

## ESTIMATING GROWTH SPILLOVERS AND SPILLBACKS TO THE ASEAN+3 REGION: APPLICATIONS (OR NOT) TO THE PANDEMIC SITUATION<sup>1</sup>

### I. Introduction

1. **The global spread of COVID-19 disease has significantly impacted ASEAN+3 growth.** The virus quickly spread from Wuhan, China to the rest of the Asian countries in the first two months of 2020, and evolved into a full-blown global pandemic in March. As infection spread like wildfire from East to West, economic activity shut down, the outlook for global growth darkened, and financial markets went into a tailspin as investors grappled to understand the full implications of the unprecedented health crisis. Meanwhile, policymakers scrambled to put together support packages to keep their economies afloat.

2. **In a swift turnaround from the optimism surrounding the US-China trade deal in late-2019, the pandemic has dragged the world into a deep recession.** Severe disruptions to production networks and the virtual decimation of global demand resulted in a spectacular collapse in Asia's exports in March and April (Figure 1). Market consensus forecasts are now suggesting that China's growth could decelerate to a historical low of 1.7 percent in 2020. Meanwhile, Europe and the United States are projected to post significantly larger contractions than during the 2008-09 global financial crisis, with significant uncertainty surrounding the outlook (Figure 2).

**Figure 1. ASEAN-5 and Plus-3:  
Merchandise Exports in Growth**  
(Percent year-on-year, 3mma)



Sources: National authorities.  
Note: Refers to China; Hong Kong, China; Indonesia; Japan; Korea; Malaysia; the Philippines; Singapore; Thailand; and Vietnam. Data through April 2020, except for Philippines (March 2020).

**Figure 2. United States and Euro Area:  
Actual and Market Forecasts of GDP  
Growth**  
(Percent change)

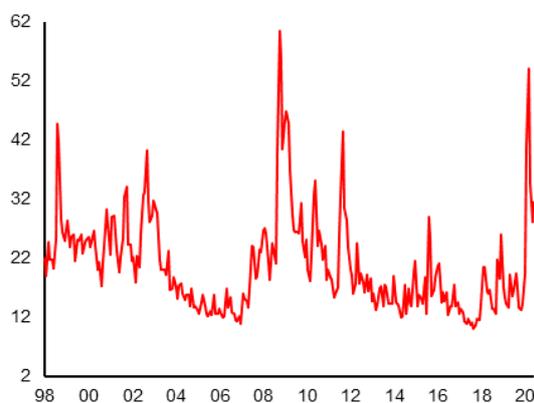


Sources: National authorities and Bloomberg Finance LP.  
Note: Forecasts refer to Bloomberg consensus estimates (median, low, and high) submitted for the US and Euro Area, from April 29 to May 29, 2020, and accessed by AMRO staff on June 1, 2020.

<sup>1</sup> Prepared by Diana del Rosario (Regional Surveillance) and Trung Thanh Vu (Financial Surveillance); reviewed by Li Lian Ong (Financial and Regional Surveillance); authorized by Hoe Ee Khor (Chief Economist). The views expressed in this note are the authors' and do not necessarily represent those of the AMRO or AMRO management.

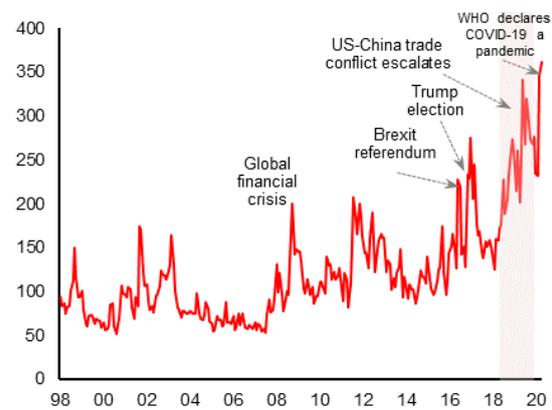
3. **The sharp rise in risk aversion and tight global financial conditions aggravated difficulties in the region.** Emerging markets, for example, recorded their largest monthly outflows on record in March, reflecting the global US dollar liquidity squeeze ([Pande and del Rosario, 2020](#)). Financial conditions eased following the US Federal Reserve's commitment to inject US dollar liquidity into the global financial system, although markets are still nervous as reflected in the still-elevated volatility and uncertainty about policy direction (Figures 3 and 4). Meanwhile, crude oil and other commodity prices have collapsed, in line with the plunge in global demand amid a supply glut ([Pande, 2020](#)), providing some relief to commodity-importing economies in the region, but squeezing the oil exporters (Figures 5 and 6, and Appendix I).

**Figure 3. CBOE Volatility Index (VIX), through June 25, 2020**



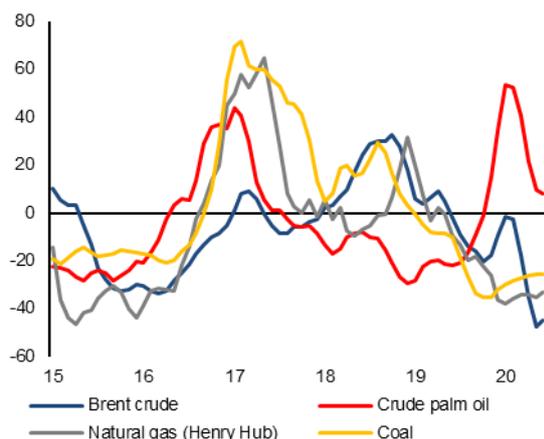
Source: Haver Analytics

**Figure 4. Global Economic Policy Uncertainty Index, through April 2020**



Source: policyuncertainty.com

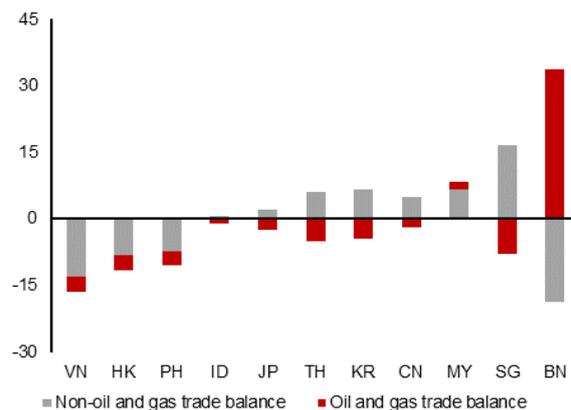
**Figure 5. Selected Commodities: Prices through June 25, 2020 (Percent year-on-year, 3mma)**



Source: Bloomberg Finance LP.

Note: Crude palm oil (CPO) prices are the reference prices for Indonesia and Malaysia, the world's two largest producers of CPO. Coal prices are Indonesia's price reference.

**Figure 6. ASEAN+3: Non-oil and, Oil and Gas Trade Balance (Percent of GDP)**



Sources: IHS Markit Global Trade Atlas; International Monetary Fund; and AMRO staff calculations.

Note: Data cover January to December 2019; BN = Brunei; CN = People's Republic of China; HK = Hong Kong; JP = Japan; ID = Indonesia; KR = Korea; MY = Malaysia; PH = the Philippines; SG = Singapore; TH = Thailand; VN = Vietnam.

**4. The seismic turn of events in recent months provides a good opportunity to study the extent of spillovers from and back to (spillbacks) the ASEAN+3 economies.**

We employ the Global Vector Autoregressive (GVAR) model for our analysis—as it is able to capture those effects that have intensified as a result of the increasing interconnectedness of the global economy. Our model covers 13 economies, representing over two-thirds of the global economy and 97 percent of the ASEAN+3 region. It utilizes monthly data from July 2003 to December 2019 and is thus not influenced by impact of the pandemic. It also allows for trade and financial sector interactions within and across economies.<sup>2</sup> Spillovers, presented over a one year period, are derived from the model’s generalized impulse response functions.<sup>3</sup>

**5. Our estimates can only be a very approximate guide in the current pandemic situation, which has upended many existing macro-financial relationships.** Even at the nadir of previous crises, economic activity has continued, albeit at sharply slower or even contractionary levels. During this pandemic, entire economies have been brought to a virtual standstill by the necessity of physical containment measures to stop the spread of the virus. Other factors include the unprecedented size and nature of economic stimuli measures introduced by some governments to support their respective economies, and the rolling disruptions to supply chains as the pandemic spreads from one region to another.

## II. Regional Spillovers

### A. From China via G2 and Regional Channels

**6. With the pandemic originating in China and exacting its initial toll on the economy, we first estimate the extent of growth spillovers from the Chinese economy to the rest of the world.** Our GVAR simulations confirm China’s role as an important node in global supply chains and a major consumer hub. A one percent decline in China’s GDP over a course of a year is associated with a 0.8 percent average decline in ASEAN-5 and Plus-2 output, with the region’s more trade-oriented economies (Hong Kong, China (hereafter “Hong Kong”); Japan; Malaysia; Singapore; and Thailand) exhibiting more than proportionate declines (Figure 7).<sup>4</sup> Euro Area GDP could also be pared down by 0.5 percent, and the US by 0.2 percent. These responses are statistically significant, underscoring the strain arising from a slowdown in the Chinese economy.

**7. Interestingly, growth shocks to individual regional economies are largely a result of spillbacks and spillovers from other economies within the region, rather than directly from China.** Our estimates suggest that a significant portion of China’s growth

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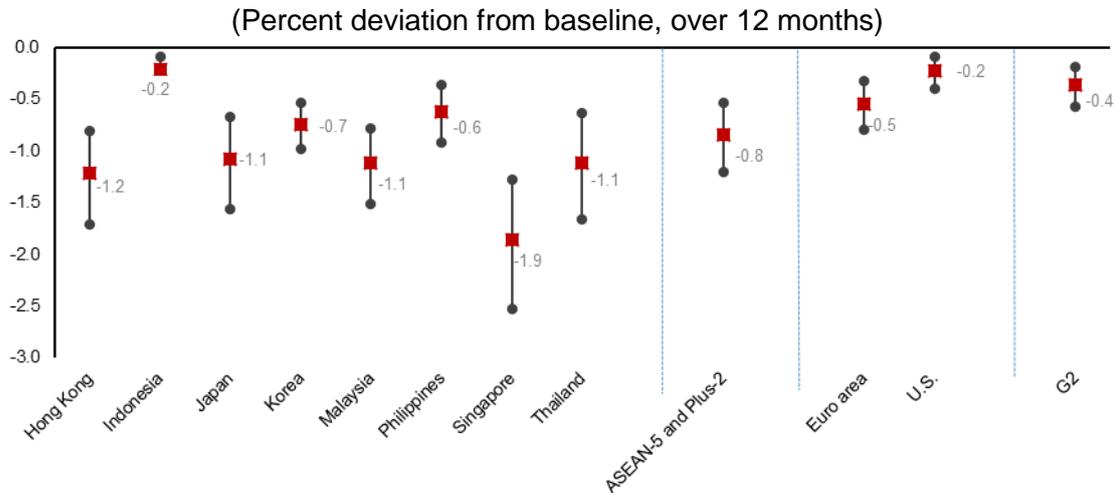
<sup>2</sup> The economies in the model are China, Euro Area, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Thailand, the United Kingdom, and the United States. The economy-specific variables are: real GDP (interpolated from quarterly data), inflation, equity prices, bilateral exchange rates against the US dollar, long-run and short-run interest rates. Foreign variables enter into individual economy VAR models as a weighted aggregate, using either trade or financial weights. In addition, innovations in oil prices and global economic policy uncertainty are able to propagate into and across economies in the GVAR system. AMRO (2020b) discusses the weights used in the model and provides a brief explanation of how the GVAR model is estimated.

<sup>3</sup> The generalized impulse response function (GIRF) method is a convenient alternative to the orthogonalized impulse response function especially in the absence of a strong prior conviction on the order by which country shocks are transmitted to another country and variable in the GVAR.

<sup>4</sup> ASEAN-5 refers to Indonesia, Malaysia, the Philippines, Thailand, and Singapore; Plus-2 refers to Japan and Korea; and Plus-3 refers to China (including Hong Kong), Japan, and Korea.

spillovers into the region is transmitted in the form of spillbacks via the G2 (Euro Area and United States). The spillovers increase markedly when feedback from the ASEAN-5 and Plus-2 economies are accounted for (Figure 8), illustrating the region's strong trade and financial ties with the G2 and the extent of intraregional integration especially with China (Figure 9). Not surprisingly, Hong Kong is an exception as the spillovers are primarily transmitted directly from Mainland China, consistent with its role as a gateway for the Mainland's trade and capital flows. In contrast, direct China spillovers to the other economies in the region are not as large, likely reflecting the relatively small contribution of the individual economy's exports to China's domestic demand (Figure 10), although they are substantial when combined (per Figure 8).<sup>5</sup>

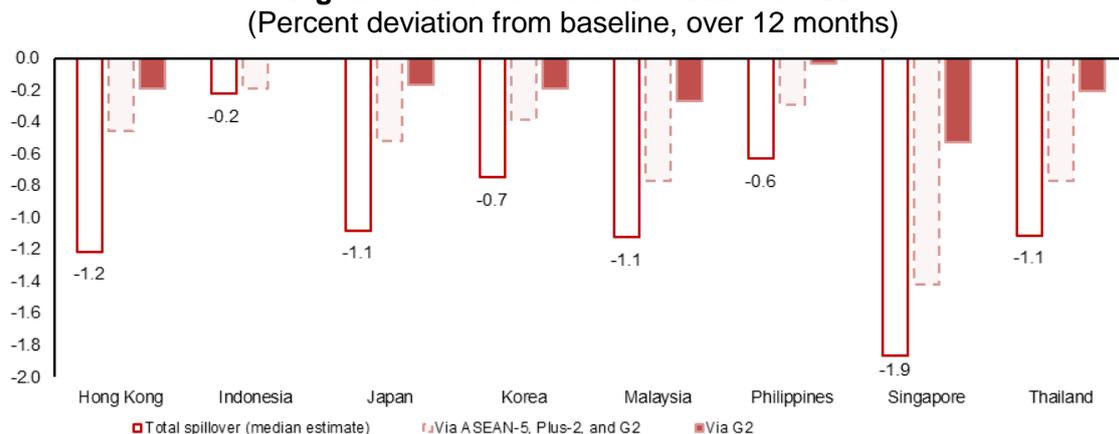
**Figure 7. ASEAN-5, Plus-2, and G2: GDP Responses to a Negative 1 Percent Shock to China's GDP**



Sources: Haver Analytics; policyuncertainty.com; Refinitiv; and AMRO staff estimates.

Note: Upper and lower bounds represent 90 percent confidence intervals; Red boxes refer to the median estimate from an empirical distribution of the impulse response functions obtained through bootstrapping. The above results can also be applied to changes in year-on-year growth rates.

**Figure 8. ASEAN-5 and Plus-2: Geographical Decomposition of GDP Responses to a Negative 1 Percent Shock to China's GDP**

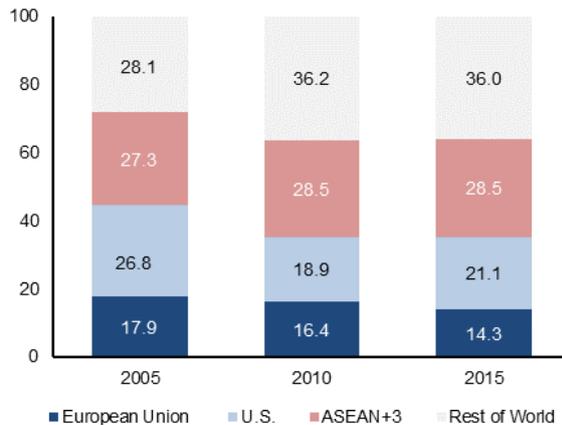


Sources: Haver Analytics; policyuncertainty.com; Refinitiv; and AMRO staff estimates.

Note: Consistent with the practice in [Swiston and Bayoumi \(2008\)](#) and [Sun \(2011\)](#), the decomposition is estimated by taking the difference between the GIRFs from the baseline GVAR model and a modified GVAR model without the weakly exogenous foreign variables of the specified blocs (G2, and then ASEAN-5, Plus-2, and G2). The difference between the "Total spillover" and the "Via ASEAN-5, Plus-2, and G2" can be a rough gauge of the direct spillovers from China's GDP shock to a particular economy. The "Via G2" component represents all the spillovers from the China GDP shock that are channeled through the Euro Area and the United States.

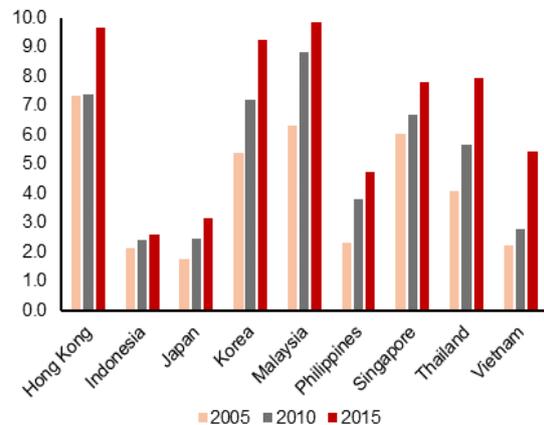
<sup>5</sup> The results are consistent with [Dizioli and others \(2016\)](#), who show that the first round effects of a slowdown in China's GDP growth on ASEAN economies through trade are marginal.

**Figure 9. ASEAN+3: Value-added Exports**  
(Percent of total final demand)



Source: OECD.

**Figure 10. China: Value-added Embedded in Domestic Demand**  
(Percent of GDP)



Source: OECD.

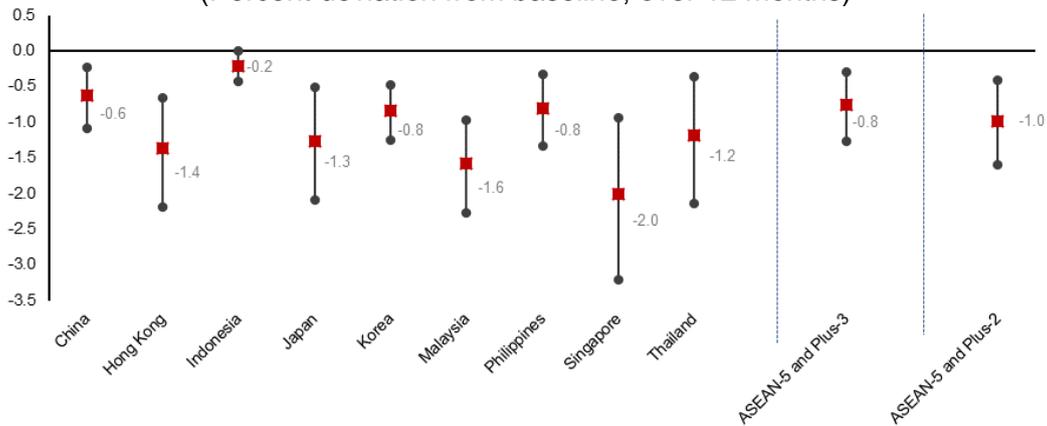
## B. From G2 via Regional Channels

8. **With the Covid-19 pandemic subsequently causing severe disruptions to economic activity in the West, spillovers originating in the Euro Area and the United States have also affected regional economies.** Our estimates suggest that the region's responses to total G2 GDP shocks are only slightly larger than to China shocks. That is, a one percent decline in G2 output over the course of a year leads to an equivalent one percent decline in ASEAN-5 and Plus-2 output (Figure 11). The responses are also statistically significant (at the 10 percent level) for all except Indonesia, which is a largely domestic-oriented economy. Responses tend to be larger toward the US than Euro Area shocks (Appendix II), consistent with the region's closer trade ties with the US (Figure 9).

9. **In contrast to the shock from China, G2 GDP spillovers to the region are transmitted more directly to most economies.** One possible reason is that, despite increased intraregional trade over the past two decades, the region still counts on the European and US markets for at least a third of its exports (Figure 9). It thus leaves the region substantially exposed to developments affecting demand in the West, as can be inferred from the difference between total spillovers and those via regional economies (Figure 12). The decomposition exercise also shows that a significant proportion of G2 spillovers to the region passes through China, and an equally big proportion via the ASEAN-5 and Plus-2 bloc, notably for Malaysia and Singapore.

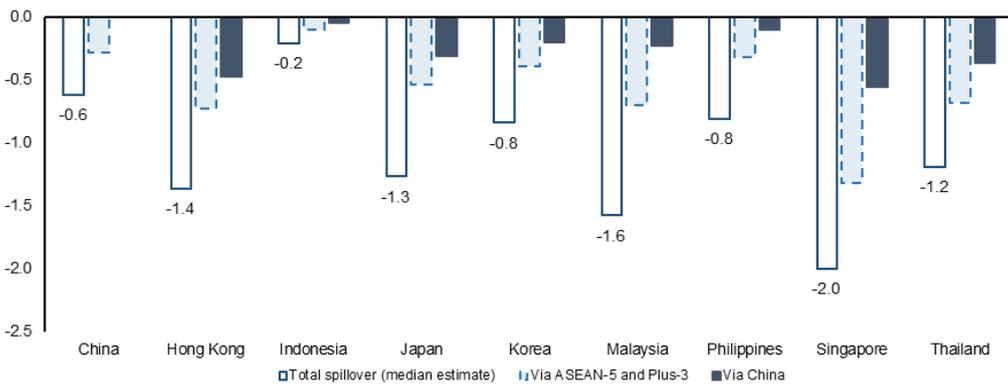
10. **Overall, the projected G2 recession is likely to be a significant drag on the ASEAN+3 growth, particularly in Q2, followed by a gradual recovery.** Assuming a market median estimate of a 6.6 percent decline in G2 output, our GVAR model estimates that ASEAN-5 and Plus-3 GDP could be hit by as much as 5.0 percent in one year (Figure 13), with the more open, trade-oriented economies likely to feel a greater impact. Market consensus suggests that the G2 economies are expected to stage a shallow V-shaped recovery this year, after bottoming out in Q2, which will likewise spill over into the region, where we estimate the drag to individual economies to dissipate starting in Q2 2021 (Figures 14-15).

**Figure 11. ASEAN-5 and Plus-3: GDP Responses to a Negative 1 Percent Shock to G2 GDP**  
(Percent deviation from baseline, over 12 months)



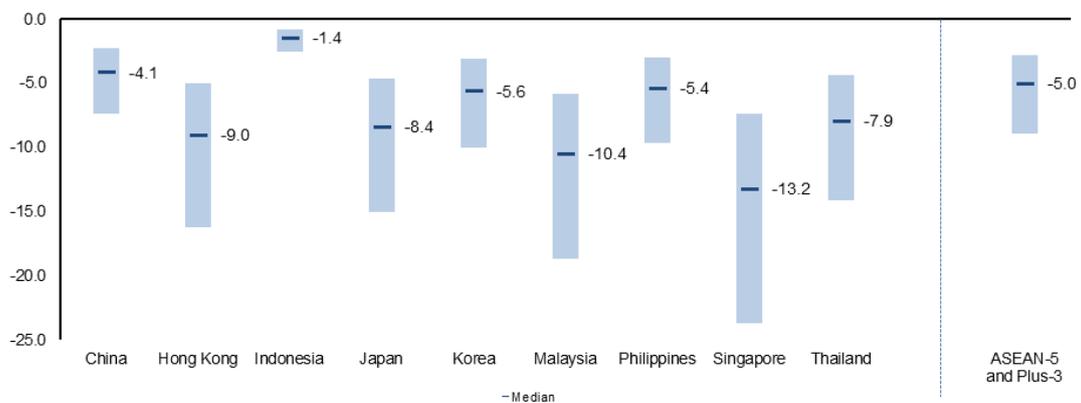
Sources: Haver Analytics; policyuncertainty.com; Refinitiv; and AMRO staff estimates.  
Note: Upper and lower bounds represent 90 percent confidence intervals; Red boxes refer to the median estimate from an empirical distribution of the impulse response functions obtained through bootstrapping. The above results can also be applied to changes in year-on-year growth rates.

**Figure 12. ASEAN-5 plus 3: Geographic Decomposition of GDP Responses to a Negative 1 Percent Shock to G2 GDP**  
(Percent deviation from baseline, over 12 months)



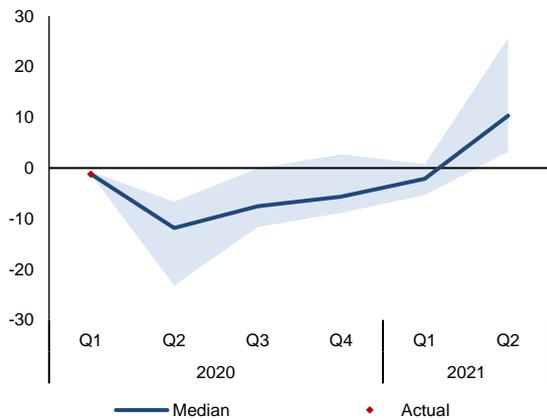
Sources: Haver Analytics; policyuncertainty.com; Refinitiv; and AMRO staff estimates.  
Note: Similar to the practice in [Swiston and Bayoumi \(2008\)](#) and [Sun \(2011\)](#), the decomposition is derived by taking the difference between the GIRFs from the baseline GVAR model and a modified GVAR model without the weakly exogenous foreign variables of the specified blocs (China, and then ASEAN-5 and Plus-3). The difference between the "Total spillover" and the "Via ASEAN-5 and Plus-3" can be a rough gauge of the direct spillover of the G2 GDP shock to that economy. The "Via China" component are all the spillovers of the G2 GDP shock that are channeled through China.

**Figure 13. ASEAN-5 and Plus-3: GDP Spillovers from a G2 Recession**  
(Percent deviation from baseline, over 12 months)



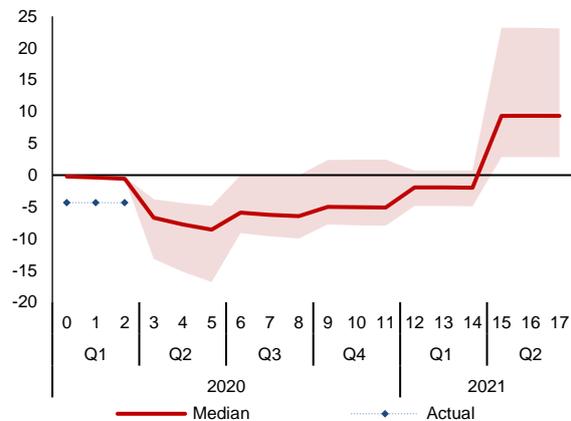
Sources: Bloomberg Finance L.P.; national authorities; and AMRO staff estimates.  
Note: Edges refer to the low and high ends of the spillover estimates based on the corresponding G2 forecast ranges for 2020, per Figure 2.

**Figure 14. G2: Growth Forecast, Quarterly Profile**  
(Percent year-on-year)



Sources: Bloomberg Finance LP and AMRO staff estimates.  
Note: Forecasts refer to Bloomberg consensus estimates (median, low, and high) submitted for the Euro Area and United States, from April 29–May 29, 2020, and accessed by authors on June 1, 2020.

**Figure 15. G2: Spillovers into ASEAN-5 and Plus-3**  
(Percent deviation from baseline)



Sources: National authorities and AMRO staff estimates.  
Note: The actual GDP turnout for the region could also be influenced by other factors such as the impact of varying degrees of containment measures, as well as policy responses.

11. **Not all shocks are created equal, and so our results come with caveats.** Shocks in our GVAR model are derived from historical trends that are largely based on normal business cycles, which may not be applicable to the current pandemic given the unprecedented nature of the shock. For instance, the pandemic could induce structural changes in consumer behavior and production, which could undermine the relevance of our results. Moreover, the economic impact could be uneven, with the pandemic potentially resulting in a more protracted recovery in services relative to manufacturing, where the latter could be supported by a marked increase in demand for biomedical products and electronics due to telecommuting ([AMRO, 2020a](#)). To this end, crucial to our analysis is an understanding of the channels by which G2 economic shocks are transmitted to the region.

### III. Sectoral Spillovers

12. **We attempt to decompose the transmission of the shocks to the ASEAN+3 economies into goods, services, financial market, and other channels.** We adopt a simplified version of the methodology adapted by [Swiston and Bayoumi \(2008\)](#) and [Sun \(2011\)](#). The channels are derived from the difference between the growth responses from a base Vector Autoregression (VAR)—a 2-variable system with the quarterly growth rates of the G2 and the individual regional economy, estimated over the same period as the GVAR, and an augmented base VAR, where the channel is introduced as an exogenous variable. The goods and services trade channels are captured by their respective contributions to real GDP growth, while the financial channel is proxied by market interest rates and equity price returns.<sup>6</sup> The resulting shares of the channels are then applied to the spillovers previously estimated from the GVAR model.

<sup>6</sup> The base VAR is augmented by the channel proxy variables for both the G2 and the regional economy, although we also make the judgment to remove the G2 proxy variables in some cases, in order for the channel shares to sum up to at most 100 percent. Market interest rates refer to the short- (3-month) and long-term (10-year) rates. For Singapore, market interest rates are excluded from the financial channel, as they can be inversely related to the SGD nominal effective exchange rate, which is the main monetary policy instrument.

**13. Unsurprisingly, China spillovers to the regional economies have been dominated by goods trade, although services trade is also an important channel.**

Transmission through the goods trade accounts for about 60 percent of China growth spillovers to the region's economies (Figure 16), while financial market fluctuations account for another 20 percent.<sup>7</sup> Separately, the prominence of shocks via services trade is likely a reflection of the surge in Chinese visitors to the ASEAN+3 economies, which has fueled a boom in the region's tourism industry over the past decade.

**14. Thailand's services sector appears to have been relatively resilient to China shocks.** Thailand's tourism revenues was tilted more toward Europe than China during the 2003-19 period, and Europe was seemingly less vulnerable to China shocks compared to the rest of the region (Figure 11). Under the GVAR estimation period (2003–19), Europe accounted for 33 percent of Thailand's tourism revenue and the United States for another 6 percent, while China accounted for about 14 percent. The composition had changed by 2015–19, with China accounting for 28 percent and Europe for 26 percent. Still, Thailand has been less reliant on Chinese tourists than, say, Korea and Japan, where shares range from 40–50 percent in 2015–19.

**15. Similarly, G2 output spillovers into the region are primarily transmitted via trade in goods.** Shocks via services trade are less important from the G2 than from China. On average, goods trade accounts for nearly two-thirds of the G2 shocks transmitted to the ASEAN-5 and Plus-3 (Figure 17)—an intuitive outcome given the strong trade ties between the two regions. Financial conditions also show up as an important channel of spillovers, accounting for nearly a fifth of the impact. Services trade represents around a tenth of G2 spillovers to the region, consistent with the importance of its travel and tourism exports, which have been one of the biggest casualties of the pandemic ([Choo and others, 2020](#)).

**16. However, the pandemic has introduced new, and largely unquantifiable, aspects in the relationships among economies.** The services sector is a salient example, notably in tourism. For instance, while Thailand's tourism industry appears to have been largely immune to growth shocks previously—in part possibly because it was income inelastic—international travel bans that have brought the sector to a virtual standstill during the pandemic have intensified the negative shocks to growth via the services trade channel.

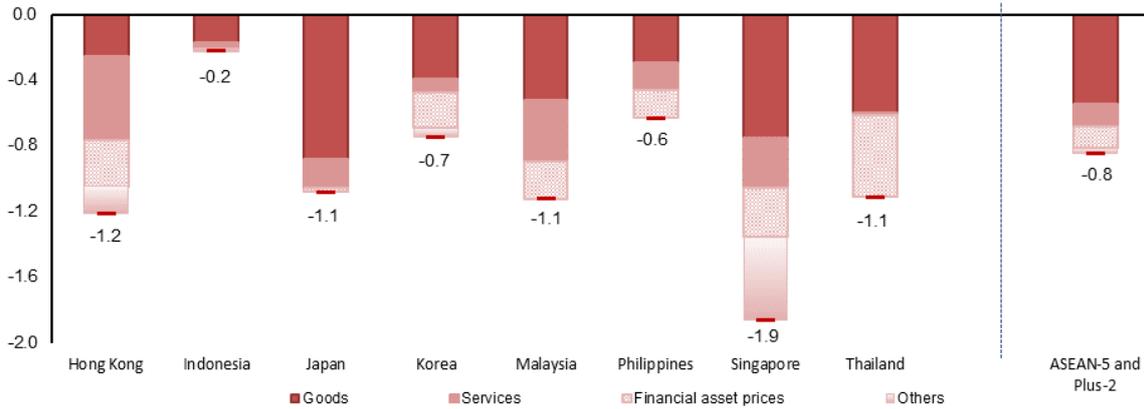
#### IV. Concluding Thoughts

**17. The outlook for the ASEAN+3 region will continue to be dictated by pandemic developments for some time to come and the fate of individual economies, especially the US and Europe, to which it is closely linked.** Our GVAR model simulation results suggest that the external drag on the region is substantial—transmitted via various country and sectoral channels—and will likely remain so for many months to come. On a positive note, however, our findings also intimate that the impact from the spillovers and spillbacks could be mitigated by coordinated global policy action of an unprecedented scale that could facilitate a synchronized recovery of the global economy (Figure 18).

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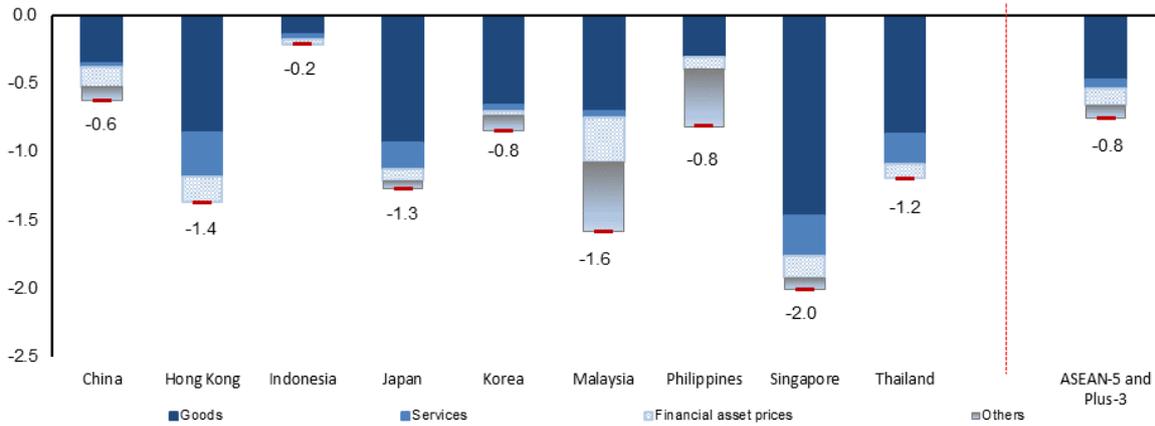
<sup>7</sup> For the decomposition of China's GDP shocks, we use a 3-variable VAR model consisting of China, the G2, and a regional economy. We include the G2 to enhance the results, given that direct China spillovers to the ASEAN-5 and Plus-3 economies are shown to be not as large as the G2's (Figure 8). Moreover, the regressions cover a shorter timeframe (Q1 2006Q1 to Q4 2019) owing to the shorter available series for China's goods and services trade data.

**Figure 16. China Spillovers to ASEAN-5 and Plus-2: Channels of Transmission**  
(Percent deviation from baseline)



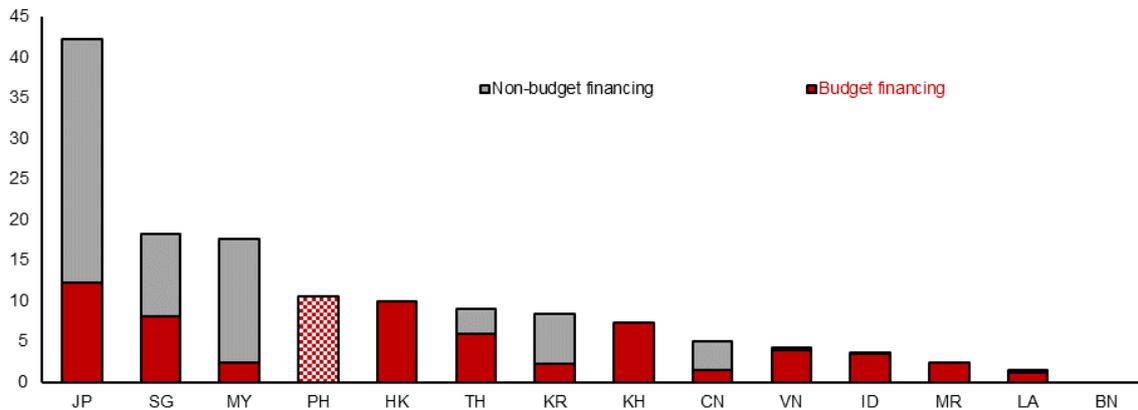
Sources: National authorities and AMRO staff estimates.  
Note: Based on median estimates as shown in Figure 7.

**Figure 17. G2 Spillovers to ASEAN-5 and Plus-3: Channels of Transmission**  
(Percent deviation from baseline)



Sources: National authorities and AMRO staff estimates.  
Note: Based on median estimates shown in Figure 11.

**Figure 18. ASEAN+3: Economic Stimulus Packages, February 1 – June 2, 2020**  
(Percent of GDP)



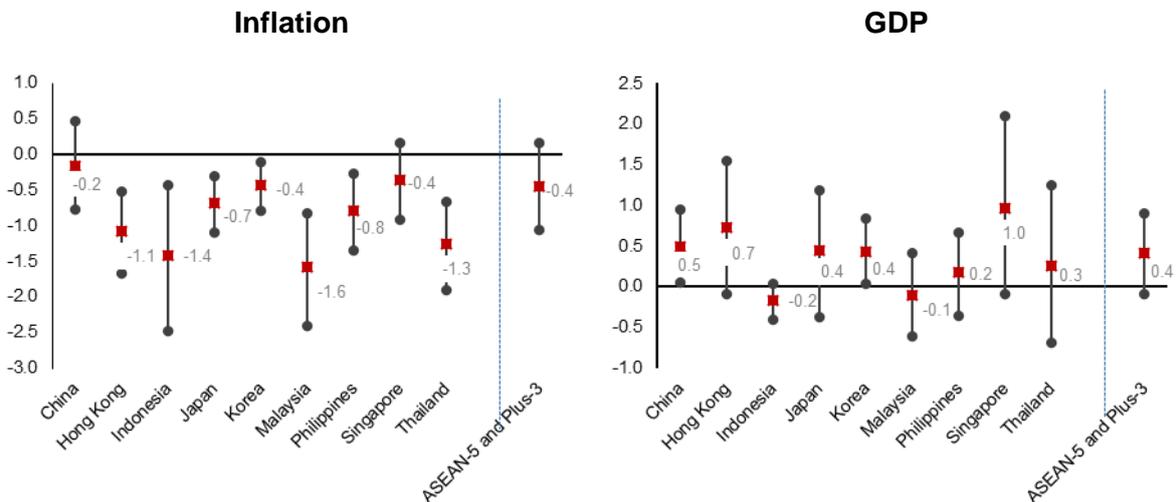
Sources: National authorities; and AMRO staff estimates.  
Note: Based on the government's announced stimulus packages across regional economies and do not include monetary policy measures and other indirect supporting measures such as regulatory forbearance. The breakdown for the Philippines' stimulus package is not available. JP = Japan; SG = Singapore; MY = Malaysia; PH = Philippines; HK = Hong Kong, China; TH = Thailand; KR = Korea; KH = Cambodia; VN = Vietnam; ID = Indonesia; MR = Myanmar; LA = Lao PDR; BN = Brunei.

## Appendix I. What about Inflation? Responses to Crude Oil Price Shocks

**A decline in crude oil prices clearly puts downward pressure on inflation in the region.** Our GVAR results show that a 40 percent decline in crude oil prices over a 12-month period—a likely scenario this year—would dampen headline inflation in the ASEAN+3 region by 0.4 percentage point on average (Appendix Figure 1). Interestingly, the pass-through of oil prices to inflation is more pronounced for countries with existing fuel subsidy schemes, such as Indonesia, Malaysia, and Thailand. The fuel subsidy reforms taken by these countries over the past half a dozen years, when oil prices were generally low, may have amplified the vulnerability of retail fuel prices and consequently, consumer inflation, to oil price movements. It could also be the case that tightly regulated retail fuel prices respond faster to declines in oil prices than market-driven ones.

**On the other hand, the pass-through of lower oil prices to the region’s economic output is shown to be empirically weak.** The responses are generally not significantly different from zero (Appendix Figure 1), and as such, the drop in crude oil prices may only provide little relief to ASEAN-5 and Plus-3 economies from the global recession. Moreover, commodity exporters, such as Indonesia and Malaysia, tend to be negatively affected by declines in crude oil prices. Although Indonesia is not a net oil and gas exporter, unlike Malaysia, it is nonetheless a net commodity exporter based on coal and crude palm oil (CPO) exports, and coal and CPO prices had broadly moved in line with crude oil prices in past years although CPO prices have slightly diverged this year (Figure 5). Separately, GVAR results do not show any conclusive relationship between (China and G2) GDP growth shocks and aggregate ASEAN-5 and Plus-3 inflation (Appendix Figure 2).

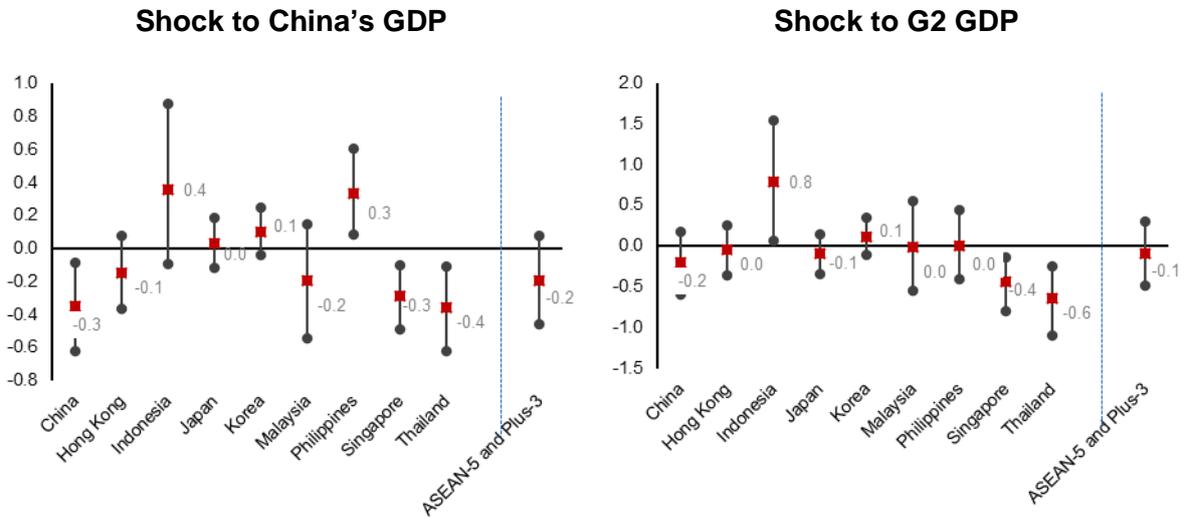
**Appendix Figure 1. ASEAN-5 and Plus-3: Inflation and GDP Responses to a 40 Percent Drop in Oil Prices**  
(Percent deviation from baseline, over 12 months)



Sources: Haver Analytics; policyuncertainty.com; Refinitiv; and AMRO staff estimates.

Note: Upper and lower bounds represent 90 percent confidence intervals; Red boxes refer to the median estimate from an empirical distribution of the impulse response functions obtained through bootstrapping. The above results can also be applied to changes in year-on-year growth rates.

**Appendix Figure 2. ASEAN-5 and Plus-3: Inflation Responses to a Negative 1 Percent Shock to China and G2 GDP**  
(Percent deviation from baseline, over 12 months)

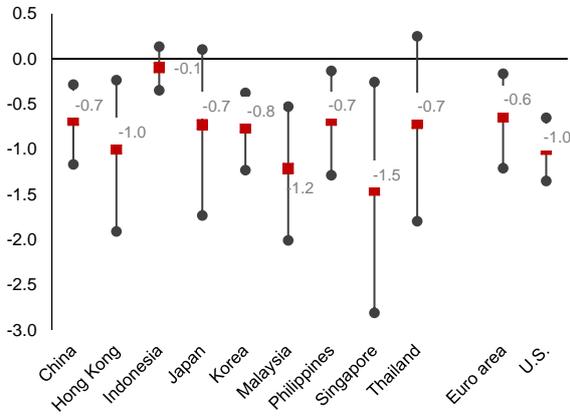


Sources: Haver Analytics; policyuncertainty.com; Refinitiv; and AMRO staff estimates.

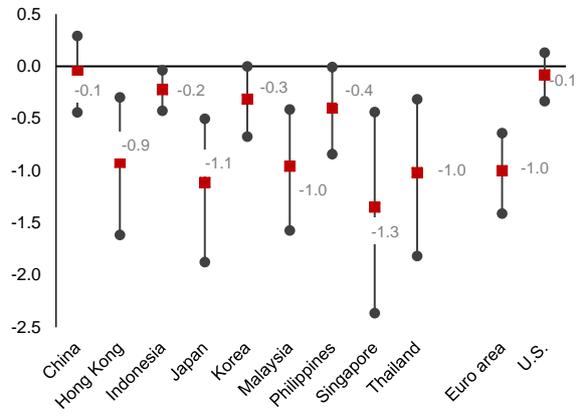
Note: Upper and lower bounds represent 90 percent confidence intervals; Red boxes refer to the median estimate from an empirical distribution of the impulse response functions obtained through bootstrapping. The above results can also be applied to changes in year-on-year growth rates.

**Appendix II. ASEAN-5, Plus-3, and G2: GDP Responses to Various Shocks**  
(Percent deviation from baseline, over 12 months)

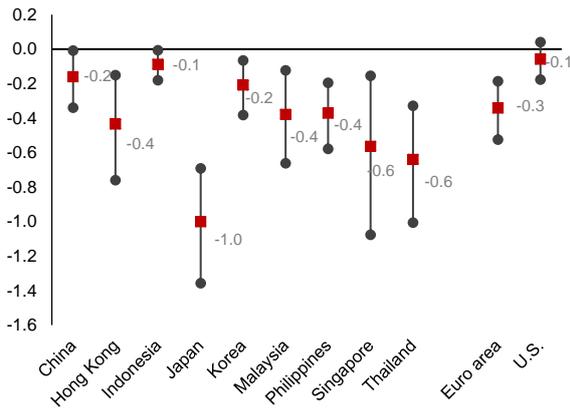
**Appendix Figure 3. 1 Percent Decline in US GDP**



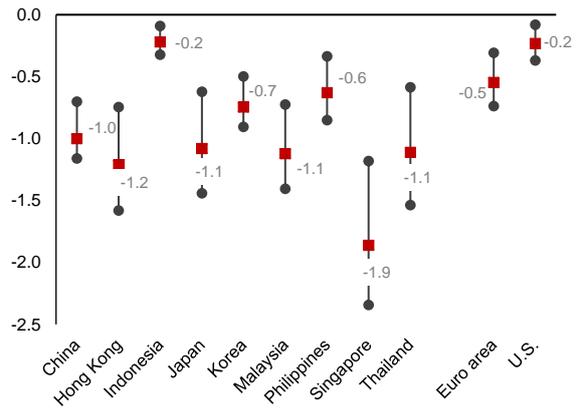
**Appendix Figure 4. 1 Percent Decline in EA GDP**



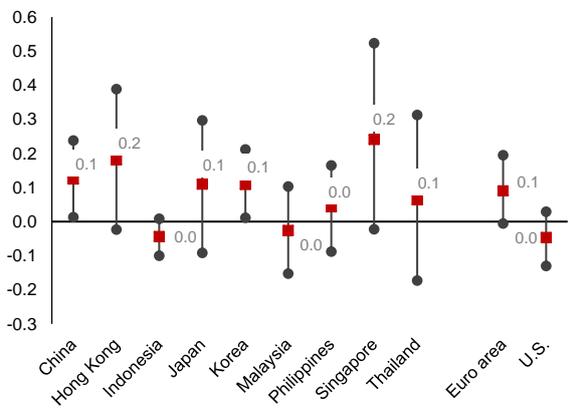
**Appendix Figure 5. 1 Percent Decline in Japan's GDP**



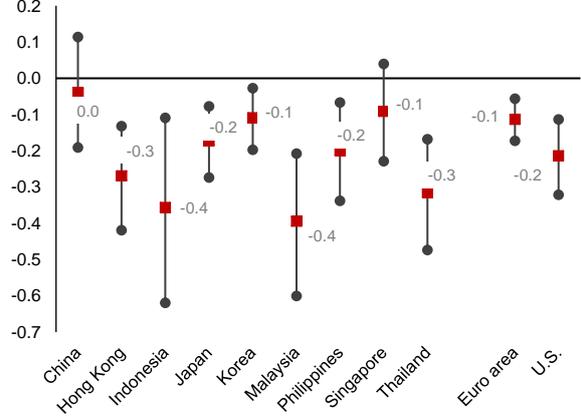
**Appendix Figure 6. 1 Percent Decline in China's GDP**



**Appendix Figure 7. 10 Percent Decline in Crude Oil Prices**



**Appendix Figure 8. Inflation Response to 1 Percent Decline in Crude Oil Prices**



Sources: Haver Analytics; policyuncertainty.com; Refinitiv; and AMRO staff estimates.  
Note: Upper and lower bounds represent 90 percent confidence intervals; Red boxes refer to the median estimate from an empirical distribution of the impulse response functions obtained through bootstrapping. The above results can also be applied to changes in year on year growth rates.

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