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**Working Paper**

## Determinants of consumer price inflation versus producer price inflation in Asia

ADB Economics Working Paper Series, No. 491

**Provided in Cooperation with:**

Asian Development Bank (ADB), Manila

*Suggested Citation:* Jongwanich, Juthathip; Wongcharoen, Petchtharin; Park, Donghyun (2016) : Determinants of consumer price inflation versus producer price inflation in Asia, ADB Economics Working Paper Series, No. 491, Asian Development Bank (ADB), Manila

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# DETERMINANTS OF CONSUMER PRICE INFLATION VERSUS PRODUCER PRICE INFLATION IN ASIA

*Juthathip Jongwanich, Petchtharin Wongcharoen, and Donghyun Park*

NO. 491

July 2016

ADB ECONOMICS  
WORKING PAPER SERIES

ADB Economics Working Paper Series

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No. 491 | July 2016

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Printed in the Philippines.

ISSN 2313-6537 (Print), 2313-6545 (e-ISSN)  
Publication Stock No. WPS168272-2

#### Cataloging-In-Publication Data

Asian Development Bank.

Determinants of consumer price inflation versus producer price inflation in Asia.  
Mandaluyong City, Philippines: Asian Development Bank, 2016.

1. Asia. 2. Commodity price shocks. 3. Consumer price. 4. Exchange rate. 5. Inflation.  
6. Monetary policy. 7. Pass-through. 8. Producer price. I. Asian Development Bank.

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## ABSTRACT

We empirically examine and compare the determinants of producer and consumer price inflation in 10 Asian economies during 2000–2015. In this connection, we also investigate the pass-through of global oil prices, global food prices, and exchange rates to domestic producer and consumer prices. Overall, we find that cost-push factors such as oil and food prices are more important in explaining producer price inflation than consumer price inflation in the 10 Asian economies. On the other hand, for consumer prices, demand-pull factors still explain much of the inflation. Finally, we find that the pass-through of global oil prices, global food prices, and exchange rates tend to be higher for producer prices than consumer prices in Asia.

*Keywords:* Asia, commodity price shocks, consumer price, exchange rate, inflation, monetary policy, pass-through, producer price

*JEL codes:* E31, F43, O53

## I. INTRODUCTION

Inflation has dropped drastically in many economies since the second half of 2009. Producer and consumer price inflation have both declined visibly. In advanced economies, consumer price inflation dropped from 1.5% in 2010 to 1.4% in 2014, and is expected to decline further to 0.3% in 2015.<sup>1</sup> This trend is also evident in developing Asia. In East Asia, inflation is expected to decline to 1.4% in 2015 from almost 3% in 2010. In Southeast and South Asia, inflation is expected to drop from 4% to 3% and 10% to 5%, respectively, between 2010 and 2015.<sup>2</sup> In Thailand; Viet Nam; Singapore; and Taipei, China, inflation is expected to be zero or negative in 2015. There are two possible drivers of Asia's recent disinflation. First, global commodity prices have fallen sharply since 2012. Second, economic growth and aggregate demand has weakened, especially in East Asia. However, so far there has been no formal empirical analysis of the sources of Asia's recent disinflation.

Against this background, the central objective of our paper is to empirically identify the determinants of Asia's inflation. That is, we investigate the extent to which inflation in 10 Asian economies—People's Republic of China (PRC); Hong Kong, China; India; Indonesia; Republic of Korea; Malaysia; Philippines; Singapore; Thailand; and Viet Nam—reflects cost-push inflation or other factors such as excess aggregate demand or inflationary expectations. An important contribution of our paper is that we look at both producer and consumer prices. The two prices are based on different baskets of goods and services. As such, producer price and consumer price inflation (and deflation) may be driven by different factors. Furthermore, producer prices may be more relevant for producers and their decision making, while consumer prices may be more relevant for consumers and their decision making.

In addition, we empirically assess the extent of the pass-through of global food and oil prices to domestic producer and consumer prices in the 10 economies. A high pass-through would imply that global commodity price shocks are a significant source of inflation in the region. Since producer and consumer prices embody different baskets of goods, the pass-through may differ for the two prices. Furthermore, to the extent that politically motivated government subsidies for consumers distort the price of food and oil products, consumer prices will not fully adjust to higher global prices. Producers tend to pass on higher input prices to consumers only after a time lag, especially if they face a competitive market environment. Since exchange rate movements can cushion or amplify the effect of commodity shocks, we also look at pass-through of exchange rate shocks to domestic prices.

Our empirical model applied is based on the dynamic interrelationship between the price variables in the distribution chain (McCarthy 1999, Bhundia 2002, and Duma 2008). The model is estimated for Q1 2000 to Q2 2015. In addition to the whole sample period (Q1 2000 to Q2 2015), we also look at the subperiod preceding the recent global oil price decline (Q1 2000 to Q4 2011). A higher pass-through effect of oil prices on inflation during the earlier subperiod could imply that the impact of oil prices on inflation has weakened during the recent world oil price decline. We cannot directly look at the post-2012 subperiod since the data are not long enough to perform reasonable estimation.

The rest of this paper is organized as follows. Section II reviews the empirical literature on the determinants of inflation. Section III examines trends in inflation in developing Asia, along with recent fluctuations in global oil and food prices during 2000–2015. This section also tracks recent movements in the region's exchange rates. Section IV lays out the empirical methodology we use to

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<sup>1</sup> World Economic Outlook, October 2015

<sup>2</sup> Asian Development Outlook, 2015



estimate the sources of inflation in the 10 Asian economies. Section V reports and discusses the main findings of our empirical analysis on the determinants of consumer and price inflation in Asia, and section VI concludes the paper.

## II. LITERATURE SURVEY

Studies that assess the impact of demand-pull and/or cost-push factors on inflation use a variety of approaches that differ in empirical methodology, country and period coverage, and choice of control variables. In terms of methodology, we can divide the studies into two broad groups. The first group is based on panel data analysis. For example, Choudhri and Hakura (2001) examine the exchange rate pass-through to domestic prices under different states of inflation. The authors use 71 economies during 1979–2000, and the variables they include are listed in the Appendix. They find strong evidence of a positive and significant association between the pass-through and the average inflation rate across countries and periods. Habermeier et al. (2009) examine the impact of the food and oil price shock on consumer price inflation for 50 developing economies from 2005 to June 2008. They find that both aggregate demand and commodity prices played a role in inflation. In addition, countries under inflation targeting frameworks managed to better contain inflation. Exchange rate policy and central bank independence and transparency were also associated with lower inflation.

Jaumotte and Morsy (2012) examine the determinants of inflation differentials in the euro area, highlighting the role of country-specific labor and product market institutions. They apply a panel data model to 10 euro area countries during 1983–2007. They find that labor and product market conditions influence the cost-push factor. Oil and raw materials price shocks are more likely to contribute to wage and consumer price inflation when the degree of coordination in collective bargaining is intermediate. High employment protection, intermediate coordination of collective bargaining, and high union density increase the persistence of inflation. Gelos and Ustyugova (2012) analyze the inflationary impact of commodity price shocks for 31 advanced and 61 developing economies during the period 2001–2010. The analysis suggests that economies with higher food shares in consumer price index (CPI) baskets, fuel intensities, and preexisting inflation levels experience more sustained inflationary effects from commodity price shocks, which also have stronger inflationary effects in developing countries.

The second group of studies applies various time series econometric analysis techniques in examining determinants of inflation. For example, Bonato (2007) looks at the determinants of consumer price inflation in Iran during 1988–2006. Results show that money is the most significant determinant of inflation, followed by exchange rate and output. Kandil and Morsy (2009) study the determinants of consumer price inflation in six oil-rich states of the Gulf Cooperation Council (GCC) in 1970–2007. They find that oil revenues reinforced inflationary pressures and in the short run, binding capacity constraints also explain higher inflation given increased government spending. Hossain and Islam (2012) examine the determinants of consumer price inflation in Bangladesh using data from 1990 to 2010. They find that money supply and lagged interest rate has a significant positive effect on inflation while lagged money supply and lagged fiscal deficit has a significant negative effect.

A number of studies examine the pass-through of exchange rates to inflation using vector autoregression (VAR) models that incorporate a distribution chain of pricing. McCarthy (1999) examines the impact of exchange rates on producer price index (PPI) and CPI in 9 advanced economies during 1976–1988, and find that they have a modest effect on domestic price inflation during the post-Bretton Woods era. Bhundia, A. (2002) examines the exchange rate pass-through to

consumer prices in South Africa during 1980–2001, and finds that when depreciation is generated by a real shock, the pass-through is limited. By contrast, when depreciation is from nominal shock, the pass-through effect becomes significant. Ca’ Zorzi, Hahn, and Sánchez (2007) examine the degree of exchange rate pass-through to prices in 12 emerging markets in Asia, Latin America, and Central and Eastern Europe during 1980–2004.<sup>3</sup> They find that for emerging markets with low inflation, pass-through is small and comparable with the levels of developed economies. In addition, there is only weak evidence of a link between import openness and exchange rate pass-through.

De Gregorio et al. (2007) deploy rolling VARs to examine the pass-through of global oil prices to consumer price inflation in 24 advanced and 12 emerging markets during 1960–2006. Their results show a fall in the average estimated pass-through for advanced economies and, to a lesser degree, for emerging economies. The decline could be due to lower oil intensity of the global economy, lower exchange rate pass-through, and a more benign inflation environment. Furthermore, the oil price shock was largely the result of strong global demand. Duma (2008) investigates pass-through of external shocks—i.e., exchange rate, oil price, and import price shocks—to inflation in Sri Lanka during 2003–2007, and uncovers a weak and incomplete pass-through. This possibly reflects administered prices, high share of food in the consumption basket, and volatility and limited persistence of the exchange rate.

Nguyen, Cavoli, and Wilson (2012) use VAR to investigate the determinants of consumer price inflation in Viet Nam during 2001–2009. They find that money supply, oil prices, and rice prices are the main determinants of CPI inflation in Viet Nam. Bhattacharya (2013) deploys both ordinary least squares and VAR to examine consumer price inflation in Viet Nam during 2000–2012, and finds in the short run that nominal effective exchange rate is the key driver of inflation. Credit growth is a significant driver in the medium term. In addition, interest rates do not have a significant impact on inflation, which implies that the monetary policy transmission mechanism is rather weak in Viet Nam.

Most existing studies analyze the determinants of consumer price inflation through either panel or time series analysis. Although a few studies apply the distribution chain of pricing, following McCarthy (1999), the focus is consumer price inflation. Only few studies, e.g., McCarthy (1999), Bhundia (2002), and Duma (2008), examine determinants of both producer and consumer prices. Moreover, so far there has been no study that compares the impact of global oil and food prices on producer and consumer price inflation before and after the recent commodity decline. Therefore, we hope to contribute to the literature by looking at both producer and consumer prices, and by taking a closer look at the impact of the recent decline in global oil and food prices.

### III. TRENDS IN ASIAN INFLATION AND GLOBAL COMMODITY PRICES

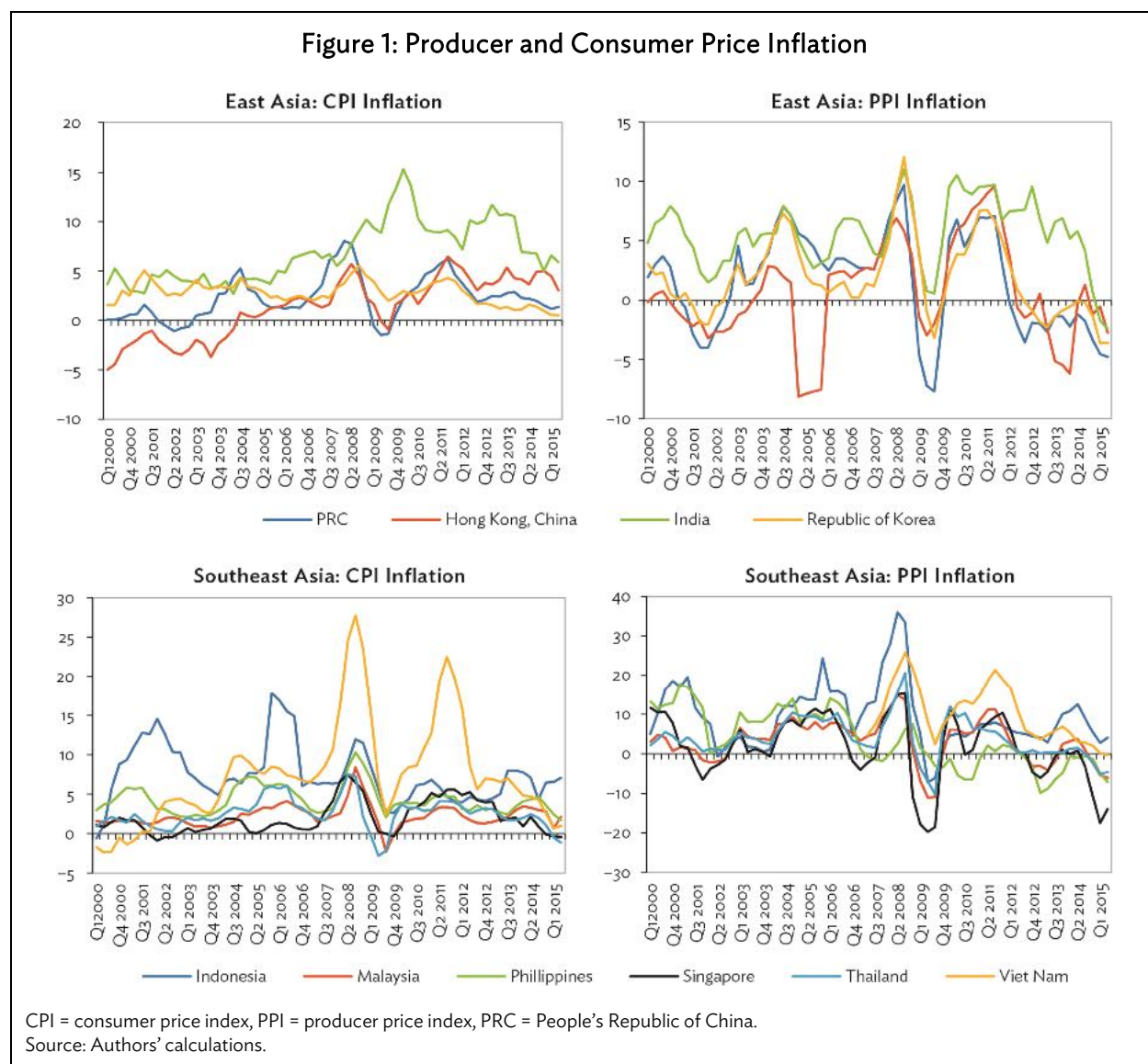
Before we delve into our main task of empirically investigating the relationship between global commodity prices and inflation, it is worthwhile to take a look at the actual trends of the two variables. High inflation emerged as a major risk to Asia’s macroeconomic outlook during 2007–2008 although the risk receded since the fall of 2008. More recently, the sharp global oil price decline has fueled worries about deflation in some countries. Therefore, now is an opportune time to examine the actual recent trends in global food and fuel prices. Exchange rate movements also deserve a look since they affect the extent of the pass-through of dollar-denominated global commodity prices into domestic prices. In addition, we examine developing Asia’s recent gross domestic product (GDP) growth performance.

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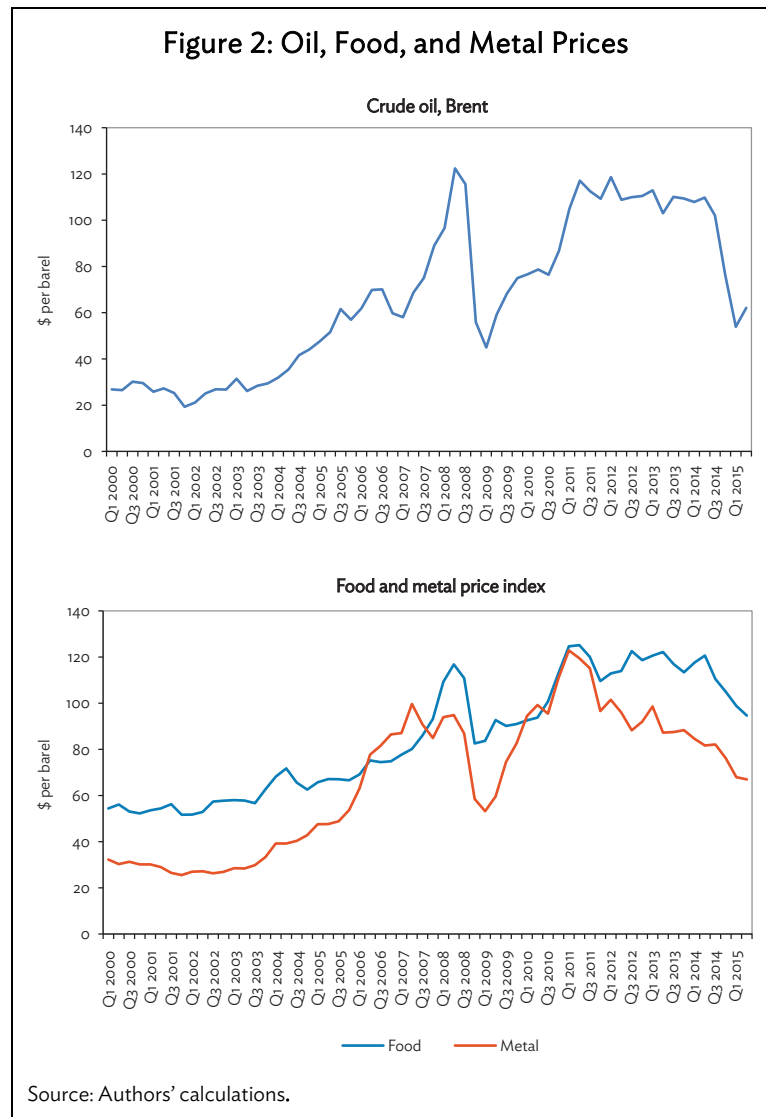
<sup>3</sup> Asia (PRC; Republic of Korea; Singapore; Taipei, China; and Hong Kong, China); Central and Eastern Europe (Czech Republic, Hungary, Poland) plus Turkey; and Latin America (Argentina, Chile, and Mexico).

Figure 1 shows inflation from 2000 to Q2 2015 in the 10 developing Asian economies included in our empirical analysis—PRC; Hong Kong, China; India; Indonesia; Republic of Korea; Malaysia; Philippines; Singapore; Thailand; and Viet Nam. Producer and consumer price inflation picked up noticeably since early 2007. In Viet Nam, the consumer price inflation accelerated to almost 25% year on year in early 2008 while in the PRC it jumped to almost 9% in the second quarter of 2008, from less than 2% in 2006. In the first quarter of 2008, Indonesia's inflation surged to almost 6.5%. Producer prices have risen even faster than consumer prices in almost everywhere. This is especially true in Indonesia, where producer price inflation soared to 25% year on year in Q1 2008, compared to 10% in early 2007.

The surge of inflation was interrupted in 2009 when producer and consumer price inflation both declined noticeably. In particular, producer price inflation slowed down everywhere, especially in Singapore, Malaysia, Thailand, and the PRC. Consumer price inflation fell markedly in the PRC; Hong Kong, China; Singapore; Malaysia; and Thailand. However, in 2010 inflation rose again until the first quarter of 2012.



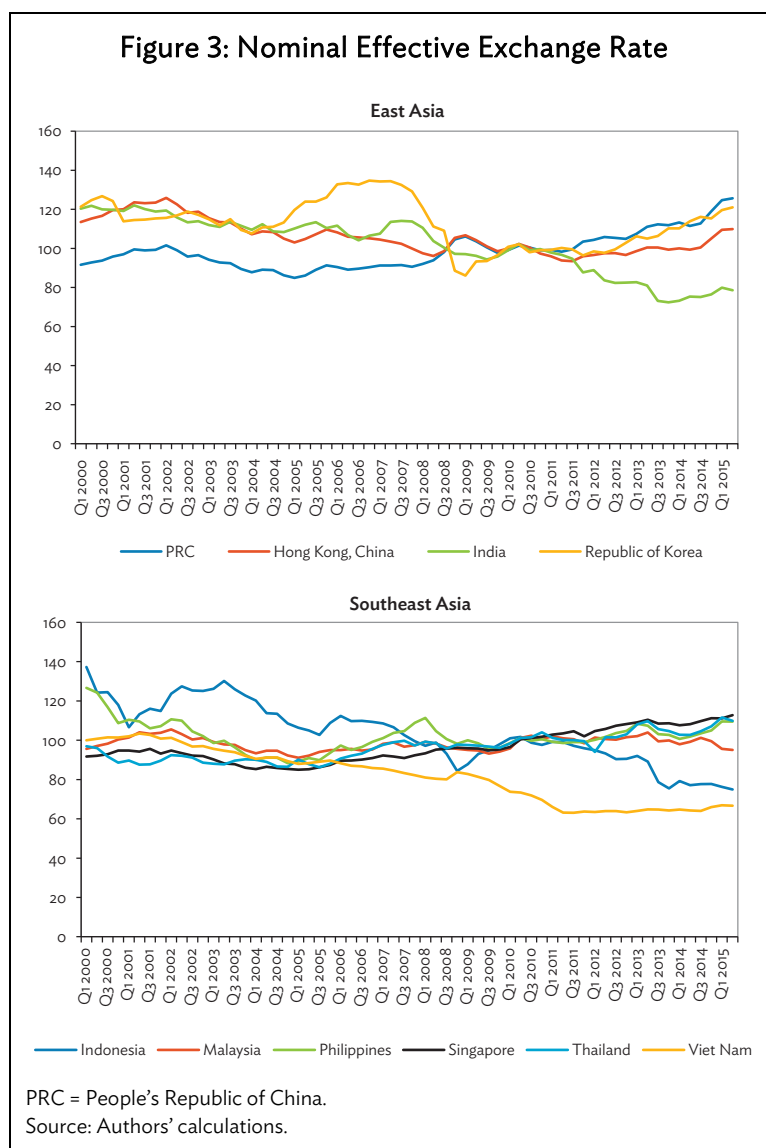
Since the first quarter of 2012, inflation in Asian economies showed a downward trend, especially for producer prices. In all economies, except Indonesia, producer prices declined. In East Asian economies, producer price inflation dropped since 2012, while in India and Southeast Asian countries, deflation began in 2014. Producer price inflation in Singapore declined the most (–15.7%), followed by the Philippines (–6.1%), Malaysia (–5.8%), and Thailand (–4.9%). Consumer price inflation also fell but by less than producer prices. Only Thailand and Viet Nam experienced consumer price deflation in 2015, while consumer price inflation rate remained relatively high in India and Indonesia.



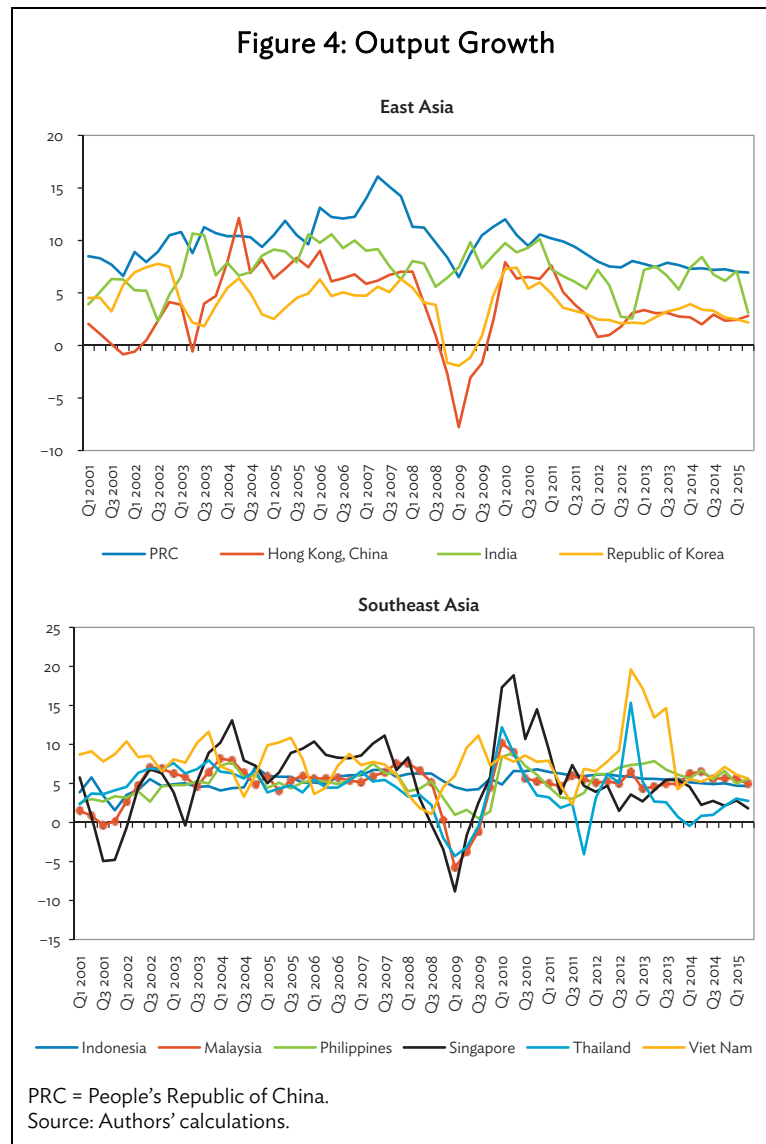
The price of Brent crude oil surged from \$60 in early 2007 to a record high of \$125 per barrel in early 2008 (Figure 2). The cost of food, especially rice, palm oil, and wheat, soared too since 2007. An important structural factor behind the escalation of food was the rapid economic growth of the PRC and India, which lifted global demand. However, fuel prices dropped rapidly after September 2008, to \$41 per barrel in December 2008 before slightly rebounding to \$60 in May 2009 and almost \$120 in 2011. Since then the price of Brent fell sharply, averaging around \$50 in 2015. Nonfuel commodity prices showed broadly the same pattern as that in fuel commodity prices. Slower global growth since

the global financial crisis has weakened both fuel and food prices although the impact has been smaller for food prices.

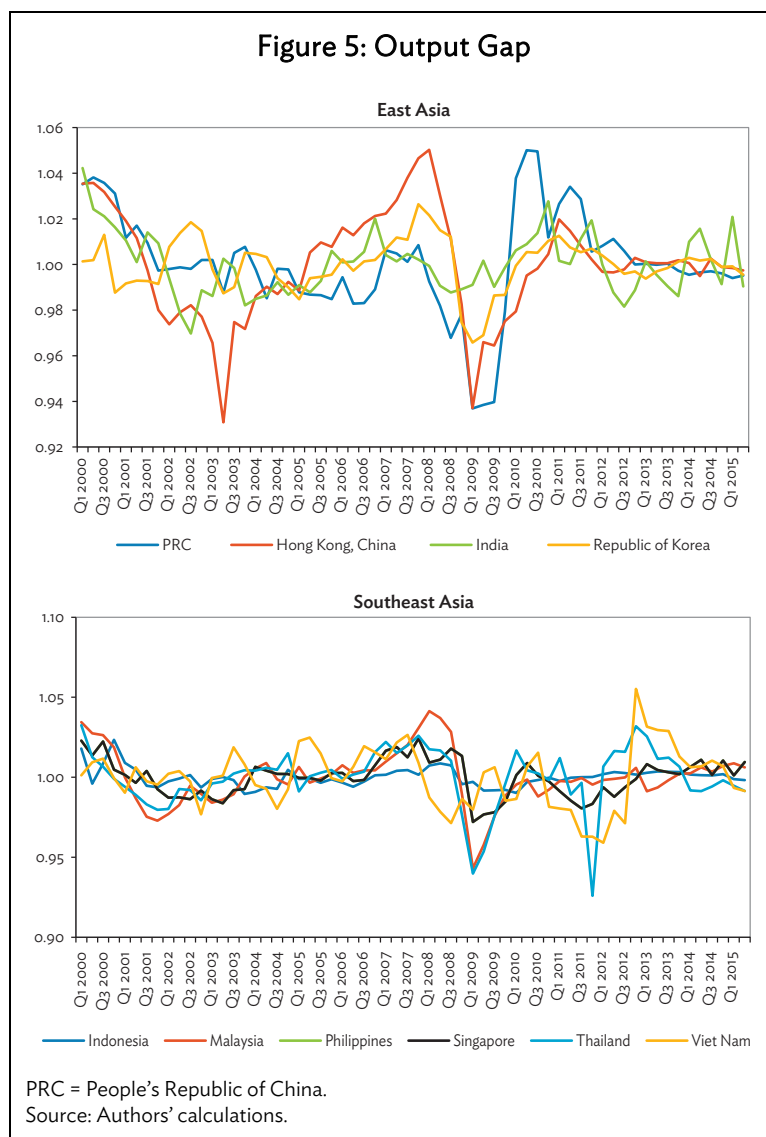
One factor which could limit the pass-through of change in global commodity prices into domestic prices is exchange rate movements. During episodes of high commodity prices, currency appreciation can limit the pass-through. The nominal effective exchange rate (NEER) appreciated in many Asian economies, especially against the US dollar, as Figure 3 shows. For example, the Philippine peso appreciated by 25% in 2005–2008 while the currencies of the PRC, Malaysia, Singapore, and Thailand appreciated by smaller margins. On the other hand, during the recent slump in oil prices, the currencies of India, Indonesia, and Malaysia depreciated, with the Indonesian rupiah hit the hardest.



The marked slowdown in economic growth since the second half of 2008 has gone hand in hand with the deceleration of inflation. Figure 4 shows that in late 2008–2009, economic growth decelerated in all Asian economies. In Q1 2009, real GDP contracted in Singapore; Hong Kong, China; Malaysia; Thailand; and the Republic Korea by 8.8%, 7.7%, 5.7%, 4.3%, and 2%, respectively. Growth fell marginally in India, the PRC, Indonesia, Viet Nam, and the Philippines, all of which grew by more than 5%. In all Asian economies during 2008–2009, the ratio of actual output to potential output, proxied by the trend of real GDP derived from the Hodrick-Prescott filter, was well below 1, implying excess capacity.



Output growth rebounded in 2010, but since then it has declined in Asian economies. Interestingly, although growth has declined, there is no significant sign of excess capacity in the region during this period. The ratio of actual output to potential output is still close to 1 in all Asian economies (Figure 5).



#### IV. DATA AND METHODOLOGY

We seek to identify the underlying sources of developing Asia's inflation, in particular the relative importance of demand-pull factors versus cost-push factors. In this section, we discuss the model, data, and econometric procedure used in our analysis. Our sample consists of 10 Asian economies, namely the PRC; Hong Kong, China; India; Indonesia; Republic of Korea; Malaysia; the Philippines; Singapore; Thailand; and Viet Nam. A VAR model is estimated and a recursive Cholesky orthogonalization is applied to identify the primitive shock in the VAR. This approach is used to model the dynamic interrelationship between the price variables in the distribution chain. The ordering and choice of variables is motivated by the idea that prices are revised at each of three different stages—i.e., import, production, and consumption—which together make up a stylized distribution chain of goods. The model controls for external shocks and aggregate demand pressures. The model applied here is based on McCarthy (1999), Bhundia (2002), and Duma (2008), but is extended to include nonfuel commodity prices.

In this model, inflation at each stage in the distribution chain, namely import, producer, and consumer prices, is composed of seven components. The first three components, i.e., oil ( $\pi^{oil}$ ), metal ( $\pi^{metal}$ ), food ( $\pi^{food}$ ) price inflation, capture the effect of international supply shocks on inflation, referred to here as cost-push inflation. The third component, namely output gap ( $y$ ), captures demand shock, while the fourth measures the effect of exchange rate shock ( $e$ ) on inflation. The fifth component measures the effect of shocks to inflation at the previous stage of the distribution chain and the sixth captures the effect of shocks at the current stage. For example, import price inflation ( $\pi^{im}$ ) affects consumer price inflation ( $\pi^c$ ) both directly and indirectly through its effects on producer price inflation ( $\pi^p$ ). The last component reflects the expected inflation at each stage, which is based on information available at period  $t-1$ . The seven components can be written as in (1).

$$\begin{aligned}
\pi^{oil} &= E_{t-1}(\pi_t^{oil}) + \varepsilon_t^{oil} \\
\pi^{metal} &= E_{t-1}(\pi_t^{metal}) + a_1 \varepsilon_t^{oil} + \varepsilon_t^{metal} \\
\pi^{food} &= E_{t-1}(\pi_t^{food}) + b_1 \varepsilon_t^{oil} + b_2 \varepsilon_t^{metal} + \varepsilon_t^{food} \\
y_t &= E_{t-1}(y_t) + c_1 \varepsilon_t^{oil} + c_2 \varepsilon_t^{metal} + c_3 \varepsilon_t^{food} + \varepsilon_t^y \\
\Delta e_t &= E_{t-1}(\Delta e_t) + d_1 \varepsilon_t^{oil} + d_2 \varepsilon_t^{metal} + d_3 \varepsilon_t^{food} + d_4 \varepsilon_t^y + \varepsilon_t^{\Delta e} \\
\pi_t^{im} &= E_{t-1}(\pi_t^{im}) + e_1 \varepsilon_t^{oil} + e_2 \varepsilon_t^{metal} + e_3 \varepsilon_t^{food} + e_4 \varepsilon_t^y + e_5 \varepsilon_t^{\Delta e} + \varepsilon_t^{im} \\
\pi_t^p &= E_{t-1}(\pi_t^p) + f_1 \varepsilon_t^{oil} + f_2 \varepsilon_t^{metal} + f_3 \varepsilon_t^{food} + f_4 \varepsilon_t^y + f_5 \varepsilon_t^{\Delta e} + f_6 \varepsilon_t^{im} + \varepsilon_t^p \\
\pi_t^c &= E_{t-1}(\pi_t^c) + g_1 \varepsilon_t^{oil} + g_2 \varepsilon_t^{metal} + g_3 \varepsilon_t^{food} + g_4 \varepsilon_t^y + g_5 \varepsilon_t^{\Delta e} + g_6 \varepsilon_t^{im} + g_7 \varepsilon_t^p + \varepsilon_t^c
\end{aligned} \tag{1}$$

where  $\varepsilon_t^{oil}$ ,  $\varepsilon_t^{metal}$ ,  $\varepsilon_t^{food}$ ,  $\varepsilon_t^y$  and  $\varepsilon_t^{\Delta e}$  are the shocks corresponding to supply, demand, and exchange rates.  $\varepsilon_t^{im}$ ,  $\varepsilon_t^p$  and  $\varepsilon_t^c$  are the shocks emerging from import, producer, and consumer price inflation, and  $E$  is expectation.<sup>4</sup>

In this study, aggregate demand is proxied by output gap, which is the gap between actual and potential output or the level of output consistent with nonaccelerating inflation. Actual output is real GDP, while potential output is proxied by the trend of real GDP, derived from the Hodrick-Prescott filter. Other methods, such as exponential smoothing and the Kalman filter, also provide virtually identical results, but the Hodrick-Prescott filter is selected here since it has performed most satisfactorily in terms of both explanatory and predictive power and diagnostic tests. Potential output is an exogenous variable in our model. Therefore, changes in the output gap purely reflect movements of aggregate demand. An increase in this variable thus implies an upward pressure of aggregate demand. In particular, a value of the output gap which is greater than 1 reflects excess aggregate demand.

The transmission mechanism of the model in determining sources of inflation is as follows. Suppose there is an exogenous shock from international oil prices. In the model, international metal

<sup>4</sup> In fact, the formation of inflationary expectations could have both backward-looking and forward-looking components (Mankiw, Reis, and Wolfers 2003 and Ball 2000). However, previous studies such as McCarthy (1999), Bhundia (2002), and Duma (2008) found that backward-looking expectations better explain domestic prices in developing Asia. In addition, we need to recognize that in developing Asia, we do not have as reliable forward-looking indicator as in industrial countries with well-developed financial systems.



and food prices would immediately adjust (on a quarterly basis in this study). Changes in international oil, metal, and food prices would affect aggregate demand, while the exchange rate would respond to commodity price hikes, as well as changes in aggregate demand. That is, the exchange rate adjusts as a result of changes in the balance of payments position. Changes in international oil and food prices, together with changes in the exchange rate, then affect import prices. This would result in an impact on producer and consumer price inflation, as well as on aggregate demand. Import prices affect consumer prices in two ways, directly— i.e., since some imported products are consumed directly— and indirectly through producer prices. In the next period, changes in consumer prices would feed back to aggregate demand, the exchange rate, import demand, and producer prices through their effect on expected inflation. Note that in this model, the degree of endogeneity increases as the order is moved down.

The model is estimated by covering the period Q1 2000 to Q2 2015. While our study also focuses on the effect of the recent world commodity price decline, i.e., since 2012 onward, on (producer and consumer) inflation, our data are divided into two subperiods, i.e., one is covering the whole sample size ( Q1 2000 to Q2 2015), while the other is covering the sample before the recent oil price decline (Q1 2000 to Q4 2011). Note that we cannot divide the whole sample into before and after the world commodity price slump since the data covered in the latter are not enough to perform reasonable estimation. Suppose that the pass-through effect of world oil prices on inflation is higher during the latter period than the former. This could imply that during the recent world oil price decline (2012 onward), its effect on inflation tend to be lower than that during the oil price surge.

The spot oil prices is from averaging three types of crude prices, including United Kingdom Brent (light), Dubai (medium), and West Texas Intermediate. Food prices are measured by the weighted average of 21 commodity prices, while metal prices are the weighted average of eight commodity prices, provided by the IMF's International Financial Statistics (IFS).<sup>5</sup> Bilateral and nominal effective exchange rates (trade weighted) are applied in the model to check the sensitivity of the results. The measure of import prices, measured in domestic currency, varies among economies. In Thailand, the unit value of imports is applied, while in Hong Kong, China; the Republic of Korea; and Singapore, the actual import price data are used. For India, Indonesia, Malaysia, and the PRC we use a deflator derived from quarterly imports of goods and services. It is important to note that due to data limitations import prices and producer prices are excluded from Viet Nam's estimations. The exclusion of these variables may lead to the underestimation of the pass-through of external shocks into inflation in these economies.

We obtained the data for oil, metal, food, consumer and producer prices, bilateral exchange rates from the IMF's IFS. Import prices of Hong Kong, China; the Republic of Korea; Singapore; and Thailand are from the IMF's IFS. The GDP data, exchange rate, and nominal effective exchange rate are from the CEIC database.

Based on the Augmented Dickey-Fuller, all variables were found to be nonstationary I(1), with the exception of output gap ( $y$ ), which exhibits stationary I(0) characteristics. No cointegration was found between the variables with the output gap entering as a stationary variable. Thus, the VAR

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<sup>5</sup> The 21 food commodity products comprise of bananas, 0.4%; cereals (maize, rice, and wheat), 3.6%; meat (beef, lamb, swine meat, and poultry), 3.7%; vegetable oils and protein meals (coconut oil, fishmeal, groundnuts, olive oil, palm oil, soybeans, soybean meal, soybean oil, and sunflower oil), 4.4%; seafood (fish and shrimp), 3.2%; oranges, 0.5%; and sugar, 0.9%. Metal prices are composed of aluminum, 3.9%; copper, 2.8%; iron ore, 1.3%; lead, 0.2%; nickel, 1.1%; tin, 0.2%; uranium, 0.5%; and zinc, 0.6%.

model was estimated in first differences to avoid the spurious regression problem. Diagnostic tests composed of the AR root test (stability condition), auto correlation LM test, normality test, and White heteroskedasticity test are applied. A visual inspection of the residuals is also performed to ensure that there are no major outliers. To determine the appropriate lag lengths, we apply the criteria provided by Akaike and Schwarz information criterion and diagnostic tests.

In order to measure the pass-through coefficients, impulse response functions are applied. Impulse response functions trace out the dynamic effects on prices originating from a one-time shock to the system, and accounts for disturbances of the other endogenous variables. Thus, the pass-through coefficients of oil (food) prices are obtained by dividing the cumulative impulse responses of each price index after  $j$  months by the cumulative response of the oil price after  $j$  months to the oil (food) price shock.

The relative importance of cost-push versus demand-pull factors in determining producer and consumer price inflation is explored through variance decomposition analysis, which separates the variation in endogenous variables—producer and consumer price inflation—into the component shocks in the VAR model. Of particular interest to us is the extent to which the oil and food price shocks account for the variation in inflation.

## V. EMPIRICAL RESULTS

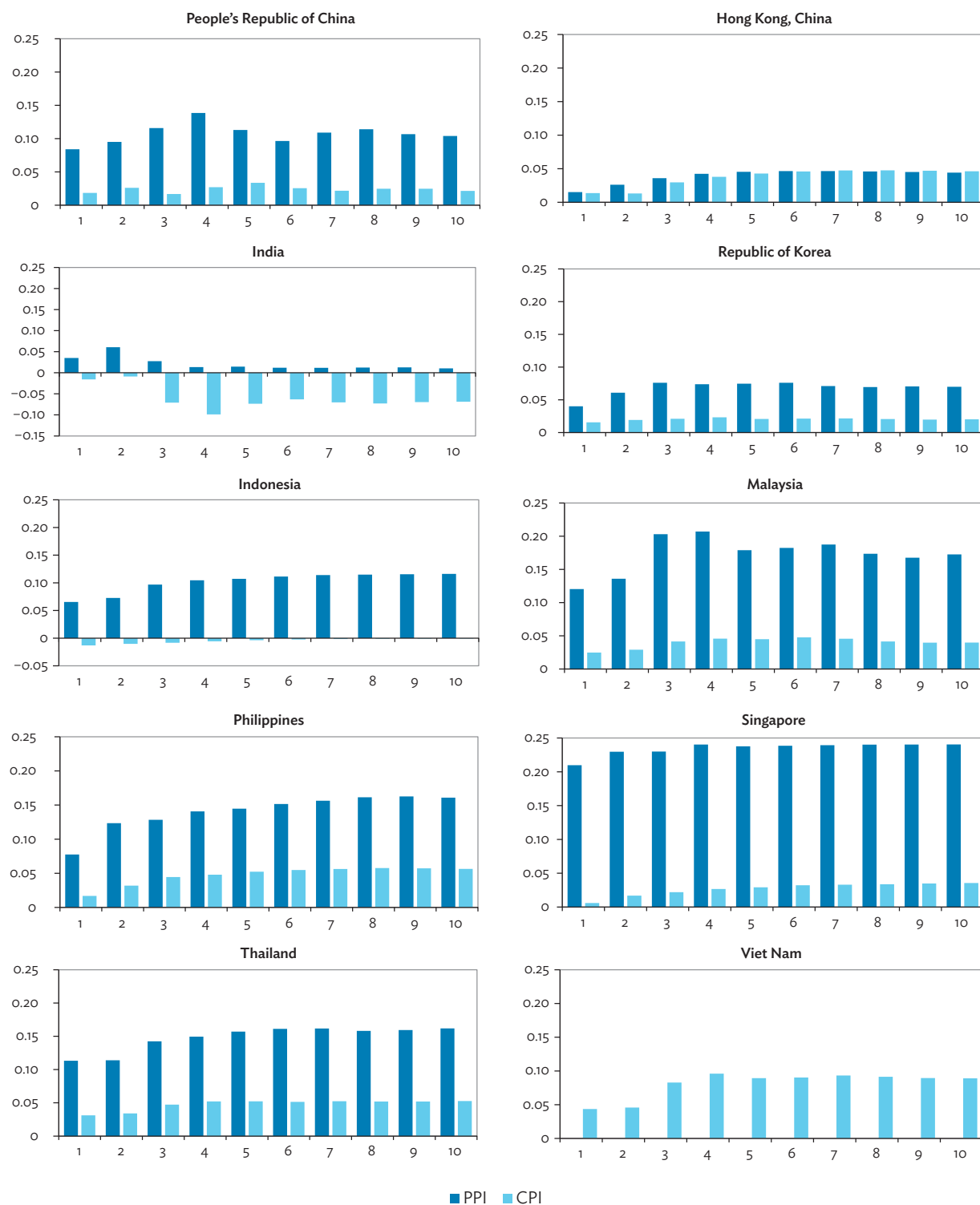
In this section, we report and discuss the results of our estimation of the pass-through coefficients of global oil and food prices and exchange rate, in addition to variance decomposition. In the first subsection, we report and discuss the results of the pass-through of global oil and food prices to domestic inflation. In the second subsection, we do the same for the pass-through of exchange rate. In the last subsection, we report and discuss the results of variance decomposition analysis, which seeks to assess the relative importance of the various inflation drivers.

### A. Pass-Through of Global Oil and Food Prices

First, the pass-through of oil prices to producer prices (using the whole sample) tends to be higher in oil-exporting economies than in oil-importing economies (Figure 6). In Malaysia, the pass-through to producers gradually increases from 0.12% in the first quarter to reach a cumulative total of 0.2% in the fourth quarter.<sup>6</sup> For other oil-importing economies, the cumulative annual pass-through of oil prices to producer prices is somewhat smaller. Singapore is an exceptional case in which the pass-through to producer prices is high due to high intensity of oil use in total energy consumption.<sup>7</sup> Table 1 shows that while the intensity of oil use in total energy consumption was almost 90% in Singapore, it was less than 50% for all the other economies. Although Indonesia, the PRC, and Thailand imported lower amount of oil than the Republic of Korea and Hong Kong, China, the pass-through of world oil price changes to producer prices tends to be higher in the former economies. This could be due to superior energy efficiency of the latter economies. In India, relatively low pass-through to producers could be due to government policy measures such as fuel subsidies and price controls.

<sup>6</sup> Cumulative pass-through refers to the total pass-through after a specified time period. For example, if the pass-through after 1 quarter is -0.03 and the pass-through during the second quarter is 0.08, then the cumulative pass-through after two quarters is 0.05.

<sup>7</sup> The high pass-through of oil prices in Singapore may also be due to the fact that the country reexports a lot of refined products.

**Figure 6: Pass-Through of Oil Prices (Producer and Consumer during 2000–2015)**

CPI = consumer price index, PPI = producer price index.  
Source: Author's calculation.

Second, the impact of crude oil price changes on domestic prices is diluted along the distribution chain. The pass-through coefficients tend to be lower for consumer prices than producer prices. This could be due to the fact that the share of oil and oil-related products is higher in producer prices than in consumer prices. As shown in Table 2, the share of fuel and possible petroleum-related products in producer prices tends to be more than 50% while in consumer prices, the share is approximately around 30%. More generally, the share of tradable products is higher in producer prices.

The gap between these two price indices in each economy depends on the ability of firms to pass higher costs onto consumers. For example, in the face of intense market competition, private producers may cut their profit margins instead of immediately charging higher prices to consumers. Government policy measures—e.g., fuel subsidies, electricity subsidies, and price controls—which aim to mainly help consumers may reduce or delay the pass-through of oil price changes to consumer price inflation, and increase the gap between producer and consumer prices. Figure 6 shows that the gap between pass-through to producer prices and pass-through to consumer prices is limited in Hong Kong, China; the PRC; India; and Thailand compared to the other economies.

Third, the degree of oil price pass-through to consumer prices is higher for countries with limited government intervention in energy and energy-related sectors, e.g., fuel subsidies/tax, price control. Within a group of four economies with comparable energy efficiency levels (Table 1), pass-through to consumer prices is higher in Singapore and Malaysia—about 0.03%–0.05% after 1 year—than in Indonesia and India—i.e., –0.006% and –0.1%, respectively. The level of energy efficiency is relatively comparable between Thailand and the PRC—i.e., total energy consumption to GDP in 2011 was around 24%. However, due to government intervention and lower intensity of oil use, the pass-through coefficient is slightly higher in Thailand. In the Philippines, energy efficiency is far better than Thailand, but because of higher intensity of oil use, the pass-through of oil price change is still comparable to Thailand. The Republic of Korea is an exceptional case in the sense that the low pass-through to consumer prices is due to superior energy efficiency rather than fuel subsidies.

Table 1: Oil Self-Sufficiency, Intensity of Oil Use, and Energy Efficiency

Region/Economy	Oil Self-Sufficiency					Intensity of Oil Use (%)					Energy Efficiency				
	1995	2003	2005	2010	2013	1995	2003	2005	2010	2012	1995	2003	2005	2010	2011
United States	-0.5	-0.6	-0.7	-0.6	-0.5	37.8	39.6	40.3	36.9	36.4	10.0	8.3	7.9	7.5	7.3
Euro zone	-0.6	-0.6	-0.7	-0.7	-0.8	41.5	40.1	39.6	37.6	36.5	6.5	5.8	5.7	5.4	5.1
Japan	-1.0	-1.0	-1.0	-1.0	-1.0	55	49.5	47.6	40.9	46.9	5.1	5.1	5.0	4.8	4.6
East Asia(excluding Japan)	-0.5	-0.6	-0.6	-0.7	-0.7	29.6	28.9	26.7	23.2	23.0	27.1	18.3	17.7	16.6	15.9
PRC	-0.1	-0.4	-0.4	-0.5	-0.6	20.3	22.9	21.6	19.3	19.7	36.9	27.1	28.5	24.7	24.7
Hong Kong, China	-1.0	-1.0	-1.0	-1.0	-1.0	62.6	61.5	63.1	67.9	62.7	4.9	6.3	6.3	6.3	5.7
Republic of Korea	-1.0	-1.0	-1.0	-1.0	-1.0	66	51.7	49.2	42.9	41.5	11.6	11.2	10.9	10.6	10.7
Taipei,China	-1.0	-1.0	-1.0	-1.0	-1.0	55	45.6	43.9	43	39.9	12.0	13.0	12.2	11.0	10.4
Southeast Asia	-0.1	-0.2	-0.3	-0.5	-0.5	62.7	56.6	57.6	51.7	52.0	14.5	15.9	16.5	16.3	17.0
Indonesia	0.9	0.1	-0.1	-0.3	-0.4	52.1	57.1	57.8	47.9	53.2	14.8	16.1	16.0	16.6	15.7
Malaysia	0.8	0.7	0.5	0.2	0.0	56.4	43.5	45.7	40.9	42.9	17.0	18.1	16.6	17.7	17.5
Philippines	-1.0	-1.0	-0.9	-0.9	-0.9	76.8	57.9	55.1	51.6	48.1	13.1	12.8	11.3	9.3	9.2
Singapore	-1.0	-1.0	-1.0	-1.0	-1.0	95.0	87.8	88.6	89.0	87.9	15.9	15.8	17.2	16.8	17.0
Thailand	-0.9	-0.7	-0.7	-0.7	-0.6	67.2	53.5	55.1	47.8	44.4	15.7	20.2	21.3	21.3	23.0
Viet Nam	0.9	0.7	0.5	-0.1	-0.1	39.2	45.5	44.2	41.1	39.5	19.3	21.6	23.7	27.3	28.3
South Asia	-0.6	-0.7	-0.7	-0.8	-0.8	28.9	34.5	32.0	29.4	30.8	17.0	16.0	15.0	18.7	17.4
India	-0.5	-0.7	-0.7	-0.7	-0.7	28.4	34.0	31.6	29.3	30.6	25.7	20.0	19.7	18.3	17.5
Sri Lanka	-1.0	-1.0	-1.0	-1.0	-1.0	68.7	82.0	83.2	76.2	85.0	9.3	9.2	9.0	7.3	7.5
Pacific	2.7	0.1	1.6	2.0	1.5	76.4	82.4	82.8	77.8	77.0	6.7	7.8	8.2	6.9	6.6
Central Asia	-0.2	0.8	1.1	1.9	1.5	31.1	25.7	24.3	23.6	22.0	85.6	65.0	58.5	38.8	39.7
World	0.0	0.0	0.0	0.0	0.0	39.1	38.3	37.6	34.7	34.6	18.7	16.5	15.7	13.9	13.6

PRC = People's Republic of China.

Notes: The oil self-sufficiency index is oil production less consumption, divided by consumption; a positive number indicates some degree of self-sufficiency. If there is no domestic oil production the index is equal to -1. Intensity of oil use in energy consumption is petroleum consumption divided by total energy consumption. Energy intensity of GDP is total energy consumption in (1,000) BTU per US dollar of GDP (in 2000 prices).

Source: Energy Information Administration. 2005. International Energy Annual 2003. Washington, DC. <http://www.eia.doe.gov/emeu/international/oilconsumption.html>

Table 2: The Basket of Producer and Consumer Prices in Selected Asian Countries

	India		Republic of Korea		Malaysia		Singapore		Thailand	
	PPI	CPI	PPI	CPI	PPI	CPI	PPI	CPI	PPI	CPI
All items										
<b>Primary</b>	20.1	48.2	3.5	25.7	6.7	32.5	3.2	21.7	10.9	33.5
<b>Fuel and power</b>	14.9	6.8	6.4		19.9		22.2			
<b>Manufactured products</b>	65.0		56.7						86.1	
Food products	10.0		3.8						14.3	
Clothing and footwear	7.3	6.5	2.4	6.6	11.3	3.4	4.4	2.7	4.7	3.1
Rubber and plastic products	3.0								4.3	
Coal and petroleum products			3.7						8.4	
Chemicals and chemical products	12.0		9.8		8.2		23.4		4.8	
Nonmetallic mineral products	2.6		1.9						2.5	
Basic metals, alloys and metal products	10.7		12.2						3.4	
Machinery and machine tools	8.9		9.0						27.7	
Transport equipment and parts	5.2		6.7		33.9		39.0		7.8	
<b>Nontradable</b>										
Housing and furnishing		10.1								
Electricity, gas and other fuels				21.1		26.7		31.3		29.0
Health				7.3		1.3		6.2		6.5
Transport				11.1		14.9		15.8		17.7
Communication				5.9		5.7		3.9		4.1
Recreation and culture				5.3		4.6		7.9		
Education				10.4		1.4		6.2		6.0
Restaurants and hotels						3.2				
Others	5.2	28.3	33.5	6.5	20.0	6.3	7.9	4.5	11.2	0.1

CPI =consumer price index, PPI = producer price index.

Note: There are only five countries where information about both PPI and CPI basket is available.

Sources: Countries' National Statistics Office.

Fourth, our results show that the pass-through coefficient of world oil prices to *producers* become higher in Malaysia, the PRC, India, and the Republic of Korea when our sample period includes the recent global oil price decline (i.e., 2012 onward) (Figure 7). This implies that the effect of global oil prices on producer prices is higher during the recent price decline than during the preceding period of high prices. In Malaysia, the PRC, and India, this could be due to the government policies that reduce distortion in energy and energy-related sectors. For example, in the PRC, the tax on gasoline, naphtha, solvent oil, and lubricating oil was increased to CNY1.52 (about \$0.25) per liter in January 2016 from CNY1.4. The levy on diesel, jet fuel, and fuel oil will be increased from CNY1.1 per liter to CNY1.2. This will be the third increase in as many months, following one in November 29 and another in December 13. Meanwhile, government reduced the windfall profit tax to accommodate struggling producers. The windfall tax on output increased to \$65 a barrel, from \$55, starting January 2015, and is expected to increase to \$75 in a year. This aligns domestic oil prices more closely with global oil prices.

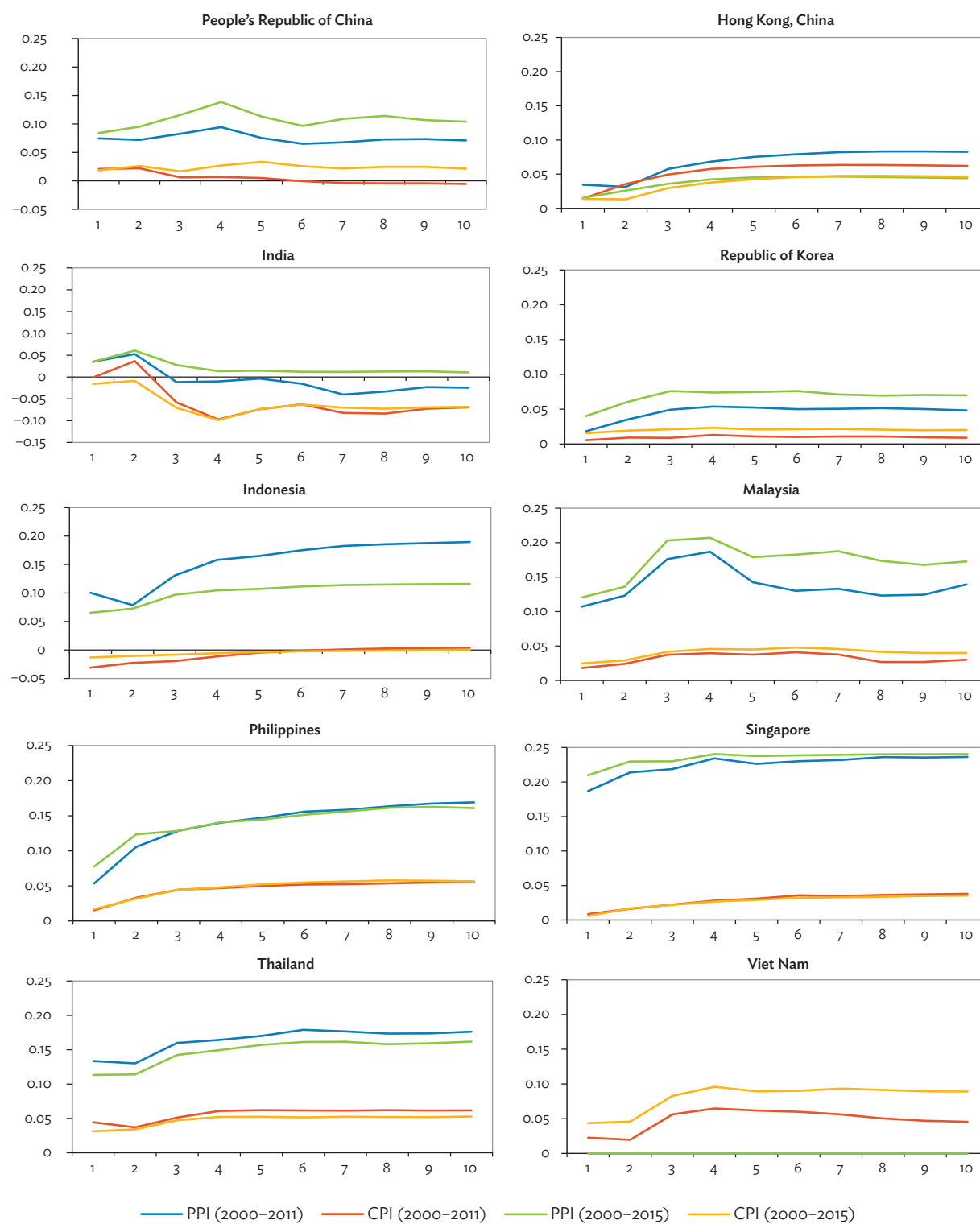
In Malaysia, the government has reduced fuel subsidies to improve its fiscal position. The Indian government axed expensive diesel subsidies and raised the excise duty on petrol and diesel. In the Republic of Korea, the higher pass-through of oil prices to producers might mainly be due to the nature of price adjustment in the country, i.e., more rigidity upward than rigidity downward. The Korean government imposed a tax on coal used for power generation and lowered taxes on fuels used for cooking and heating on 1 July 2014. The government imposed a tax of W17 (\$0.02) per kilogram on coal with a net calorific value below 5,000 kilocalories per kilogram, and W19 per kilogram on coal above 5,000 kilocalories per kilogram. It reduced the consumption tax for LNG to W42 per kilogram from W60, fuel oil to W63 per liter from W90, and propane gas for households and industrial sectors to W14 per kilogram from W20. Not surprisingly, in these countries, there is also evidence of higher pass-through for *consumer* prices (Figure 7).

In Viet Nam, the higher pass-through of oil prices to consumers during the world oil price decline could be due to two factors. First, Viet Nam has become a net oil importer since 2010. Second, although the government raised tariff caps on imports of fuel, petrol, and diesel products in December 2014, in May 2015 the government cut import tariffs on some oil products in an effort to trim prices and support businesses. Import duty on diesel was cut to 10% from the 12% set on 4 May, while tax on kerosene fell 7 percentage points to 13% and fuel oil tariff was cut to 10% from 13%.<sup>8</sup>

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<sup>8</sup> See the details in <http://www.reuters.com/article/idUSL3N0TO3LV20141204> and <http://www.reuters.com/article/vietnam-petrol-idUSL3N0YB4CA20150520>

Figure 7: Compare Pass-Through of Oil Prices between 2000–2015 and 2000–2011



CPI = consumer price index, PPI = producer price index.

Source: Authors' calculation.



For the Philippines and Singapore, the pass-through to producers and consumers did not increase during the recent global oil price decline. This could reflect no significant adjustments in policy measures relating to energy and energy-related sectors and more or less stable oil use intensity and energy efficiency (Table 1). Interestingly, the pass-through to producers has become lower in Indonesia; Hong Kong, China; and Thailand. In fact, Indonesian government has gradually cut back on subsidies in recent years (10%–15% per year during 2011–2014) as have Malaysia and India. The government now sets prices for subsidized low-octane gasoline and diesel each month based on international crude oil prices and the performance of the Indonesian rupiah against the US dollar. The government now provides direct subsidies to poor people (around 15.5 million households) (Thaipost 2013). The nature of price setting, i.e., downward rigidity, and direct subsidies provided by the government may explain the lower pass-through evident during the decline in world oil prices. Note that Indonesia is the only country in our sample where producer prices in the first half of 2015 *increased*. (Figure 1). The pass-through to consumer prices is comparable between high and low world oil price periods.

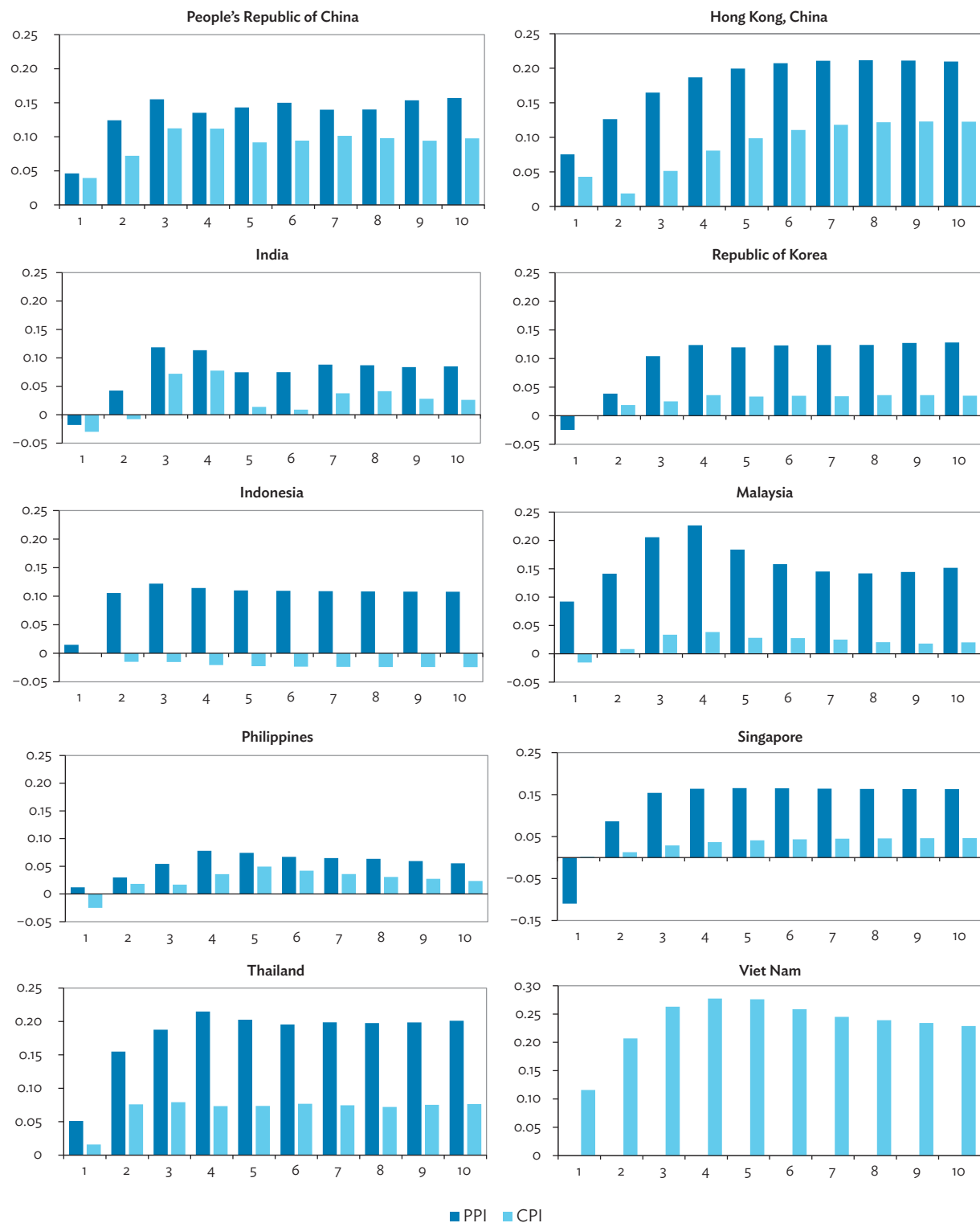
In Thailand, the slightly lower pass through to both producer and consumer prices may be due to the increase in the rate of oil fund and excise tax. During the oil price escalation (2008–2009), the rate of oil fund was around 7 baht per liter. Then the rate was adjusted to 10 baht per liter and 6.2 baht per liter in 2013 and 2015, respectively. Excise tax increased from 3.6 baht per liter to 7 baht per liter and 5.6 baht per liter, during the same period.<sup>9</sup> In Hong Kong, China, the low pass-through might be due to the fact that there was a decline in intensity of oil use and improvement in energy efficiency (Table 1). There were no significant policy changes.

Fifth, the pass-through of world food price change to *producer prices* is higher in food-exporting economies than in food-importing economies for the whole sample period. The higher pass-through gives farmers incentives to expand production during world price increases. The immediate pass-through coefficients are 0.09% in Malaysia; 0.5% in Thailand; 0.04% in the PRC but in the Philippines, the Republic of Korea, and Singapore, they are 0%, –0.02%, and –0.11%, respectively (Figure 7). The pass-through gradually increases in both exporting and importing economies. The cumulative pass-through after 1 year increases to 0.23% in Malaysia, 0.21% in Thailand, and 0.14% in the PRC, while the pass-through is around 0.11%–0.16% in importing economies. Interestingly, the immediate pass-through coefficient of India is negative, though India is a net exporter. This may reflect government subsidies, including for wheat. Meanwhile, during the world food price decline, the government imposed higher tariff on vegetable oil imports to help domestic producers. These policies tend to limit the pass-through to producers in the country. In Hong Kong, China, a net food importer, the pass-through is relatively high, compared to other importers such as the Republic of Korea, Singapore, and the Philippines. The immediate pass-through is 0.07% and the cumulative pass-through after 1 year is 0.19%. This may be due to absence of duty on imported agricultural and seafood products.

Sixth, as was the case for world oil prices, the impact of world food prices on domestic prices is diluted along the distribution chain (Figure 8). The pass-through tends to be lower for consumer prices than producer prices. However, the gap between the two prices is higher for food prices than for oil prices. For example, in Thailand, the cumulative pass-through to producers after 1 year is 0.21%, while it is only 0.07% for consumers. The corresponding figures are 0.23% versus 0.04% for Malaysia, 0.11% versus –0.02% for Indonesia, 0.12% versus 0.04% for the Republic of Korea, and 0.07% versus 0.03% for the Philippines. Possibly, price controls and direct subsidies to households limit the ability of firms to pass costs on to consumers.

<sup>9</sup> Data are available at <http://www.eppo.go.th/petro/price/index.html>

**Figure 8: Pass-through of Food Prices (Producer and Consumer during 2000–2015)**



CPI = consumer price index, PPI = producer price index.

Source: Authors' calculation.

Seventh, the pass-through of world food prices to both *producers and consumers* become lower in all economies when our sample period includes the recent global food price declines (i.e., 2012 onward) (Figure 9). This implies that the impact of global food prices on producer and consumer prices has declined during the recent food price slump. The nature of price adjustment mechanism, i.e., downward price rigidity, and policy measures to protect domestic producers tend to limit the pass-through. For example, Indian government imposed higher import tariff on vegetable oils to protect domestic producers from cheaper oil imports from Malaysia and Indonesia. In August 2013, the Indian Parliament approved the food security law, heavily subsidizing food for poor people.<sup>10</sup> In the Republic of Korea, subsidy levels rose since 2012 and government support now accounts for 54% of farmers' income. Most producer support is commodity specific and targets a small number of products, including rice. In some products, such as rice, tariffs have risen to the highest levels allowed by the World Trade Organization agriculture agreement.<sup>11</sup> The Malaysian government has decided to temporarily exempt the 4.5% export tax on crude palm oil in late 2014. The move is aimed at boosting crude palm oil exports and reducing stocks, to boost local palm oil prices.<sup>12</sup> Indonesia also cut export tax for some key agriculture products, including palm oil. Rice subsidies remain in Thailand and Viet Nam. In Viet Nam, protectionist measures against some imported agriculture products such as vegetables oil still remain.<sup>13</sup>

## B. Exchange Rate Pass-Through

The pass-through of exchange rate, measured in terms of NEER, tends to be higher for producer than consumer prices in all Asian economies (Figure 10). The higher pass-through to producer prices could be due to the nature of producer price, which is dominated by tradable products, in contrast to consumer prices, which is dominated by nontradable products. However, even for producer prices, our study found the incomplete pass-through of exchange rate in all countries. This could be due to either shifts in the marginal cost curve associated with higher cost of imported inputs or changes in strategic pricing behavior of firms. The latter means that exporting firms aims to protect market share during currency appreciation by lowering prices and augment profit margins during currency depreciation. Likewise, importing firms might lower prices when currency depreciates to protect market share and augment profit margins during currency appreciation.

The exchange rate pass-through tends to be higher in countries implementing relatively flexible exchange rate regimes. Exchange rate pass-through tends to be higher in the Republic of Korea, Indonesia, the Philippines, and Thailand (Figure 10). Viet Nam is an exception since exchange rate pass-through is high despite rigid exchange rate regime.

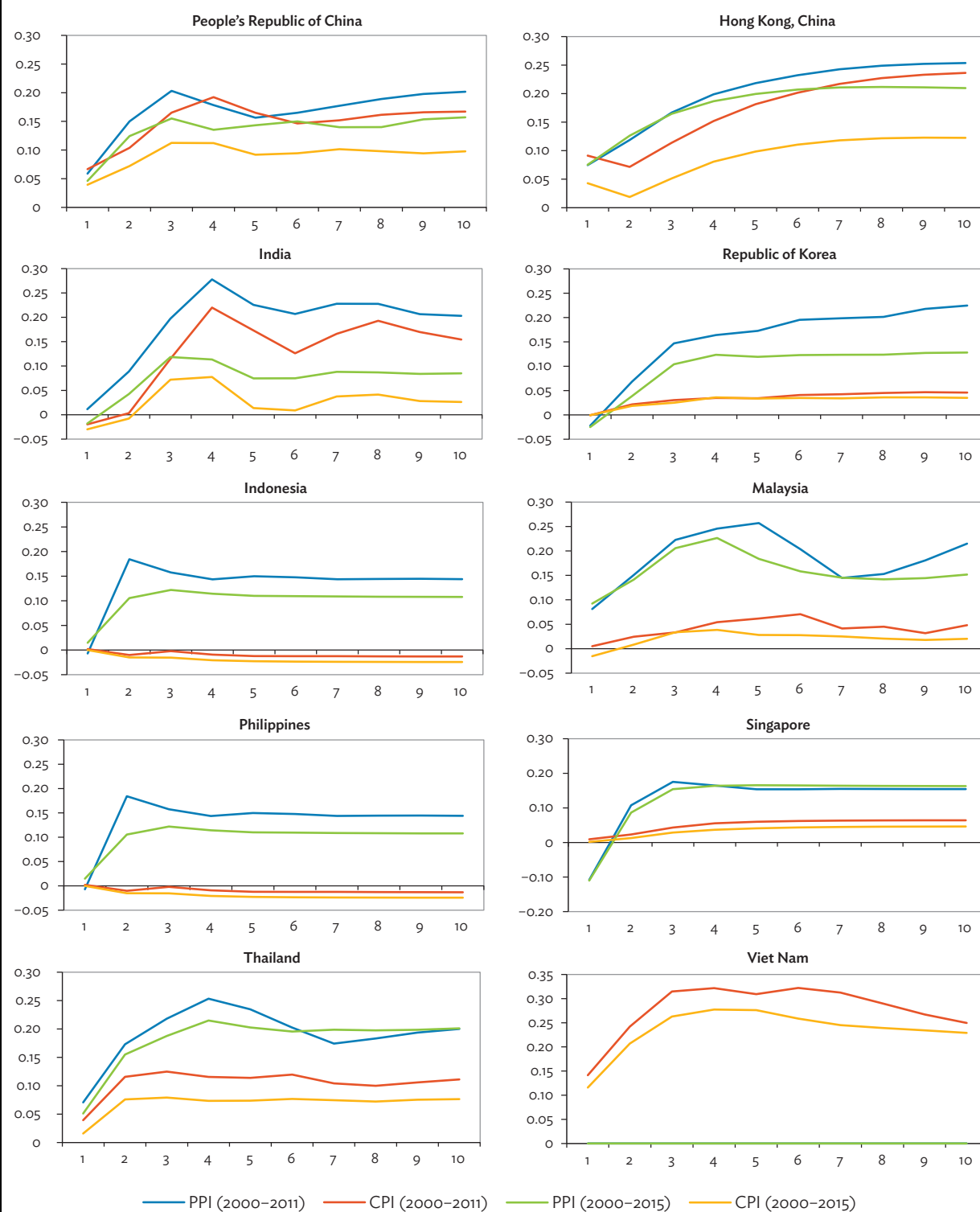
<sup>10</sup> See details at [http://india.blogs.nytimes.com/2013/07/04/indias-cabinet-passes-food-security-law/?\\_r=0](http://india.blogs.nytimes.com/2013/07/04/indias-cabinet-passes-food-security-law/?_r=0)

<sup>11</sup> <http://www.koreaherald.com/view.php?ud=2013102800077>

<sup>12</sup> <http://www.globaltimes.cn/content/737981.shtml>

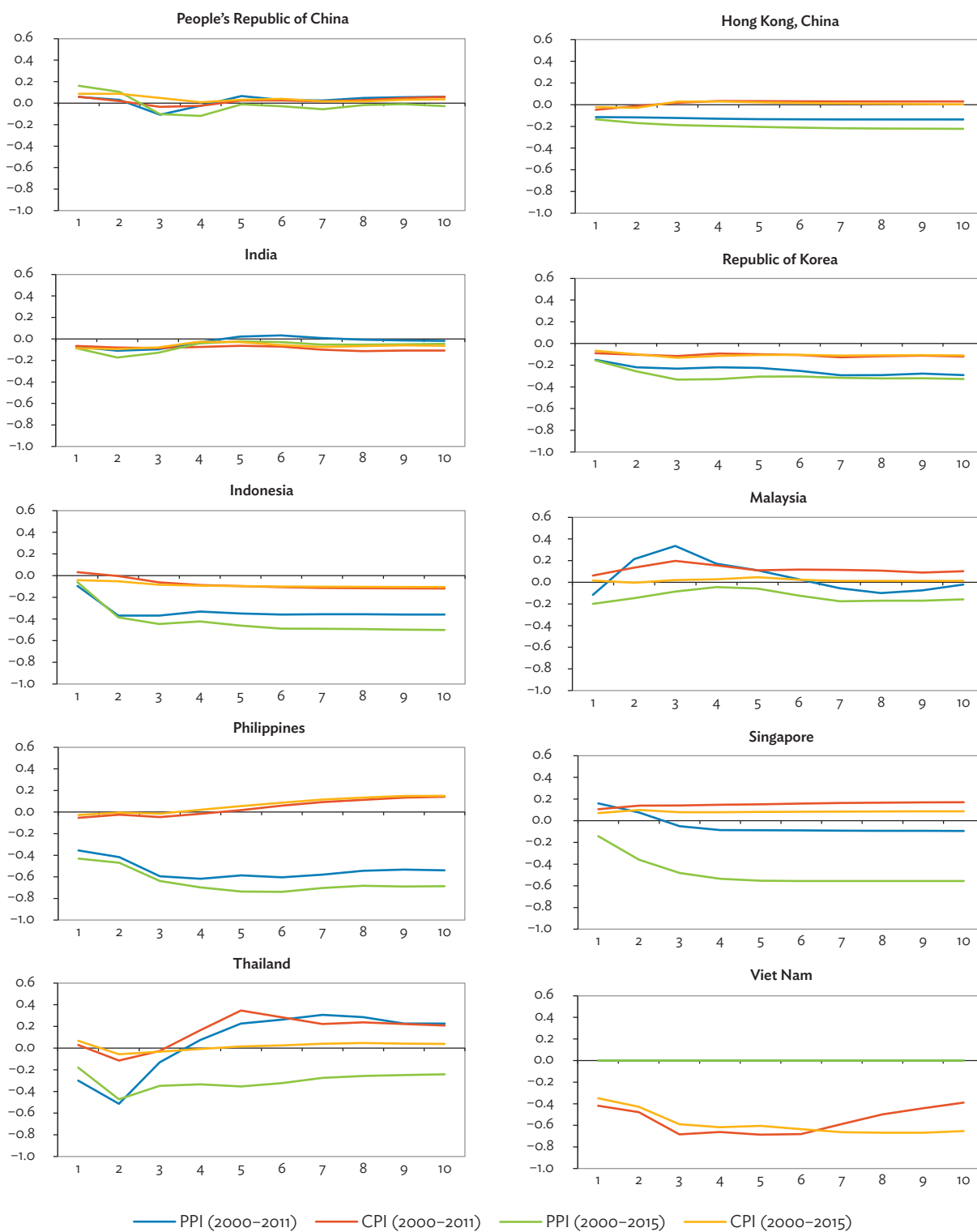
<sup>13</sup> <http://vietnamnews.vn/economy/274400/import-tariff-on-vegetable-oil-imports-to-remain-in-place.html>

**Figure 9: Compare Pass-Through of Food Prices between 2000–2015 and 2000–2011**



CPI = consumer price index, PPI = producer price index.

Source: Authors' calculation.

**Figure 10: Compare Pass-Through of Exchange Rate between 2000–2015 and 2000–2011**

CPI = consumer price index, PPI = producer price index.

Source: Authors' calculation.

Lastly, the pass-through of exchange rate to *producer prices* becomes higher in all economies, when our sample period includes the recent world commodity price declines (i.e., 2012 onward) (Figure 10). The higher pass-through could partly reflect firm pricing strategy in the context of declining world commodity prices. Interestingly, since 2012, the NEER of the 10 Asian economies, except India, Viet Nam, Indonesia, and Malaysia, appreciated (Figure 3). The higher pass-through amplifies the effect of currency appreciation. The NEER was stable in India, Viet Nam, and Malaysia, but clearly depreciated in Indonesia. The depreciation can cushion the decline in producer price inflation, which still remains positive in Indonesia. The pass-through of exchange rate to consumer prices is relatively quite stable in all economies, reflecting the inability of firms to pass costs onto consumers.

### C. Variance Decomposition

In this section, we report and discuss the results of our variance decomposition analysis for the full sample period. The analysis seeks to assess the relative importance of various inflation drivers. It is conceptually useful to distinguish between cost-push and demand-pull drivers of inflation. The main cost-push factors are global oil and food prices, and the main demand-pull factors are excess aggregate demand, proxied by the output gap, and inflationary expectations, which are a function of lagged domestic inflation.

Table 3 suggests that external cost-push factors are more important in explaining producer price inflation than consumer price inflation. These factors account for about 32% of the variation in producer price inflation but explain only around 20% of the variation in consumer price inflation. Except India; Indonesia; the Republic of Korea; and Hong Kong, China, oil prices tend to dominate the movements of producer price inflation in the region. In economies where exchange rates are relatively stable—i.e., Malaysia and Singapore—international oil prices explain about one-half of producer price inflation.

Due to the high proportion of food in consumption basket, food prices tend to be more important in explaining consumer price inflation in almost all economies (Table 4). In particular, in Viet Nam, food prices explain 35%, whereas oil prices explain less than 7%. The Republic of Korea, the Philippines, and Malaysia are exceptions, with oil prices explaining more.

Note that the relative importance of nonexternal and external factors in explaining producer price inflation differs substantially across Asian economies (Table 3). For Malaysia, the Republic of Korea and Singapore, external factors explain more of producer price variation, while in the other economies, nonexternal factors, i.e., excess demand and inflation expectations, have greater explanatory power.

Second, two nonexternal factors, namely excess aggregate demand and inflationary expectations, still explain much of *consumer price* inflation in the 10 Asian economies (Table 4). Over a year, more than 55% of the variation in consumer prices is explained by inflationary expectations and, in some economies, they explain around 30%–45%. Almost 35% of consumer price inflation variation in Singapore is explained by demand pressures, and the corresponding figure is almost 10% in the Philippines, the PRC, Indonesia, and the Republic of Korea. Demand pressures explain less than 5% in the rest. On average, the two nonexternal factors jointly explain about 53% of consumer price inflation in the region. These results imply that the region's disinflation is not entirely due to outside forces.

Nonexternal factors, especially *inflationary expectations*, are still more important than external shocks as sources of Asian inflation, and this has significant implications for monetary policy in the region.<sup>14</sup>

**Table 3: Variance Decomposition of PPI**

			Oil	Metal	Food	NEER	Import Prices	Output Gap	PPI	CPI
PRC	2000–2015	1 Year	13.78	6.30	9.34	6.91	0.00	1.23	52.19	10.24
		2 Year	14.40	6.16	8.89	7.89	0.00	1.38	50.53	10.75
	2000–2011	1 Year	11.17	7.73	17.47	3.79	0.00	3.87	48.95	7.01
		2 Year	11.51	7.92	16.96	4.72	0.00	4.02	47.35	7.52
Hong Kong, China	2000–2015	1 Year	5.65	6.85	25.89	3.54	7.11	2.45	48.49	0.02
		2 Year	5.59	6.78	25.82	3.54	7.17	3.30	47.77	0.03
	2000–2011	1 Year	6.64	8.90	30.91	2.62	8.13	4.91	37.72	0.17
		2 Year	6.44	8.65	30.54	2.55	8.96	6.14	36.56	0.17
India	2000–2015	1 Year	12.01	2.25	18.02	11.09	8.38	3.84	36.17	8.25
		2 Year	11.31	3.19	18.47	10.87	8.22	3.79	35.91	8.24
	2000–2011	1 Year	11.80	6.91	27.49	6.36	16.74	1.10	20.60	9.01
		2 Year	11.79	7.39	26.48	7.31	15.67	1.24	19.25	10.86
Republic of Korea	2000–2015	1 Year	13.00	10.30	14.60	17.46	12.33	7.92	13.64	10.75
		2 Year	13.10	10.05	14.17	16.92	12.32	9.66	13.22	10.56
	2000–2011	1 Year	4.82	11.77	25.87	8.34	9.64	5.86	13.56	20.16
		2 Year	4.98	11.33	24.58	8.40	10.15	7.29	13.15	20.12
Indonesia	2000–2015	1 Year	11.78	4.87	18.44	16.39	3.10	2.86	40.69	1.87
		2 Year	10.46	5.17	16.86	16.40	2.80	3.12	41.54	3.66
	2000–2011	1 Year	10.98	9.07	17.42	11.63	3.69	12.22	30.65	4.33
		2 Year	10.15	8.32	16.24	12.18	4.54	11.90	31.15	5.53
Malaysia	2000–2015	1 Year	47.19	9.42	11.77	4.08	0.18	0.55	19.48	7.32
		2 Year	46.52	9.04	12.56	4.44	0.51	0.69	18.86	7.38
	2000–2011	1 Year	22.88	31.85	16.21	8.73	3.11	2.18	12.69	2.35
		2 Year	22.22	29.83	18.12	9.10	3.10	4.06	11.47	2.09
Philippines	2000–2015	1 Year	18.63	0.72	1.01	21.24	0.78	2.22	53.19	2.21
		2 Year	18.13	1.41	1.02	20.56	1.03	4.88	50.85	2.13
	2000–2011	1 Year	16.93	3.74	3.03	15.90	2.61	1.86	53.62	2.31
		2 Year	16.46	4.56	3.22	14.98	2.81	6.18	49.60	2.19
Singapore	2000–2015	1 Year	49.58	3.71	10.55	4.92	18.18	3.64	5.51	3.91
		2 Year	48.78	3.98	10.58	5.13	18.11	3.80	5.65	3.96
	2000–2011	1 Year	41.21	5.13	7.29	1.04	30.65	4.45	6.61	3.62
		2 Year	40.23	5.29	7.54	1.25	30.58	4.58	6.71	3.83
Thailand	2000–2015	1 Year	19.66	5.99	8.50	7.74	15.21	2.51	32.77	7.63
		2 Year	19.53	6.04	8.43	7.95	15.08	2.78	32.57	7.63
	2000–2011	1 Year	22.52	7.10	3.59	9.69	14.27	1.87	35.20	5.76
		2 Year	21.80	7.58	3.78	9.53	13.98	2.82	34.11	6.40
Viet Nam	2000–2015	1 Year	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		2 Year	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2000–2011	1 Year	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		2 Year	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CPI = consumer price index, NEER = nominal effective exchange rate, PPI = producer price index, PRC = People's Republic of China.  
Source: Authors' estimation.

<sup>14</sup> Without the zero-bound interest rate problem in the Asian region, the conventional monetary policy, i.e., interest rate channel, is the key policy tool for the central bank.

Table 4: Variance Decomposition of CPI

			Oil	Metal	Food	NEER	Import prices	Output gap	PPI	CPI
PRC	2000–2015	1 Year	5.93	4.09	16.48	5.03	0.00	8.51	25.59	34.36
		2 Year	6.32	4.53	16.53	5.27	0.00	8.80	24.82	33.74
	2000–2011	1 Year	5.51	4.52	27.84	2.74	0.00	15.12	17.64	26.63
		2 Year	5.20	6.18	26.62	3.61	0.00	14.46	18.47	25.45
Hong Kong, China	2000–2015	1 Year	5.65	6.85	25.89	3.54	7.11	2.45	48.49	0.02
		2 Year	5.59	6.78	25.82	3.54	7.17	3.30	47.77	0.03
	2000–2011	1 Year	6.64	8.90	30.91	2.62	8.13	4.91	37.72	0.17
		2 Year	6.44	8.65	30.54	2.55	8.96	6.14	36.56	0.17
India	2000–2015	1 Year	6.89	5.97	10.23	3.35	9.02	1.37	16.01	47.16
		2 Year	7.30	5.81	13.91	3.42	8.39	1.54	16.40	43.23
	2000–2011	1 Year	12.65	4.52	13.42	1.47	17.91	3.30	5.62	41.12
		2 Year	12.86	4.69	14.82	1.60	17.21	3.43	5.84	39.56
Republic of Korea	2000–2015	1 Year	7.64	11.67	4.41	12.45	7.93	5.40	3.89	46.60
		2 Year	7.76	11.19	4.31	11.90	8.00	7.35	3.76	45.73
	2000–2011	1 Year	2.12	12.16	5.81	11.90	10.11	4.48	2.02	51.39
		2 Year	2.25	11.02	5.51	11.56	9.83	6.65	2.16	51.03
Indonesia	2000–2015	1 Year	2.77	3.13	5.78	1.04	5.08	6.76	15.67	59.78
		2 Year	2.80	3.58	6.57	2.80	4.82	6.93	16.33	56.17
	2000–2011	1 Year	14.48	3.79	4.44	1.20	7.52	9.55	7.53	51.48
		2 Year	13.32	4.30	5.00	3.80	7.21	11.64	8.13	46.60
Malaysia	2000–2015	1 Year	24.71	7.96	11.23	1.45	1.23	3.05	4.32	46.05
		2 Year	24.24	7.73	11.54	2.50	2.21	3.03	4.76	43.99
	2000–2011	1 Year	10.06	32.50	7.46	11.01	10.26	1.39	1.56	25.76
		2 Year	8.81	30.52	8.99	9.76	17.12	1.92	1.56	21.31
Philippines	2000–2015	1 Year	20.84	2.78	4.76	4.16	2.65	7.14	1.56	56.12
		2 Year	16.54	7.24	3.64	7.07	3.25	19.14	1.27	41.86
	2000–2011	1 Year	17.21	5.56	5.90	5.78	3.32	10.90	5.20	46.14
		2 Year	12.37	13.25	4.23	8.26	3.26	23.24	4.08	31.30
Singapore	2000–2015	1 Year	6.12	0.37	6.29	1.94	4.04	35.41	4.70	41.14
		2 Year	5.72	0.41	6.02	2.46	5.24	35.43	5.38	39.34
	2000–2011	1 Year	5.71	2.99	5.76	8.19	11.06	22.95	2.74	40.60
		2 Year	5.25	2.52	7.10	7.01	13.18	20.90	2.88	41.16
Thailand	2000–2015	1 Year	11.25	3.29	17.22	5.69	18.43	1.46	7.74	34.92
		2 Year	11.16	3.32	17.19	5.83	18.45	1.79	7.68	34.58
	2000–2011	1 Year	16.65	3.70	10.80	8.95	11.97	5.17	10.55	32.22
		2 Year	16.02	4.66	10.47	8.93	11.89	5.29	10.36	32.37
Viet Nam	2000–2015	1 Year	4.64	8.47	36.06	17.80	0.00	1.47	0.00	31.56
		2 Year	4.48	8.72	35.66	17.62	0.00	2.93	0.00	30.59
	2000–2011	1 Year	2.45	7.70	30.02	17.53	0.00	10.33	0.00	31.98
		2 Year	2.16	10.40	27.70	15.78	0.00	16.25	0.00	27.71

CPI = consumer price index, NEER = nominal effective exchange rate, PPI = producer price index, PRC = People's Republic of China.  
Source: Authors' estimation.

Third, exchange rate has a bigger effect on PPI than CPI. This is consistent with what we found in the pass-through analysis. However, exchange rates have weaker explanatory power for both PPI and CPI than commodity price changes.

Fourth, oil prices became more important in explaining the variation of both producer and consumer inflation during the recent world commodity price declines than during earlier oil price increases (Tables 3 and 4). One possible factor is the reduction of oil subsidies in many Asian economies. In Malaysia, Singapore, Indonesia, the PRC, and Viet Nam, the explanatory power of food



prices has also increased. In Thailand, food prices explain more than oil prices. Nonfuel commodity prices have less explanatory power during the recent commodity price decline than during the earlier surge in commodity prices. Interestingly, we find that the explanatory of nonexternal factors, especially inflationary expectations, increased during the global commodity price decline in many Asian economies. The exceptions are Thailand, the Republic of Korea, and Viet Nam, where external factors increase their importance in explaining inflation variation.

## VI. CONCLUSIONS AND POLICY INFERENCES

The central finding which emerges from the empirical analysis of this paper is that the pass-through of global oil and food prices tends to be higher for producer prices than consumer prices. That is, global commodity price shocks seem to have a bigger effect on the price index that is more relevant for producers than on the price index that matters more for consumers. One possible explanation is the recent reduction of subsidies and other distortionary policies in energy and energy-related sectors. The reduction of distortions increases the pass-through of world oil prices to *producers* in some Asian economies, including Malaysia, the PRC, India, and the Republic of Korea. Not surprisingly, there is also evidence of higher pass-through to *consumer* prices in these countries. Other possible explanations are the nature of price adjustment mechanism, i.e., downward price rigidity, as well as policy measures imposed during the food price decline to protect domestic producers. The pass-through of world food prices to both *producers and consumers* become *lower* in all economies, when our sample period includes the recent global food price declines (i.e., 2012 onward).

The pass-through of exchange rates into producer prices is higher than consumer prices in all Asian economies. The exchange rate pass-through tends to be higher in economies with more flexible exchange rate. This could be due to changes in firm pricing strategy. The pass-through of exchange rates to *producer prices* becomes higher in all economies when our sample period includes the commodity slump. This might help explain why PPI inflation in Indonesia is still positive.

Variance decomposition shows that historically, external cost-push factors appear to be more important in explaining *producer price* inflation in the 10 economies. However, the relative importance of *nonexternal* and *external* factors in explaining *producer price* inflation varies across the countries. For *consumer prices*, nonexternal factors, namely excess aggregate demand and inflationary expectations, still explain much of the variation in inflation. Exchange rate plays a more important role in explaining producer prices than consumer prices.

Our study suggests that exchange rate policy can play a major role in controlling producer price inflation. In a country with managed floating exchange rates, i.e., Thailand, Indonesia, the Republic of Korea, the Philippines, and India, changes in monetary policy, i.e., changes in interest rate or money supply, could affect direction of exchange rate. Thus, during the recent decline in PPI, which was largely due to decline in commodity prices rather than domestic demand weakening, expansionary monetary policy and currency depreciation might help to cushion the decline in producer prices. However, the size of the effect of monetary policy on exchange rate depends on the relationship between monetary and exchange rate policy in each country. Furthermore, if all countries try to depreciate the currencies to increase domestic prices, the net effect of exchange rate change would be neutral. For consumer prices, determined largely by nonexternal factors, the recent region's disinflation is not entirely due to uncontrollable outside forces and monetary policy could thus still play a role in managing inflation.

In other economies implementing a soft peg—i.e., Malaysia, Singapore, the PRC, and Viet Nam—or a hard peg—Hong Kong, China, monetary policy should be pursued when the impossible trinity is not violated. Exchange rate devaluation and depreciation would have a bigger effect on PPI than CPI. However, as mentioned earlier, if all economies try to depreciate the currencies to increase domestic prices, the net effect of exchange rate changes may become neutral.

## APPENDIX: EMPIRICAL LITERATURE

Author	Economy Coverage	Period Coverage	Estimation Techniques	Variables Included
McCarthy (1999)	Belgium, France, Germany, Japan, The Netherlands, Sweden, Switzerland, United Kingdom, United States	Q1 1976–Q4 1998	VAR	oil price, output gap, exchange rate, import price, and inflation (consumer and producer)
Choudhri, and Hakura (2001)	71 economies from all major regions	1979–2000	Panel estimation	inflation, exchange rate, foreign inflation, and import share
Bhundia (2002)	South Africa	Q1 1980–Q2 2001	VAR	oil price, output gap, exchange rate, import price, inflation (consumer and producer)
Bonato (2007)	Iran	Q2 1988–Q1 2006	Cointegration and General-to-specific	inflation, money supply, output, interest rate, and exchange rate
Ca' Zorzi, Hahn, and Sánchez (2007)	Asia (People's Republic of China; Republic of Korea; Singapore; Taipei, China; and Hong Kong, China); Central and Eastern Europe (Czech Republic, Hungary, Poland) plus Turkey, and Latin America (Argentina, Chile, and Mexico)	1980s–2004	VAR	oil price, output gap, exchange rate, import price, inflation, and interest rate
De Gregorio et al. (2007)	36 economies (24 are industrial and 12 are emerging)	1960–2006	OLS and VAR	oil price, output gap, exchange rate, inflation, money supply, and interest rate
Duma (2008)	Sri Lanka	M1 2003–M7 2007	VAR	oil price, output gap, exchange rate, import price, and inflation (consumer and producer)
Habermeier et al. (2009)	50 economies in Latin America, Emerging Eastern Europe, Emerging Asia, Africa, and Middle East	M1 2005–M6 2008	Pooled OLS and GMM	inflation, interest rate, credit growth, and food and oil price
Kandil, and Trabelsi (2012)	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates	1970–2007	Error correction model (ECM) and Cointegration	inflation, exchange rate, foreign inflation, money supply, government spending, and output gap

*continued on next page*

Table continued

Author	Economy Coverage	Period Coverage	Estimation Techniques	Variables Included
Jaumotte, and Morsy (2012)	Austria, Belgium, Finland, France, Germany, Ireland, Italy, The Netherlands, Portugal, and Spain	1983–2007	Panel estimation	inflation, output gap, exchange rate, and structural indicators (include the role of collective bargaining, union density, employment protection, and product market regulation)
Gelos, and Ustyugova (2012)	31 advanced and 61 emerging and developing economies	Monthly data from 2001–2010	OLS and Panel estimation	inflation, output gap, exchange rate, and food and oil price
Nguyen, Cavoli, and Wilson (2012)	Viet Nam	M1 2001–M2 2009	OLS and VAR	inflation, exchange rate, foreign inflation, output, money supply, interest rate, and rice and oil price
Hossain, and Islam (2012)	Bangladesh	1990–2010	OLS	inflation, interest rate, exchange rate, government spending, and money supply
Bhattacharya (2013)	Viet Nam	Q1 2000–Q2 2012	OLS and VAR	inflation, output growth, credit growth, exchange rate, import price, and interest rate
Lim, and Sek (2015)	28 economies categorized into two groups as high-inflation and low-inflation economies	1970–2011	VECM and Cointegration	inflation, money supply, import share, and output growth

ECM = error correction model, GMM = generalized method of moments, OLS = ordinary least squares, VAR = vector auto regression, VECM = vector error correction model.

Source: Authors.

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\* ADB recognizes "Vietnam" as Viet Nam.

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## **Determinants of Consumer Price Inflation versus Producer Price Inflation in Asia**

The authors empirically examine and compare the determinants of producer and consumer price inflation in 10 major Asian economies during 2000–2015. In this connection, they also investigate the pass-through of global oil prices, global food prices, and exchange rates to domestic producer and consumer prices. Overall, they find that cost-push factors such as oil and food prices are more important in explaining producer price inflation than consumer price inflation in the 10 Asian economies. On the other hand, for consumer prices, demand-pull factors still explain much of the inflation.

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