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by Unggul Heriqbaldi

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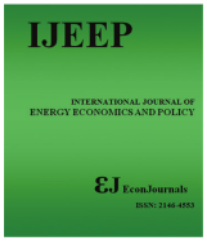

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Propagation of Economic Shocks from the United States, China, the European Union, and Japan to Selected Asian Economies: Does the Global Value Chain Matters?

Ignatia Martha Hendrati[1]*, Unggul Heriqbaldi[2], Miguel Angel Esquivias[2], Bekti Setyorani[3], Ari Dwi Jayanti[2]

[1]Universitas Pembangunan Nasional "Veteran" Jawa Timur, Indonesia, [2]Universitas Airlangga, Surabaya, Indonesia, [3]Ministry of National Development Planning, Jakarta, Indonesia. *Email: ignatia.hendrati.ep@upnjatim.ac.id

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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, Globalization
JEL Classification: F44, F62, O53, E43

1. INTRODUCTION

In this paper, we examine the responses of selected Asian countries to economic growth surprises (growth shocks) from major global economies; China, the United States (US), Japan, and the European Union (EU). The aim is to understand better the differential importance that global trade, monetary policy, oil prices, and uncertainty channels play in response to growth shocks from large economies. We look at six economies in Asia that differ in their participation in global trade and oil consumption: Indonesia, India, Malaysia, Thailand, South Korea, and the Philippines. Specifically, we compare the conventional trade openness indicator to measure global trade participation with an indicator of the involvement of a country in the Global Value Chain (GVC) to test if the impact of economic shocks differs as countries participate differently in the GVC. Moreover, the effects of oil prices, global uncertainty, and monetary policy from the US can have a different impact on countries' economic growth, often differing in the short and the long run.

The literature on the transmission of shocks is somewhat mixed. While Korea (Lee, 2019), South East Asian countries (Moeller, 2018), and Europe (Huidrom et al., 2019; Vandenbussche et al., 2019) experienced adverse effects from growth shocks, some Asian cases reported minor impacts from shocks originated from the US and China (e.g., due to trade war). Still, Raghavan and Devadason (2020), using a Structural VAR model, find that indirect linkages with China and the US are transmission

channels of shocks for Southeast Asian countries (ASEAN). Employing a multi-sector CGE (Caceres, 2019; Li et al., 2020) finds that a decrease in global demand due to trade tensions could harm indirect exports from ASEAN to the US, although considering a possible scenario where ASEAN countries may substitute Chinese exports to the US. Iacoviello and Navarro (2019) noted that foreign countries respond to monetary shocks from the US, with the impact varying according to exchange rate regimes, trade openness, and uncertainty. The impact on economic growth from monetary shocks on advanced countries is amplified through the trade channel, while the impact on developing countries is magnified due to vulnerability (risk). Harahap and Bary (2017) noted that economic growth in Asia countries (i.e., Indonesia) is exposed to growth surprises from China and monetary shocks from the US transmitted through the financial channel. The increasing vulnerability of Asian countries to global superpowers increased the awareness of policymakers on the risk and the potential impact on growth from foreign policies.

Evidence suggests that fragmented global value chains (GVCs) alter the transmission mechanism of impacts resulting from changes in the global demand (Tan et al., 2019; Xiao et al., 2020). Measuring global openness to trade in gross terms may underestimate the impact of growth shocks on third countries as gross exports do not capture indirect export flows (Huidrom et al., 2019; Simola, 2019; Vandenbussche et al., 2019). Demand may be more responsive to growth shocks depending on countries' exposure to trade under the GVC (direct and indirect trade), the position countries hold within the GVC, and the kind of goods traded (Vandenbussche et al., 2019). The case of Europe Huidrom et al. (2019) suggests the lower vulnerability of Asian countries to shocks from the EU as they have limited linkages. However, the impacts are more significant for countries more integrated with Europe through the GVC. Being firmly integrated into the GVC can magnify the impact of the shocks, as seems to be the case of Asian countries with China (Dizioli et al., 2016).

We first extract economic growth surprises from four large economies (China, the US, Japan, and the EU) using quarterly data from 2000 to 2014 to estimate growth spillovers, defined as the country-specific shocks on other countries' economic growth after isolating exogenous movements (common shocks). Business cycle comovement can be originated from a combination of common shocks and spillover (IMF, 2013). Controlling for common shocks allows for identifying country-specific growth surprises that can be employed to compare the impact of the four major economies. After removing common shocks, the country-specific growth surprise is obtained from the residual growth. We then trace the impact of spillover (growth shocks) across selected Asian economies. The model allows for interaction between growth surprises and bilateral trade, using a variable for conventional trade openness and a variable of GVC participation. As such, the model can identify whether integrating a country with major economies via trade can be a transmission channel of growth shocks.

After estimating growth surprises, we apply a panel vector autoregression (VAR) model to explore how the economic growth of the selected Asian countries is affected by the growth shocks from major economies and how the impact depends on the global integration and exposure of a country the trade. Besides, we integrate into the model the role of monetary policy (interest rates), financial position (current account), energy process (oil prices), and uncertainty. The main focus is to examine how vulnerable Asian countries may be to economic shocks, uncertainty, energy prices, and monetary policy from major economies. Emerging economies can be vulnerable to economic shocks derived from advanced countries (Dungey et al., 2018), changes in the prices of oil (da Silva Souza and de Mattos, 2022), rise in interest rates under inflationary pressure (Hoek et al., 2022), cases where current account is under pressure, and global uncertainty (Iacoviello and Navarro, 2019).

Several reasons suggest that this study is timely. First, the dark scenarios for 2022 and 2023 for the global economy, characterized by the tightening of monetary policy by the US, a decrease in global demand (economic slowdown), the rise of energy prices, and large levels of global uncertainty, suggest that is of high relevance to understand shock transmission mechanisms better. Second, Asian countries are strongly linked with China through the GVC, and at a lower extend to the US and Japan through the GVC. High linkages with the GVC indicate that countries are potentially vulnerable to the slowing down of the Chinese economy (Xiao et al., 2020), monetary policy from the US, global energy prices (Chen et al., 2022), and global uncertainty. The US-China trade war suggests that negative impacts can be transmitted to US-China partners or third countries (Chong and Li, 2019; Iqbal et al., 2019; Li et al., 2018). The impact of growth shocks from China is often estimated to be larger than that through the US, mainly through the trade channel (Itakura, 2020; Kumagai et al., 2019; Li et al., 2020). To what extent the economic shocks are transmitted to Asian partners remains an empirical question.

The choice of selected Asian countries (India, Indonesia, Malaysia, Thailand, the Philippines, and South Korea) derives from the significant participation of such countries in global trade, although holding different roles in the GVC. Some Asian countries export raw and intermediate goods (e.g., Indonesia and Japan), and some focus on final products like Malaysia, Thailand, and Vietnam (Padilla et al., 2019). Countries like Indonesia have expanded within GVC in Asia (Padilla et al., 2017), increasing market concentration, becoming increasingly specialized, and progressively fragmented, suggesting it can be more exposed to global shocks (Purwono et al., 2020). Moreover, Asian countries are strongly linked to China, the US, Japan, and to a lower extent, to the EU, suggesting that they may have exposure to growth surprises to a different extent with each superpower.

This paper will answer the following research questions. To what extent is the impact of growth shocks in China, the US, and Europe for selected Asian countries? Our study is limited to a time frame where data on GVC from the World Input-Output Dataset (WIOD) is available. Field Purwono et al. (2022) noted that changes in patterns in the GVC take a long time to change, suggesting that having a lag in the data does not impose drastic differences in the empirical results.

We contribute to the literature in different ways. We provide evidence on whether GDP growth shocks from the most significant economies impact the growth rate of Asian countries and whether participation in the GVC is a transmission mechanism for the effects. Oil prices are also likely to experience diffusion effects through GVCs (Chen et al., 2022), suggesting the need to estimate the impact of oil price variations on economic growth in Asia. Oil price fluctuations have a more significant impact on macroeconomic aspects in developing countries than changes in the supply (da Silva Souza and de Mattos, 2022).

2. LITERATURE REVIEW

The connectivity of business cycles between countries tends to increase as countries maintain closer trade links (Dizioli et al., 2016). As bilateral ties strengthen, comovements and exposure to volatility are subject to increase (Raghavan and Devadason, 2020a). Greater trade connectivity exposes countries to larger effects from global changes in demand, be it a contraction in demand, expansion, or substitution of products and services (Purwono et al., 2022). In the presence of global production networks, it is not unreasonable to consider that common global shocks can be transmitted indirectly through induced changes in domestic production, trade in intermediate inputs, or indirect trade (Xing, 2022). To illustrate the point, it is worth noting that the US-China trade war has increased the possibility of the realignment of GVCs in the Asia (Dizioli et al., 2016). In this way, it can be affirmed that the transmission of shocks to the economies connected in the network may be more susceptible to global shocks. In Asia, China (Xiao et al., 2020) and Japan play a critical node 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.

The literature on comovements or interdependence is often based on formal approaches, including 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, monetary (Barnichon and Brownlees, 2019), financial, and energy prices (Punzi, 2019) on the economic growth (Harahap and Bary, 2017), exports (Aslan and Acikgoz, 2021), and demand for labor (Vandenbussche et al., 2019). Structural VAR (Dungey et al., 2018), Global VAR (Raghavan and Devadason, 2020b), panel VAR (Punzi, 2019), and Bayesian BVAR (da Silva Souza and de Mattos, 2022) are some common approaches to estimating impacts from shocks. Non-linear models local projections in (Barnichon and Brownlees, 2019; Iacoviello and Navarro, 2019) have also been applied to similar cases.

Nevertheless, previous studies in global production networks (GVC) also noted that increasing interconnectedness nurtures countries' exposure to shocks (Huidrom et al., 2019). Empirical evidence in South Korea suggests that higher participation in GVCs is a significant channel in propagating shocks across internal and external activities (Lee, 2019). More importantly, it is found that high connectivity with superpowers as trading partners can expose countries to large economic activity swings and damage the labor market (Vandenbussche et al., 2019).

Other studies explored the role of international trade in the transmission of shock, generally supporting that higher integration in the GVC increases the exposure to shocks (Lee, 2019; Mattoo et al., 2017; Simola, 2019). Still, other studies only find a moderate impact of global trade as a channel of transmission or propagation of shocks (Berkmen et al., 2012). Dungey et al. (2018) noticed that trade relations have changed over time (specifically for ASEAN) and that the propagation mechanism of shocks through global trade has also changed. The increasing participation of Asian countries in indirect trade seems to have increased the exposure to foreign shocks. The transmission of economic shocks in highly concentrated and interconnected networks like those connected with the US, China, and the EU, has wide-ranging impacts.

Essential differences in trade shocks' effects when employing value-added instead of gross exports are evident in the European case (Huidrom et al., 2019). Countries engaged in indirect trade through GVC are likely more vulnerable to growth shocks (Dungey et al., 2018). The strand of literature covering trade shocks and propagation of impacts across GVC offers various approaches (Huidrom et al., 2019; Shrestha, 2015). In a Computable General Equilibrium (CGE), Caceres et al. (2019) find that although overall impacts on GDP could be relatively small as an effect of trade tension. The results at specific sectors and locations could be more disruptive as they are more exposed through direct-indirect spillovers.

Another set of studies employs the input-output framework to analyze the impact of growth shocks. Ma et al. (2016) examine the effects of the Chinese economy's rebalancing from investment to consumption. Identifying the negative impact transmitted to foreign players as exports to China are estimated to fall. Vandenbussche et al. (2019) apply the I-O framework to evaluate the effects of Brexit. Identifying those strong linkages across European countries increases the negative impacts, especially for upstream players. Huidrom et al. (2019) estimates that economic shocks' effects are felt more substantially in highly integrated economies (more value-added across GVC) than in less interconnected countries. For example, a 1% negative growth shock in the US impacted –0.6% points growth in the EU in 2 years. For countries more engaged in GVC, the impact could rise to –1.4% growth.

Another issue affecting Asian countries is their strong and increasing dependence on China and Japan in trade and production networks over time (Purwono et al., 2020). Similarly, Asian countries are less directly exposed to North American and European value chains. A rebalancing of the Chinese economy (Ma et al., 2016) -the largest trade partner for most Asian countries-rises the probability of possible shocks in demand. Similarly, the trade tensions (US-China), global energy prices, disruption in production, supply shortages, and a potential global slowdown could trigger significant direct and indirect effects on Asian economies.

Previous studies on spillover effects from major economies (China, US, Japan, and EU) to Asian countries also suggest that Asian

countries are vulnerable 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. The response of the ASEAN to a growth shock from China was low before 1998, although it increased substantially by 2015. At the country level, Dungey et al. (2018) found that the cumulative response of Indonesia, Malaysia, Thailand, and the Philippines to the growth shock from Chine 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 deriving from China's economic slowdown on the ASEAN-5, finding that a 1% fall in China's GDP would translate into a 0.2-0.5% fall in the largest ASEAN countries GDP. Moreover, a slowdown in the Chinese economy, a rebalancing of the economy, and high uncertainty can exacerbate the impacts.

Building on a global VAR model, Harahap and Bary (2017) show that a 1% shock (decline) in China's real GDP will follow 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 trade war. Still, under particular scenarios, Indonesia's GDP could increase by 0.01-0.04%, considering that Indonesian goods could replace Chinese exports to the US. Using the Structural VAR model, Raghavan and Devadason (2020) also reveal increasing exposure to growth shock from China and the US for ASEAN countries due to the growing connectivity. They also find that due to the growth multiplier effect, the US has a more dominant growth driver in some Asian countries (e.g., Indonesia) than China, even though Indonesia's export shares to China are larger than the US. Such disputing evidence suggests the need to assess further the transmission mechanism of growth surprises from superpower countries to Asia.

3. METHODOLOGY

3.1. Growth Shocks

3.1.1. Identification of China, Euro Area, Japan, and United States shocks

We first estimate growth surprises in the spillover source countries, United States, China, Japan, and Europe, by identifying the share of own growth, which is country-specific, removing common sources of growth (commonalities). We follow approaches as that of Morgan et al. (2004) applied in studies like (Iacoviello and Navarro, 2019; IMF, 2013). Country-specific growth shocks are estimated as the residual growth after removing commonalities. A series of quarterly GDP data measuring the four largest economies' growth was employed, covering 2000Q1 to 2014Q4 in a similar fashion (Iacoviello and Navarro, 2019). Growth residuals are estimated close to orthogonal, indicating that commonalities affecting growth across countries are generally 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 surprises.

We identify shocks by regressing the log GDP on a set of controls and use the residuals as the identified shocks. In particular, we estimate shocks u_t as the residual in the regression:

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

Where Δy_t is the log real GDP for China, Euro Area, Japan, United States. The set of controls Zt includes contemporaneous and GDP lagged of China, Euro Area, Japan, United States, oil prices, stock market index volatility, current account, discount rate and a quadratic time trend. We use quarterly data from 2000:Q1 to 2014:Q4.

3.1.2. Panel VAR model

We employ a panel VAR approach to estimate how growth shocks could affect economic activity in global value chains. We build on the comovements theoretical background in which economic growth can have synchronized effects around the World, while a share of growth remains specific to each economy. We are interested in capturing how specific growth shocks can be transmitted via Global Value Chains to trade partners. Protectionism, retaliatory responses, uncertainty, and other sorts of policy and economic shocks could slow growth. It is common to find that the greater the value-added exports of an economy to each trading hub, the more significant the growth correlation between that economy and the respective hub country (Huidrom et al., 2019). For instance, we study how the largest hub countries' growth shocks (unexpected growth movements) are transmitted to their trading partners via the GVC.

After estimating growth residuals (surprises or shocks), we evaluate the transmission effect towards selected Asian countries. To do so, we model the growth of Asian countries as a function of an exogenous effect from the growth surprise, an interaction term between growth surprise and GVC share participation, and a set of control variables. We follow Huidrom et al. (2019), who propose oil prices and global uncertainty (proxied by stock market volatility) as key exogenous variables. Additionally, current account and discount rates are added, as are standard control variables (Iacoviello and Navarro, 2018).

As such, the model traces the effects of shocks on growth in other countries, with spillovers varying based on the country's exposure to trade in value-added with large hubs (Iacoviello and Navarro, 2018). Local projections models, VAR, GVARs, and panel Regressions are common approaches. Although panel VAR imposes restrictions and mainly captures linear relations, it appears to fit the data better than the other alternatives for our case.

We employ the same quarterly GDP data to estimate the panel VAR while incorporating quarterly surprises in each of the four economies. Additionally, an interaction variable of growth surprise and GVC participation is created to capture whether GVC may be a shock channel. A panel VAR is represented as

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

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

$$y_{it} = y_{i,h-1}A_1 + U_t A_2 + U_t x GVC_{i,t-1}A_3 + y_{i,t-1}A_4 + X_{it}B + u_i + e_{it} \quad (2)$$

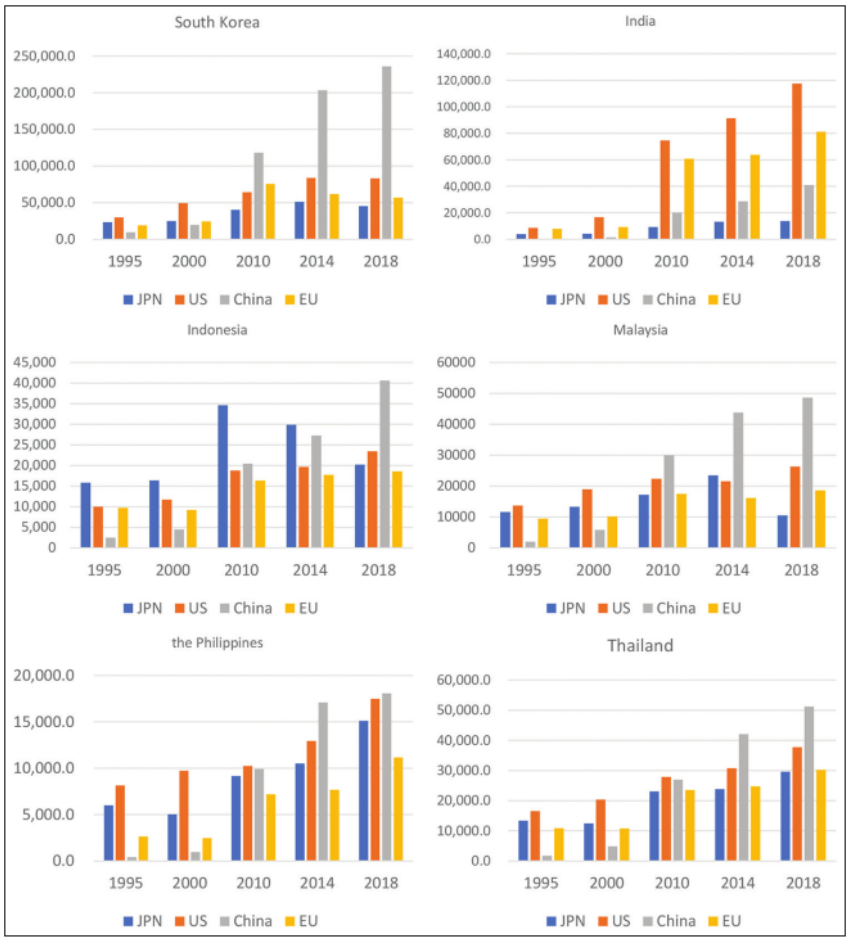
Where y_{it} is real GDP growth for selected Asian countries; Indonesia, India, South Korea, Malaysia, Thailand, and the Philippines. U_t is the Growth shock (surprise) estimated for the US, China, Japan, and the Euro Area. The surprise variable are estimated as the residuals of growth, based on IMF (2013), equation 3.5. The $U_t \times GVC_{i,t}$ is an interaction term between Ut and the share of *GVC* (Value Added Export Indonesia from each of the selected Asian countries 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 for the US, China, Japan, and the EU, obtained from the World Bank. Oil rents are the difference between the value of crude oil production at world prices and the total production costs. Global uncertainty is the stock market volatility index for the US (www.cboe.com/vix). Discount rates and current accounts are extracted from the International Financial Statistics - IMF Data.

3.2. Trade Patterns in Asian Countries

From Figure 1, it is noticeable five changes in the pattern of trade between Asian countries and four superpowers. First, all Asian selected countries increased the share of exports to China but India, opening the door to China as its largest trade partner. Second, the United States no longer remained the main trade partner for Asian countries but India. Japan lost market share from Indonesia and Malaysia and decreased its pivotal role as the second-largest trade partner with the Philippines, Thailand, South Korea, and India. Fifth, the value of trade increase substantially for the selected countries.

Regarding the pattern of value-added exports (Figure 2), Korea, India, and Thailand reduced their share of value-added contained in exports. Indonesia, the Philippines, and Malaysia increased their share. Malaysia and Thailand are the countries in ASEAN with the lowest share of value-added contained in exports as they are active

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.



Source: Gross Exports in US Dollar, Millions Data extracted on 22 October 2022 02:19 UTC (GMT) from OECD Stat

participants in the GVC in producing final goods, where a large share of intermediate parts and components needed to produce export goods are imported. Indonesia, by contrast, exports more raw materials, high in domestic value-added.

The variable on oil rents reflects the difference between the value of crude oil production and the production cost. Differences between the value and the cost reflect 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.

4. RESULTS

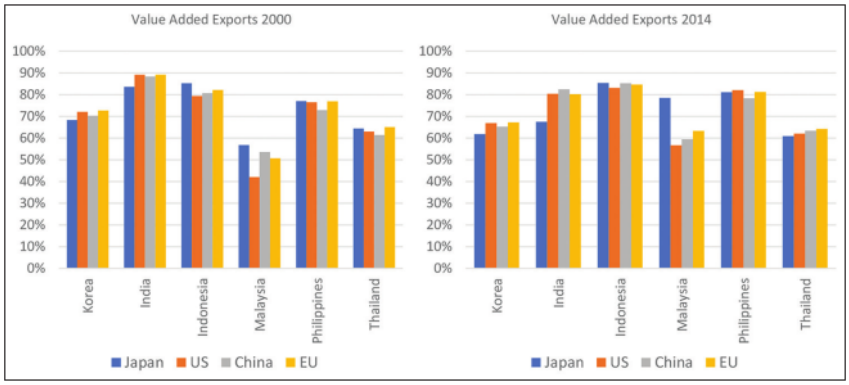
We incorporate a Panel Vector Autoregression (VAR) model to analyze whether the economic growth rate of India, Indonesia, Malaysia, Thailand, South Korea, and the Philippines responds to economic growth shocks from large economies. More interestingly, we analyze whether GVC is a channel in which effects spill over to Asian countries and whether Asian growth responds to oil prices, uncertainty, interest rate, and current account.

4.1. Growth Shocks

Once we have checked for the VAR model's fitness, we estimate the companion matrix's moduli, finding that most models are stable as the moduli included are less than one (Appendix). Once the panel VAR model appears to be stable, we proceed to estimate impulse response (IRFs). The confidence intervals (CI) are calculated using the Monte Carlo iterations. Considering that 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.

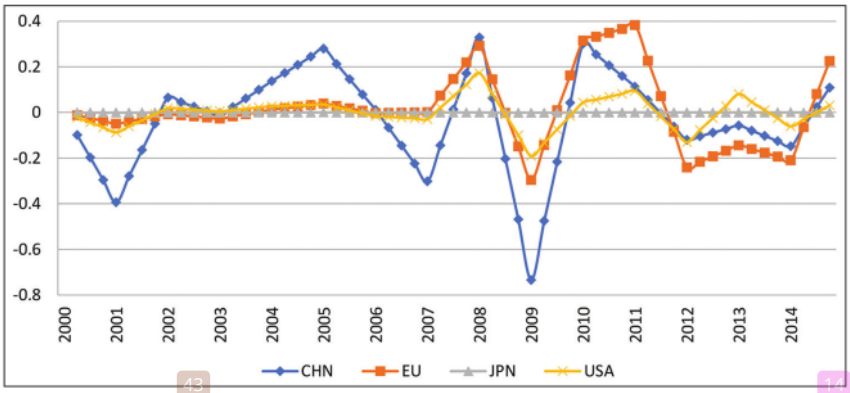
Before fitting the chosen model, we test for unit root to validate stationarity in the data. We then estimate the selection-order statistics and identify the optimal lag model. We evaluate different lag orders to identify the most appropriate model lag. The moment and model selection criteria (MMSC) were applied for each of the countries studied (Asian countries) for GDP growth shock

Figure 2: Value Added Exports share from Gross Exports from South Korea, India, Indonesia, Malaysia, The Philippines, and Singapore to Japan, US, China, and the EU 2000-2014



Source: Value added Exports as Percentage of Gross Exports. Data extracted on 22 October 2022 02:19 UTC (GMT) from OECD.Stat

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



Source: Oil rent for the US, CHN, JPN, and the EURO AREA. Data extracted from the World Bank and measured as the Oil rents are the difference between the value of crude oil production at regional prices and total production costs

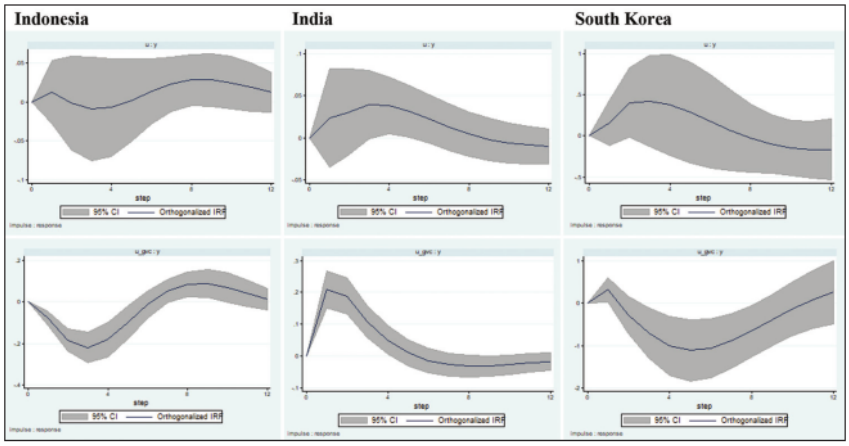
(results available upon request). We employ the GMM approach to generate the fit panel-VAR model using instrumental variables of the GMM framework. Two main models are applied. Model 1 employs GVC participation (share of trade under GVC) to measure participation in trade, and Model 2 uses the conventional variable of trade openness (gross trade to GDP). We first report the results of the model using the variable of GVC participation as a variable to measure trade for each of the selected Asian countries. The IRF of the stable models (three countries with stable results) is reported in Figure 4.

The results show that the growth surprise from the advanced economies (captured by IRF on *u: y*) has a direct positive impact on Indonesia's growth rate in the short term and is subsequently followed by an adjustment in GDP back to its equilibrium after 12 quarters. This positive effect may occur due to Indonesia's expansionary fiscal and monetary policy responses in anticipation of adverse changes in advanced economies' GDP. India and South Korea had a similar effect, where growth shock in advanced economies was responded to by both countries with expansionary macroeconomic policies so that GDP in both countries experienced improvements in the short term. The impact of growth shock on Indonesia and South Korea is in line with earlier studies that found that the GDP growth of Indonesia and South Korea responds positively to a unit growth shock 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 but with a negative magnitude, even though it is not permanent since the GDP returns to its equilibrium after the shock occurs (12t). A 1% shock in GDP growth in global economies leads to a fall of 0.2 to 0.25% of GDP growth in Indonesia (lowest point). South Korea experiences a similar effect as that Indonesia. However, the impact from the shock is substantially larger than Indonesia's (nearly 1% decrease in GDP growth following a 1% Growth shock in major economies). This finding is in line with the scenarios proposed in Harahap and Bary (2017) where GDP growth in ASEAN was found to be responsive to shocks in China, likely as trade ties are strong. India experiences a different pattern, where the effect of GVC tends to be in line with the growth shock effect (i.e., positive). However, the impact is not permanent as it starts to decline towards equilibrium after the second period. India's low participation in GVC and trade with China (Figures 1 and 2) suggests that the country is less vulnerable to growth shocks. Besides, being less immersed in the GVC suggest that growth shocks are not substantially transmitted to India through the GVC.

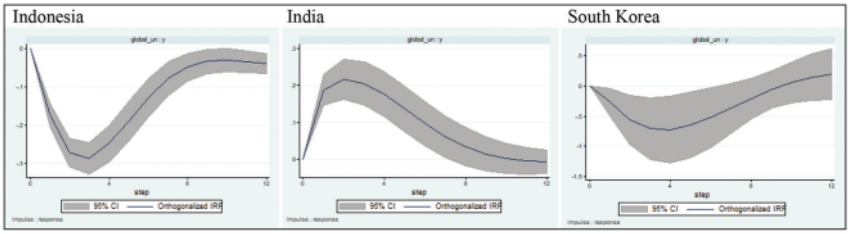
We also estimate the impact of global uncertainty on the GDP of Indonesia, India, and South Korea in the framework of the above model (Figure 5). This global uncertainty uses a proxy

Figure 4: Impulse Response Function for Indonesia, India, and S Korea: GVC Model



Source: Growth surprise (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 it is borderline in terms of stability condition

Figure 5: IRF of global uncertainty on Indonesia, India and South Korea GDP



Source: Global Uncertainty (Global_un)

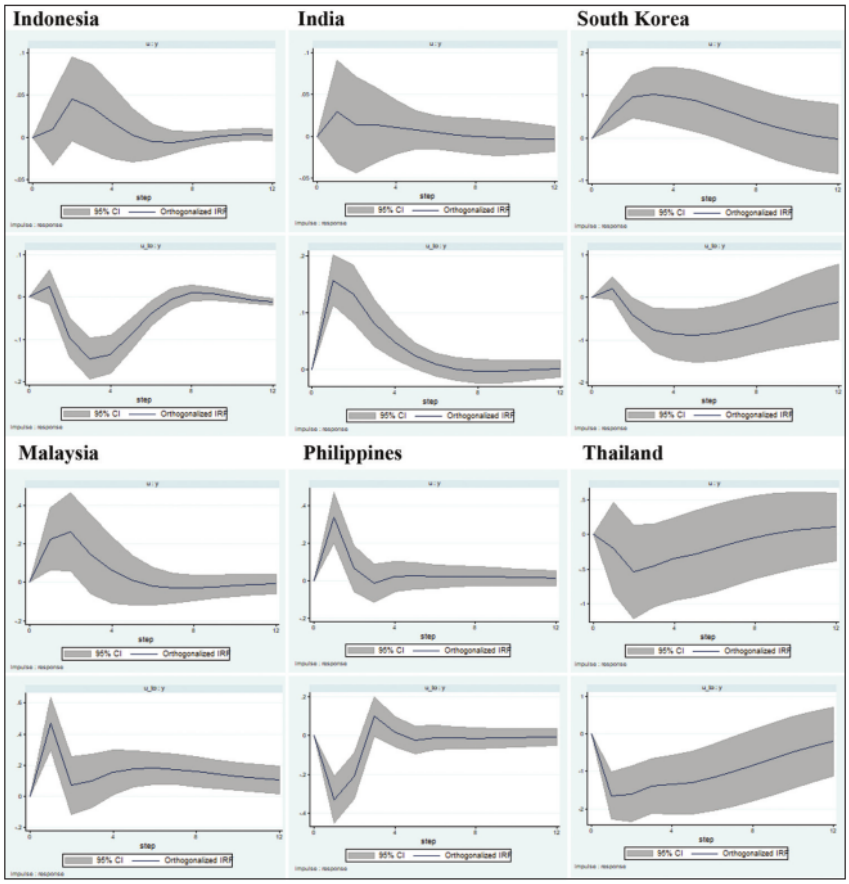
stock market volatility index from the four advanced economies above. It can be seen that the GDP of Indonesia and South Korea responded negatively to the shock of global uncertainty for at least the first 1-year period. In contrast, India's GDP responded positively to global uncertainty in the first two quarters. In terms of magnitude, the most significant negative impact was experienced by South Korea when compared to Indonesia and India. The negative impacts experienced by Indonesia and South Korea also occurred immediately after the shock in developed countries. Overall the adjustment in the GDP of Indonesia, India, and South Korea took 3 years to return to equilibrium. These findings align with previous studies (Huidrom et al., 2019; Iacoviello and Navarro, 2019; World Bank, 2018). Developing countries (i.e., Indonesia and India) often appear to be more exposed to uncertainty than to trade (Hoek et al., 2022; Iacoviello and 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 besides trade links being an essential channel for transmitting shocks in ASEAN derived from the China-US trade war, indirect (external effects) account for a substantial share of the shocks. Dizioli et al. (2016) point out similar findings arguing that if the rebalancing of Chinese growth coincides with global uncertainty, the negative impact on ASEAN markets will be more significant.

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 share of 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 countries are stable).

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, it was also found that the effect of GVC was more significant than the impact caused when using total gross trade, suggesting that extensive participation in GVC can magnify the impact of uncertainty on economic growth.

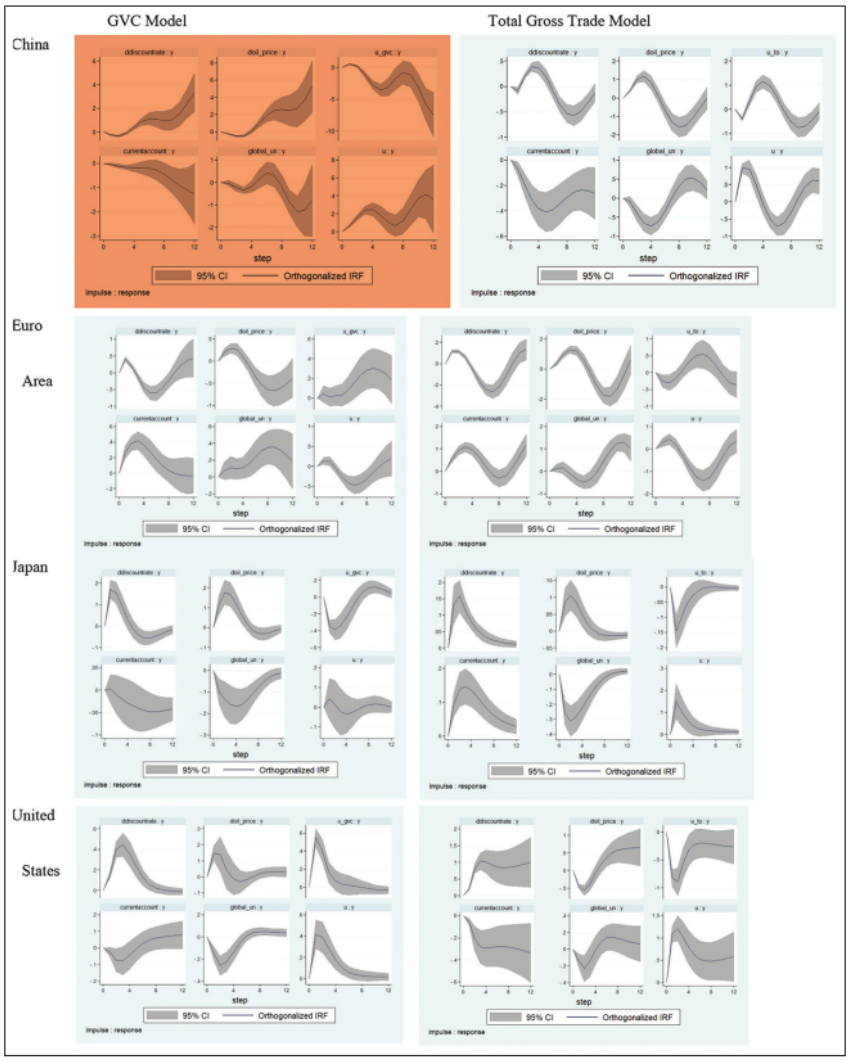
In the context of Malaysia, the Philippines, and Thailand, the response to growth shock (*u: y*) in four advanced economies is quite diverse. Thailand experienced a negative impact following the growth shock, while Malaysia and the Philippines experienced positive changes only in the first 3 and 4 quarters. If the growth shock factor interacts with the total gross trade (*u.to: y*), the impact felt by these three countries will be even greater. We also find that the growth shock in Thailand has a more significant and

Figure 6: Impulse Response Function: Gross Trade Model



Source: Interaction of growth shock (u) and trade openness (u_to: y)

Figure 7: The impact of growth shock from four large countries on the Asian economies (as a group)



Source: Discount rate, Oil Price, current account, global uncertainty, growth shock (u), GDP growth (y), Global Value Chain (trade in value-added), Trade openness (TO) quarterly data

long-lasting effect than the shock to economic activity in the Philippines, taking nearly 3 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 shock (Huidrom et al., 2019; IMF, 2013). Studies as that of Dizioli et al. (2016) find that trade linkages between ASEAN-5 with China are an essential channel of spillover transmission effects, as growth in ASEAN-5 is expected to fall between 0.2% and 0.5% following a 1% decrease in China's growth. Harahap and Bary (2017) also noted that Indonesia's economic growth is exposed to shocks in real GDP growth from China. More often, Indonesia appears to be more exposed to growth shocks from China (Dungey et al., 2018) than to shocks from the US, while being more exposed to the US's monetary policy.

4.2. Country-Specific Shocks from China, Japan, the US, and Europe

Additionally, we explore how growth surprises from each of the four advanced economies influence growth levels in the Asian economies as a group (Figure 7). Three models are displayed: a model without trade variable (baseline), a model using trade under GVCs, and a model using trade openness. Some results are unstable, so the IRFs are not displayed for such cases.

The results indicate that growth shocks (*u: y*) from China and the United States positively impact growth in Asian countries, suggesting they remained 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 1st quarter. The impact of growth shocks from

Japan on Asian countries is positive for a few months, then returns to equilibrium.

Regarding the interaction between trade openness and growth shock (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), the growth shock originating from China has the greatest impact on Asian economies when viewed from the trade openness perspective. The effects of growth shock and trade openness are initially negative for the case of the Euro area but turn positive over the medium term. However, the impact of trade shocks and trade openness from the United States and Japan is negative, although it starts recovering after two quarters (2t).

Interestingly, the impact of the GVC in transmitting the effects of shocks differs across countries. The response of GDP growth in Asian countries to the interaction between growth surprise and trade variables (u_gvc: y and u_to: y) from Japan is negative for the first three quarters before moving towards equilibrium. However, the impact of growth shocks and trade is magnified when observed from the optic of GVC. By contrast, the negative impact decreases if seen with the optic of conventional gross trade. That suggests that Asian countries trade more with Japan under the GVC (indirect trade matters) than under gross trade. Shocks are transmitted through production and distribution networks under the GVC. For the case of Europe, the response to shocks and trade is larger under the trade openness variable (u_to: y) than the response to the GVC (u_gvc: y). Asian countries trade much less with the EU under the GVC, suggesting they are not vulnerable primarily to the propagation of shocks through European value chains.

For the case of the US, the response to a shock through the GVC is positive, while the response to shocks with 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 the GVC (indirect linkages). From the perspective of total gross trade (u_to: y), Asian countries have the most significant impact when the shock originates from the United States, 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 noted in Purwono et al. (2021). 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 more enormous 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, the negative impact on economic activity in several Asian countries also occurred due to shocks from China which tended to be volatile and permanent.

As for the other control variables, the impact of oil prices tends 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), then falls to a negative impact (from 3rd quarter to the eighth) before recovering. 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 shock). In the medium term, a change in oil prices can cause a decrease in nearly 1.5% growth rate for Asian countries after 2 years, while it causes 0.5% in the model for the US. For 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. The impact becomes negative, reaching –0.6% around the 8th quarter after the price change, before returning to equilibrium (12th quarter). In the model with Japan, 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, it has a similar trend in the four models, causing an initial positive impact on growth for 3-4 quarters before turning towards a negative impact that will last until the eighth period, where recovery towards equilibrium will start. As for the current account (gross trade model), in the model of China and the US, growth in the Asian countries responds negatively to a change in the current account. In the model for Japan and the Euro (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 the latter (GVC) captures indirect exports and imports. The current account is particularly critical in the case of Asian countries with China, as most countries are running 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 (GVC model).

5. CONCLUSION

We explore how growth surprises from large partner countries (the US, China, Japan, and the EU) affect emerging Asia's economic growth. Additionally, we examine whether the GVC may be a channel for transmitting growth shocks. We are regressing selected Asian countries' growth on their GDP, the growth surprise from partner countries (U), an interaction of growth surprise with a trade indicator, a variable capturing their own lagged growth rate, and four control variables capturing exposure to external aspects. We look at oil prices, global uncertainty, current account, and discount rate as external variables. The interaction term between growth surprise and trade aims at capturing whether international trade is a channel of transmission of shocks. More importantly, we compare the conventional trade openness measures (total trade

to GDP) with a measure of trade under the Global Value Chain (value-added trade).

The participation of Asian countries in the Global Value Chain (GVC) has increased over time as an increasing share of total value-added exports is intermediate inputs that would travel through the Global Value Chain (GVC) before reaching its final destination. Most Asian countries created stronger linkages with production networks with 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 the GVC.

Our results suggest that Asian countries are exposed to growth surprises from the four largest economies (US, China, Japan, and EU), and shocks transmitted via the GVC tend to be larger for Indonesia. For South Korea, the impact of growth surprises is lower as the country participates more in GVC. However, the shocks' impact is positive for India, which has low participation in the GVC. A larger share in GVC leads to extensive exposure to surprises for Indonesia, with nearly twice the impact compared to the shock propagated through the total gross trade model (not considering indirect trade). In the South Korean context, participation in the GVC lowers the impact of growth surprise originating 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 surprises from advanced countries propagate to their economies through international trade (trade openness), responding negatively to shocks. GDP growth in Malaysia, by contrast, responds positively to growth surprises from superpowers.

The findings indicate that growth shocks from China and the United States significantly impact growth in Asia, compared to Japan and the EU. China and the US remained the region's most important sources of growth. GDP growth in Asia also responds to the growth shock from China through the trade channel, signaling that trade can serve as a means of propagation of growth surprises. Asian countries also respond to growth surprises from Japan that are transmitted through trade, intensified under the GVC perspective. In other words, the extensive integration of Asian countries with Japan raises the likeliness of the propagation of shocks through the GVC. In the case of Asian trade with the US, the impact of growth shocks through trade is the opposite 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 not visible if only looking at direct trade.

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 counties responds significantly to oil prices, with a positive impact in the short run but a negative effect over the long run, particularly in the case of Asia with China and the EU.

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