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By Eilyn Chong, Helmi Ramlee and Jay Sern Tan

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Global Commodity Prices, Inflation and Monetary Policy: A Study of Selected Commodity Exporters and Importers

Eilyn Chong, Helmi Ramlee and Jay Sern Tan[1]
Bank Negara Malaysia

Abstract
Global commodity prices have again taken centre stage following moderating prices in the recent period, which ended the recent price upswing. The macroeconomic impact of changes in global commodity prices will depend, inter alia, on whether the economy is a commodity importer or exporter. Even among commodity exporters, the type of commodity that is exported matters. This paper uses an event study approach and an estimated GVAR model to attempt to address two key questions: how different would the macroeconomic impact be to a commodity price shock; and what would the monetary policy response be. Our analysis suggests that a positive commodity price shock leads to lower growth for non-energy commodity exporters and commodity importers. The commodity price shock raises inflation for both commodity exporters and importers, albeit with a higher inflationary impact on the former. In line with the growth and inflation outcomes, commodity exporters tighten monetary policy. However, the results show that a tighter monetary policy may not necessarily address the risks to price stability, which implies that monetary policy may not be the best tool to address a commodity price shock and underscores the need for complementary policies.

JEL Classification: E31, E52, E58, F42
Keywords: Monetary policy, Inflation, Commodity prices, Event studies, GVAR model

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[1] The authors are economists from the Monetary Policy Department of Bank Negara Malaysia. They wish to thank participants from the BIS 7th Annual Workshop of the Asian Research Networks particularly to Piti Disyatat, Pym Manopimoke, Aaron Mehrotra, Torsten Ehlers, Koji Nakamura, Samita Sareen; and Ahmad Razi, for their contributions, feedbacks, comments and recommendations. Any errors and omissions are the responsibility of the authors. Authors' email addresses: eilyn@bnm.gov.my, mohdhelmi@bnm.gov.my, jaysern@bnm.gov.my.

1. Introduction

Amid growing concern over a slowdown in Euro Area and emerging economies, as well as the increase in the production of commodities, observers claim that the commodity price super cycle that began since early 2000s has ended. However, there remains uncertainty over the future path of commodity prices. In terms of the macroeconomic implications, the commodity price shocks over the past decade had been associated with higher domestic inflation but with varying impact on GDP growth. The impact on inflation and growth will depend, inter alia, on whether an economy is a commodity exporter or importer. Even among commodity exporters, the type of commodity that is exported matters. The relevance of the current global and domestic economic environment in assessing the impact of commodity prices changes has also become more pronounced lately against the backdrop of low inflation, weak growth and uncertainties in the global financial market. All these represent a challenge for monetary policy as policymakers strive to disentangle the impact of higher commodity prices on inflation and growth.

This paper explores the macroeconomic impact of a commodity price shock as well as the monetary policy response based on the perspective of commodity exporters and importers. We start with an event study approach by observing changes in inflation, GDP growth and policy rates during the four recent episodes of commodity price shocks. Next, we estimate a global vector autoregression (GVAR) model, originally proposed by Pesaran et al. (2004). We consider a model of 13 countries that are grouped into commodity exporters and importers based on the share of net export of commodities over total goods exports. The model is subsequently used to produce the generalised impulse response functions to a shock in commodity price.

In each of the recent episode of commodity price shock, higher inflation is observed for both commodity exporters and importers but the impact on output growth is not synchronised in either group due in part to country-specific economic factors. More specifically, the econometric exercise suggests that a positive commodity price shock reduces growth for non-energy commodity exporters and commodity importers, while the impact on growth for energy commodity exporters is not statistically significant. Across the sample countries, the commodity price shock raises inflation, albeit with a higher inflationary impact on commodity exporters. The interest rate responses to a commodity price shock are in generally in line with the effects on inflation and growth; energy commodity exporters tighten monetary policy to stabilise inflation in the absence of the negative impact on growth. Meanwhile, the variation in

policy rates in non-energy commodity exporters and commodity importers in response to the commodity price shock is not statistically significant. This is, to some extent, corroborated by the event studies.

The paper then investigates the macroeconomic impact associated with a monetary policy response based on the generalised impulse response functions to a shock in policy rate. We find that a tighter monetary policy may not necessarily address the risks to price stability, as inflation does not decline in response to the increase in policy rate. Based on this analysis, we highlight the benefits of having a suite of policy tools during a commodity price shock to address any risk to price and output stability, especially over the medium- to long-term. To this end, complementary measures such as fiscal policy and structural policies to enhance productivity can be considered.

This rest of the paper is organised as follow: Section 2 reviews the link between commodity price, inflation and monetary policy. Section 3 summarises past policy reactions of selected commodity exporters and importers to recent commodity price shocks. Section 4 describes the GVAR model while Section 5 reports its results and outlines some policy implications from the analysis. Section 6 concludes the paper.

2. The Link between Commodity Price, Inflation and Monetary Policy

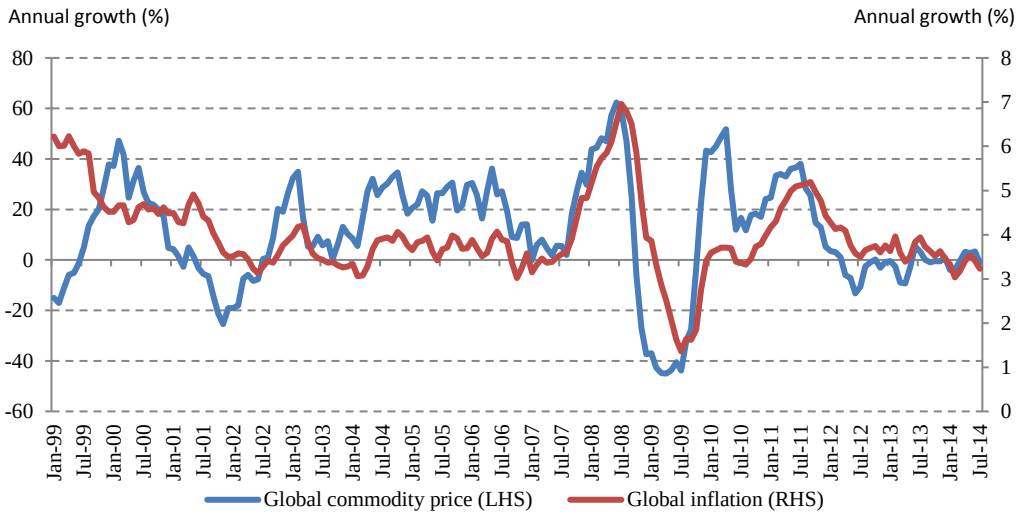
Global commodity prices are driven by a range of supply- and demand-related factors. A common demand factor that would drive prices of all commodities is the strength of global economic growth, supported in part by more rapid industrialisation in emerging economies such as China and India. Supply-side factors tend to be commodity-specific. For energy commodities, these factors include supply disruptions arising from geopolitical tensions in energy commodity exporters. For food commodities, weather patterns can affect supply conditions and hence their prices. Another common factor that can influence commodity prices is the performance of the USD; based on the empirical analysis in the April 2008 IMF's World Economic Outlook, a dollar depreciation can raise prices of crude oil, which is traded in USD[2].

Until recently, the literature has generally documented the impact of an increase, rather than a decrease, in global commodity prices. A change in commodity prices can be transmitted to inflation directly and indirectly. The direct effect happens when global commodity prices

[2] For more details on the factors driving commodity price movements, see, for example European Central Bank (2013).

are transmitted directly into prices of final consumer goods and services. The indirect effect happens when global commodity prices affect the costs pressure for businesses and, in turn, influence their pricing decision for non-commodity related consumer goods and services[3]. If higher inflation becomes pervasive i.e. high commodity prices fully feed through the supply chain, expectations of future inflation can become unhinged and set higher wage demands in motion. The process where higher inflation expectations are incorporated into the wage- and price-setting behaviour is referred as the second-round effects on inflation, subject to the state of demand-driven inflation.

Figure 1: Global Commodity Prices and Global Inflation



Source: International Monetary Fund (IMF)

From the perspective of commodity importers, inflation may be more susceptible to the fluctuations in global commodity prices. In the face of higher global commodity prices, the strong reliance on imported commodities can put upward cost pressure on producers and lead them to raise prices. Under a flexible exchange rate regime, the cost pressures may be compounded by currency depreciation[4]. For example, if the currency depreciates for an extended period, expectations of continued exchange rate depreciation could eventually lead

3 See, for example, Bank Negara Malaysia (2011).

4 De Gregorio (2012) highlights the importance of the exchange rate channel in the transmission of commodity price shocks. For example, a commodity importer would experience currency depreciation when commodity prices rise and therefore, exacerbate its inflationary effects.

to an inflationary spiral. A possible mitigating factor on inflationary pressure would be lower aggregate demand, which results from lower income following the deterioration in terms of trade.

For commodity exporters, the inflationary impact of a commodity price shock depends on the balance of few factors. First, the type of commodity that the country exports can affect the net import bill. For example, non-energy commodity exporters that are reliant on imported crude oil may face an increase in energy import bills that outpaces any revenue gain from their non-energy commodity exports. Meanwhile, energy commodity exporters may accumulate sufficient fiscal revenue to grant larger subsidises depending on their current fiscal position (Table 1).

Table 1: Pre-Tax Subsidies for Petroleum Products in Selected Countries (2011)

Country	Pre-tax subsidies (% of GDP)
Energy commodity exporters:	
Australia	0
Canada	0
Indonesia	2.58
Malaysia	1.24
Non-energy commodity exporters	
Brazil	0
New Zealand	0.09
Philippines	0
South Korea	0
Thailand	0.15
Commodity importers:	
Euro Area	n.a.
United Kingdom	0
United States	0.05
India	1.25

Source: International Monetary Fund

Second, the type of exchange rate regime can influence the inflationary pressure that emanates from commodity prices. A flexible exchange rate regime would allow for currency appreciation, which can mitigate the inflationary effect of commodity price increases (Table 2), while a heavily managed exchange rate regime may pose the additional challenge to contain

inflationary pressure in the face of capital inflows[5]. Third, higher real income during a commodity price increase would generate stronger domestic demand, particularly for energy and metal exporters. IMF (2012) suggests that the growth for energy and metal exporters move in tandem with commodity price cycles, attributable to two factors: (i) higher sensitivity of energy and metal prices to the global business cycles; and (ii) energy and metal account for a larger share in total exports and GDP.

Table 2: Terms-of-Trade in Selected Countries (Annual growth, %)

	Commodity exporters		Commodity importers		
	Australia	New Zealand	United Kingdom	United States	Euro Area
2000	6.0	1.0	-1.1	-4.6	-11.3
2001	4.0	7.4	0.1	2.9	1.4
2002	1.8	-4.6	1.1	1.5	1.9
2003	0.0	1.0	2.0	-1.3	-0.2
2004	9.6	6.2	1.3	-1.7	-2.7
2005	12.9	1.1	-0.6	-4.0	-4.2
2006	11.0	0.0	-1.4	-1.3	-3.7
2007	4.8	5.9	-0.5	0.7	1.0
2008	14.0	7.4	-0.4	-4.7	-4.7
2009	-6.5	-10.2	-0.6	7.5	7.0
2010	10.2	10.5	1.0	-1.9	-4.8
2011	12.1	4.5	-0.7	-2.5	-4.4

Note: Highlighted periods are identified periods of commodity price shocks in the 2000s
Source: Haver Analytics

In practice, monetary policy may accommodate the first-round effects of commodity price upswings, unless they run the risks of unhinging inflation expectations and triggering second-round effects on prices. The manifestation of second-round effects as well as the scope for a monetary policy response would depend on the strength of the price and demand pressures. The variation in the inflationary and growth impact from a commodity price shock, due in part to the economic structure, clearly highlights the need to tailor an appropriate monetary policy response. Economies whose GDP growth and inflation co-move with global commodity prices may have a relatively larger policy scope for monetary policy response should there be risks to

[5] Urruchi *et al.* (2008) finds higher inflation in economies with fixed exchange rate regimes, as exemplified by the Persian Gulf economies, due to upward pressures on the real exchange rate resulting from improvement in the terms of trade and large inflows.

price stability. Unlike commodity exporters, inflation and GDP growth for commodity importers will likely move in the opposite direction.

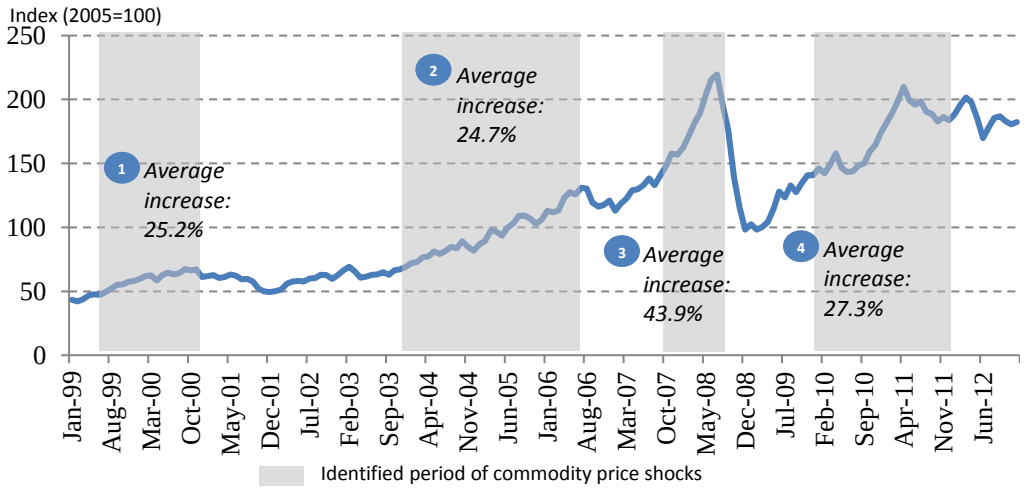
The risks to price stability also depend on the degree of policy credibility[6]. In an environment of high capacity utilisation and low policy credibility, a stronger and more active monetary policy response may be required in order to anchor inflation expectations. There remain challenges of conducting monetary policy in the current environment of weak global growth. Any strong and active attempt to address the risks to price stability, such as in the case when commodity prices unexpectedly resumed its upward trend driven by supply factors, may induce significant output costs and weaken the global growth recovery.

3. Event studies: How do central banks react in the past?[7]

Global commodity prices have doubled since the 2000s[8]. For analytical purposes, we define four episodes of surge in commodity prices in the 2000s as follow (figure 2):

i. First episode: July 1999 till December of 2000 (18 months);
ii. Second episode: January 2004 till June 2006 (30 months);
iii. Third episode: October 2007 till September 2008 (12 months); and
iv. Fourth episode: January 2010 till December 2011 (24 months).

Figure 2: Global Commodity Prices



Source: International Monetary Fund (IMF)

[6] See, for example, IMF (2008b).

[7] Refer to appendix A1 for data source.

[8] Global commodity prices increased by only 16% in the 1990s.

During these four episodes, global commodity prices have increased between 24% and 44%. In this section, we examine the policy reactions in 13 advanced and emerging market economies by clustering them into net commodity exporters and importers (table 3.).

Table 3: Categorisation of Countries into Net Commodity Exporters and Importers[9]

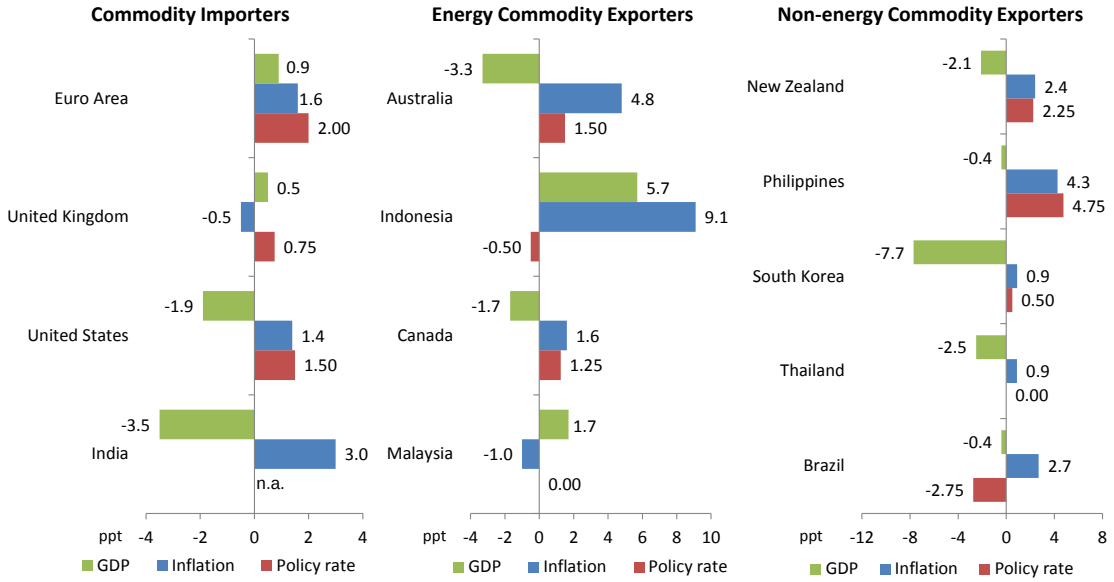
Net commodity exporter		Net commodity importer
Countries	Net energy exporter?	Countries
Australia	Yes	Euro Area
Canada	Yes	United Kingdom
New Zealand	No	United States
Brazil	No	India
Indonesia	Yes	
Malaysia	Yes	
Philippines	No	
South Korea	No	
Thailand	No	

In the first episode (July 1999 – December 2000), global commodity prices increased by an average of 25.2%, led by higher energy prices amid geopolitical tension in the Middle East and North Africa (MENA) region, as well as declining petroleum reserves in the US. As a result, all commodity importers in our sample tightened their monetary policy to contain the heightened inflationary risks (refer to figure 3). In addition, there were concerns over narrowing production capacity following strong domestic demand conditions in some of these economies such as in the US and the UK. There were mixed monetary policy reactions among the commodity exporters due mainly to country-specific reasons. While most commodity exporters such as Australia, New Zealand and the Philippines raised their policy rates between 150 and 475 basis points (bps) citing intensifying inflationary pressures, Brazil cut its key policy rate by 275 bps in line with the path of interest rate normalisation and to boost private consumption following weak growth. On the contrary, Malaysia and Thailand kept their policy rates unchanged following expectations of balanced risks for both inflation and economic growth[10].

[9]Categorisation of countries is done based on the share of net export of commodities over total goods exports. Countries with net exports of commodities less than 10% are considered as net commodity importers.

[10] The provision of subsidies and prices controls in Malaysia and Thailand on essential goods, such as food and fuel, has helped contain excessive price increases.

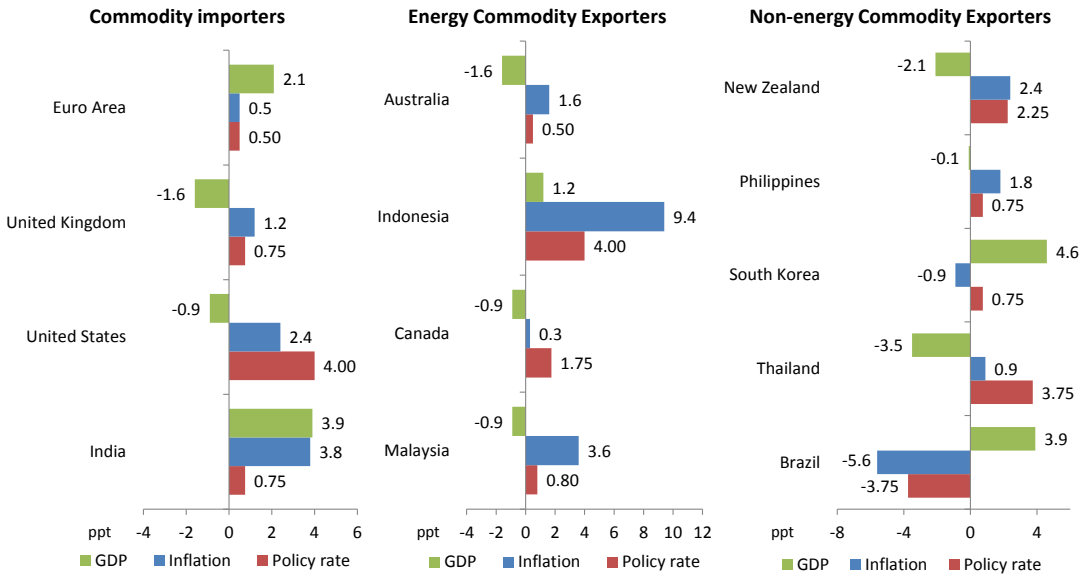
Figure 3: Net Change in GDP, Inflation and Policy Rate (Jul. 1999 – Dec. 2000)



In the second episode (January 2004 – June 2006), global commodity prices increased by 24.7% amid strong global demand pressure. The International Monetary Fund estimated global growth between 2004 and 2006 at about 5%, which was significantly higher than the long term average of 3.4%[11]. The monetary policy stance taken by all three groups was broadly synchronised until the end of 2005 as all central banks in our sample, with the exception of Brazil, tightened the monetary policy (refer to figure 4). Most central banks highlighted the upside risks to domestic inflation and even concerns on second-round effects on inflation, amid relatively strong domestic demand conditions. There was a divergence in monetary policy stances emerged towards the end of 2005. This could be possibly explained by the varying assessments on the future path of commodity prices. For example, while the US and Thailand continued to tighten their monetary policy in 2006 over continuous concerns on elevated global commodity prices, other central banks such as the UK and Brazil decided to loosen their monetary policy as they anticipated a moderation in commodity prices. Brazil, in particular, normalised their interest rates by cutting its policy rate by 375 bps in the first half of 2006, citing diminishing inflationary risk.

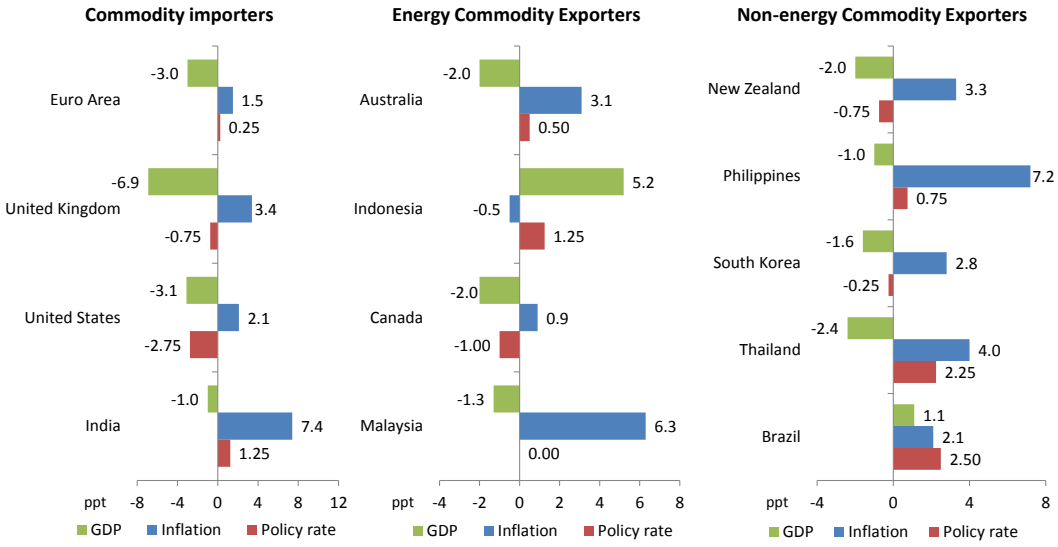
[11] Average global growth from 1990-2013

Figure 4: Net Change in GDP, Inflation and Policy Rate (Jan. 2004 – Jun. 2006)



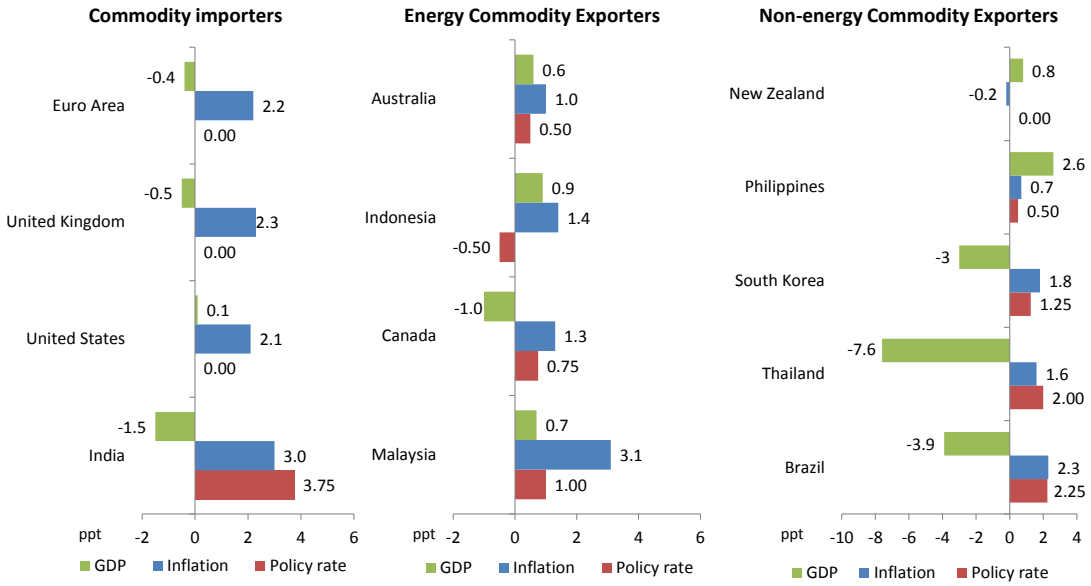
The commodity price shock during the 2008 episode (October 2007 – September 2008) was immediately followed by the global financial crisis. Hence, for the purpose of this study, we exclude the fourth quarter of 2008 from the sample period and focus on the period prior to the global financial crisis. Prior to the crisis, global demand conditions, particularly from the emerging economies were strong as global GDP grew by more than 5% in 2006 and 2007. In addition, there was also a surge in investment flows into the commodity futures markets amid the environment of negative real interest rate, which further magnified the spike in global commodity prices. As a result, inflationary pressure was building up. While some central banks decided to hike their policy rate to contain inflationary risk, others cut the policy rate to focus on supporting growth as they expected the increase in global commodity price to be transitory (refer to figure 5). For both commodity exporters and importers, the monetary policy reaction towards the surge in global commodity prices was not synchronised. The Euro Area hiked its policy rate by 25 bps to prevent any risk of second-round effects on inflation while the US cut its policy rate by 275 bps to boost domestic demand, which had started to weaken as the financial crisis began to intensify. While Australia and Thailand hiked their policy rate in order to anchor inflation expectations amid relatively robust domestic demand, New Zealand and Canada reduced their respective policy rate.

Figure 5: Net Change in GDP, Inflation and Policy Rate (Oct. 2007- Sep. 2008)



In the most recent commodity price shock (January 2010 to December 2011), commodity prices rose by an average of 27.3%. The increase in global commodity prices was attributed to both supply and demand factors. During this period, the Russian government banned their grain exports in August 2010 following the severe drought, which led to a decline of about 25% in grain production. In addition, there were concerns on the global supply of crude oil following the geopolitical unrest in the Middle East and North Africa (MENA) region. Meanwhile, global demand, particularly in the emerging economies, was also robust following the post-crisis recovery. This is, arguably, supported in part by the stimulus measures introduced in the aftermath of the global financial crisis in the US, UK and Euro Area, which are the commodity importers in our sample. India, however, raised its policy rate by a cumulative of 375 bps in order to anchor inflation expectations. Most commodity exporters tightened monetary policy with the exception of New Zealand and Indonesia, due to country-specific factors (refer to figure 6). Policy rates were hiked cumulatively by 50 bps to 225 bps to contain inflationary pressure, anchor inflation expectations as well as normalise interest rate. Of note, Australia hiked interest rate by a cumulative of 100 bps in 2010 following strong expansionary pressure and high commodity prices but subsequently reduced it by 50 bps by the end of 2011 to contain the adverse impact of strong appreciation of Australian dollar. In New Zealand, however, rising commodity prices, robust growth and the increase in the Goods and Services Tax (GST) prompted a tighter monetary policy. Subsequently, the earthquake led RBNZ to reverse its action by cutting its policy rate by 50 bps in order to restore business confidence and economic growth.

Figure 6: Net Change in GDP, Inflation and the Policy Rate (Jan. 2010 – Dec. 2011)



4. Empirical Estimation: A GVAR Approach

In addition to the event study, we support our analysis using an empirical model. The econometric framework we apply is a Global Vector Autoregressive (GVAR) model, adapted from Pesaran et al. (2004) and Dees et al. (2007)[12,13]. The GVAR model is composed of a set of countries modelled individually as a VAR approach with the relevant endogenous variables and augmented by a set of exogenous variables. The country-specific VARs are subsequently combined to solve for a global model in which the world variable and country-specific variables are jointly determined. The main benefit of a GVAR model compared to an individual country specific VAR model is that it allows for interactions between countries in the studied group to be captured explicitly. The construction of a GVAR model follows in two steps:

4.1 Constructing country-specific models, augmented with a set of foreign variables

Each country, I, is represented as a VARX$^{*}(p_i, q_i)$ model as outlined in the equation (1):

[12] The GVAR model was originally developed as a tool for credit risk analysis.

[13] The GVAR model estimation, construction and dynamic analysis were implemented using the toolbox by Smith and Galesi (2011).

$$\boldsymbol{\Phi}_i(L, p_i)\boldsymbol{x}_{it} = \boldsymbol{a}_{i0} + \boldsymbol{a}_{i1}\boldsymbol{t} + \boldsymbol{\Lambda}_i(L, q_i)\boldsymbol{x}^*_{i,t} + \boldsymbol{\Psi}_i(L, q_i)\boldsymbol{d}_t + \boldsymbol{u}_{it} \quad (1)$$

for $i = 0,1, \dots, N$ and $t = 1, \dots, T$ where:

x_{it} is the vector of the country-specific variables at time t ;
$x^*_{i,t}$ is the vector of the foreign variables specific to country i at time t, constructed as the weighted cross-sectional averages of the domestic variables for the rest of the countries in the group, such that:

$$\boldsymbol{x}^*_{i,t} = \sum_{j=0}^{N} w_{ij,t}\boldsymbol{x}_{j,t} \quad (2)$$

Where

$$w_{ii,t} = 0; \sum_{j=1}^{N} w_{ij,t} = 1, \qquad \forall\, i, j = 1, \dots, N$$

- d_t is the vector of observed common variable, such as global commodity prices, and which can be endogenous to some individual model within the GVAR;
- a_{i0} and a_{i1} are the vectors of fixed intercepts and coefficients of the deterministic elements;
- $\Phi_i(L, p_i)$, $\Lambda_i(L, q_i)$and $\Psi_i(L, q_i)$ are the matrices of lag polynomials in the lag operator L of the associated coefficients; and
- u_{it} is the vector of idiosyncratic, serially uncorrelated country-specific factors $u_{it} \sim iid\ (0, \Sigma_{ii})$ for $i = 0,1, \dots, N$ and $t = 1, \dots, T$ where Σ_{ii} is non-singular.

The GVAR model allows for a cross-country correlation of the idiosyncratic shocks, where

$$E\left(\boldsymbol{u}_{it}, \boldsymbol{u}'_{jt'}\right) = \begin{cases} \boldsymbol{\Sigma}_{ij} & \text{for } t = t' \\ \boldsymbol{0} & \text{otherwise} \end{cases} \quad (3)$$

By construction, the GVAR model allows for interdependence through: (i) the dependence of domestic variables, x_{it} on foreign and global variables $x^*_{i,t}$ and d_t respectively, and their respective lagged values; and (ii) the contemporaneous dependence of shock in country i on the shocks in country j, as described by the cross-county covariances Σ_{ij} for $i \neq j$.

For the estimation of the VARX* model for each country, the country-specific foreign variables ($x^*_{i,t}$) and the global variables (d_t) are assumed to be weakly exogenous. The lag orders p_i and q_i, which are associated with the domestic and foreign variables respectively, can vary across countries and are determined based on the Akaike information criterion (AIC), where the maximum lag order is set equal to four.

4.2 Stacking the Country-Specific Models into a Single VAR Model

The subsequent step is to simultaneously solve the endogenous variables of the global economy, whereby the estimated individual models are stacked to build a GVAR model and linked with a matrix of predetermined weights.

Equation (1) can be re-written as the following:

$$\mathbf{A}_i(L, p_i, q_i)\boldsymbol{z}_{it} = \boldsymbol{\varphi}_{it} \text{ for } i = 0, \dots, N \tag{4}$$

where

$$\mathbf{A}_i(L, p_i, q_i) = [\boldsymbol{\Phi}_i(L, p_i) - \boldsymbol{\Lambda}_i(L, q_i)], \tag{5}$$

$$\boldsymbol{\varphi}_{it} = \boldsymbol{a}_{i0} + \boldsymbol{a}_{i1}\boldsymbol{t} + \boldsymbol{\Psi}_i(L, q_i)\boldsymbol{d}_t + \boldsymbol{u}_{it}, \tag{6}$$

$$\boldsymbol{z}_{it} = \begin{pmatrix} \boldsymbol{x}_{it} \\ \boldsymbol{x}^*_{i,t} \end{pmatrix} \quad \text{for } i = 0, \dots, N \tag{7}$$

z_{it} can be written compactly as

$$\boldsymbol{z}_{it} = \boldsymbol{W}_i\, \boldsymbol{x}_{\boldsymbol{t}} \text{ for } i = 0, \dots, N \tag{8}$$

where $W_i = (W_{i0}, W_{i1}, \dots, W_{iN})$ is a country-specific weight matrix. The weights used to combine the individual country models can be based on the trade flows of a particular year or an average over a period. We can therefore rewrite (4) as:

$$\mathbf{A}_i(L, p_i)\boldsymbol{W}_i\boldsymbol{x}_t = \boldsymbol{\varphi}_{it} \text{ for } i = 0, \dots, N \tag{9}$$

and stacked to produce a $VAR(p)$ model in $x_t = \begin{pmatrix} x'_{0t} \\ x'_{1t} \\ \vdots \\ x'_{Nt} \end{pmatrix}$ as

$$\boldsymbol{G}(L, p)\boldsymbol{x}_t = \boldsymbol{\varphi}_t \tag{10}$$

$$\boldsymbol{G}(L,p)\boldsymbol{x}_t = \begin{pmatrix} \mathbf{A}_0(L,p) \\ \mathbf{A}_1(L,p) \\ \vdots \\ \mathbf{A}_N(L,p) \end{pmatrix}, \boldsymbol{\varphi}_t = \begin{pmatrix} \boldsymbol{\varphi}_{0t} \\ \boldsymbol{\varphi}_{1t} \\ \vdots \\ \boldsymbol{\varphi}_{Nt} \end{pmatrix} \tag{11}$$

The $GVAR(p)$ model above is then solved recursively and used to conduct generalised impulse response analysis.

4.3 Model specification[14]

The version of the GVAR model in this paper is composed of 13 advanced and emerging economies. We employ a quarterly time series ranging between the first quarter of 2000 and second quarter of 2014. The set x_{it} of the country-specific variables includes: GDP growth, headline inflation and policy rate all expressed in annual percentage form with the exception of policy rate, which is maintained in its percentage form[15]. The set $x^*_{i,t}$ has the trade-weighted average of GDP growth, headline inflation and policy rate of the remaining countries in the group. The d_t contains global commodity prices in annual percentage form which are common to each country VARX* model. This global variable is included as endogenous variables in the US model and exogenous in other country-specific VAR as imposing the small open economy assumption to the US may not reconcile with empirical evidence (Galesi and Lombardi, 2009). The weights used to construct the country-specific foreign variables $w_{ij,t}$ are based on the average trade flows from 2000 to 2013.

We investigate the impact of commodity price shock on GDP and headline inflation through the Generalised Impulse Response Functions (GIRFs) to a one standard error shock in commodity prices for a period of 12 quarters[16]. We construct the aggregate responses to global commodity price shock for commodity exporters and importers using weights according to the averages of country GDP at purchasing power parity (PPP) over the period

[14] Data on *real GDP growth*, *headline inflation* and *policy rate* are sourced from IMF's International Financial Statistics (IFS) Database. Trade flows data are from the IMF's Direction of Trade Statistics (DOTS) while GDP at purchasing power parity is obtained from the World Bank's World Development Indicators.

[15] Appendix B1 and B2 show the plot of GDP growth and inflation for these countries against global commodity prices over time while Appendix C1 and C2 illustrate the same variables against policy rates.

[16] Unlike orthogonalised impulse responses that are traditional to the VAR literature, the generalised framework does not require identification restrictions, and it does not depend on the ordering of endogenous variables.

of 2000-2013. Subsequently using the GIRFs to a one standard error increase in policy rates, we examine the responses of GDP and headline inflation to a shock to policy rate.

5. Empirical results and policy implication

5.1 Dynamic response to global commodity price shock

In this section, we assess the impact from a positive shock in global commodity prices on GDP growth and inflation for commodity exporters and importers. We examine the generalised impulse response functions (GIRFs) up to 12 quarters to one standard error (s.e.) shock in the global commodity prices, which is equivalent to approximately a 10% increase in global commodity prices. The charts also include the associated 90% confidence intervals, which are bootstrapped with 1000 replications[17].

Empirical estimates have shown that higher global commodity prices have inflationary effects on both commodity exporters and importers, with varying impact on growth on these groups (figures 7a and 7b). For commodity importers, the resulting increase in inflation following higher global commodity prices can result in a negative impact on growth but the extent of the impact remains inconclusive. For commodity exporters, the terms-of-trade gains could even offset any negative impact on growth. The positive impact on growth for commodity exporters whose main export is oil is more pronounced when compared to other commodity exporters. Indeed, our estimations show that commodity price shock leads to higher inflation for both commodity exporters and importers. A stronger inflationary impact is observed for commodity exporters, particularly for energy commodity exporters, due perhaps to the stronger demand pressure prevailing in those economies following higher commodity prices.

[17] We acknowledge that due to relatively short sample size, the conclusions drawn on the differences between the impact of shocks for commodity exporters and importers may not be statistically significant.

Figure 7a: GIRFs of Inflation to 1 s.e. Shock to Global Commodity Prices

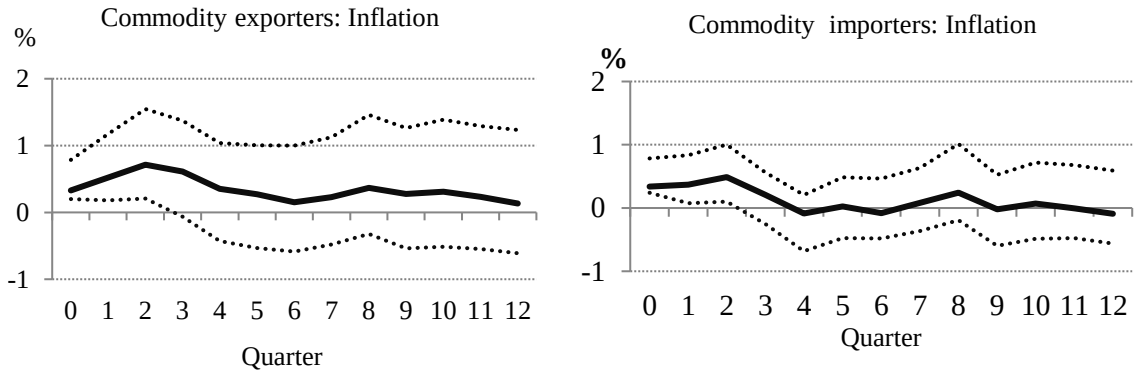


Figure 7b: GIRFs for Commodity Exporters of Inflation to 1 s.e. Shock to Global Commodity Prices

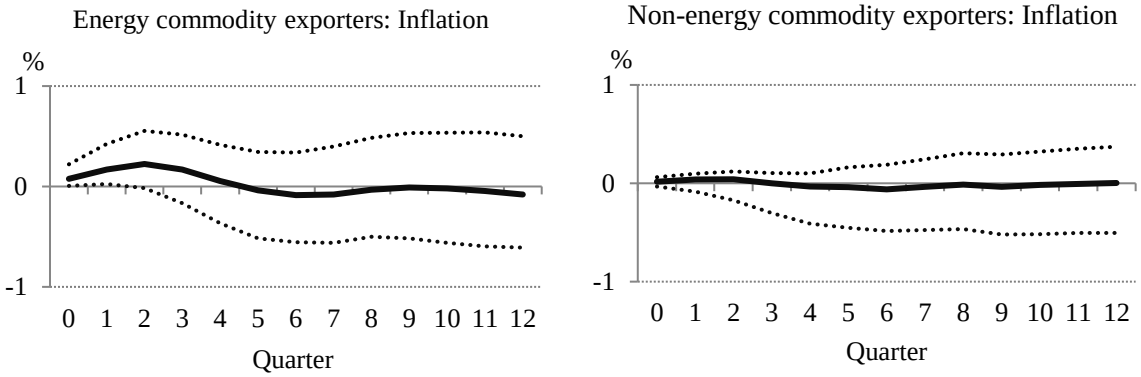


Figure 8a compares the adjustment paths of GDP growth for commodity exporters and importers in response to one s.e. increase in global commodity prices. Both commodity exporters and importers experience a short-run decline in GDP growth. For commodity importers, the shock exerts a negative impact on growth by the second quarter and the impact persists for a year. The result for commodity importers are as expected but the negative impact on growth for commodity exporters is surprising at first.

We then attempt to identify if there is a difference in the impact of the commodity price shock on GDP growth between energy commodity exporters and non-energy commodity exporters. We find a larger negative impact on GDP growth for the latter. Considering that commodity price shocks in the 2000s are largely influenced by increases in energy prices, and given the need of non-energy exporters to meet its energy consumption through energy imports, it is expected that there is a relatively larger impact on growth in these economies. The impact on GDP growth for energy commodity exporters is relatively modest, though not statistically significant.

The interest rate responses to a commodity price shock are in generally in line with the effects on inflation and growth (figures 9a and 9b); energy commodity exporters tighten monetary policy to stabilise inflation in the absence of the negative impact on growth. Meanwhile, the variation in policy rates among non-energy commodity exporters and commodity importers in response to the commodity price shock is not statistically significant. The next section discusses on whether a monetary policy response, if any, has an effect on GDP growth and inflation.

Figure 8a: GIRFs of GDP Growth to 1 s.e. Shock to Global Commodity Prices

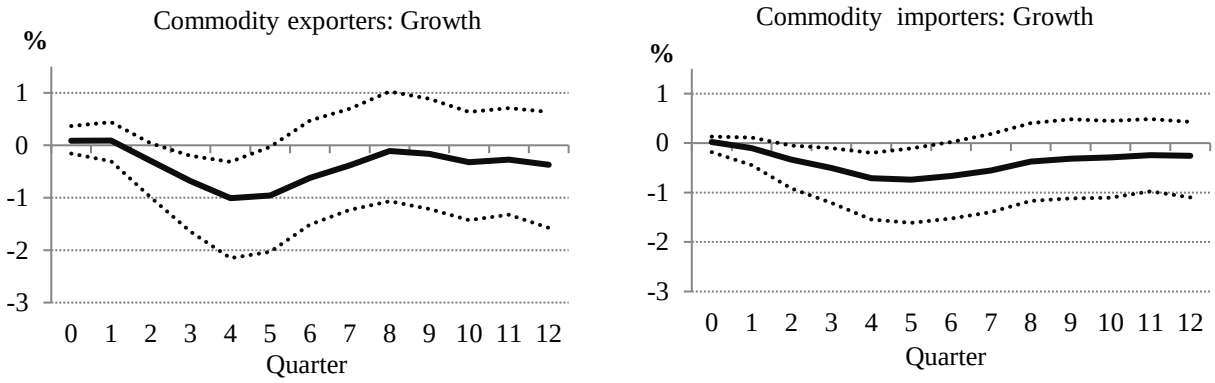


Figure 8b: GIRFs for Commodity Exporters of GDP Growth to 1 s.e. Shock to Global Commodity Prices

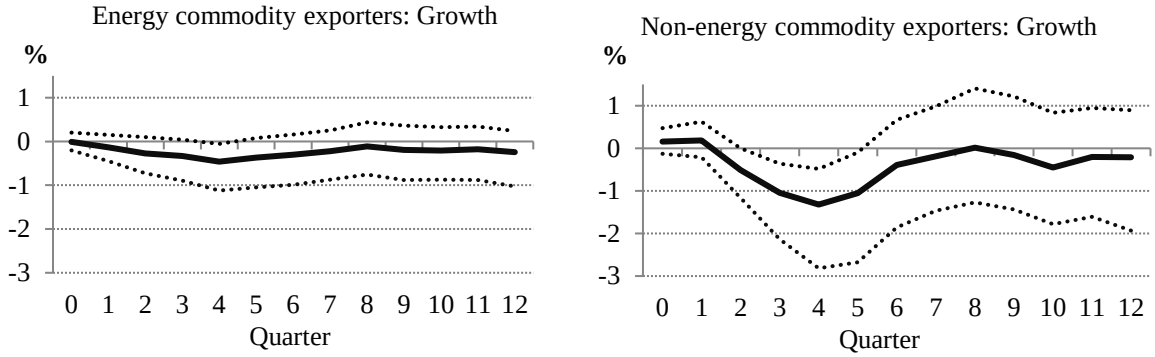


Figure 9a: GIRFs of Policy Rate to 1 s.e. Shock to Global Commodity Prices

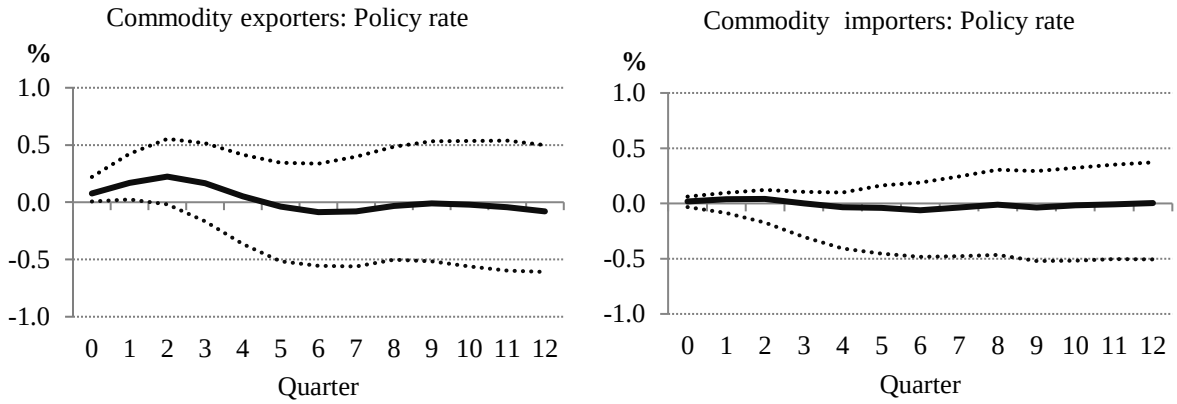
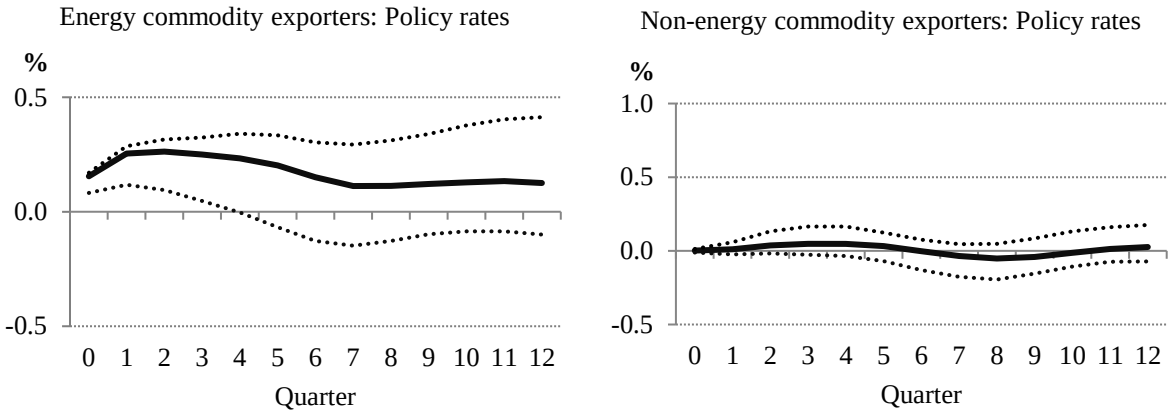


Figure 9b: GIRFs for Commodity Exporters of Policy Rate to 1 s.e. Shock to Global Commodity Prices



5.2 Dynamic response to a monetary price shock

We examine within the GVAR framework the responses of macroeconomic variables to a monetary policy tightening (Figures 10a, 10b and 10c). One surprising observation for non-energy commodity exporters is that, while GDP falls in response to a monetary policy tightening, inflation increases rather than declines. Balke and Emery (1994) put forth a possible explanation to the "prize puzzle" incidence: systematic policy response to supply shocks does not fully to offset the actual inflationary impact of the supply shock.

For energy commodity exporters and commodity importers, the responses of GDP growth and inflation to a shock in the policy rate are not statistically significant. The weak impact from monetary policy tightening on growth and inflation amid higher global commodity prices suggest that a monetary policy response may not be effective in addressing the risks to price and output stability arising from a commodity price shock. The subdued variability in inflation and output to changes in monetary policy in these countries maybe a reflection of two factors: lower potency of monetary policy in addressing supply shocks or a systematic change in the mechanism that propagates these shocks. A detailed analysis on this is beyond the scope of this paper[18].

[18] See, for example, Boivin and Giannoni (2002).

Figure 10a: GIRFs of GDP Growth and Inflation to 1 s.e. Shock to Policy Rate for Energy Commodity Exporters[19]

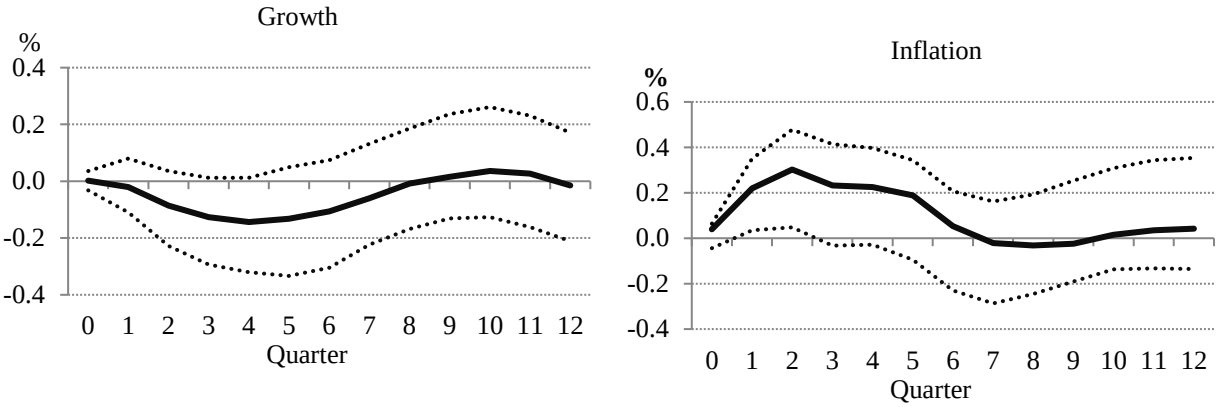


Figure 10b: GIRFs of GDP Growth and Inflation to 1 s.e. Shock to Policy Rate for Non-Energy Commodity Exporters[20]

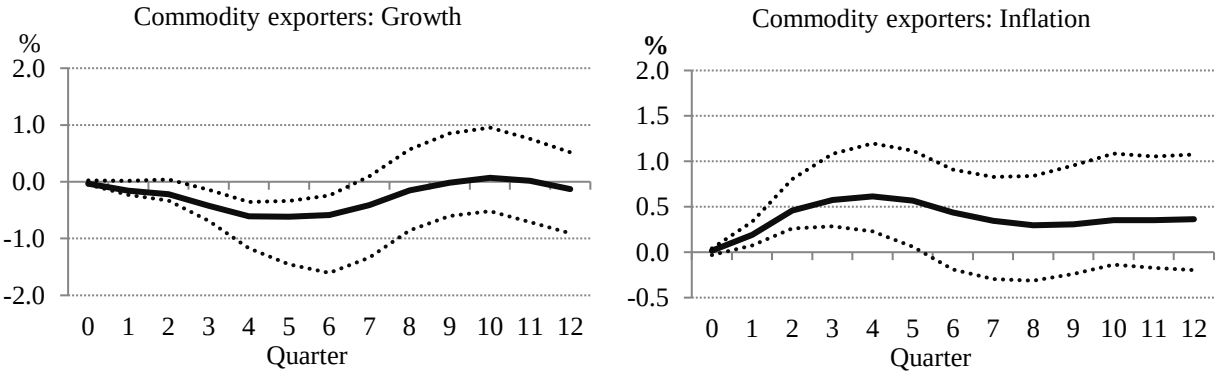
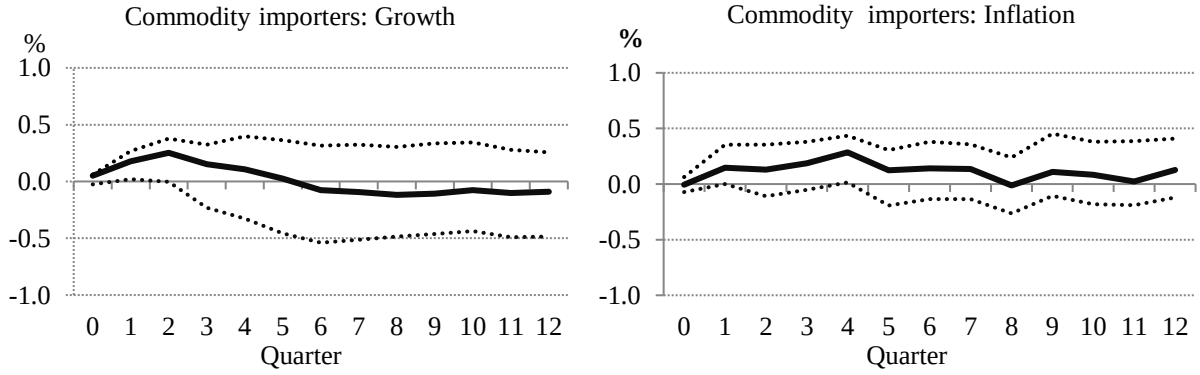


Figure 10c: GIRFs of GDP Growth and Inflation to 1 s.e. Shock to Policy Rate for Commodity Importers



[19,20] While Balke and Emery (1994) resolved the prize puzzle incidence for the post-1980 period by including commodity prices in the VAR model, the puzzle is still present in the post-1980 period. They find that by including the spread between the ten-year and three-month Treasury rates eliminates the puzzle for both subsamples.

5.3 Policy implications

Overall, the variation in the macroeconomic impact of commodity prices on both commodity exporters and importers suggests a need for policymakers to tailor an appropriate policy response. It is important to identify the potential path of GDP growth and inflation in the wake of a commodity price shock for the implementation of pre-emptive policies[21]. Our findings highlight a few challenges. First, commodity exporters may find it hard to assess whether the impact of the commodity shock will materialise into a build-up in demand pressure. Second, by taking lessons from the experiences in the 1970s and 1980s, commodity importers have to remain vigilant of the consequent impact on inflation expectations in the environment of higher inflationary pressure despite slower growth following a commodity price shock. Inflation expectations could become unhinged as a result of the shock and set second-round effects in motion.

This study shows that monetary tightening may not address the risks to price stability following a commodity price shock. Interestingly, the more recent literature highlights the role of a globalised response that can materially affect aggregate global commodity demand. Nevertheless, beyond an active monetary policy response to a supply shock, there is a need for central banks to establish and maintain a strong credibility and in the process, keep inflation expectations anchored. In particular, communication strategy by central banks can play key role in anchoring expectations of households and businesses during periods of commodity price shock. This can be complemented by a suite of non-monetary policy measures that can be deployed to limit the impact of commodity price shock. Policymakers can design structural policies to enhance productivity as alternative long term measures to mitigate the effects of commodity price increases, such as through investment grants for improved efficiency of commodity usage in the production process. These structural policies, however, may take time to have an impact. In the meantime, countries can take steps to build fiscal policy buffers during good times, to build up the capacity for counter-cyclical policies. For instance, commodity exporters can adopt a balanced budget fiscal rule, where fiscal revenues generated during a commodity boom can be distributed immediately to households and firms in the form of lower tax rates to address the impact of rising costs.

[21] This analysis is pursued by Filardo and Lombardi (2013). They also explore the role of global demand and supply factors in driving global commodity prices and the policy response to these developments.

6. Conclusion

The paper evaluates the macroeconomic impact of commodity price shock from the perspective of commodity exporters and importers as well as the monetary policy reaction to this shock. Monetary policy responses to commodity price shocks vary across countries as the impact on these two analytical groups of economies is indeed different. Using the GVAR model approach, we find that a positive commodity price shock reduces growth for non-energy commodity exporters and commodity importers, but with no significant impact on growth for energy commodity exporters. The commodity price shock raises inflation for all sample countries, particularly for commodity exporters. In line with the outcome on inflation and growth, commodity exporters tighten monetary policy. However, we find that that monetary tightening may not address the risks to price stability arising from a global commodity price shock. Therefore, having a suite of policy tools to deploy, such as fiscal and structural policies, can be beneficial as they play complementary roles to monetary policy in price and output stabilisation.

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Appendix 1

The monetary policy decisions that were discussed in Section 3 of this paper were compiled from the reports and statements published on central bank websites.

A1: Data source from each central bank

Country	Central Bank	Name, frequency, and availability of reports/ statements
Australia	Reserve Bank of Australia	Statement by Governor on Monetary Policy Decisions, 11 times a year; http://www.rba.gov.au/
Canada	Bank of Canada	Monetary Policy Report, 4 times a year; http://www.bankofcanada.ca/
Malaysia	Bank Negara Malaysia	Monetary Policy Statement, 6 times a year; http://www.bnm.gov.my/
Indonesia	Bank Indonesia	Monetary Policy Review, 12 times a year; http://www.bi.go.id/
Brazil	Banco Central do Brasil	Committee of Monetary Policy Minutes, 8 times a year; http://www.bcb.gov.br/
New Zealand	Reserve Bank of New Zealand	Statement by Governor on Monetary Policy Decisions, 8 times a year; http://www.rbnz.govt.nz/
Philippines	Bangko Sentral ng Pilipinas	Inflation Report, 4 times a year http://www.bsp.gov.ph/
South Korea	Bank of Korea	Monetary Policy Decision, 12 times a year & Monetary Policy Report, 2 times a year; http://eng.bok.or.kr/
Thailand	Bank of Thailand	Monetary Policy Report, 4 times a year & Minutes of Monetary Policy Committee Meeting, 8 times a year; http://www.bot.or.th/
Euro Area	European Central Bank	Monthly Bulletin, 12 times a year https://www.ecb.europa.eu/
United Kingdom	Bank of England	Minutes of Monetary Policy Committee Meeting, 12 times a year http://www.bankofengland.co.uk/
United States	Federal Reserve System	FOMC Meetings Statement and Minutes, 8 times a year; http://www.federalreserve.gov/
India	Reserve Bank of India	Macroeconomic and Monetary Developments, 4 times a year; http://www.rbi.org.in/

Source: National central bank websites

A2: Monetary Policy Responses by Central Banks during Commodity Price Shocks in the 2000s

Period of commodity price increases	Countries		
	United States	**Euro Area**	**United Kingdom**
Net commodity exporter/importer[22]	Net commodity importers	Net commodity importers	Net commodity importers
1999-2000 (25.2% increase in commodity prices)	**Cumulative change: +100 bps** (+25 bps each in February and March and +50 bps in May) • Demand increases continue to exceed growth in potential supply and exerting pressure on resources • Increases in energy prices • Core inflation projected to rise due partly to larger advances in labour compensation	**Cumulative change: +175 bps** (+25 bps each in February, March, April, +50 bps in June, +25 bps in August, October) • Generous liquidity conditions are indicative of upside risks to price stability in the medium term • Larger-than-expected price and cost increases, posing risks of "second-round" effects • Prospects of cyclical upswing in euro area	**Cumulative change: +25 bps** (+25 bps in January) • Upside risks to medium-term inflation even though RPIX inflation was below target, reflected developing pressures in labour market and productive capacity • RPIX growth has remained below target despite higher commodity prices, due partly to appreciation in sterling and greater competitive
2004 – 2006 (24.1% increase in commodity prices)	**Cumulative change (2004): +100 bps** (+25 bps each in June, August, November and December) **Cumulative change (2005): +200bps** (+25 bps each in February, March, May, June, August, September, November and December) • Persistence of solid gains output • Indication of increases in inflation due to pass-through of higher energy and import costs	**Cumulative change (2004): 0 bps** **Cumulative change (2005): +25bps** (December) • Oil prices continued to exert pressure on price level and lifted inflation to level significantly in excess of the target • Increased upside risks to price stability from pass-through of oil price increases to consumers • Outlook for economic activity remains subject to downward risks	**Cumulative change (2004): +100 bps** (+25 bps each in February, May, June and August) • Growing pressures on supply capacity as output growth to be above trend • Firmly anchored inflation expectations • Cost pressures from higher prices for fuel and raw materials **Cumulative change (2005): -25bps** (August) • Impact of increases in oil prices to wane • Pressure on capacity anticipated to ease
2007-2008 (43.9% increase in commodity prices)	**Cumulative change: -350 bps** (-75 bps followed by -50 bps in January, -75 bps in March, -25 bps in April, -50 bps twice in October and -75 bps in December) • Steep increases in commodity prices but expected to flatten out • Inflation expectations are expected to be well-anchored • Substantial reduction in credit availability and decline in housing activity weighing on overall economic activity	**Cumulative change: -150 bps** (+25 bps in July) • To prevent broadly based second-round effects and to counteract the increasing upside risks to price stability over the medium term • Inflation remained well above level consistent with price stability • Vigorous money and credit growth (Subsequently adjusted , -50 bps in October and November and -75 bps in December) • Downside risks on the outlook for economic activity from high levels of commodity prices and financial market tensions • Inflationary pressures to diminish from lower commodity prices	**Cumulative change: -350 bps** (-25 bps each in February and April, -50 bps in October, -150 bps in November and -100 bps in December) • Sluggish output growth due partly to tightening in money supply and credit • Despite sharp increase in inflation, inflation was expected to decline
2010 – 2011 (27.3% increase in commodity prices)	**Cumulative change: 0 bps** • Slack in resource utilisation restrained cost pressures from increases in crude oil prices • Long-term inflation expectations remained stable • Inflation expected to drift to levels consistent with mandate • Modest expansion in economic activity	**Cumulative change: 0 bps** (+25 bps each in April and July) • Risks to price stability amid sharp increases in energy and good prices • Increases in indirect taxes and administered prices may be greater than currently assumed • Underlying momentum of economic activity continues to be positive (Subsequently, -25 bps in November and December) • The intensified financial market tensions continued to dampen economic activity and the outlook remained subject to substantial downside risks • Cost, wage and price pressures expected to be modest over policy-relevant horizon	**Cumulative change: 0 bps** • Significantly weaker outlook for demand growth • Inflation was expected to be more likely to be below target

[22] Based on net export of commodities over total goods exports. An economy is considered a net commodity importer if the share of net exports of commodities over total goods exports is less than 10%. Source: IMF's staff calculations, World Economic Outlook, April 2012.

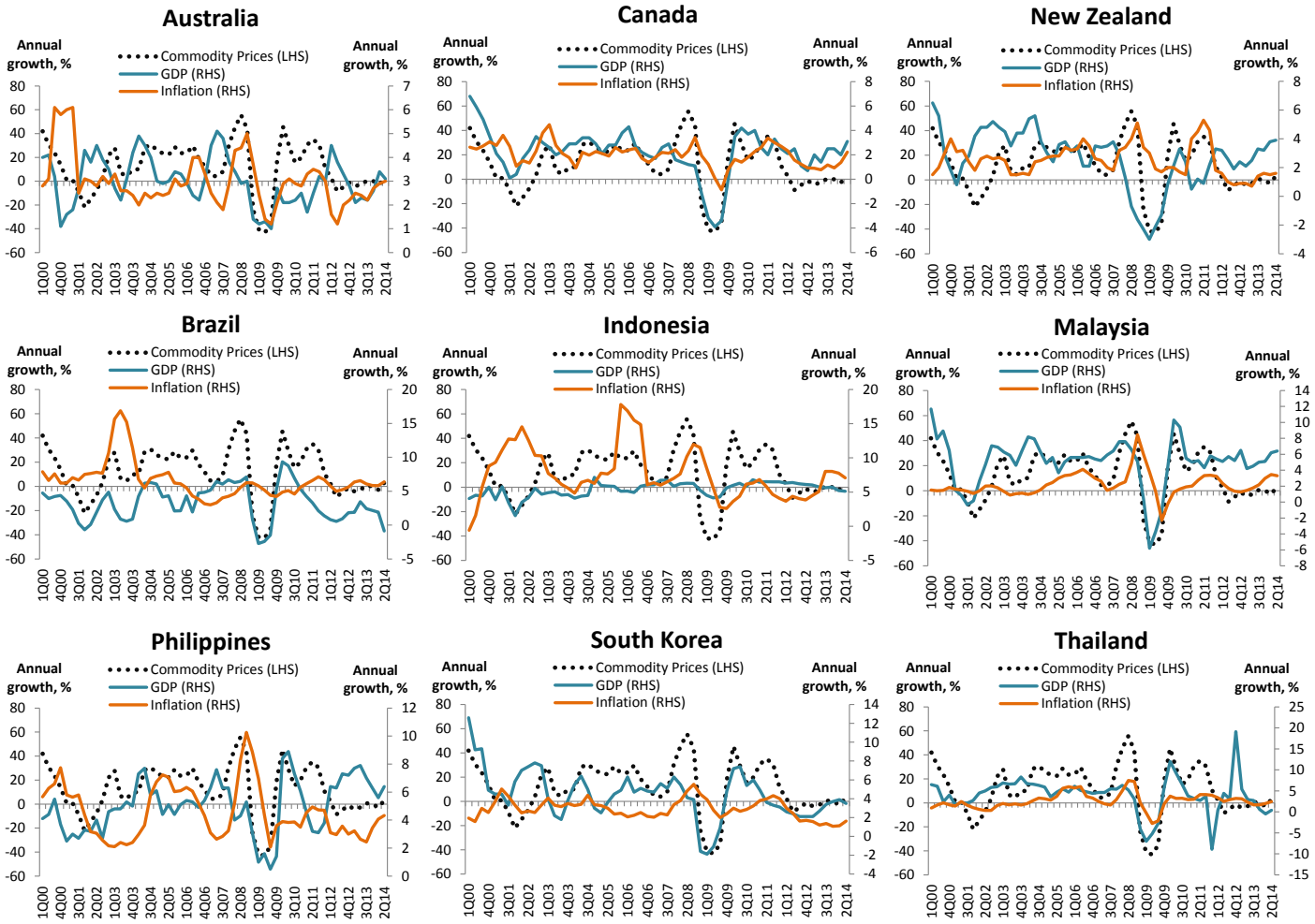
Period of commodity price increases	Countries		
	Australia	**New Zealand**	**Canada**
Net commodity exporter/importer	Net commodity exporter (30-50%)	Net commodity exporter (30%-50%)	Net commodity exporter (10%-20%)
1999-2000 (25.2% increase in commodity prices)	**Cumulative change: +125 bps** (+50bps in Feb, and +25bps each in Apr, May and Aug) • Domestic growth stronger than expected • Credit expansion was at a rapid rate • Period of low inflation was over due to the increase in commodity prices • Pre-emptive decision before overheating emerged • Concern shifted to inflation as growth is expected to be strong	**Cumulative change: +150bps** (+25bps each in Jan and Apr, +50bps each in Mar and May) • Resilient domestic and global economic growth • Signs of increasing utilisation of spare capacity • As a result, it could prove to be inflationary • Rising commodity prices • Despite to tightening stance, RBNZ still view the rate as stimulatory • Important to tighten to make sure solid growth with no inflationary issues	**Cumulative change: +100bps** (+25bps each in Feb, Mar and May) • Concern over Canada's economy hitting full capacity • Strong demand both domestically and internationally • Export, particularly to USA remained very robust • All these posed risks to inflation, especially with capacity reaching full limit
2004 – 2006 (24.7% increase in commodity prices))	**Cumulative change (2005): +25bps in March** • Limited space capacity available arising from still relatively easy financing • Stronger inflationary pressure due to rising global commodity prices	**Cumulative change (2004): +75bps** (+25bps each in Jul, Sep and Aug) • Tight labour market with limited productive capacity • Housing market expanding faster than expected • Strong NZD • Inflationary pressure due to strong economic strength and higher crude oil price **Cumulative change (2005): +25 bps** (+25bps each in Mar, Jul, Dec) • Inflation to be at the top of targeted range due to higher commodity prices and strong domestic growth • Employment to remain robust • Investment expanded faster than expected	**Cumulative change (2004): +50bps** (+25bps each in Sep and Oct) • Growth stronger than expected due to robust external demand • Economy is close to its capacity • Risk to higher inflation following higher than expected oil price **Cumulative change (2005): +75bps** (+25 each in Sep, Oct and Dec) • Canadian economy operating close to its capacity • Global energy prices have increased rapidly • Hurricane Katrina in US will send domestic gasoline prices higher
2007-2008 (43.9% increase in commodity prices)	**Cumulative change: -250 bps** (+25 bps each in Feb and March) • Strong domestic demand with high capacity usage • Inflation is still concern despite global economy expected to go below trend (-25 bps in Sep, -100bps in Oct, -75bps in Nov and -100bps in Dec) • Apparent success in controlling demand condition which then help to contain inflationary pressure • Financial conditions starting to get tight due to high interest rate • Apparent signs on increase in producer prices • Significant turn for worse in the financial markets • Broad-based moderation in economics' of trading partner • Falling commodity prices	**Cumulative change: -325bps** (-25bps in Jul, -50bps in Sep, -100bps in Oct, -125bps in Dec) • Marked slowdown in domestic economy • Moderation in global economy • Inflation to peak beyond the targeted range due to higher commodity prices, depreciation of NZD as well as domestic generated factors (local body rates and electricity tariff) • RBNZ needed to boost domestic demand in light of weak external sector	**Cumulative change : -250bps** (-50bps each in Mar and Apr, -75bps in Oct and Dec) • 1H: Domestic demand remained buoyant but significantly weak exports • Rising commodity prices could be inflationary, but contained demand and domestic factors (lower price adjustment for cars and cheaper tax systems) • 2H: Impact of GFC affecting Canadian economy • US went into mild recession leading to weaker domestic demand • Commodity price moderating
2010 – 2011 (27.3% increase in commodity prices)	**Cumulative change: -50 bps** (-25bps each in Nov and Dec) • Weak external sectors • AUD strengthened significantly • Despite rising commodity prices, inflation to remain subdued due to low demand and strong AUD	**Cumulative change: -50bps in March** • Earthquake in Christchurch affecting domestic economy and business confidence • Cautious household spending • Apparent signs to higher inflation due to poor crops harvest and high global commodity prices • Pre-emptive decision to contain the negative effect of earthquake	**Cumulative change: Unchanged**

Period of commodity price increases	Countries		
	Thailand	**Philippines**	**Brazil**
Net commodity exporter/importer	Net commodity exporter (16%)	Net commodity exporter (12%)	Net commodity exporter (29%)
1999-2000 (25.2% increase in commodity prices)	**Cumulative change: 0 bps** • Inflation pressure remained subdued and less than previously estimated • Recovery in domestic economy was still modest	**Cumulative change: +500 bps** (+125 bps in May, +100 bps in September, +400 bps in October) • To address narrowing interest rate different between peso- and dollar-denominated assets and pass-through from adjustment in domestic oil prices, transport fares and wage rates (Subsequently adjusted -125 bps in December) • To sustain momentum of economic activity	**Cumulative change: -225 bps** (-50 bps in March, -100 bps each in June and July, -75 bps in December) • Real rate of interest is not neutral and above equilibrium level for the economy • More moderate pace of consumer and investment growth • Absence of imbalances that could generate inflationary pressures, notwithstanding the risks from international commodity prices. Inflation target was expected to be attained. • Stability of inflation expectations
2004 – 2006 (24.7% increase in commodity prices)	**Cumulative change (2004): +75 bps** (+25 bps each in August, October, December) **Cumulative change (2005): +200bps** (+25 bps each in March, June, July, +50 bps in September and October followed by +25 bps in December) • Greater risks to price stability • Rise in global crude oil prices led to adjustment to price administered items (benzene, diesel, electricity) • Increase in core inflation • Demand-side price pressures due to strong economic growth	**Cumulative change (2004): 0 bps** **Cumulative change (2005): +75bps** (+25 bps each in April, September and October) • Supply-side price pressures to build up given likelihood of continued high crude oil prices for the foreseeable future • Greater risk that public will expect future inflation to spiral away from inflation target	**Cumulative change (2004): +125 bps** (-25 bps each in March and April, +25 bps in September and +50 bps each in October, November, December) **Cumulative change (2005): -25bps** (+50 bps in January and March, +25 bps in April and May) • Inflation to remain above target due to adjustments to administered prices and domestic food price increases • Increase in inflation expectations (Subsequently adjusted -25 bps in September, -50 bps each in October until December) • Consistent with inflation convergence to the target path, given benign inflationary environment
2007-2008 (43.9% increase in commodity prices)	**Cumulative change: +50 bps** (+25 bps each in July and August) • Impact of supply-side pressures on price stability would remain significant • Inflation expectations were anticipated to remain at high level (Subsequently adjusted -100 bps in December) • Larger risks to growth due to drastic slowdown in global economy • Marked decrease in risks to inflation	**Cumulative change: +75 bps** (-25 bps in January[23], +25 bps in June, +50 bps in July and +25 bps in August) • Inflation rate was likely to breach target, given persistent surge in commodity prices • Increase in core inflation indicated that supply-driven pressures were feeding into demand • Upward shifts in inflation expectations • Solid domestic growth implies economic can withstand tightening measure	**Cumulative change: +250 bps** (+50 bps each in April and June, +75 bps each in July and September) • Inflation was projected to remain above target due to adjustments to administered prices • Increase in inflation expectations • Robust domestic demand growth
2010 – 2011 (27.3% increase in commodity prices)	**Cumulative change: +50 bps** (+25 bps each in January, March, April, June. July and August) • Heightened price pressures from both demand and supply factors (Subsequently adjusted -25 bps in November) • Support domestic recovery from flood, amid limited upside risks to inflation	**Cumulative change: +50 bps** (+25 bps each in March and May) • Risks of inflation forecast breaching the target • Sustained price pressures from elevated global oil prices. Headline and core inflation have started to rise • Upward shits in public's inflation expectations • Economy was expected to grow above trend with high capacity utilisation and pick-up in private investment	**Cumulative change: +25 bps** (+50 bps each in January and March, +25 bps in April, June and July, -50 bps in August, October and November) • Continuous increase in global prices of commodities led to price adjustments, which reinforces future price increase expectations

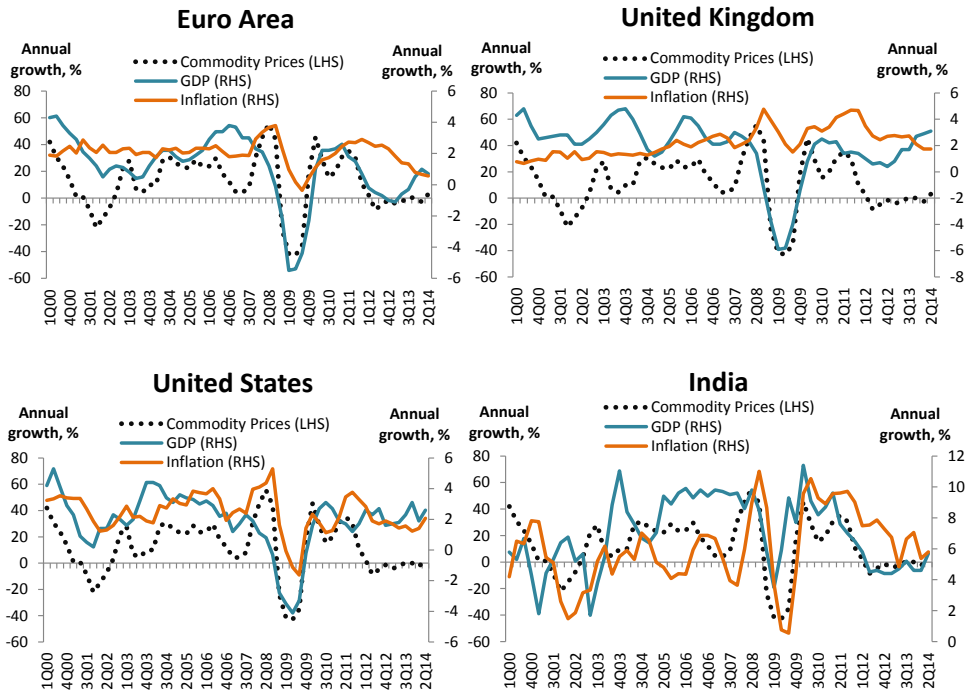
[23] This is the fourth consecutive rate reduction Bangko Sentral ng Pilipinas since October 2007 in view of benign inflation outlook.

Period of commodity price increases	Countries		
	Malaysia	**Indonesia**	**South Korea**
Net commodity exporter/importer (net export of commodities over total goods exports)	Net commodity exporter (36%)	Net commodity exporter (49.1%)	Net commodity exporter (20%-30%)
1999-2000 (25.2% increase in commodity prices)	**Cumulative change: 0 bps** • Accommodative stance to support growth in the absence of inflationary pressures • Economic activity expanded strongly • Low inflation, due to stable exchange rate and low inflation abroad	**No policy rate used**	**Cumulative change: +50bps** (+25bps in Feb and Oct) • Inflation has been on an increasing trend due to the surge in international oil price and public service charges • Keeping IR low would give rise to an undesirable bunching of funds at the short term
2004 – 2006 (24.7% increase in commodity prices)	**Cumulative change (2004): 0 bps** **Cumulative change (2005): +30 bps** (+30 bps in November) • Risks of slower growth diminished while inflation risks biased towards the upside • Domestic economy activity gained momentum • Strong inflationary pressures from increase in administered prices	**Cumulative change (2005): +425bps** (+25bps in Aug, +125bps in Sep, +100 in Oct, +125bps in Nov and +50bps in Dec) • Inflation needs to be brought to down to medium term target after a hike in domestic petrol price following spike in global commodity price • Rupiah weakened considerably in the 1H of 2005 • Need to rebuild investor and public confidence following weaker external demand	**Cumulative change (2004): -50bps** (-25bps in Aug and Nov) • Sluggish private consumption and facilities investment • Exports and construction investment are expected to moderate • Despite upside risk to inflation remains following increasing global oil price **Cumulative change (2005): +50bps** (+25bps each in Oct and Dec) • Investments improved rapidly, robust export growth, and strong private consumption • Risk to higher inflation following persistently high global oil price • Improvement in investments, robust exports growth, and strong private consumption
2007-2008 (43.9% increase in commodity prices)	**Cumulative change: -25 bps** (-25 bps in November) • Inflation moderated after reaching high levels in 3Q • Marked deterioration in global conditions affected the economy, as reflected in the rapid slowdown in export performance and industrial production	**Cumulative change: +125bps** (+25 bps each from May till Oct) • Rising inflationary pressure, particularly external factor following spike in global oil price. As a result, administered petrol price is revised upwards • Domestic food price increased • Global economic slowdown • Important to manage future expectations particularly on inflation • (-25bps in Dec) • Easing inflationary pressure following moderation in global commodity prices • Impact of financial crisis waning • Important to resolve issue of segmentation on the interbank money market • Need to sustain business momentum in light with global economic slowdown	**Cumulative change: -200bps** (+25bps in Aug) • Export remained robust despite sluggish domestic demand • Risk to higher domestic inflation following elevated global oil price (-50bps in Sep, -100bps in Oct, -125bps in Dec) • Domestic demand slowed down rapidly • Sluggish domestic demand and investment, while export turned negative • Inflation also decelerated rapidly following fall in global oil prices • Hence, there was a need to improve liquidity conditions and ward off the risk of a severe slowdown in economic activity
2010 – 2011 (27.3% increase in commodity prices)	**Cumulative change: +25 bps** (+25 bps in May) • Steady economic growth with signs that domestic demand factors could exert upward pressure on prices • Global commodity prices were projected to remain elevated with inflation in major trading partners to rise further	**Cumulative change: -50 bps** (+25bps in Feb) • To contain rising inflation expectations following higher global commodity price and escalating domestic food price • There was a need to strengthen rupiah (-25bps in Oct and -50bps in Nov) • Declining trend in inflation pressure • Bank's aim to narrow interest rate term structure • Contain impact from worsening global economy • Moderation in global commodity prices	**Cumulative change: +50bps** (+25bps each in Mar and Jun) • Favourable economic conditions in emerging economies • Domestic demand remained strong and resilient • Inflationary risk due to rising oil prices and strong demand condition • Housing price increase at a fast rate due to strong credit expansion

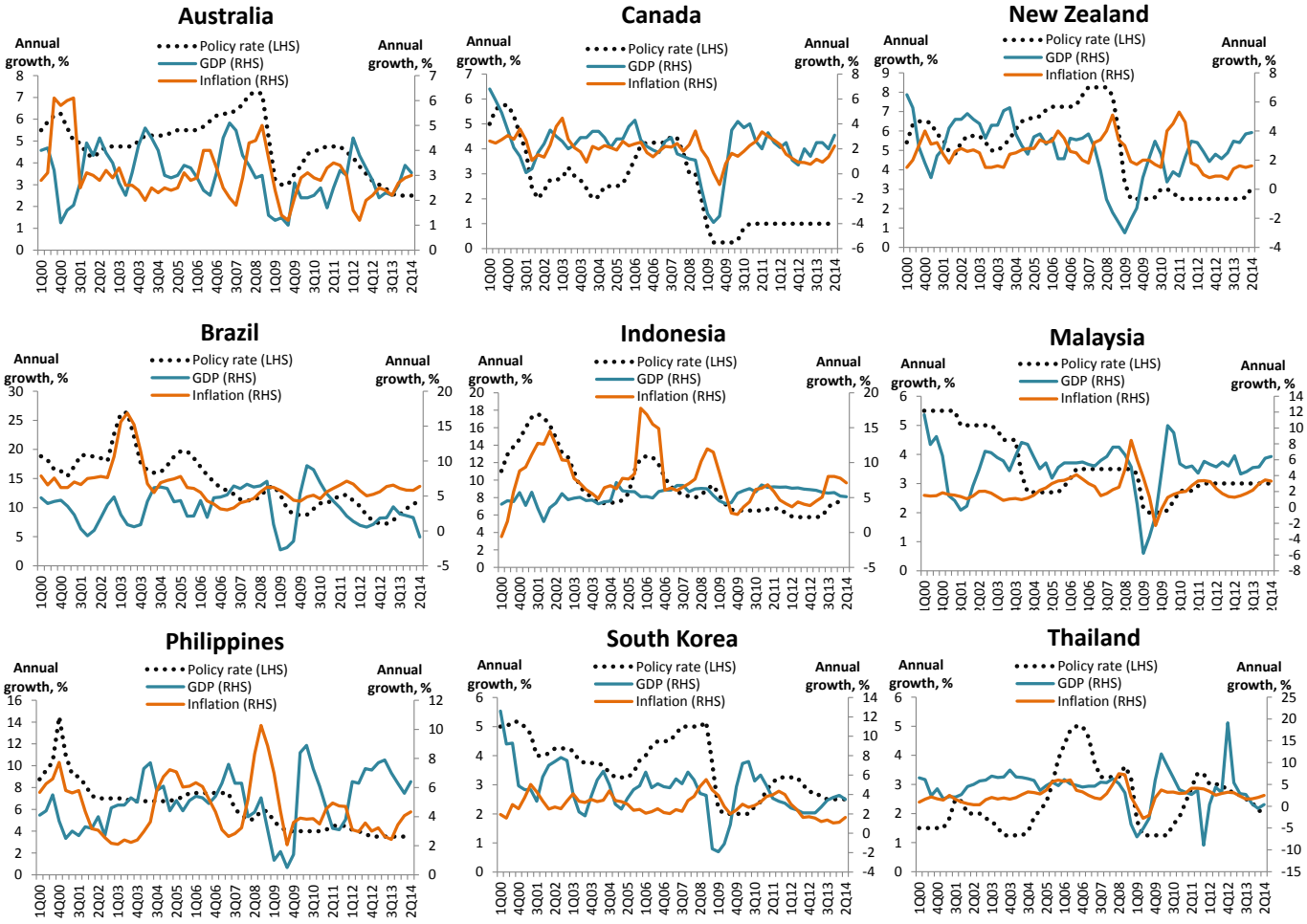
Period of commodity price increases	Countries
	India
Net commodity exporter/importer (net export of commodities over total goods exports)	Net commodity importer
1999-2000 (25.2% increase in commodity prices)	**No information available** (A combination of various tools of monetary policy was deployed: Cash Reserve Ratio, Reverse Repo, Money supply and etc)
2004 – 2006 (24.7% increase in commodity prices)	**Cumulative change (2004): 0bps** **Cumulative change (2005): +25bps in October** • Growing uncertainties to global oil prices • Robust domestic demand condition • Stabilising domestic financing condition
2007-2008 (43.9% increase in commodity prices)	**Cumulative change: -125 bps** (+75bps in Jun and +50bps in Jul) • Managing expectations (particularly anchoring inflation expectation) in the environment of uncertainties • Escalating food and energy prices • Domestic demand pressures persisted (-100bps in Oct, -50bos in Nov, -100 bps in Dec) • Spillover effects from US financial crisis and Europe slowdown • Low confidence in business • Pre-emptive move to boost domestic demand • Signs of easing in inflation
2010 – 2011 (27.3% increase in commodity prices)	**Cumulative change: +175 bps** (+50bps in May and Jul, +25bps in Jun, Sep and Oct) • High and persistent inflation arising from rising global commodity prices and domestic food prices • As a result, inflation expectations showed signs of firming up • Demand condition still remained strong



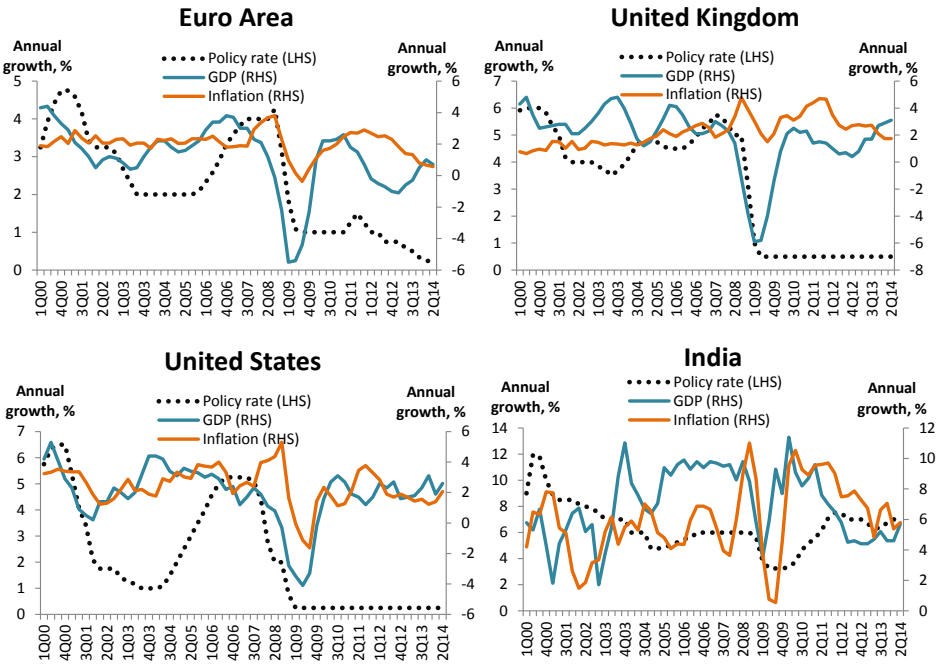
B1: GDP Growth, Inflation of Commodity Exporters against Global Commodity Prices



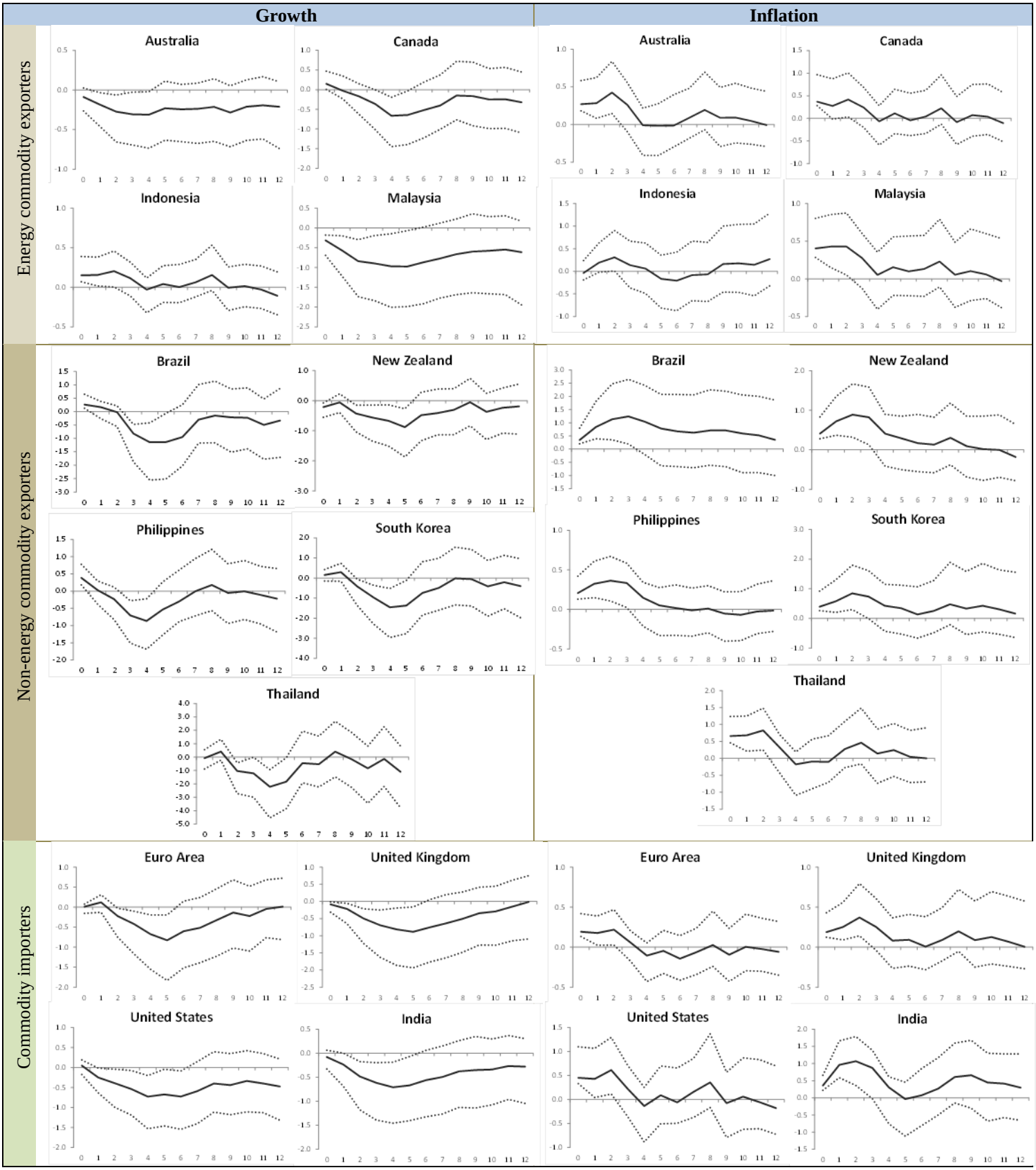
C1: GDP Growth, Inflation and Policy Rate of Commodity Exporters



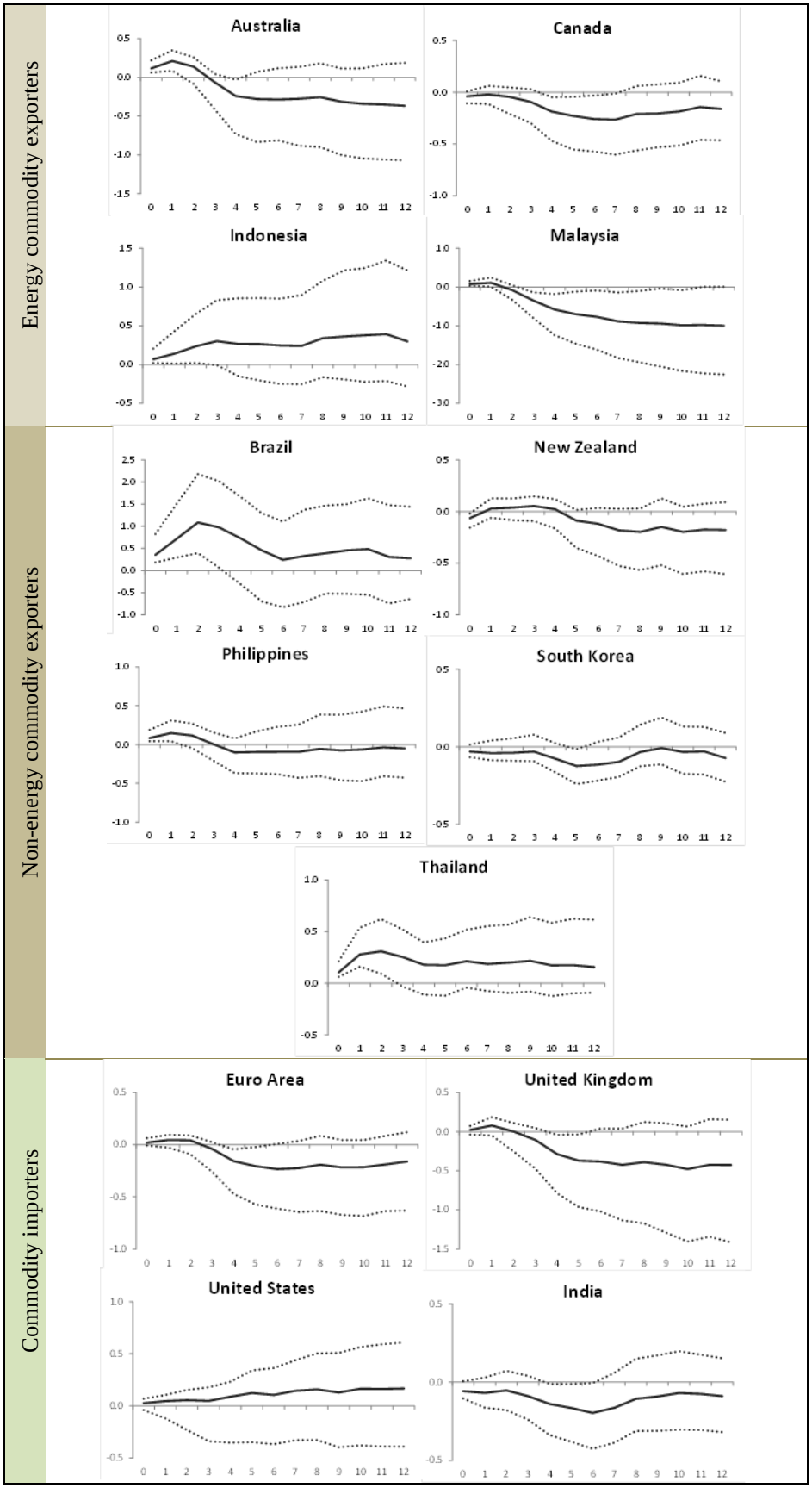
C2: GDP growth, inflation and policy rate of commodity importers



D1: GIRFs of Growth and Inflation to 1 s.e. Shock to Global Commodity Price (with 90% Bootstrapped Error Bands)



D2: GIRFs of Policy Rates to 1 s.e. Shock to Global Commodity Price (with 90% Bootstrapped Error Bands)



D3: GIRFs of Policy Rates to 1 s.e. Shock to Policy Rate (with 90% Bootstrapped Error Bands)

