trade (not considering indirect trade). In South Korea, participation in GVC lowers the impact of growth shocks from four advanced economies and shortens the recovery process. Indonesia mainly exports raw materials and essential intermediate goods, while South Korea exports more advanced intermediate parts and components to the world. For Thailand and the Philippines, growth shocks from advanced countries propagate to their economies through trade openness, responding negatively to shocks. GDP growth in Malaysia, by contrast, responds positively to growth shocks from superpower countries.

The findings indicate that growth shocks from China and the US significantly impact growth in Asia, compared to Japan and the EU. China and the US remain the region's most important sources of growth. GDP growth in Asia also responds to the growth shocks from China through the trade channel, signaling that trade can serve as a means of propagation of growth shocks. Asian countries also respond to growth shocks from Japan that are transmitted through trade, intensified under the GVC perspective. In other words, the close linkage of Asian countries with Japan

intensifies the propagation of shocks through GVC. In the case of Asian trade with the US, the impact of growth shocks through trade is conflicting when using GVC (direct and indirect trade) and trade openness (direct trade). Policymakers need to consider that the sizeable indirect share of exports to the US exposes the region to growth shocks—something invisible if only examined through direct trades.

Global uncertainty hurts Asian economies, especially in the short term, although an adjustment to equilibrium may occur in the next 12 quarters. Uncertainty is more critical for developing countries (i.e., Indonesia, Thailand, and the Philippines) than for advanced ones (South Korea). Current account deficits with China may support growth in Asia, although it has the opposite effect with the US (when considering the current account in the GVC context). The GDP growth of Asian countries responds significantly to oil prices, with a positive impact in the short run but a negative impact over the long run, particularly in the case of Asia with China and the EU.

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