

## Price Wars: The Return of ASEAN+3 Inflation?<sup>1</sup>

September 23, 2021

*“No problems are temporary until they are over. All problems are potentially permanent.”*

~ Austin Wright  
American novelist, 1922–2003

### I. Introduction

1. **The recent rise in global inflation, underpinned by both demand and supply side factors, has fueled both optimism and concern.** On the one hand, the outlook for demand has improved, with the rebound of the global economy from pandemic lows; on the other, supply-related issues, such as semiconductor chip shortages, port congestions and oil production cuts, have contributed to greater cost pressures. Moreover, rising inflation in the United States has heightened expectations of an earlier than expected policy normalization by the US Federal Reserve (“Fed”), causing some volatility in global markets.

2. **The inflation dynamics have, thus far, played out differently within the ASEAN+3 region.** The effects of higher commodity prices from rising demand, coupled with supply bottlenecks, have been manifested in the sharp rise in regional PPI inflation, while CPI—outside of the low-base effect—has remained subdued, suggesting the lack of pricing power at the final point of sale. This note seeks to analyze the implications of both the global and domestic inflationary environment for ASEAN+3 economies and financial markets. Although the current rise in prices is expected to be transitory, this note also discusses the risk scenarios where inflation could remain elevated for a prolonged period.

### II. Demand vs. Supply Pressures

3. **Commodity prices have risen significantly over the past one year.** Following the sharp decline in the first half of 2020, the prices of oil and most other commodities have not

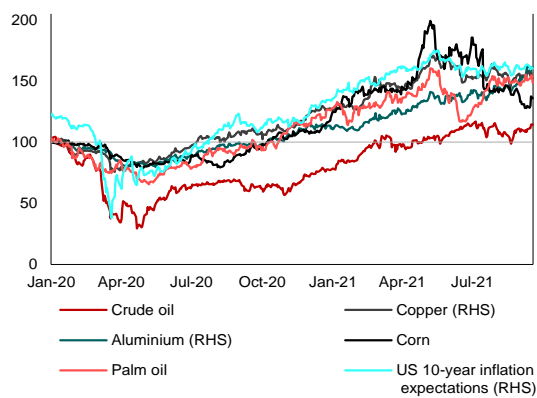
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only recovered but also reached multi-year highs. The jump was accompanied by an increase in inflation expectations (Figure 1), with price gains attributable to both:

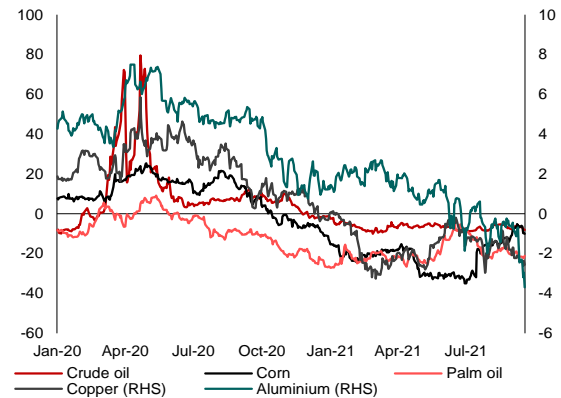
- actual and expected improvements in demand as the global economic recovery gathers momentum; and
- supply side factors, as reflected in many of the commodity forward curves showing increased backwardation in recent months (Figure 2),<sup>2</sup> that is, financial markets' assessment that the elevated prices are temporary, likely because of supply disruptions, particularly to oil (Figures 3 and 4).<sup>3</sup>

**Figure 1. Recent Trends in Commodity Prices and Inflation Expectations**  
(Index January 1, 2020 = 100; percent)



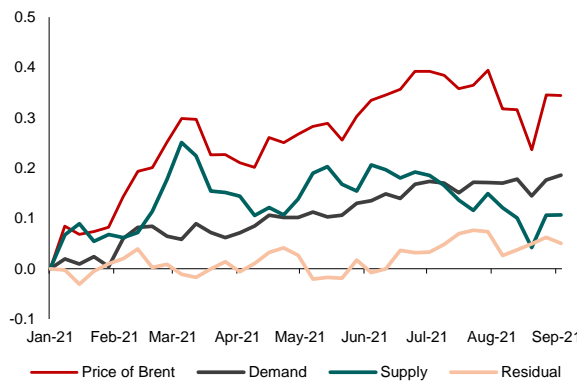
Sources: Bloomberg Finance L.P.; and AMRO staff calculations.

**Figure 2. Change in Commodity Prices, 12-Month Forward Contracts**  
(Percent)



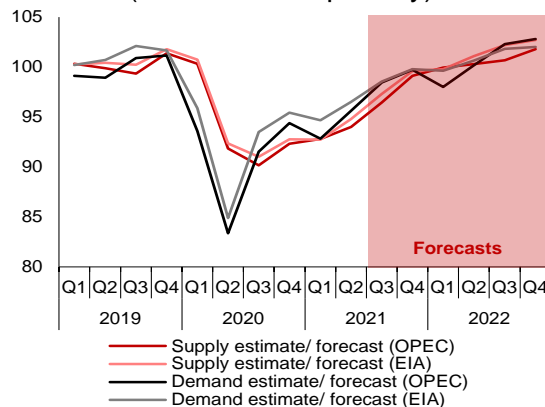
Sources: Bloomberg Finance L.P.; and AMRO staff calculations.

**Figure 3. Crude Oil: Supply and Demand Price Drivers**  
(Million barrels per day)



Sources: Organization of the Petroleum Exporting Countries; US Energy Information Administration; and AMRO staff calculations.

**Figure 4. Crude Oil: Estimates and Forecasts for Supply and Demand**  
(Million barrels per day)



Sources: Organization of the Petroleum Exporting Countries; US Energy Information Administration; and AMRO staff calculations.

<sup>2</sup> Backwardation in a forward price curve is seen when the forward price is lower than the spot price; contango is when the forward price is higher than the spot price.

<sup>3</sup> Specifically for crude oil, the pick-up in prices is also an outcome of production cuts introduced by the Organization of the Petroleum Exporting Countries (OPEC) and other major oil producing nations. Both OPEC and the Energy Information Administration (EIA) expect the rise in the global production of crude oil to lag the recovery in demand, suggesting that oil prices may remain elevated in the coming months as oil inventories, which were built up in the first half of 2020, continue to be drawn down.

#### 4. **Global supply chain bottlenecks have also exerted upward pressure on prices.**

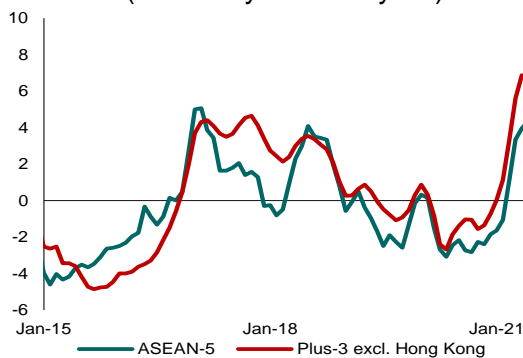
Manufacturing production has been affected by global chip shortages, resulting in higher costs for electrical and electronic products, ranging from computers to automobiles. Semiconductor prices are forecast to remain elevated with chip shortages expected to persist until at least the second quarter of 2022 (Gartner 2021). Chip scarcity continues to be exacerbated by pandemic containment measures in key production nodes such as Malaysia and Thailand (Clarke 2021; Muramatsu 2021; Raghu 2021). Elsewhere, operations in the agriculture and construction sectors have been disrupted by labor shortages and physical distancing measures, resulting in the ratcheting up of food and construction-related goods and services prices, respectively. Input costs across industries have also increased due to higher freight rates, following tight shipping capacities and port congestions globally (del Rosario and Quach 2021; Horowitz 2021).

### III. Producer vs. Consumer Prices

#### 5. **Unsurprisingly, the increase in commodity prices, supply bottlenecks, and strong global demand for manufactured goods have led to higher producer prices.**

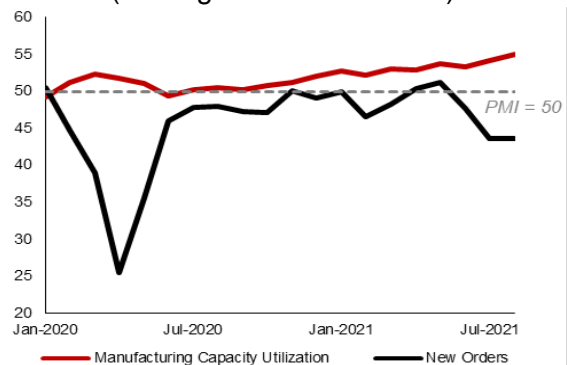
Producer price indices (PPIs) across the region have risen sharply in the first half of 2021, with the PPI for the Plus-3 economies (excluding Hong Kong, China) registering increases of the magnitude last seen in October 2009 (Figure 5). Apart from transportation costs, the jump in commodity prices has led to higher input costs for resource-based manufactured goods, such as chemicals and chemical products, plastics, and rubber gloves. That said, increased capacity utilization amid declining new orders point to continuing uncertainty in the underlying strength of the recovery in global demand (Figure 6).

**Figure 5. Selected ASEAN+3: Producer Price Index**  
(Percent year-over-year)



Sources: National authorities via Haver Analytics; and AMRO staff calculations.  
Note: Regional PPI denotes the simple average of PPI in individual economies. Monthly data for Brunei, Cambodia, Hong Kong, Lao PDR, Myanmar and Vietnam are unavailable.

**Figure 6. Selected ASEAN+3: Composite PMI**  
(Average diffusion indices)

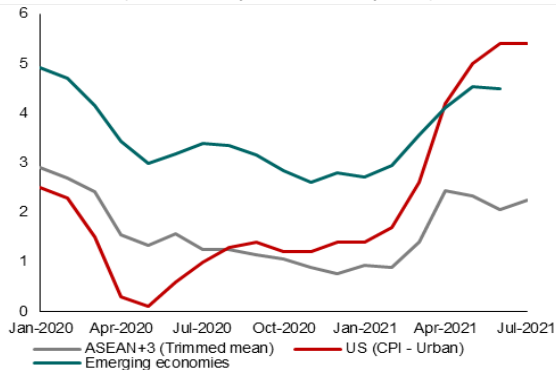


Sources: IHS Markit Purchasing Managers Survey via Haver Analytics; and AMRO staff calculations.  
Note: The diffusion indices range from 0 to 100, where an index above 50 signifies expansion. Data is unavailable for Brunei, Cambodia, Lao PDR and Singapore. Given data limitations, new orders refer to manufacturing new orders for Indonesia, Korea, Malaysia, Myanmar, Philippines, Thailand and Vietnam.

6. **Conversely, inflation, measured by the consumer price index (CPI), has been more muted in the ASEAN+3 region compared to developments elsewhere.** While inflation in the region picked-up in the first half of 2021, the increase has been more moderate compared to other emerging market (EM) economies and the United States (Figure 7), attributable in part to the decoupling of local food prices from global food prices in recent years (Jongwanich, Wongharon, and Donghyun Park 2016; Figure 8), and the closer regional integration of Asia's food markets (ADB 2013). The more benign increase in

food prices in the region likely reflects, in part, the prevalence of policy interventions, such as price ceilings and subsidies, to maintain food affordability.

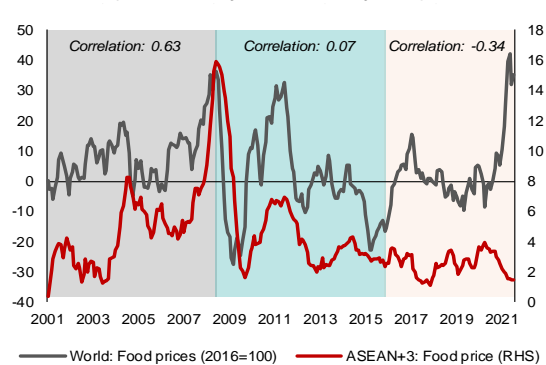
**Figure 7. ASEAN+3, US and Emerging Economies: Headline inflation**  
(Percent year-over-year)



Sources: National authorities via Haver Analytics; and AMRO staff calculations.

Note: The CPI of emerging economies is calculated by Haver Analytics and refer to 51 countries in Emerging Europe, Latin America, Middle East, Africa and Asia Pacific.

**Figure 8. World and ASEAN+3: Food Inflation**  
(Percent year-over-year)

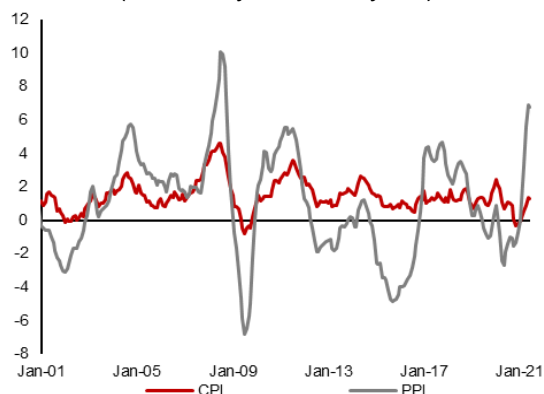


Sources: IMF and national authorities, both via Haver Analytics; and AMRO staff calculations.

Note: Food inflation for the ASEAN+3 represents the simple average of food components in the CPI baskets of all member economies.

7. **Although the pass-through from PPI to CPI appears to be weak at the moment, higher producer prices could eventually seep into consumer prices.** Where firms have pricing power, higher input costs—as reflected in the PPI—are typically passed on to the consumers, resulting in commensurate increases in the CPI. However, regional increases in PPI tend to be accompanied by more modest pick-ups in CPI inflation, especially among the Plus-3 economies (Figures 9 and 10; Box 1). The divergence between PPI and CPI inflation could be attributable in part to differences in basket coverage. The PPI contains fewer service items compared to the CPI; the former also includes items that do not enter the domestic economy, notably, agricultural goods for industrial processing and intermediate products for exports (Fan, He, and Hu 2009). Granger-causality tests on CPI and PPI data for Plus-3 and ASEAN-5 economies show that post-GFC, changes in the PPI Granger-causes changes in the CPI with a time lag of between 2–12 months (Appendix I). Hence, it may be too soon to dismiss any pass-through from PPI to CPI in the coming months.

**Figure 9. Plus-3: CPI and PPI**  
(Percent year-over-year)



Sources: National authorities via Haver Analytics; and AMRO staff calculations.

Note: Hong Kong is omitted given that monthly data are unavailable.

**Figure 10. ASEAN-5: CPI and PPI**  
(Percent year-over-year)

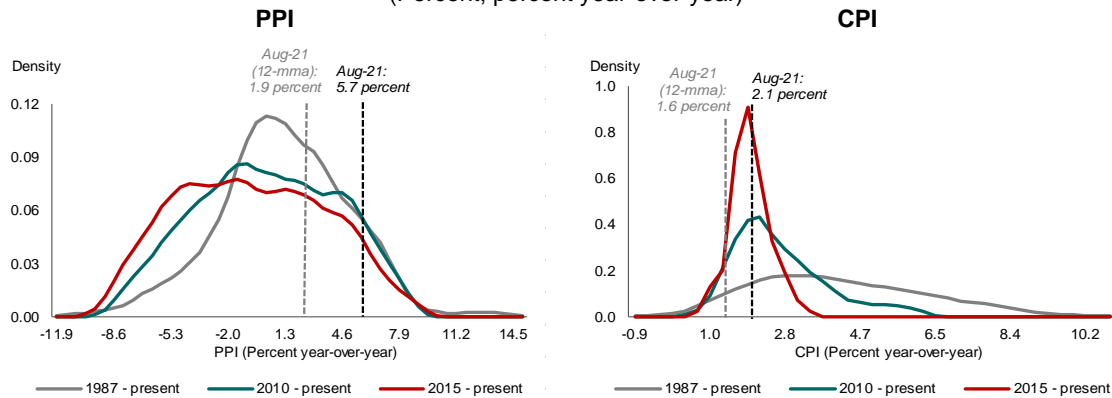


Sources: National authorities via Haver Analytics; and AMRO staff calculations.

**Box 1. Contextualizing Inflation in the ASEAN+3**

**A comparison of current price increases to their historical distribution helps to put current inflation rates into perspective.** Current PPI in the ASEAN+3 region is at the higher end historically (Box Figure 1), consistent with recent developments in the United States, where PPI registered 7.8 percent in July 2021, the highest reading since the measure was introduced in 2010. The lower annual average PPI suggests that it has been rising at a faster rate in recent months. Meanwhile, the current regional CPI rate has been markedly more subdued compared to historical distributions, especially in the intervening years since 2015, which saw large fluctuations in commodity prices. Annual average CPI has only risen at a moderate 1.6 percent per month. The more muted ASEAN+3 CPI stands in stark contrast to that in the United States, which has reached highs not seen since the mid-1990s, beginning in April 2021.

**Box Figure 1. Selected ASEAN+3: Density Curves for Monthly Prices**  
(Percent; percent year-over-year)

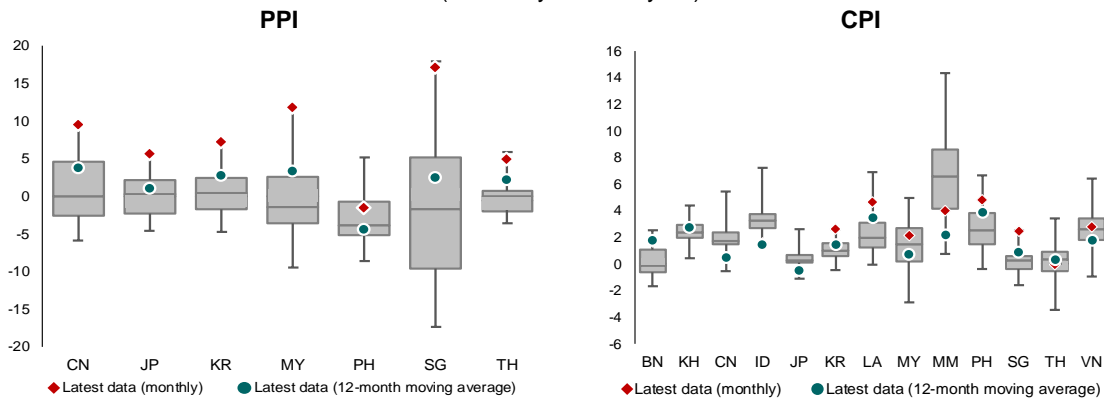


Sources: National authorities via Haver Analytics; and AMRO staff estimates.

Note: The distribution of monthly PPI and CPI across different time horizons are plotted using the kernel density estimation consistent with Famiglietti and Garriga (2021), ASEAN+3 inflation is calculated as the average of member economies' inflation rates. Where PPI data are unavailable, they are proxied by the Wholesale Price Index (Indonesia and Singapore) or PPI for the manufacturing sector (Philippines). Monthly data are unavailable for Brunei, Cambodia, Lao PDR, Hong Kong, Myanmar, and Vietnam.

**PPI and CPI increases have also varied across regional economies.** They mainly reflect the respective monetary policy strategies and economic structures, particularly their exposures to price-volatile items such as commodities. More generally, PPI, ranging between -17.3 to 18.0 percent, has tended to be more volatile than CPI, which ranges between -3.4 to 14.4 percent (Box Figure 2). Although most country PPIs are presently at the high end of their respective historical ranges, the majority of CPIs are at the 75<sup>th</sup> percentile or lower. The 12-month average inflation rate has also remained within the target inflation band for Indonesia, Korea and Philippines, and is in fact below the target inflation band for Thailand.

**Box Figure 2. ASEAN+3: Distribution of Monthly PPI and CPI by Economy, 2015–Present**  
(Percent year-over-year)



Sources: National authorities via Haver Analytics; and AMRO staff estimates.

Note: Latest data is as of August 2021 except for Japan, Korea, Malaysia, Philippines and Singapore (July 2021). Monthly data is unavailable for Brunei, Cambodia, Lao PDR, Hong Kong, Myanmar, and Vietnam. Monthly data for Indonesia is omitted due to its short time series. Annual change in the Wholesale Price Index is only available from December 2020 onward.

Sources: National authorities via Haver Analytics; and AMRO staff estimates.

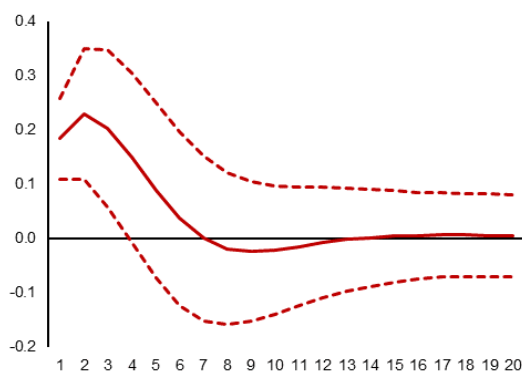
Note: Latest data is as of August 2021 except for Japan, Lao PDR, Malaysia, and Singapore (July 2021); Brunei and Cambodia (June 2021); and Myanmar (April 2021). Hong Kong is omitted as monthly data is unavailable.

## Box 2. Drivers of PPI and CPI

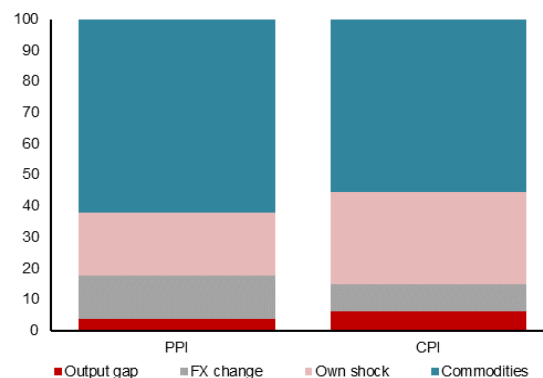
**Vector autoregressive (VAR) modelling confirms the mild pass-through of PPI to CPI inflation for Malaysia, Philippines and Thailand.** The VAR allows for dynamic inter-relationships between PPI and CPI inflation, while controlling for the impact of other factors, such as aggregate demand pressures on inflation via the output gap. Results from the country-level VAR impulse response functions show that a 1 percentage point (pp) increase in PPI inflation in the first quarter instantaneously increases headline inflation by 0.2 pp on average for the three ASEAN economies (Box Figure 3).<sup>1/</sup> The pass-through peaks slightly above 0.2 pp in the succeeding quarter, before tapering off gradually and becoming statistically insignificant from the fourth quarter onward. The pass-through of producer to consumer prices also differs across economies. It can depend, for example, on the source of the PPI shock, share of fuel in the CPI basket, intensity of domestic market competition, strength of domestic demand pressures, and government policies, such as price controls and fuel subsidies (Jongwanich, Wongharaen, and Park 2016).

**While commodity price changes are a common and dominant factor driving past fluctuations in PPI and CPI inflation, domestic demand figures more prominently in CPI inflation.** Another VAR model is estimated individually for the three ASEAN economies to identify the underlying sources of fluctuations in PPI and CPI inflation for the period 2002 Q2–2021 Q2, similar to Jongwanich, Wongharaen, and Park (2016). The variance decomposition analysis shows that historical shocks to producer prices largely originate from movements in global commodity prices and, to a lesser extent, fluctuations in a country's foreign exchange rate (Box Figure 4). Meanwhile, the greater contribution of the output gap in the CPI variance compared to PPI's confirms the view that aggregate demand pressures can intensify the pass-through of PPI to CPI inflation. Additionally, the results show that consumer price pressures can persist more strongly than producer prices, highlighting the importance of proactively managing inflationary pressures.

**Box Figure 3. ASEAN-3: CPI Inflation Response to a 1 Percentage Point Increase in PPI Inflation**  
(Percentage point from the baseline)



**Box Figure 4. ASEAN-3: PPI and CPI Inflation—Variance Decomposition**  
(Percent of total)



Sources: IMF and national authorities, both via Haver Analytics; and AMRO staff estimates.

Note: ASEAN-3 refers to Malaysia, the Philippines, and Thailand. The aggregated CPI inflation response and variance decomposition are derived as the weighted average of the respective CPI inflation responses and variance decompositions for Malaysia, the Philippines, and Thailand. Weights refer to the relative size of the country's Purchasing Power Parity (PPP)-based GDP. Country-specific VARs in Box Figure 1 feature the output gap, PPI inflation, and CPI inflation as endogenous variables, and shocks are identified via Cholesky decomposition following said order of the endogenous variables. The VARs have a lag order of two, as commonly suggested by various lag length criteria in EViews. Broken lines refer to the 95 percent confidence interval of the response profile. Country-specific VARs in Box Figure 2 incorporate (1) world commodity prices (percent year-on-year); (2) output gap; (3) exchange rate against the US dollar (percent year-on-year); and (4) PPI or CPI inflation as endogenous variables, and shocks are identified via Cholesky decomposition following said order of the endogenous variables. The VARs have a lag order of two for Malaysia and the Philippines, and one for Thailand, as suggested by various lag length criteria in EViews.

<sup>1/</sup> Indonesia's PPI inflation and output gap series are not stationary at the 5 percent significance level according to standard unit root tests, thereby preventing its inclusion into the VAR analysis.

#### IV. Market Expectations vs. Valuations

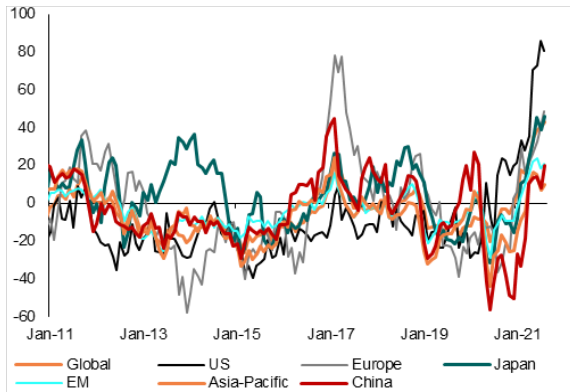
8. **The pickup in global inflation has been higher than forecast but markets had started positioning for it before the data turned.** The rise in inflation, especially in the United States, was higher than market forecasts (Figure 11), and a steady rise in market indicators of inflation expectations was seen in late-2020 and early-2021 (Figure 12). That said, market pricing of inflation expectations also indicated that the rise in inflation was assessed to be temporary. Inflation expectations over the shorter-term (5-year) in the United States rose significantly above those over the longer-term (10-year), while the spread narrowed significantly in other economies where market-based inflation expectations are available (Figure 13).

9. **Rising US inflation has sparked concerns over an earlier-than-expected monetary policy normalization.** The US personal consumption expenditures price index (PCEPI), the price measure used by the Federal Open Market Committee (FOMC) to measure inflation, has exceeded the 2 percent target for four consecutive months (Figure 14). The PCEPI inflation exceeded 3 percent in April 2021—the first time since September 2008—and has continued to increase since then. The FOMC has stated that it believes these increases reflect transitory factors, such as low base effects and supply bottlenecks (Ihrig, Peneva, and Wolla 2021; Kliesen 2021). It has also argued that the flat Phillips Curve imply that the recovery in labor markets would not lead to unwanted upward pressures on inflation (Powell 2021). Nonetheless, a strongly recovering US economy, aided by the wide availability of vaccines and a large fiscal stimulus package, has fueled concerns that the Fed could scale back on its asset purchases in the near-term (Irwin 2021; Figure 15).

10. **Expectations of Fed tightening have dampen sentiment in EM asset markets, but other idiosyncratic considerations have come to the fore.** Although a rise in inflation expectations *per se* tends to be accompanied by a strengthening in global risk assets (Pande 2021), the rise in US real rates in 2021Q1, which reflected concerns about tighter monetary conditions (Figure 16), had adversely affected EM equity markets, currencies and bonds. Since then, Fed communications (which have tilted toward the dovish side of market expectations), global spread of the COVID-19 Delta variant, and the associated risks to the growth outlook, have kept expectations for Fed tightening in check and provided a benign backdrop for ASEAN+3 markets. However, factors such as domestic Delta variant infections (and the resultant mobility restrictions), political tensions, and legislative and regulatory changes, have had a material impact on market sentiment in the region. Looking ahead, expectations of ECB tapering are attracting market attention and could cause further volatility. However, any effect will likely be muted compared to 2021Q1.

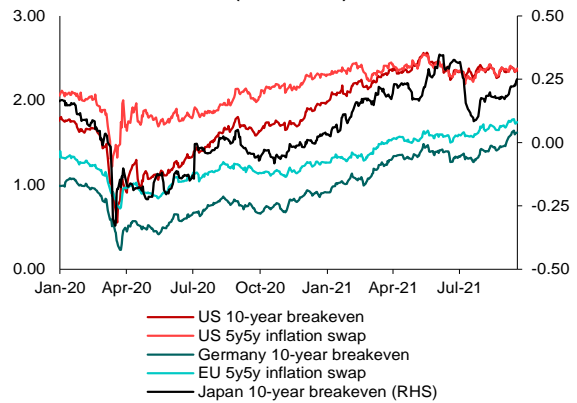
11. **Apart from the expectations around monetary policy in the advanced economies (AEs), inflation also impacts regional markets through valuations.** *Ceteris paribus*, the rise in inflation leads to a fall in real asset returns, thus reducing their attractiveness. Inflation-adjusted bond yields (which represent a proxy for regional real rates) have declined in recent months (Figure 17). Concurrently, inflation-adjusted equity risk premia in regional markets have also dipped lower (Figure 18), although the impact of rising inflation on valuations was offset to some extent by the weakening in some equity markets, which helped preserve valuations. The less attractive valuations do not necessarily translate into stress in financial markets but they could lead to further price adjustments as investors seek compensation for reduced attractiveness.

**Figure 11. World: Inflation Surprise Index**



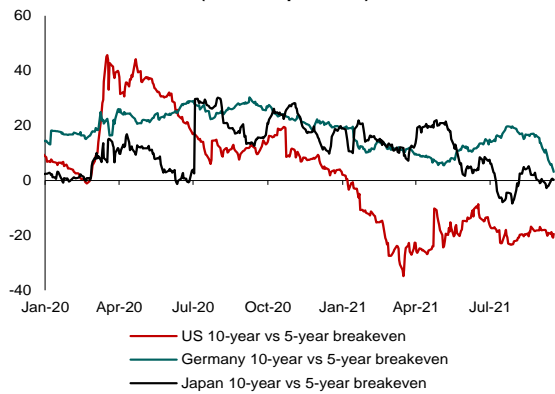
Sources: Bloomberg Finance L.P.; Citi Inflation Surprise Index; and AMRO staff calculations.

**Figure 12. Selected AEs: Market-Implied Inflation Expectations (Percent)**



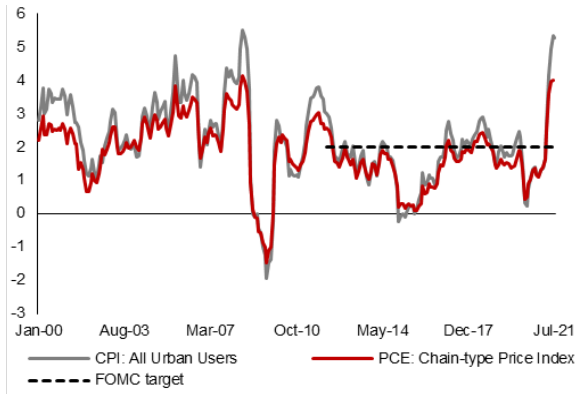
Sources: Bloomberg Finance L.P.; and AMRO staff calculations.

**Figure 13. Selected AEs: Market Pricing of 10-Year vs. 5-Year Inflation Expectations (Basis points)**



Sources: Bloomberg Finance L.P.; and AMRO staff calculations.

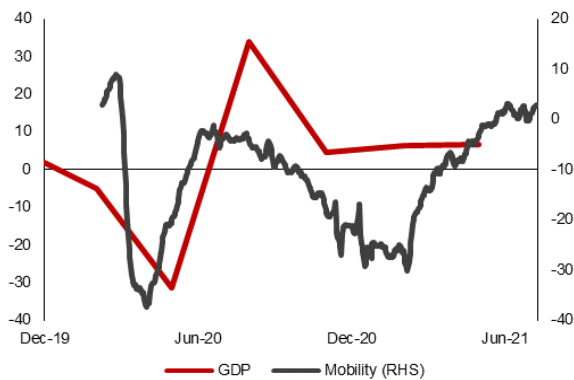
**Figure 14. United States: Consumer Price Index and PCEPI (Percent year-over-year)**



Source: US Bureau of Labor Statistics.

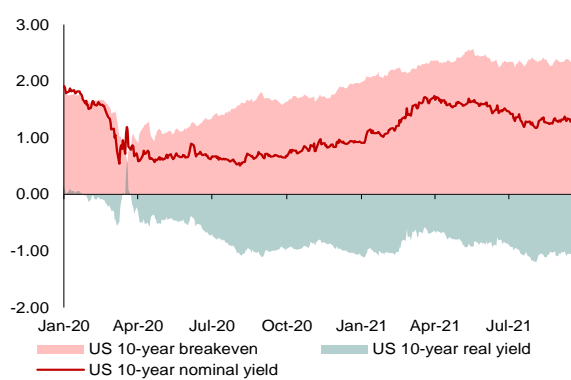
Note: FOMC's target of 2 percent inflation is based on the PCEPI.

**Figure 15. United States: GDP Growth and Non-Residential Mobility (Percent annualized quarter-over-quarter, seasonally-adjusted; index)**



Sources: Our World in Data via Haver Analytics; and AMRO staff calculations.

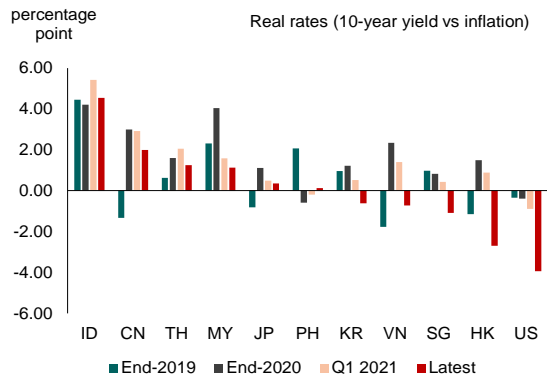
**Figure 16. United States: Breakdown of 10-year Nominal Yields (Percent)**



Sources: Bloomberg Finance L.P.; and AMRO staff calculations.

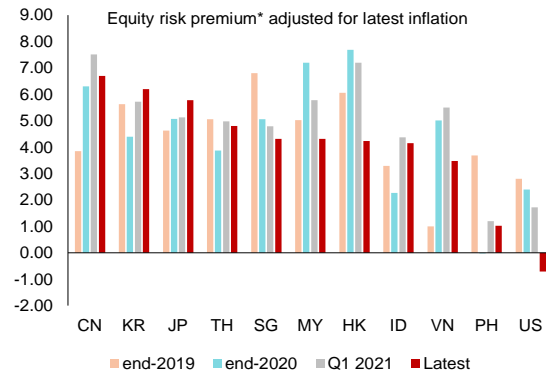


**Figure 17. United States and Selected ASEAN+3: Real Interest Rates**  
(Percentage points)



Sources: Bloomberg Finance L.P.; Haver Analytics; and AMRO staff calculations.

**Figure 18. United States and Selected ASEAN+3: Equity Risk Premia Adjusted for Latest Inflation**  
(Percentage points)



Sources: Bloomberg Finance L.P.; Haver Analytics; and AMRO staff calculations.

## V. Risks vs. Policies

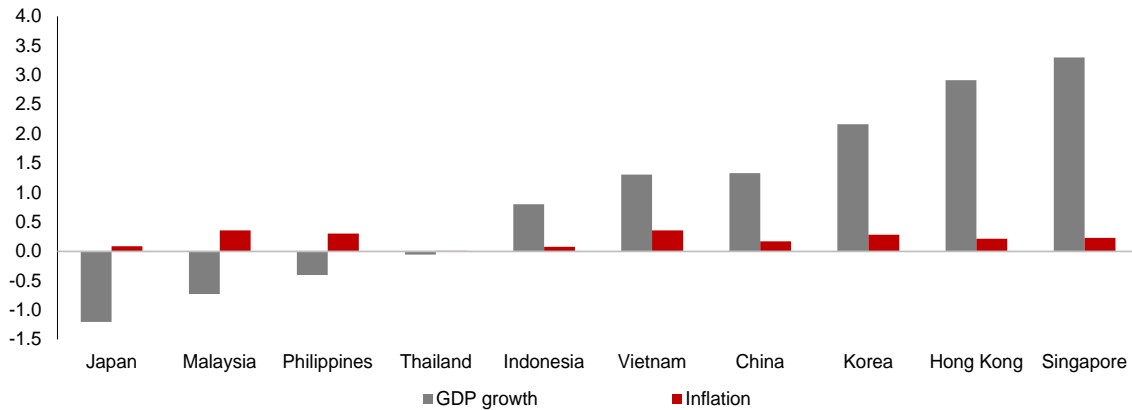
12. **There is a non-negligible risk that global and regional inflation could remain elevated for a prolonged period.** Although factors such as the base effect and supply-side issues are expected to be transitory (Neumann 2021), there are two possible scenarios in which inflation may remain elevated for a prolonged period:

- **The optimistic scenario.** A rapid pick-up in growth as economies reopen and vaccination gathers pace is very likely. In this scenario, demand would play a greater role which would be a welcome development as it would herald a sustained economic recovery. GDP growth momentum that is improving alongside an uptick in inflation is an early indication of this scenario. In the first half of 2021, these signs have been observed for China, Hong Kong, Indonesia, Korea, Singapore, and Vietnam. (Figure 19).
- **The pessimistic scenario.** If the supply-side squeeze does not subside, particularly as more infectious and virulent COVID-19 variants prevent economies from reopening, inflationary pressures will eventually be passed on to consumers, stifling demand and raising the specter of stagflation. If the growth momentum in countries such as Japan, Malaysia, the Philippines, and Thailand continues to lag the pick-up in inflation, their economic recovery could be at risk. With prices expected to remain on an upward bias in the near-term, any premature monetary policy tightening—either to ease inflationary pressures or in response to global interest rate hikes—risks disrupting the recovery of consumer spending and private investment (Baig 2021; Summers 2021). Further fiscal expansion to support growth would also be difficult as higher interest rates would increase government debt burden.

13. **Inflationary spillovers to the real economy could derail an already-fragile economic recovery.** Broad-based increases in the prices of goods and services, including necessities, would disproportionately affect low-income households that have less disposable income and a larger share of income that is spent on staple goods. It would therefore be crucial to provide continuing financial assistance to these vulnerable households to support basic consumption spending. At the same time, efforts should be

channeled toward ensuring the smooth operation of domestic supply chains to avoid abrupt price increases by businesses that could adversely impact private consumption. Commodity-importing economies should proactively diversify their sources to avoid disruptions to supplies in the event of unanticipated lockdowns in some commodity-producing economies.

**Figure 19. Selected ASEAN+3: Growth Momentum of GDP and CPI, 2021H1**  
(Percent quarter-over-quarter, seasonally adjusted)



Sources: National authorities via Haver Analytics; and AMRO staff calculations.

Note: GDP growth refers to average quarter-over-quarter growth for 1Q 2021 and 2Q 2021. Growth momentum for inflation refers to average month-over-month growth from January 2021 to July 2021.

**14. Inflationary pressures could intensify uncertainties in financial markets, leading to capital outflows and weaker asset valuations.** Elevated global inflation will fuel expectations of an earlier than expected AE monetary policy normalization, which could potentially induce volatility and trigger capital outflows from regional markets, causing financial and liquidity conditions to tighten. On the other hand, elevated domestic inflation may lead to some repricing of domestic assets, especially bonds and exchange rates. Regional central banks have taken a prudent approach in intervening in markets to smooth volatility thus far and should continue to do so, and also to ensure that liquidity conditions remain ample to facilitate proper functioning of financial markets. From a medium-term perspective, the ability to ensure that the economic recovery remains on track while maintaining policy prudence, will define the performance of EM ASEAN+3 markets vis-a-vis other comparable EMs.

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### Appendix I. Granger Causality Test and Results

The Granger causality test used to investigate the relationship between ASEAN+3 *CPI* and *PPI* is expressed as follows:

$$(1) \quad PPI_t = \alpha + \sum_{i=1}^k \alpha_i \times PPI_{t-i} + \sum_{i=1}^k \beta_i \times CPI_{t-i} + \varepsilon \quad (1 < i < k)$$

$$(2) \quad CPI_t = \alpha + \sum_{i=1}^k \alpha_i \times CPI_{t-i} + \sum_{i=1}^k \beta_i \times PPI_{t-i} + \delta \quad (1 < i < k)$$

where,

$i$  refers to the number of lagged months;

$k$  refers to the lag length;

$\alpha$  and  $\beta$  are the respective coefficients of lagged values of the dependent and independent variables;

$\varepsilon$  and  $\delta$  are error terms.

The null hypothesis  $H_0$  in equation (1) is that CPI does not Granger-cause PPI; and in equation (2) is that PPI does not Granger-cause CPI. The null hypothesis is accepted if and only if

$$\beta_1 = \beta_2 = \dots = \beta_k = 0.$$

There are four possible outcomes regarding causal relationships between CPI and PPI: one-way causality from CPI to PPI or vice versa; two-way causality between the two variables; and finally, the lack of any relationship.

**Appendix Table 1. ASEAN-5: Granger Causality Test Results**  
(Monthly year-over-year, 2009–21)

No. of lags (k)	Null hypothesis	F statistic	P value	Direction
1	(1)	5.714	0.018**	CPI ↔ PPI
	(2)	12.233	0.001***	
2	(1)	1.693	0.000***	PPI → CPI
	(2)	10.686		
3	(1)	0.578	0.000***	
	(2)	9.278		
4	(1)	0.550	0.000***	
	(2)	6.533		
5	(1)	0.138	0.000***	
	(2)	6.780		
6	(1)	0.134	0.000***	
	(2)	5.448		
7	(1)	0.338	0.000***	
	(2)	4.737		
8	(1)	0.454	0.000***	
	(2)	4.617		
9	(1)	0.378	0.000***	
	(2)	4.284		
10	(1)	0.576	0.000***	
	(2)	4.522		
11	(1)	0.890	0.000***	
	(2)	3.695		
12	(1)	0.995	0.000***	
	(2)	3.821		

**Appendix Table 2. Plus-3 excluding Hong Kong: Granger Causality Test Results**  
(Monthly year-over-year, 2009–21)

No. of lags (k)	Null hypothesis	F statistic	P value	Direction
1	(1)	24.90	0.000***	CPI ↔ PPI
	(2)	8.68	0.004***	
2	(1)	5.36	0.006***	
	(2)	7.99	0.001***	
3	(1)	5.15	0.002***	
	(2)	8.61	0.000***	
4	(1)	3.68	0.007***	
	(2)	7.12	0.000***	
5	(1)	3.21	0.009***	
	(2)	5.19	0.000***	
6	(1)	2.74	0.015**	
	(2)	4.30	0.001***	
7	(1)	3.06	0.005***	
	(2)	3.81	0.001***	
8	(1)	2.29	0.026**	
	(2)	4.08	0.000***	
9	(1)	2.37	0.017**	
	(2)	3.96	0.000***	
10	(1)	2.32	0.016**	
	(2)	3.77	0.000***	
11	(1)	1.66	0.091*	
	(2)	3.33	0.001***	
12	(1)	1.67	0.084*	
	(2)	2.95	0.001***	

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