Chapter 1

THE ROLE OF GLOBAL AND DOMESTIC SHOCKS FOR INFLATION DYNAMICS: EVIDENCE FROM ASIA[1]

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1. Introduction

Over the past two decades, many advanced and emerging economies experienced low and relatively stable inflation rates. At the same time, inflation more and more appears to be decoupled from economic activity. The sharp drop in GDP during the Great Recession did not lead to a further drop in inflation, thus giving rise to the 'missing deflation' phenomenon. Likewise, the strong economic recovery did not go hand in hand with rising inflation rates. Based on these observations, the literature largely studies the changing nature of inflation dynamics and, in particular, the shifting relationship between inflation and economic activity. Often this research agenda is described in terms of a 'flattening' of the Phillips curve (see Coibion and Gorodnichenko, 2015, and others). A reduction in the slope of the Phillips curve relationship would have drastic consequences for monetary policy. For given inflation expectations, the argument goes, a flatter Phillips curve would require a deeper recession in order to bring inflation back to the target.

One explanation for the apparent changes in the inflation process is the ongoing global integration of financial and goods markets. However, quantifying the extent to which global driving forces explain inflation is not straightforward. In her survey article, Forbes (2018) argues that the role of global factors (commodity prices, measures of global slack, exchange rates, price competition) has changed over time. She finds that the relation between domestic output gaps and inflation rates has weakened and advocates that models of inflation such as the Phillips curve should incorporate changes in the global economy in order to provide a good account of the determinants of inflation. If global factors are indeed driving a substantive share of inflation, domestic monetary policy is less able to stabilize inflation and the real economy. As monetary policy primarily affects inflation through expanding or contracting domestic demand, the power of central banks to control inflation would be limited in a world in which global forces dominate.

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In this paper, we add to this literature and study six Asian emerging market countries: Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. Countries in Asia are prototypical small open economics that are well integrated into the world economy.[4] In addition, all six economies explicitly or implicitly have a mandate for maintaining price stability.[5] Recently, IMF (2018) claims that the sensitivity of inflation rates in Asian emerging market economies with respect to real activity declined, thus leading to a flatter Phillips curve.

We proceed in three steps. First, we estimate a series of structural vector autoregressive (VAR) models, in which we use alternative sets of constraints to identify a battery of shocks. In our baseline model, we apply sign restrictions as in Corsetti et al. (2014) to identify domestic demand and supply shocks as well as global demand and supply shocks. While demand and supply shocks can be distinguished based on the responses of inflation and GDP growth being positively correlated (in the case of demand shocks) or negatively correlated (for supply shocks), we disentangle domestic from global shocks based on the relative response of domestic GDP to world GDP. Second, the identified VAR model allows the application of several structural analyses in order to address the role of the structural shocks we identify on the variability of inflation and the growth rate of real GDP. By doing so, we focus on four categories of shocks, i.e. global, domestic, exchange rate and monetary policy shocks. We first decompose the variance of forecast errors. The forecast error variance decomposition (FEVD) tells us how much of the forecast error variance can be explained due to exogenous shocks to other variables in the system. We therefore ask for the amount of information each variable contributes to the other variables in the autoregressive process. While the FEVD describes average movements in the data, it does not allow us to quantify the amount of how much of the observed variability is explained by specific shocks. Hence, we also decompose the history of inflation and GDP growth into the historical contributions of each shock in order to quantify the cumulative effects on these series. Our results of both the FEVDs as well as the historical decompositions suggest that global shocks play an important role for all six countries under investigation. In particular, global shocks are an important driver of inflation around the Great Recession, as they explain most of the increase and subsequent plunge in inflation rates during 2008/9.

We also run counterfactual simulations in order to derive the hypothetical effects of shocks in the past on today's outcomes. By changing the history of certain structural shocks, we are able to simulate counterfactual outcomes and ask how our endogenous series would have evolved in the absence of these shocks. The advantage here is that contrary to the historical decomposition of our series, we can easily visualize uncertainty around the cumulative effects and can underpin the relative role of global versus domestic shocks more easily.

In the third step, we revisit the Phillips curve relationship. The VAR model provides us with the domestic component of GDP, i.e. the fraction of GDP that is driven by all shocks other than global shocks, and global components of GDP, the part of economic activity driven by global demand and supply shocks. We estimate the Phillips curve using this decomposition of GDP. The model allows different domestic and global components to enter the Phillips curve with different coefficients and potentially different signs. Hence, the model nests the conventional Phillips curve specification if the coefficient on the global component equals the one on the domestic component. We find that for all countries, the Phillips curve is still alive with respect to pure domestic economic activity. Taking

4. Auer and Mehrotra (2014) argue that the integration of Asian economies into global supply chains matters. The correlation of inflation rates across Asian economies increases with the extent of their bilateral trade relationships.

5. See Volz (2015) for a discussion of the experience with inflation targeting in Asia.

global driving forces into account, our results suggest that for most countries, the Phillips curve became even steeper over time. However, our results also suggest that the nature of global shocks matters. In this respect, we see that global supply shocks seem to flatten the Phillips curve throughout our set of countries, while the opposite is true for global demand shocks. On aggregate, our results reveal that the effect of global demand shocks dominates the effect of global supply shocks.

Our paper connects several strands of the literature: First, a recent branch of the literature studies the co-movement of inflation rates across countries. Ciccarelli and Mojon (2010) find that for 22 OECD countries, a single common factor explains about 70% of the variation in inflation. They refer to this phenomenon as 'global inflation'. Unless real economic activity is equally well explained by a common factor, this implies a weakening of the relationship between domestic output and inflation. The evidence provided by Neely and Rapach (2011) and Mumtaz and Surico (2012) supports this finding. In contrast, Förster and Tillmann (2014) show evidence that is consistent with 'local inflation', that is inflation being primarily driven by domestic variables. Recently, Parker (2018) uses a very large data set with more than 200 countries to show that the global inflation hypothesis does not fit emerging and developing countries, in which only a subset of prices such as those for oil and food are driven by global shocks.

A second strand of research argues that conventional Phillips curve regressions that relate inflation to, among other variables, a measure of domestic slack such as the output gap, should be augmented by measures of global slack or a 'global output gap'. Borio and Filardo (2007), using a cross-section of countries, find that the explanatory power of global factors as reflected in measures of global slack increased over time. For some countries, these authors find global factors to be the dominant drives of inflation. Supportive evidence for advanced economies is provided by Milani (2009, 2010) and others, while Ihrig et al. (2010) cannot find evidence in favor of the 'globalization of inflation' hypothesis.

The concept of global output gaps, however, is not without flaws (see Tanaka and Young, 2008, and Gerlach, 2011). Jasova et al. (2018) point to the fact that for a typical small open economy, the domestic output gap should be highly correlated with the global output gap, i.e. the weighted gap of the economy's main trading partners. This correlation obscures the identification of the true structural driving forces of inflation dynamics. The approach taken in this paper, in contrast, identifies orthogonal domestic and global components of output based on the co-movement between global and domestic variables. This procedure avoids some of the weaknesses of estimates of global slack.

A third strand uses identified time series models to study the determinants of inflation dynamics together with other key business cycle variables. As mentioned before, Corsetti et al. (2014) and Bobeica and Jarocinski (2017) propose a set of sign-restrictions that allows us to quantify the response to orthogonal domestic and global shocks, respectively. Conti et al. (2017) apply a similar identification scheme to decompose euro area inflation. All three papers attribute an important role to global driving forces of inflation. As an increasing integration of goods and financial markets should make global factors more important over time, Bianchi and Civelli (2015) allow the coefficients of their VAR model to vary over time. Their evidence suggests that global slack as a determinant of inflation does not become more important over time. Eickmeier and Kühnlenz (2018) focus on the role of China for inflation dynamics in advanced and emerging economies. Estimating a factor model for 38 countries, they find that demand and supply shocks originating in China have a significant impact on inflation in other economies.

The remainder of this paper is organized as follows. Section 2 introduces our empirical framework, including the data set and the identification strategy. The results, i.e. impulse responses, forecast error variance decompositions, historical decompositions and counterfactual simulations, are discussed in Section 3. Section 4 examines the Phillips curve trade-off based on the domestic and global components of output. Section 5 draws conclusions for monetary policy.

2. Empirical Framework

The empirical analysis in this paper is based on an identified VAR model, as pioneered by Sims (1980). Much of the analysis that follows is based on the interpretations of structural shocks, i.e. disturbances that drive the dynamics of our economic variables. Therefore, we will carefully describe how the structural shocks in our analysis are identified.

2.1 The VAR Model

Our model can be written as:

$$y_t = c + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \varepsilon_t, \qquad t = p + 1, \ldots, T, \qquad (1)$$

where y_t is an $n \times 1$ vector of endogenous variables, which in our case will include key macroeconomic time series. Furthermore, $A_1, \ldots, A_p$ are $n \times n$ matrices capturing the VAR-coefficients and ε_t is an $n \times 1$ vector of residuals which is assumed to follow a multivariate normal distribution $\varepsilon_t \sim N(0, \Sigma)$.

A major challenge when dealing with impulse responses from VAR models with Σ being unrestricted a-priori is that they arise from shocks that are correlated. Put differently, the variance-covariance matrix Σ of the reduced form VAR as in (1) is typically not diagonal. In that case, the interpretation of impulse responses is likely to be misleading and meaningless given the fact that shocks typically arise simultaneously. To overcome this issue, we derive structural VARs (SVARs) for each country as they allow us to obtain the responses of variables to distinct orthogonal shocks.

To do so, note that (1) can be formulated in a structural form that reads:

$$D_0 y_t = F + D_1 y_{t-1} + \cdots + D_p y_{t-p} + \eta_t,$$

where $\eta_t \sim N(0, \Gamma)$ is the vector of structural shocks we are interested in. Since the SVAR model as above is now augmented by the structural matrix D_0, Γ will be a diagonal identity matrix, i.e. structural disturbances in η_t are mutually independent. This is reasonable from a theoretical point of view as it makes sense to assume that structural disturbances are uncorrelated and arise independently.

In our estimation, we rely on a Bayesian framework, where the coefficients as well as the residual variance-covariance matrix are understood as random variables and characterized by some probability distribution. The basic principle of Bayesian analysis is to combine our subjective prior information with the likelihood function according to the Bayes rule in order to derive a posterior distribution which combines both sources of information. Let θ be the vector which contains all parameters of interest, also let y be the data set. The Bayes rule therefore reads:

$$\pi(\theta|y) = \frac{f\,(y|\theta)\pi(\theta)}{f(y)}.$$

The Bayes rule says that the posterior distribution, $\pi(\theta|y)$, is equal to the product of the likelihood function $f\,(y|\theta)$ with the prior distribution $\pi(\theta)$, which is normalized by the posterior density $f\,(y)$. In our benchmark model, we use $p = 2$ lags. We rely on a normal-Wishart prior, where it is assumed that both β and Σ are unknown. We follow standard literature and set the overall tightness to $\lambda_1 = 0.1$ and the lag decay to $\lambda_3 = 2$. Each country-specific benchmark estimation relies on 5000 draws, where the first 3000 draws are discarded as the first draws of the joint posterior are likely to be not representative for the target distribution we are looking for.

2.2 Data and Shock Identification

We estimate the model for six Asian emerging market economies: Indonesia (IDN), Korea (KOR), Malaysia (MAL), the Philippines (PHL), Singapore (SGP) and Thailand (THA). The vector of endogenous variables includes the oil price, real GDP, consumer prices, the short-term interest rate as a measure of monetary policy, the real effective exchange rate and the share of domestic real GDP in world real GDP. The latter variable will be particularly important in order to separate global from domestic shocks.[6] All variables other than the share in world GDP and the interest rate are included in year-on-year growth rates in percentage points. The data covers the sample period 2001Q1 to 2018Q1 and the frequency is quarterly. Our choice of year-on-year growth rates is motivated twofold: first, the seasonal pattern in the data might be different compared to advanced economies, i.e. due to the Chinese New Year and other regional effects. Using year-on-year rates allows us to ignore seasonal adjustment. Second, inflation targeting monetary policy is typically formulated in year-on-year inflation rates. Our policy counterfactuals presented below are thus in line with definitions used by central banks.

The share in world GDP is included in differences (percentage point change from year ago). An increase in the real effective exchange rate corresponds to a real appreciation of the domestic currency.[7]

6. We use headline inflation instead of core inflation. This is because central banks typically use the growth rate of the overall price index as a target variable. Moreover, data on core inflation is not available for all six countries under consideration.

7. The data GDP, prices and the interest rate is taken from the CEIC database. Oil prices are drawn from the FRED database at the St. Louis Fed. For the real effective exchange rate, we use the data provided by the BIS pertaining to a broad set of trading partners. The share in world GDP is drawn in annual frequency from the world economic outlook (2018) and interpolated (cubic spline interpolation method) in order to get quarterly data.

To identify structural shocks, we use three sets of alternative restrictions, see Table (1). The first two sets impose alternative sign restrictions onto the variables (Uhlig, 2005), while the third imposes a Cholesky ordering.

I. Baseline Sign Restrictions

Our first identification strategy follows Corsetti et al. (2014), who impose a mixture of sign and zero restrictions in order to distinguish domestic shocks from global shocks as well as supply shocks from demand shocks. The key variable in this identification pattern is the share of real domestic GDP in world real GDP, as it allows us to distinguish disturbances that hit the global economy more than the domestic economy and vice-versa.

Both a domestic as well as a global demand shock are supposed to raise both domestic prices as well as domestic real GDP. The imposed positive sign on the GDP share means that domestic real GDP increases more than real GDP in the rest of the world does, i.e. the effect of a domestic demand shock has a stronger effect on domestic GDP. In contrast, a global demand shock leads a drop in the share of domestic real GDP relative to the rest of the world GDP, meaning that a global demand shock has a stronger effect on the rest of the world, though domestic real GDP and domestic consumer prices are assumed to increase.

In order to further distinguish global demand shocks from domestic demand shocks, we also assume that a global demand shock leads to an increase of the oil price, while both the interest rate as well as the exchange rate remain unrestricted. Because we focus on small open economies, domestic demand shocks leave the oil price unchanged (i.e. unrestricted), but the interest-rate is assumed to increase in order to reduce inflation pressure.

An oil supply shock, which is intended to represent a global supply shock, is restricted to decrease domestic real GDP and increase inflation, while the immediate response of domestic short-term interest rate is restricted to zero.[8] This is due to the fact that the central bank does not contemporaneously respond to oil shocks.[9] In contrast to a domestic demand shock, a domestic supply shock leads to opposite responses of output and prices. In order to get distinct global and domestic supply shocks, the domestic supply shock is also assumed to increase domestic real GDP relative to real GDP of the rest of the world. The restrictions on the monetary policy shock imply that variables other than the exchange rate respond with at least one-month delay to an increase in the interest rate. An exchange rate shock is surprise change in the exchange rate that contemporaneously keeps all other variables unchanged.[10]

8. Indonesia is a net oil importing country, although the country also had net oil exports in the past. Malaysia is a (small) net oil exporting country. These potential limitations should be kept in mind when discussing the results for oil price shocks.

9. For a further discussion, see Bobeica and Jarocinski (2017) and Corsetti et al. (2014).

10. Singapore operates a system of a managed exchange rate against a basket of currencies. Hence, an exchange rate shock as identified here could also be interpreted as monetary policy shock.

II. Alternative Sign Restrictions

An alternative set of sign restrictions follows Bobeica and Jarocinski (2017), who adopt a mixture of the sign restrictions proposed in Corsetti et al. (2014) and Baumeister and Benati (2013). The identification scheme differs from the baseline set of restrictions only with respect to the identification of the monetary policy shock. It is assumed that real activity and inflation immediately respond to a monetary policy shock in a way that is consistent with standard theories of monetary transmission. Since the monetary policy tightening has a stronger effect on the domestic economy than the rest of the world, the GDP share is also assumed to drop immediately after the shock hits the economy. In addition, the domestic currency appreciates in real terms following a policy tightening.

III. Cholesky Ordering

For robustness purposes, the last identification strategy is based on a Cholesky approach, where the variance-covariance matrix is decomposed into a product of a lower triangular matrix and its transpose. We order the oil prices first, followed by the share of domestic real GDP relative to GDP of the rest of the world. The domestic short-term interest rate is ordered after domestic real GDP and inflation, respectively, while the exchange rate is ordered last. Note that this ordering assumption relies on a timing restriction, i.e. it is assumed that global shocks (oil supply and global demand) are assumed to immediately affect all other variables, while domestic shocks do not affect global variables (oil price and GDP share) contemporaneously. Ordering the short-term interest rate after domestic real GDP and inflation delivers a distinct monetary policy shock, as is standard in the literature (see, for instance, Christiano et al., 1999). Ordering the exchange rate last implies that all structural shocks immediately affect the exchange rate, but the contrary does not hold. Note also that the exchange rate shock is common to all three identification strategies I-III.

All results reported throughout this paper are based on the baseline identification strategy I, i.e. the Corsetti et al. (2014) identification.[11]

3. Results

3.1 Impulse Responses

The impulse responses are shown in Figures (1) to (12). Each figure presents the response of inflation or GDP growth, respectively, to each of the six identified shocks. The shock size is normalized to one standard deviation. Since the VAR model is heavily restricted, we do not emphasize the interpretation of the responses too far. Note, however, that most responses are persistent, though the restrictions on the sign of the responses are imposed on impact only. Take Korea as an example. The responses of inflation, see Figure (4), to domestic and global demand shocks is quite persistent. Inflation returns to its mean two or three years after the shock. Hence, the sign restrictions do not seem to overly stretch the data. We also find that monetary policy shocks and exchange rate shocks give rise to an insignificant response of inflation. These results will turn out to be important below.

11. The results based on identification strategies II and III lead to qualitatively similar results, which are available on request.

3.2 Forecast Error Variance Decomposition

A decomposition of the forecast error variance tells us how much of the forecast error variance is due to exogenous shocks and thus indicates the amount of information each variable contributes to the other variables in the autoregressive process. Notice that our VAR model in the reduced form can be rewritten as a moving average that reads:

$$y_t = A(L)^{-1}c + \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \Psi_2 \varepsilon_{t-2} + \cdots,$$

where Ψ_k for $k = 1, \ldots, \infty$ captures the series of impulse function matrices. By exploiting the fact that $\Psi_k \varepsilon_{t-k} = \Psi_k D_0 D_0^{-1} \varepsilon_{t-k} = \widetilde{\Psi}_k \eta_{t-k}$, it is possible to write a system in terms of structural disturbances:

$$y_t = A(L)^{-1}c + \sum_{k=0}^{\infty} \widetilde{\Psi}_k \eta_{t-k}.$$

We can decompose the forecast y_{t+h} into three components:

$$y_{t+h} = A(L)^{-1} + \sum_{k=0}^{\infty} \widetilde{\Psi}_k \eta_{t+h-k} + \sum_{k=0}^{h-1} \widetilde{\Psi}_k \eta_{t+h-k},$$

where the last term describes the contribution of unknown future shocks. The forecast errors for variable i in the VAR therefore reads:

$$y_{i,t+h} - E_t y_{i,t+h} = \sum_{k=0}^{h-1} \tilde{\psi}_{k,i1} \eta_{1,t+h-k} + \cdots + \sum_{k=0}^{h-1} \tilde{\psi}_{k,in} \eta_{n,t+h-k}.$$

Denote by $\sigma_{y,i}^2(h)$ the forecast error variance of y_i h stepts ahead and $\sigma_{\eta,1}^2, \ldots, \sigma_{\eta,n}^2$ the variance of structural disturbances. Since our structural disturbances are, by construction, uncorrelated, taking the variances on both sides and dividing by $\sigma_{y,i}^2(h)$ yields:

$$1 = \frac{\sigma_{\eta,1}^2}{\sigma_{y,i}^2(h)} \sum_{k=0}^{h-1} \tilde{\psi}_{k,i1}^2 + \cdots + \frac{\sigma_{\eta,n}^2}{\sigma_{y,i}^2(h)} \sum_{k=0}^{h-1} \tilde{\psi}_{k,in}^2.$$

Each term on the right-hand side tells us the contribution of the underlying structural shocks on the forecast error variances. Throughout the paper, we summarize the contributions of all shocks into four main categories, namely (i) monetary policy shocks, (ii) exchange rate shocks, (iii) domestic shocks and (iv) global shocks. Thereby, we exploit ‘domestic’ shocks as the umbrella term for both domestic demand as well as domestic supply shocks. Meanwhile, ‘global’ shocks summarize both global demand and oil supply shocks, while monetary policy shocks and exchange rate shocks are the remainder.

Table (2) reports the results of the forecast error variance decomposition for inflation and GDP growth for different horizons, i.e. for $h = 4{,}8$ and $h = 12$. As expected, small open economies in Asia are very much exposed to global driving forces of inflation. Our results suggest that global shocks drive a large fraction of inflation dynamics. Over a horizon on $h = 8$ quarters, global shocks explain between 35% (Indonesia) and 70% (Malaysia) of inflation. That is, whenever we try to forecast inflation, a large portion of the forecast error occurs because global shocks push inflation above or below the predicted value. The remaining part of inflation dynamics is driven by domestic shocks, with exchange rate and monetary policy shocks playing a minor role. For GDP growth, we find that global shocks explain between 34% (Thailand) and 59% (Philippines) of output growth over a two-year horizon.

3.3 Historical Decomposition

While structural forecast-error-variance decompositions and structural impulse response functions describe average movements in the data, they do not allow us to quantify the amount of how much of the historically observed fluctuations of a variable is explained by one specific shock. Even though our results so far suggest that both global and domestic shocks are an important driver for inflation and GDP growth, we do not know anything about the effect of past (known) shocks on the fluctuation of these variables. Hence, to establish the contribution of structural shocks to the dynamics of our data series, we depart from unconditional expectations and derive the posterior distribution of historical decompositions for every endogenous variable. Contrary to the average contribution of our identified shocks to the variability of inflation and GDP growth from 2001 to 2018, we are now interested in the cumulative effects of past shocks. Similar to the previous section, we will only report the results for inflation and GDP growth.

We can decompose the vector of endogenous variables y_t into a vector of contributions from deterministic variables $d^{(t)}$ and historical contributions of structural shocks as:

$$y_{i,t} = d_i^{(t)} + \sum_{k=0}^{t-1} \tilde{\psi}_{k,i1}\eta_{1,t-k} + \sum_{k=0}^{t-1} \tilde{\psi}_{k,i2}\eta_{2,t-k} + \cdots + \sum_{k=0}^{t-1} \tilde{\psi}_{k,in}\eta_{n,t-k} \quad (2)$$

where $\tilde{\psi}_{k,i1}$ denotes the entry of row i and column k of the structural impulse matrix $\tilde{\Psi}_k$, i.e. the impact of shock k on variable i.

The historical decomposition in (2) shows that, for example, a positive contribution of structural shock k to variable i means that shock k pushes variable i above the deterministic component, i.e. the unconditional forecast in the absence of any shocks.

Figures (13) and (14) show the historical contributions of structural shocks for the inflation rates for all countries. The black line reflects the difference between the unconditional forecast (i.e. the deterministic part) generated by the VAR and the actual data series, while the colored bars highlight the fraction of this series explained by each of the four groups of shocks.

When interpreting the historical contribution of structural shocks, it is important to note that negative values do not correspond to period of disinflation, but negative contributions that push the inflation rate below the deterministic component which is non-negative for all countries throughout the entire sample.[12]

Four key results stand out for all countries.[13] First, while for some countries the effect of domestic shocks dominates, global shocks (as contributions of oil supply shocks plus global demand shocks) play an important role for inflation. Both sources of inflation dynamics, i.e. domestic and global shocks, are typically positively correlated, that is they jointly push inflation up or down. There are only very few episodes in which both forces push inflation into opposite directions. This finding has important consequences for the design of monetary policy as we will discuss below. If both domestic and global shocks were negatively correlated, shocks would partly offset domestic driving forces. However, the results suggest that global shocks exacerbate inflation fluctuations, thus requiring a more aggressive monetary policy response.

Second, global shocks are particularly important in 2008/9. They drive inflation up before the global financial crisis and contribute to the fall in inflation during the subsequent Great Recession. Third, the very low levels of inflation observed more recently are partly due to global driving forces. In countries such as Korea, Singapore and Thailand global shocks put downward pressure on inflation after 2014.

Fourth, both exchange rate and monetary policy shocks contributed relatively little to the fluctuation of the inflation rate. While monetary policy shocks play some noteworthy role around the Great Recession in Singapore, the Philippines and Korea, they have almost no role on the dynamics of inflation in Malaysia and Thailand. This result suggests that central bank effectively stabilize the economy with only small deviations of monetary policy from its systematic component.

Exogenous fluctuations in the real exchange rate play a minor role for inflation dynamics. This is particularly interesting in light of the strong exchange rate movements in emerging economies around the adoption and the unwinding of the Federal Reserve's Quantitative Easing. It is, however, important to keep in mind that the historical decomposition dissects inflation into structural shocks, i.e. into exogenous changes of the exchange rate. Hence, the finding that exchange rate shocks play a small role only is consistent with the notion that of central banks being effective in stabilizing inflation in light of exchange rate movements.

Summing up our findings, our historical decompositions support our findings from the FEVDs insofar as global and domestic shocks seem to be the main drivers of inflation throughout our set of countries. However, they also uncover that global shocks are primarily important in 2008/9 by explaining most of the increase in inflation in 2008 and the subsequent fall thereafter. Finally, our results in this section suggest that global shocks account for much of the recently observed low inflation rates, especially in Korea, the Philippines, Singapore and Thailand.

12. That is, even when structural shocks contribute negatively to inflation dynamics, we can still observe positive inflation rates when the deterministic component is greater than the overall contribution of all structural shocks.

13. It is worth noting that the other identification strategies II and III yield very similar results. Hence, our results are robust with respect to the identification scheme used.

3.4 Counterfactual Analysis

Now that we have already learned about the contributions of structural shocks to the dynamics of inflation, we will go a step further in this section and run simulation exercises to investigate how the dynamics of our endogenous variables would have evolved in different scenarios. We run a battery of counterfactual experiments in order to shed light on the role of alternative drives of inflation and the business cycle.

We separately show how inflation and real GDP would have looked like in the absence of either domestic, global, monetary policy or exchange rate shocks. The previous analysis provides us with everything in order to derive these counterfactual paths, because these counterfactuals are the difference between the actual data and the contributions of structural shocks we have already derived before.[14]

In a first scenario, we study inflation in the absence of selected structural shocks. For that purpose, we suppress, one at a time, the four groups of structural shocks as aggregated in the previous section, i.e. (i) monetary policy shocks, (ii) exchange rate shocks, (iii) domestic shocks, as well as (iv) global shocks to zero.

This experiment follows, among others, Sims and Zha (2006) and can be summarized as follows: given the data, it is possible to draw all parameters from the joint posterior distribution. It is then easy to recover a sequence of unit-variance structural shocks (as described in section 2) and simulate a series that would have been observed, given the vector that contains the suppressed structural shocks. This is straightforward as we already have derived the historical decomposition.[15]

Each variable of our vector y_t can be rewritten as:

$$y_{i,t} = d_i^{(t)} + \sum_{k=0}^{t-1} \widetilde{\psi}_{k,i1}\eta_{1,t-k} + \sum_{k=0}^{t-1} \widetilde{\psi}_{k,i2}\eta_{2,t-k} + \cdots + \sum_{k=0}^{t-1} \widetilde{\psi}_{k,in}\eta_{n,t-k},$$

where the sums on the right-hand-side corresponds to the contributions of structural shocks, as in the previous subsection. We can then simulate counterfactual paths by setting an arbitrary shock to zero or, equivalently, subtracting the contribution of this shock. Given that η_1 corresponds to the vector of monetary policy shocks, for example, means that $\tilde{\eta}_{1,t}$ is equal to zero in every period. We construct counterfactual paths for inflation and GDP growth by separately suppressing each shock for the entire sample, i.e. separately setting $\eta_{1,t}, \eta_{2,t}, \eta_{3,t}$ and $\eta_{4,t}$ to zero. In order to save

14. Nevertheless, the derivation of the counterfactual paths makes sense for two reasons. First, it is much easier to visualize uncertainty surrounding the counterfactual. We can now say whether the contributions of structural shocks have led to significantly different results. Second, and more importantly, we now see the overall effects more clearly. Since the result of deriving the simulated paths is nothing more than subtracting the contribution of structural shocks from the observed series, we now see how a series of shocks in the past propagates through the system and affects today's dynamics.

15. Even without deriving the historical contributions of each structural shocks, one could also construct the same counterfactual data as follows: for each draw of our estimation procedure, recover the VAR coefficients as well as the structural matrix as in section 2. Then derive the vector of structural shocks η_t. Setting different shocks to zero results in a vector $\tilde{\eta}_t$ that can be used to construct the counterfactual paths. This is done by simulating the vector of counterfactual data as $y_t^{CF} = c + B_1 y_{t-1}^{CF} + \cdots + B_p y_{t-p}^{CF} + D_0^{-1}\tilde{\eta}_t$.

space, we mainly discuss the counterfactuals for Korea, see Figures (17) and (18), which depict the simulated paths for inflation and GDP growth, respectively, in counterfactual scenarios in which the aggregate global shock, the monetary policy shock, the aggregate domestic structural shock as well as the exchange rate shock are suppressed. The red solid paths correspond to the median counterfactual paths, while the shaded areas enclose the 16^{th} and 84^{th} percentiles.

Two things are noteworthy. First, similar to our results from the historical decomposition, our results suggest that the role of both monetary policy shocks (panel II) and exchange rate shocks (panel IV) is small, as in the absence of both structural shocks GDP growth and inflation would have looked very much like the observed series.

Second, suppressing either the global shock (i.e. the oil supply shock plus the global demand shock) or the domestic shock (domestic demand plus domestic supply shock) does make a difference. Starting with GDP growth, our results suggest that in the absence of global shocks, we would have observed lower GDP growth during 2003-2005 but higher growth rates, or a smaller recession, respectively, during the global financial crisis. Domestic shocks, however, seem to have a more important role for Korean GDP. From 2001Q3-2003Q2, our counterfactual growth paths remain at about 4% on average. However, since we observed higher growth rates in reality (peaking at about 8% in 2002Q3), we conclude that it is primarily domestic shocks that pushed up GDP growth. A similar argumentation holds for the rest of the sample, i.e. domestic shocks kept inflation low from 2002Q4-2004Q2 as well as in the aftermath of the global financial crisis. Summarizing the results for Korean GDP growth, we conclude that global shocks as well as domestic demand shocks seemed to have had a more important role than monetary policy shocks and exchange rate shocks. During times of financial turmoil, global shocks have a more important role than domestic shocks.

In the aftermath of the financial crisis, the counterfactual path for inflation in the absence of domestic shocks lies above the actual inflation rate, see Figure (18). Thus, domestic shocks kept Korean inflation rates low. The impact of global shocks goes into the same direction, though its magnitude is smaller. Again, monetary policy shocks and exchange rate shocks play a minor role for the determination of inflation as the respective counterfactuals are indistinguishable from observed inflation.

Robustness Check

So far, our results suggest that monetary policy shocks have little effect on the dynamics of real activity. Therefore, we now ask whether the same is true for the systematic part of monetary policy.

In order to do so, we follow, among others, Gordon and Leeper (1994), and Leeper and Zha (2003) who base the specification of monetary policy behavior on the information available to the central bank within the quarter. Recall that under our benchmark identification strategy, both demand and supply structural disturbances have simultaneous effects on the interest-rate equation. In order to impose an alternative systematic monetary policy behavior, we therefore restrict the corresponding coefficients in the structural matrix D to zero such that both demand and supply shocks do not have a contemporaneous impact on the short-term interest rate. The results (not presented) are qualitatively and quantitatively for all countries very much the same as in the benchmark case. This also reflects our previous results, i.e. that departures from the policy rule have only limited effects on inflation dynamics.

4. How Global Shocks Affect the Phillips Curve Trade-off

Much of the discussion about the changing nature of inflation is framed in terms of the Phillips curve relation between inflation and real activity. It is often argued that the process of inflation determination has changed. Not only advanced economies, but also many emerging market economies have experienced declines in inflation that were lower than expected. A flattening of the Phillips curve could have important consequences for monetary policy as disinflation policy becomes more costly in terms of foregone economic activity.

In this section, we estimate simple Phillips curves for our six countries under investigation and see if the Phillips curve is still 'alive' in general or whether shifts have occurred that led to a flattening or steepening of the Phillips curve. We further investigate whether these changes stem from domestic factors or from global factors. In contrast to much of the literature, we do not add additional variables to the Phillips curve such as oil prices of measures of global output gaps in order to assess these variables' effects on the slope of the output-inflation trade-off. Instead, we decompose the observed series of output growth into components attributable to domestic and global shocks, respectively. Thus, we can show whether global and domestic factors equally affect the Phillips curve, or whether global (or domestic) factors lead to a steepening or a flattening of the Phillips curve.

By decomposing economic growth into domestic and global components, we can also avoid an econometric problem faced by studies which extend the Phillips curve by measures of global slack. Global output gaps are typically highly correlated with the domestic output gap (see Jasova et al., 2018). Hence, the studies have difficulties separating the true effects from domestic and global forces. Instead, our decomposition is based on orthogonal structural shocks.

Note that up to now, we summarized the contributions of oil supply shocks and global demand shocks which we referred to as the contributions of 'global shocks'. That is, we ignore whether the contribution of oil supply shocks and global demand shocks can have different signs. We account for this possibility by splitting up the global component into its single parts, i.e. the parts that stems from oil supply shocks and global demand shocks.

Our baseline regression relies on a hybrid Phillips curve that reads:

$$\pi_t = b_{x,CF} x_t^{CF} + b_{x,j} x_t^j + b_\pi \pi_{t-1} + \varepsilon_t, \qquad (model\ A)$$

where π_t is the observed year-on-year inflation rate, x_t^{CF} is the counterfactual path of the growth rate of domestic real GDP in the absence of global shocks, i.e. the domestic component of economic growth. x_t^j for $j = \{oil, dem, global\}$ denotes the contribution of either oil supply, global demand shocks or the sum of both to the growth rate of real GDP. Technically, this contribution corresponds to the distance between the actual data (black line) and the median of our counterfactual data (red solid line) in our simulation exercise where we simulated global shocks away, see Figures (15) to (26). We further add past inflation as a proxy of today's expectations of future inflation. For $b_{x,CF} = b_{x,j}$, the distinction between domestic and global components of activity becomes obsolete. Hence, the model nests the conventional specification which regresses actual inflation on actual output growth.

Our sample includes observations from 2001Q3-2018Q1. In order to test for a structural break, we estimate the model not only for the full sample, but also for a sample starting in 2008Q1. Our estimation results are reported in Table (3).

Let us highlight a few key results. First, across all countries, the coefficient on x_t^{CF}, i.e. the effect of the domestic component of GDP growth is significantly positive. Our results suggest that the Phillips curve trade-off remains valid and has the expected sign. An increase in the domestic part of growth is inflationary.

Second, our results suggest that the Phillips curve became steeper since 2008, as in many cases $b_{x,CF}$ for the *post 2007* sample is higher (and still significant) than for the *full* sample.

Third, the effects of the global component are different across specifications of global shocks but equal across countries (except Malaysia). Starting with oil supply shocks, for example, we find that for all countries other than Malaysia and Singapore, including the GDP component stemming from oil supply shocks seem to flatten the Phillips curve. Interestingly, this coefficient is significant at the 1% level for Thailand and the Philippines and becomes stronger over time. For the other countries, our results suggest that this effect was significant up to 2008 for Indonesia, while the opposite is true for Korea, where $b_{x,oil}$ is estimated to -0.35 for the full sample and -1.05 (significant at the 1% level) for the short sample. While the negative sign also prevails for the estimation results for Singapore, the coefficients are not distinguishable from zero.

Turning to global demand shocks, our results suggest that for all countries, global demand shocks significantly steepen the Phillips curve. Put differently, ignoring the fraction of GDP growth driven by global demand shocks leads to a flatter Phillips curve. The effect of global demand shocks on inflation becomes stronger over time in Korea, Malaysia and weaker in the other countries.

We can conclude that the effect of global driving forces on the Phillips curve trade-off critically depends on the nature of these forces. While global factors in terms of oil supply shocks lead to a flattening of the Phillips curve, the opposite is true for global shock in terms of global demand shocks. We derive these results because our identification strategy is not only able to distinguish global shocks from domestic shocks in general, but also global oil supply shocks from global demand shocks.

In this respect, however, it is important to account for the relative share of inflation fluctuations explained by these shocks. Our results of the lower block that summarizes the contributions of both oil supply shocks and global demand shocks suggests that these two global shocks jointly lead to a steepening of the Phillips curve.

For robustness purposes, we also add control variables into the baseline regression. The reason is that the component of output growth driven by oil supply shocks is highly correlated with a fall in the price of oil. Including the growth rate of the oil price thus allows the capture of the effect of domestic output growth following an oil price shock on domestic inflation, while controlling for the actual effect on the price of oil. Hence, our alternative regression B reads:

$$\pi_t = \beta_{x,CF} x_t^{CF} + \beta_{x,oil} x_t^{oil} + \beta_{x,dem} x_t^{dem} + \beta_\pi \pi_{t-1} + \beta_{oil} \Delta oil_t + \varepsilon_t, (model\ B)$$

where everything is equal to model (A) and Δoil_t is the annual growth rate of the oil price. As can be seen in Table (4), our results do not change too much. Except for Malaysia, the coefficient $b_{x,CF}$ is significant at the 1% level for all countries. The coefficients on the components of output growth driven by oil price shocks and global demand shocks are still significant in most cases and have the same sign as before, although the coefficient $b_{x,oil}$ is not different from zero for Korea, Malaysia and Singapore.

Our results remain robust if we add country i's GDP relative to the world GDP as a second control variable, as is done in model (C). While the coefficient on the component of output growth driven by oil price shocks is still not significant for Malaysia, the qualitative results are very much the same as in both our baseline model (A) and in (B). We conclude that our results do not suffer from an omitted variable bias, which can potentially occur because of the correlation between the fall in oil prices and the growth component driven by oil price shocks.

5. Conclusions

This paper adds to the discussion about the changing nature of inflation dynamics in six Asian emerging market economies. We estimate a series of VAR models, in which we identify a battery of demand and supply shocks using sign restrictions. Focusing on the co-movement between domestic and global variables, our identification strategy also allows us to distinguish between global and domestic shocks. Relying on forecast error variance decompositions and historical decompositions, we find that (1) global factors play an important role for both inflation and the growth rate of real GDP across all countries under consideration and (2) the role of monetary policy is limited. While global factors can explain the sharp increases and the subsequent plunges around the Great Recession, they also contribute much to the low inflation rates that have been recently observed. Since global factors are driving a substantive share of inflation, domestic monetary policy is increasingly less able to stabilize inflation and the real economy.

We also revisit the Phillips curve relation between inflation and real activity. This is particularly important for policymakers as monetary policy in the short-run induces movements along the Phillips curve, thus stimulating the economy by controlling domestic demand. By decomposing the observed growth rates of domestic real GDP into components attributable to domestic and global shocks, we investigate whether potential shifts in the relationship between inflation and economic activity have led to a flattening (steepening) of the Phillips curve. Our results suggest that for all countries considered, the Phillips curve is still alive when estimated using the domestic component of GDP growth. Including the components of growth due to oil price shocks and global demand shocks, respectively, changes the Phillips curve trade-off. While GDP growth due to oil supply shocks seem to flatten the Phillips curve in all countries, the contrary is true for the fraction of GDP due to global demand shocks. In the latter case, the Phillips curve becomes steeper once we include the part of GDP driven by global demand. Hence, we show global integration affects the Phillips curve and that the nature of global shocks determines whether the curve steepens or flattens.

Our results highlight the difficulties facing inflation targeting central banks in the region. While monetary policy affects domestic demand, global demand, which drives the bulk of inflation, is not under the control of monetary policy. To mitigate the role of imported inflation, exchange rates should be allowed to adjust more flexibly. Furthermore, monetary policy should not respond to oil price shocks directly. While being accommodating to first-round effects of oil price changes, policy should focus on stabilizing second-round effects of imported inflation.

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Appendix

Table 1: Identification of Structural Shocks

Variable \ shock	*oil supply*	*global demand*	*domestic demand*	*domestic supply*	*monetary policy*	*exchange rate*
I. Sign restrictions, Corsetti et al. (2014)						
Oil price	+	+				0
GDP share		-	+	+	0	0
Real GDP	-	+	+	+	0	0
Consumer prices	+	+	+	-	0	0
Interest rate	0				+	0
Exchange rate	+			+		+
II. Alternative sign restrictions						
Oil price	+	+			0	0
GDP share		-	+	+	-	0
Real GDP	-	+	+	+	-	0
Consumer prices	+	+	+	-	-	0
Interest rate	0		+		+	0
Exchange rate	+			+	+	+
III. Cholesky						
Oil price	+	0	0	0	0	0
GDP share		+	0	0	0	0
Real GDP			+	0	0	0
Consumer prices				+	0	0
Interest rate					+	0
Exchange rate						+

Notes: Blank cells indicate unconstrained impulse responses. A positive or negative reaction is denoted by + and -. A zero restriction is denoted by 0. All restrictions are imposed on impact only.

Table 2: Forecast Error Variance Decompositions

		IDN	KOR	MAL	PHL	SGP	THA
Inflation							
h = 4	exchange rate	1.49	1.02	0.75	0.66	1.02	1.32
	monetary policy	1.86	0.36	0.91	0.38	1.26	0.41
	global	23.64	50.75	73.30	66.53	39.40	55.76
	domestic	73.00	47.86	25.04	32.42	58.32	42.51
h = 8	exchange rate	2.55	1.86	1.61	1.84	2.17	3.46
	monetary policy	2.95	1.19	1.70	1.44	3.45	1.13
	global	35.37	45.75	69.29	60.66	34.92	50.31
	domestic	59.13	51.20	27.40	36.06	59.47	45.10
h = 12	exchange rate	3.70	2.89	2.00	2.32	2.77	4.22
	monetary policy	3.36	2.01	2.11	2.16	4.73	1.57
	global	38.90	44.09	66.69	58.86	35.92	48.34
	domestic	54.04	51.01	29.20	36.66	57.47	45.87
GDP growth							
h = 4	exchange rate	4.96	3.45	1.29	0.72	0.93	1.26
	monetary policy	3.84	0.35	0.65	0.78	0.53	0.61
	global	45.27	40.50	48.43	60.42	51.36	33.38
	domestic	45.93	55.71	49.63	38.07	47.18	64.75
h = 8	exchange rate	7.89	6.96	2.44	1.57	1.61	2.35
	monetary policy	6.76	0.97	2.48	1.96	1.18	1.39
	global	40.86	40.21	48.60	58.62	51.12	34.42
	domestic	44.49	51.86	46.48	37.85	46.08	61.94
h = 12	exchange rate	8.56	7.53	2.96	2.08	1.94	2.84
	monetary policy	7.01	1.59	3.27	2.79	1.98	1.78
	global	40.47	40.91	47.84	57.26	48.58	35.24
	domestic	43.96	49.96	45.93	37.88	47.50	60.15

Notes: Median shares (in %) of forecast error variance for inflation (upper block) and GDP growth (lower block) due to structural shocks for different forecast horizons. The shares for global shocks comprise the contributions of global demand and oil supply shocks, while the shares of domestic shocks comprise the contributions of domestic demand and supply shocks, as explained section 2. All results rely on the Corsetti et al. (2014) identification.

Table 3: Phillips Curve Regression Results (Baseline Specification)

Coef. country		IDN	KOR	MAL	PHL	SGP	THA
oil supply shock							
$b_{x,CF}$	*full*	0.16^{*}	0.11^{***}	0.11^{**}	0.19^{***}	0.09^{***}	0.14^{***}
	post 2007	0.20^{*}	0.14^{***}	0.17^{**}	0.20^{***}	0.08^{***}	0.16^{***}
$b_{x,oil}$	*full*	-2.89^{*}	-0.35	0.33	-0.78^{***}	-0.04	-1.03^{***}
	post 2007	-1.11	-1.05^{***}	0.37	-0.92^{***}	-0.05	-1.11^{***}
b_{π}	*full*	0.85^{***}	0.82^{***}	0.74^{***}	0.72^{***}	0.85^{***}	0.70^{***}
	post 2007	0.78^{***}	0.74^{***}	0.69^{***}	0.65^{***}	0.85^{***}	0.61^{***}
R^2	*full*	70%	76%	44%	75%	86%	69%
	post 2007	62%	83%	42%	73%	88%	69%
global demand shock							
$b_{x,CF}$	*full*	0.19^{**}	0.08^{**}	0.11^{***}	0.07^{**}	0.06^{***}	0.12^{***}
	post 2007	0.21^{**}	0.05	0.15^{***}	0.07	0.09^{***}	0.12^{**}
$b_{x,dem}$	*full*	1.85^{***}	0.27^{***}	0.50^{***}	0.56^{**}	0.32^{***}	0.93^{***}
	post 2007	1.68^{***}	0.39^{***}	0.54^{**}	0.46	0.32^{***}	0.87^{***}
b_{π}	*full*	0.82^{***}	0.85^{***}	0.72^{***}	0.87^{***}	0.85^{***}	0.69^{***}
	post 2007	0.80^{***}	0.90^{***}	0.73^{***}	0.89^{***}	0.85^{***}	0.71^{***}
R^2	*full*	71%	79%	53%	70%	91%	73%
	post 2007	69%	84%	51%	65%	93%	70%
aggregate global shock (oil supply + global demand)							
$b_{x,CF}$	*full*	0.17^{**}	0.08^{***}	0.11^{***}	0.12^{**}	0.06^{***}	0.11^{***}
	post 2007	0.24^{**}	0.06	0.11^{***}	0.12^{**}	0.09^{***}	0.13^{**}
$b_{x,global}$	*full*	0.63	0.19^{***}	0.31^{***}	-0.07	0.12^{***}	0.24^{*}
	post 2007	1.15^{**}	0.27^{**}	0.36^{**}	-0.13	0.05^{***}	0.20
b_{π}	*full*	0.83^{***}	0.86^{***}	0.74^{***}	0.82^{***}	0.88^{***}	0.76^{***}
	post 2007	0.77^{***}	0.90^{***}	0.74^{***}	0.80^{***}	0.88^{***}	0.73^{***}
R^2	*full*	69%	78%	50%	69%	88%	63%
	post 2007	67%	83%	49%	65%	91%	60%

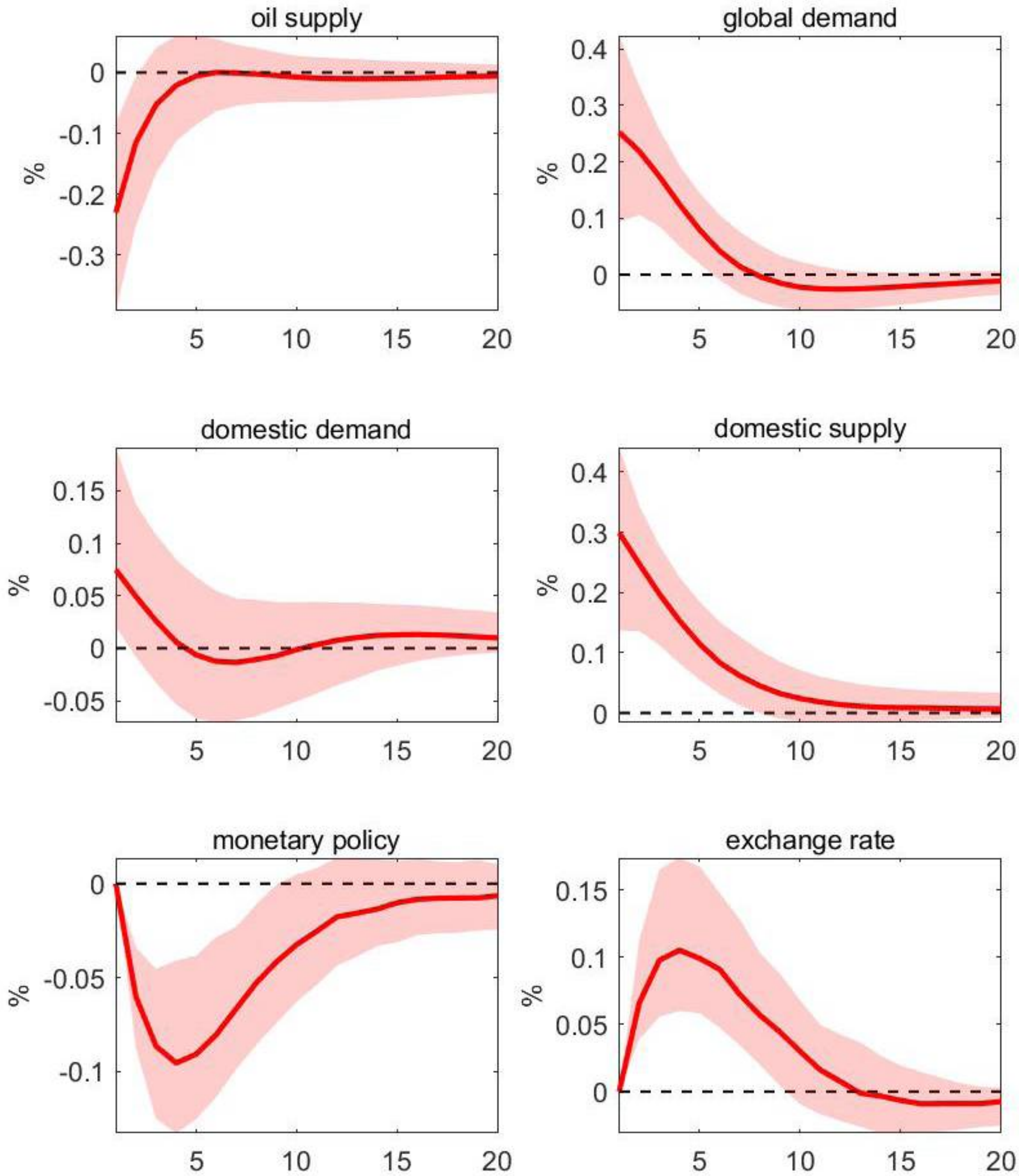
Notes: Estimation results (model A) for the baseline specification of the Phillips curve. x_t^{CF} represents the coefficient on counterfactual GDP growth that excludes the component driven by oil-supply shocks (first block), global demand shocks (second block) and the sum of both shocks (third block). $b_{x.j}$ for *j=oil, dem, global* is the coefficient on the component of GDP growth driven by oil-supply shocks, global demand shocks or the sum of both shocks, respectively. The lagged inflation rate enters with the coefficient b_{π}. The table also distiguishes between results for the full sample period (2001Q3 – 2018Q1) and the post 2007 sample (2008Q1 – 2018Q1). R^2 reports the proportion of the variance in the dependent variable that is predictable from the independent variables. Asterisks indicate significance at the 10 percent (*), 5 percent (**) and 1 percent level (***), respectively. All results rely on identification strategy I (Corsetti et al., 2014).

Table 4: Phillips Curve Regression Results (Alternative Specification with Control Variables)

Coef. \ country	IDN	KOR	MAL	PHL	SGP	THA
control variables: oil price (model B)						
$b_{x,CF}$	0.26^{***}	0.13^{***}	0.08	0.21^{***}	0.08^{***}	0.23^{***}
$b_{x,oil}$	-4.87^{***}	-0.48	-0.01	-0.81^{***}	-0.07	-1.40^{***}
$b_{x,dem}$	2.81^{***}	0.30^{**}	0.34^{*}	0.72^{***}	0.34^{***}	1.27^{***}
b_{π}	0.80^{***}	0.79^{***}	0.77^{***}	0.68^{***}	0.81^{***}	0.54^{***}
b_{oil}	-0.01	0.00	0.01^{***}	0.01^{***}	0.00	-0.01
R^2	76%	82%	59%	87%	92%	87%
control variables: oil price and share of world GDP (model C)						
$b_{x,CF}$	0.20	0.19^{***}	0.02	0.17^{**}	0.029^{**}	0.24^{***}
$b_{x,oil}$	-4.50^{**}	-1.42^{***}	0.05	-0.75^{***}	-0.37^{***}	-1.30^{***}
$b_{x,dem}$	3.13^{***}	0.57^{***}	0.37^{**}	0.70^{***}	0.61^{***}	1.14^{***}
b_{π}	0.80^{***}	0.73^{***}	0.75^{***}	0.70^{***}	0.64^{***}	0.53^{***}
b_{oil}	-0.00	-0.00^{*}	0.01^{***}	0.01^{***}	-0.02^{***}	-0.00
b_{share}	0.07	0.13^{***}	0.36	0.11	1.07^{***}	-0.08
R^2	76%	85%	60%	88%	97%	87%

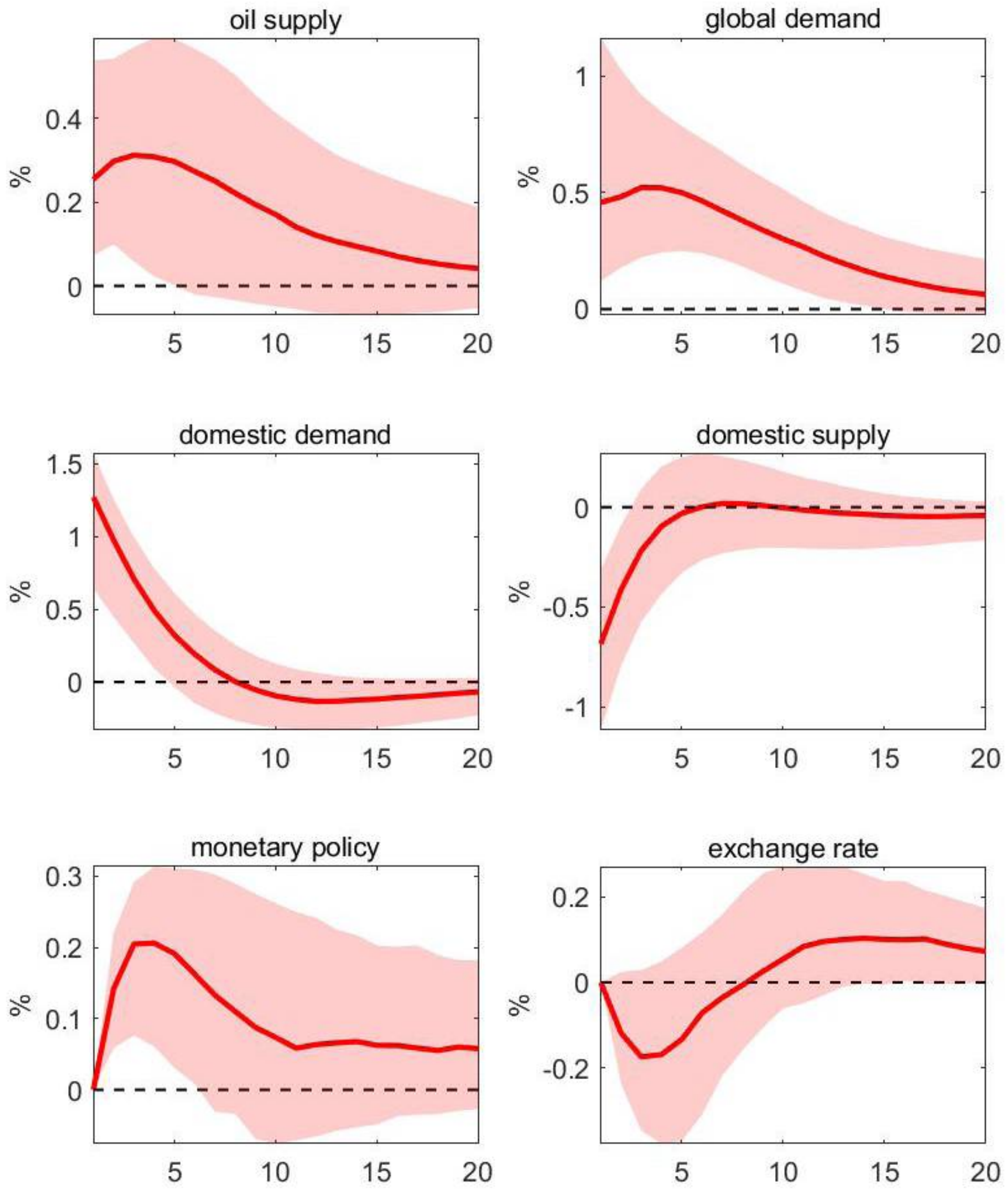
Notes: Estimation results (models A, C) for Phillips curve specifications with additional control variables. x_t^{CF} represents the coefficient on counterfactual GDP growth that excludes the sum of oil-supply and global demand shocks $b_{x.j}$ for *j=oil, dem* is the coefficient on the component of GDP growth driven by oil-supply shocks, or global demand shocks, respectively. The lagged inflation rate enters with the coefficient b_{π}, oil-price growth enters with the coefficient b_{oil} and the share of domestic GDP to world GDP enters with the coefficient b_{share}. R^2 reports the proportion of the variance in the dependent variable that is predictable from the independent variables. Asterisks indicate significance at the 10 percent (*), 5 percent (**) and 1 percent level (***), respectively. All results rely on identification strategy I (Corsetti et al., 2014).

Figure 1: Impulse Response of GDP Growth – Indonesia



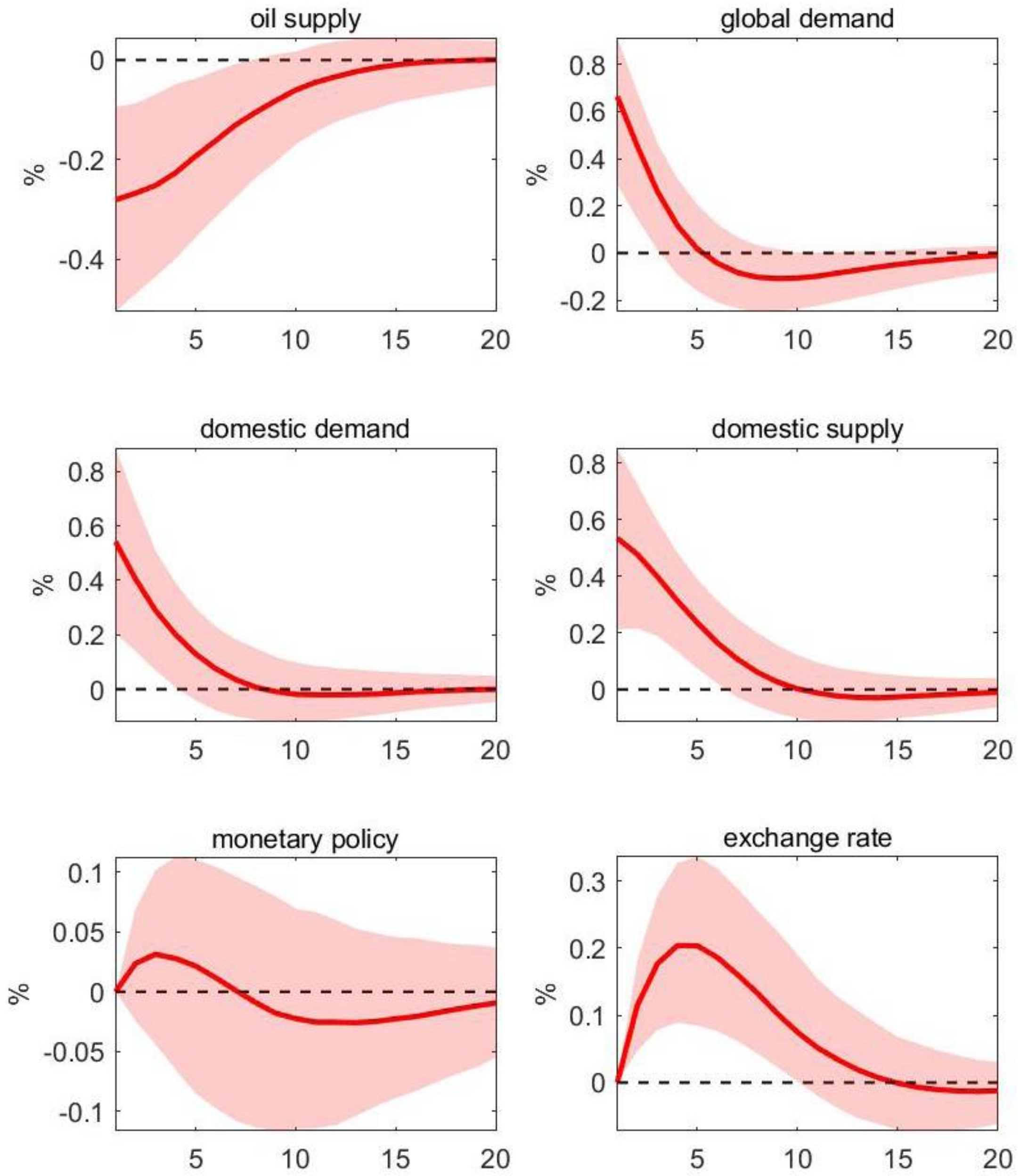
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 2: Impulse Response of Inflation – Indonesia



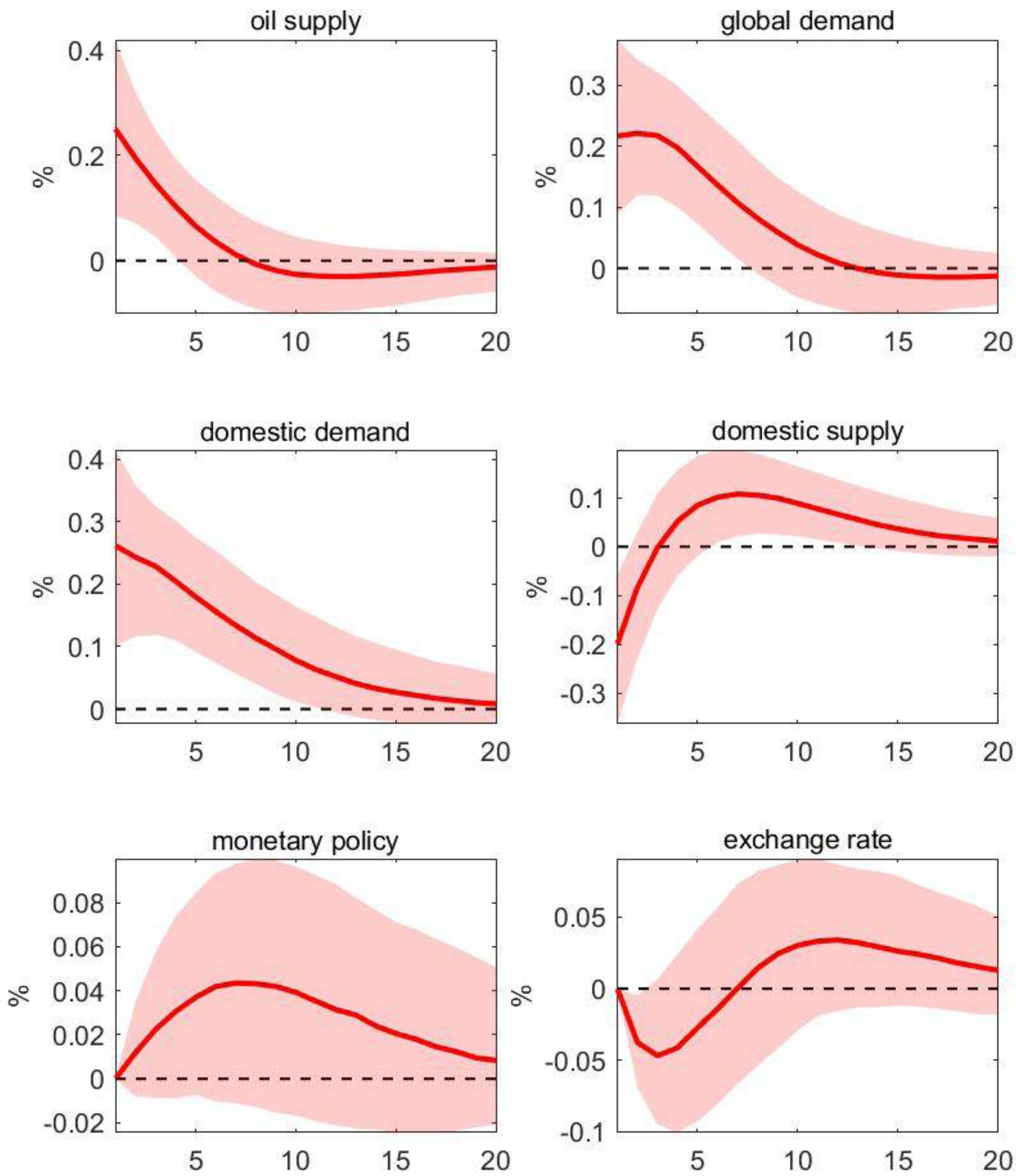
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 3: Impulse Response of GDP Growth – Korea



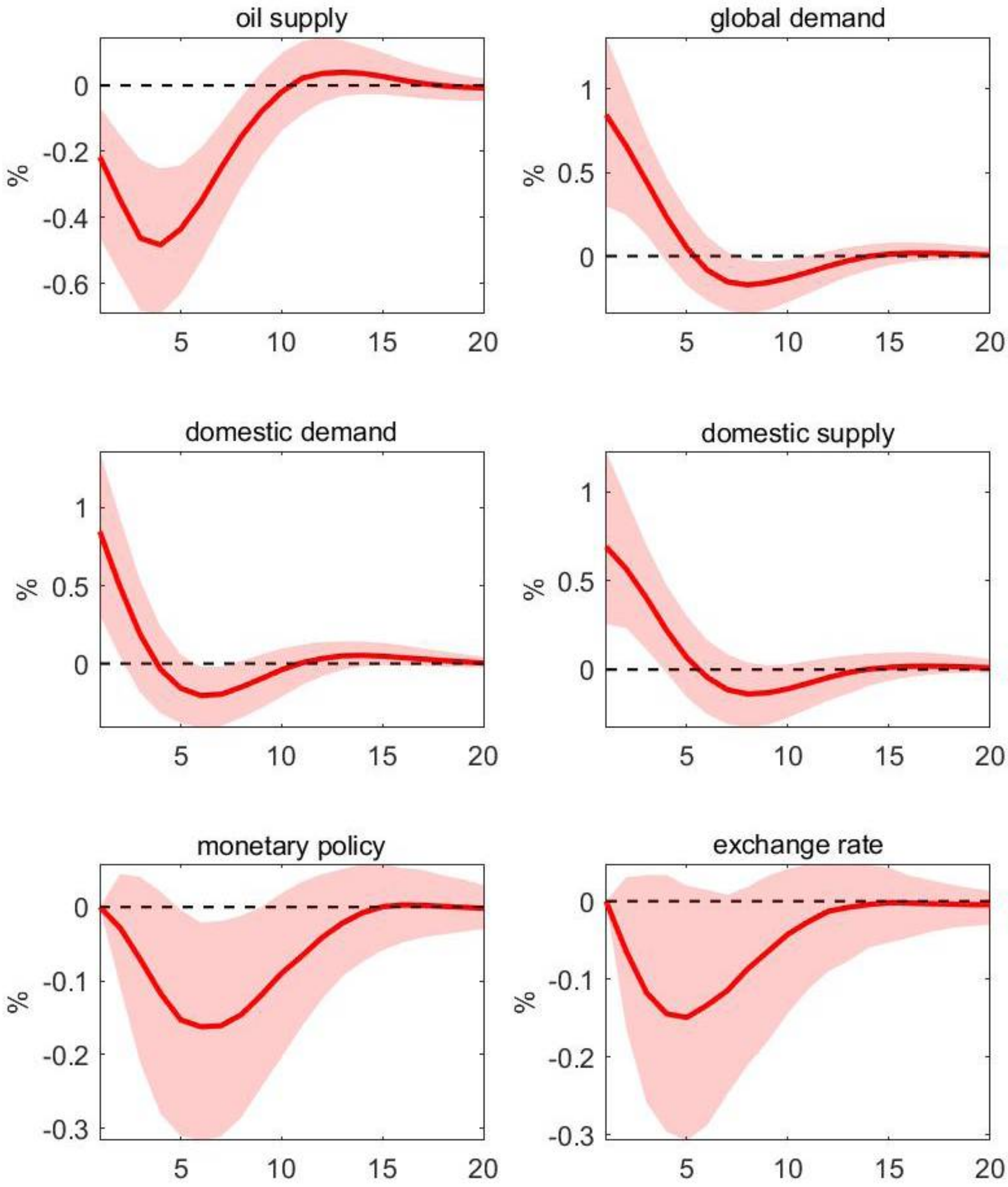
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 4: Impulse Response of Inflation – Korea



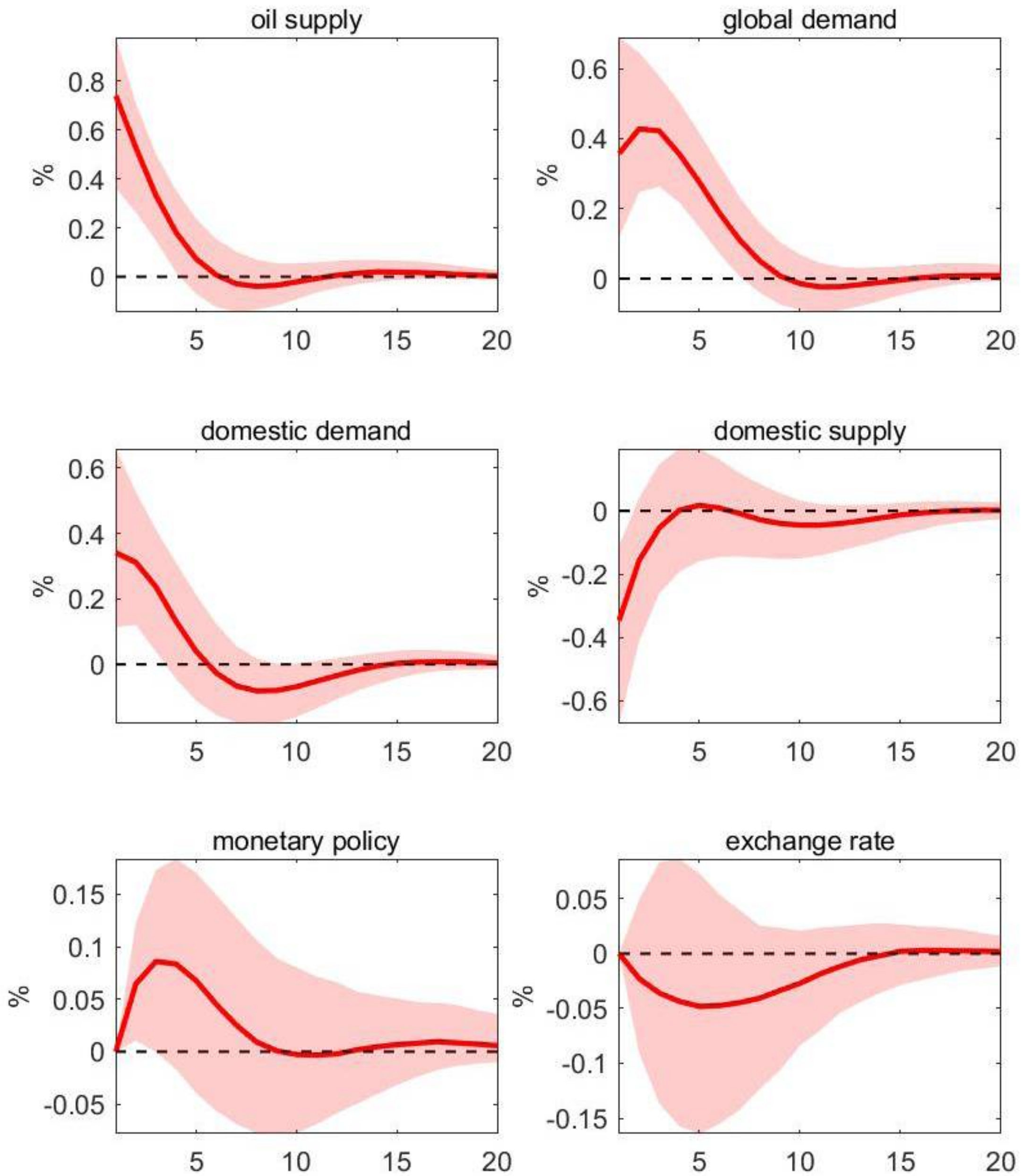
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 5: Impulse Response of GDP Growth – Malaysia



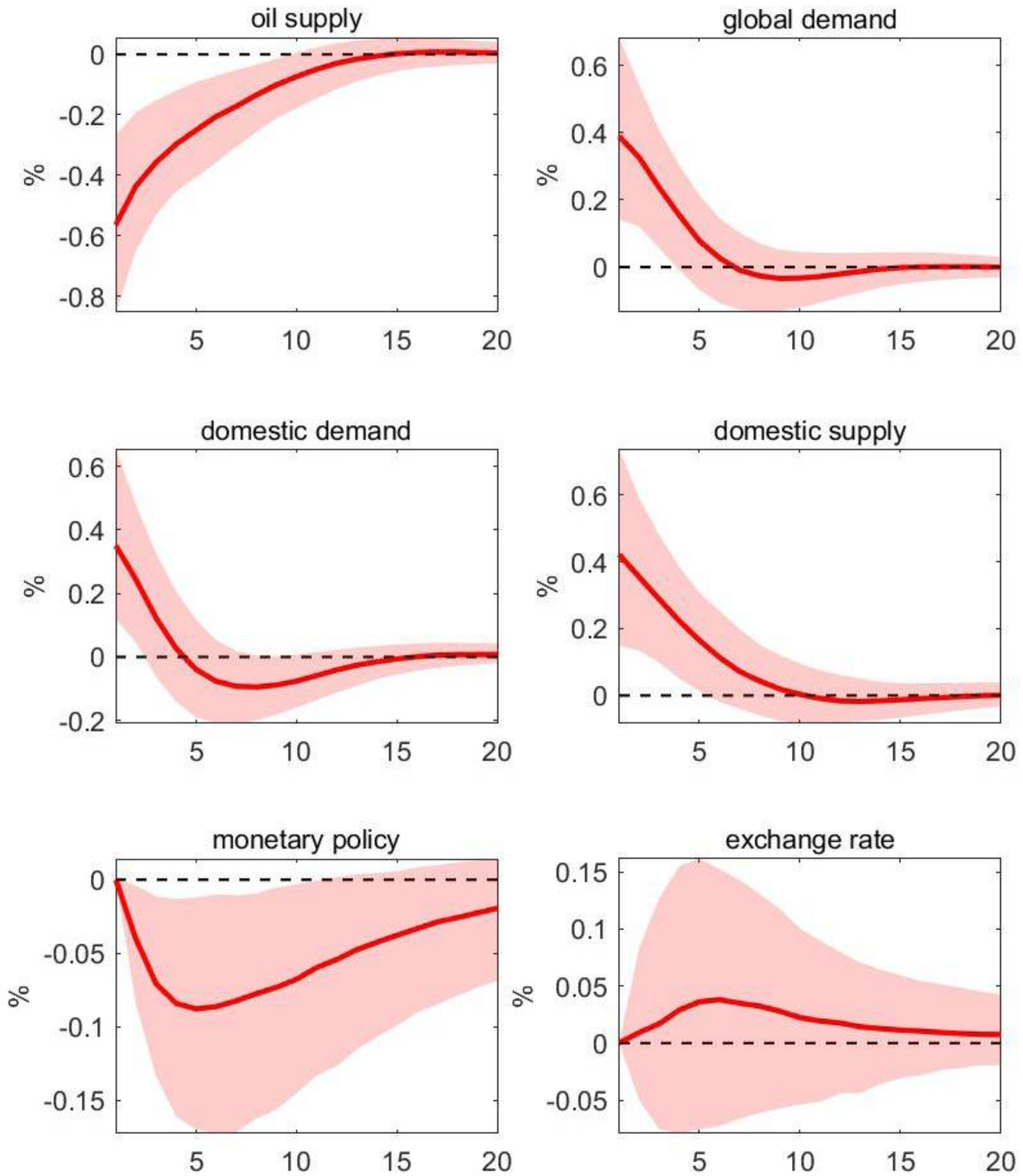
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 6: Impulse Response of Inflation – Malaysia



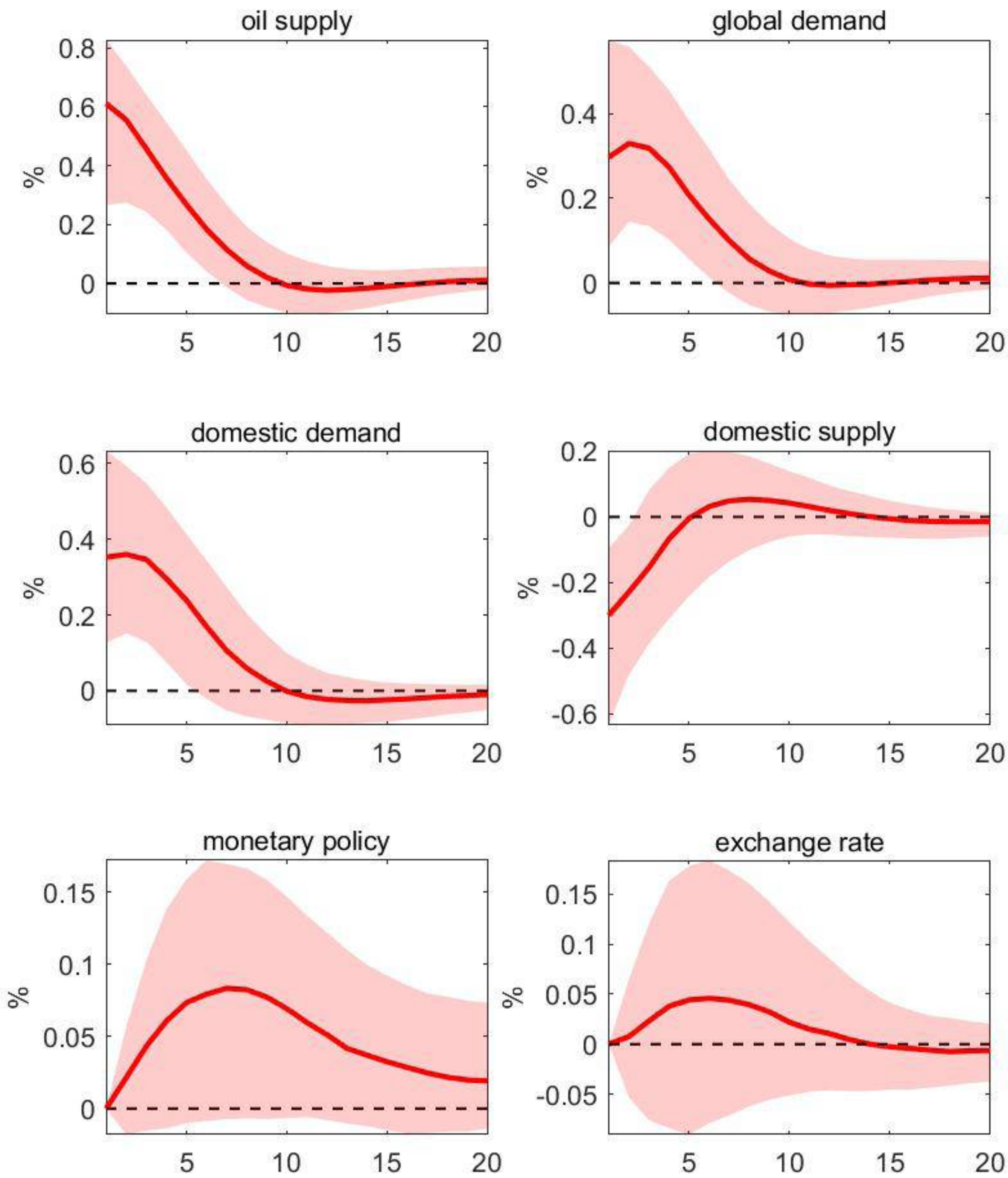
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 7: Impulse Response of GDP Growth – Philippines



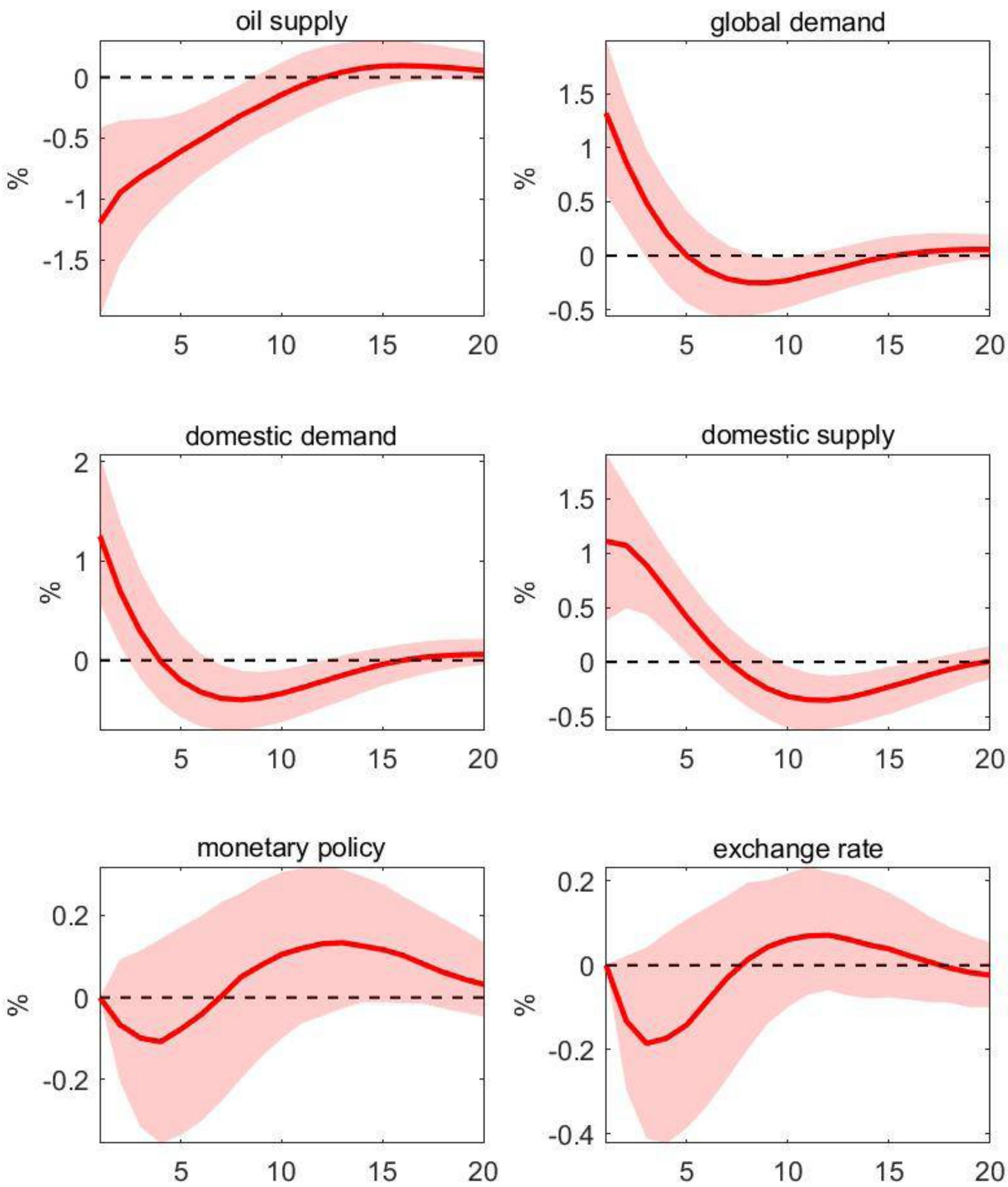
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 8: Impulse Response of Inflation – Philippines



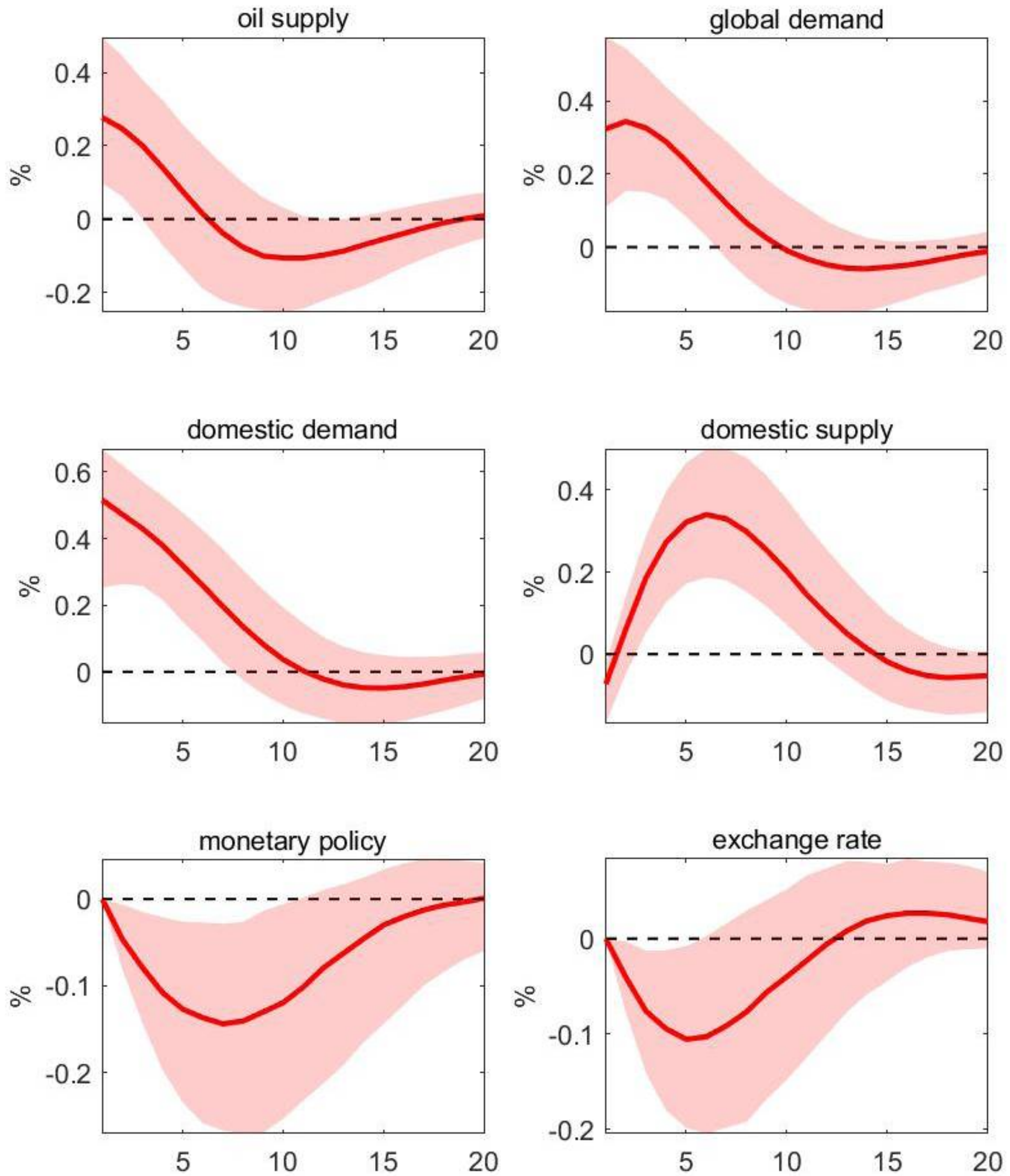
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 9: Impulse Response of GDP Growth – Singapore



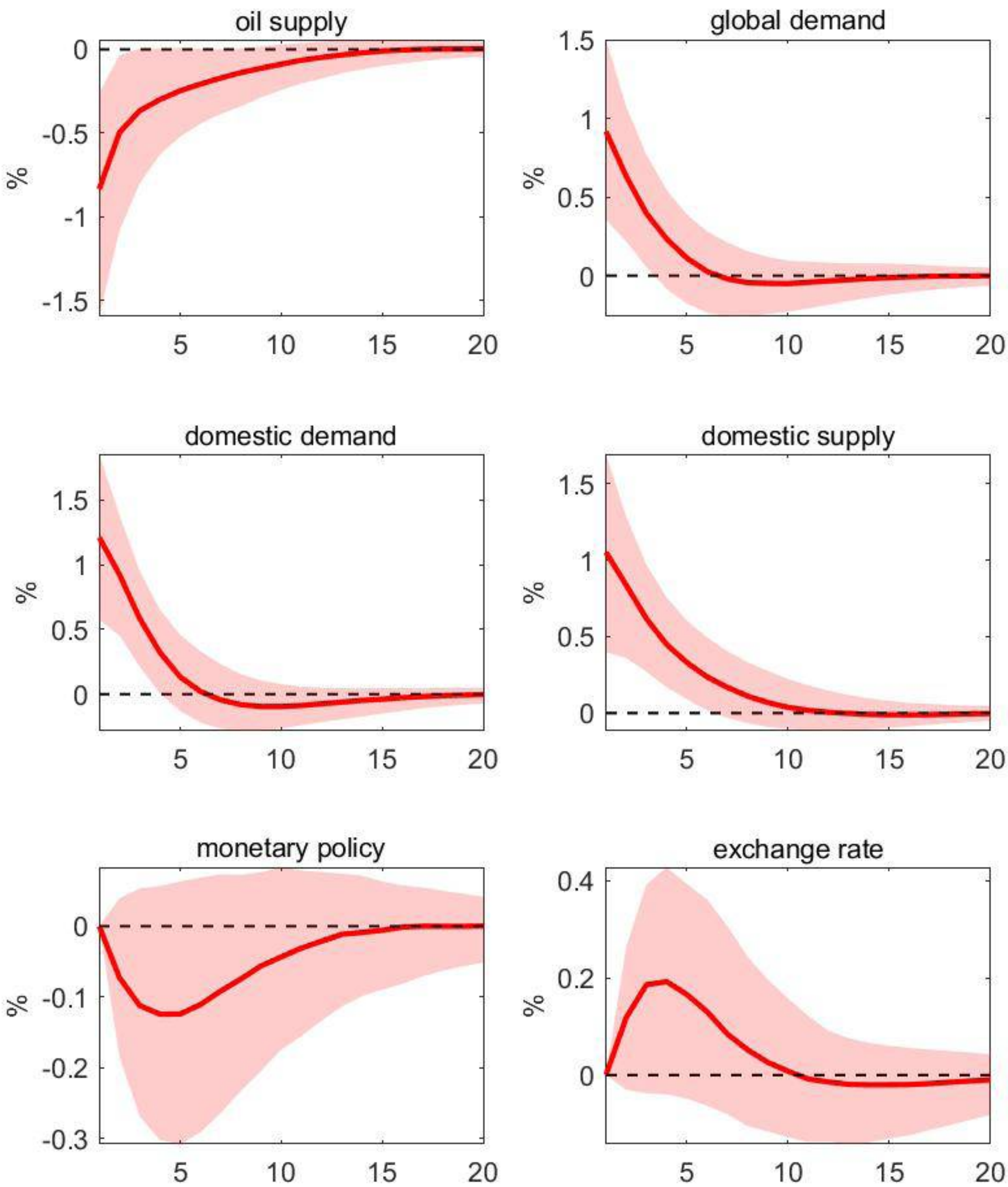
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 10: Impulse Response of Inflation – Singapore



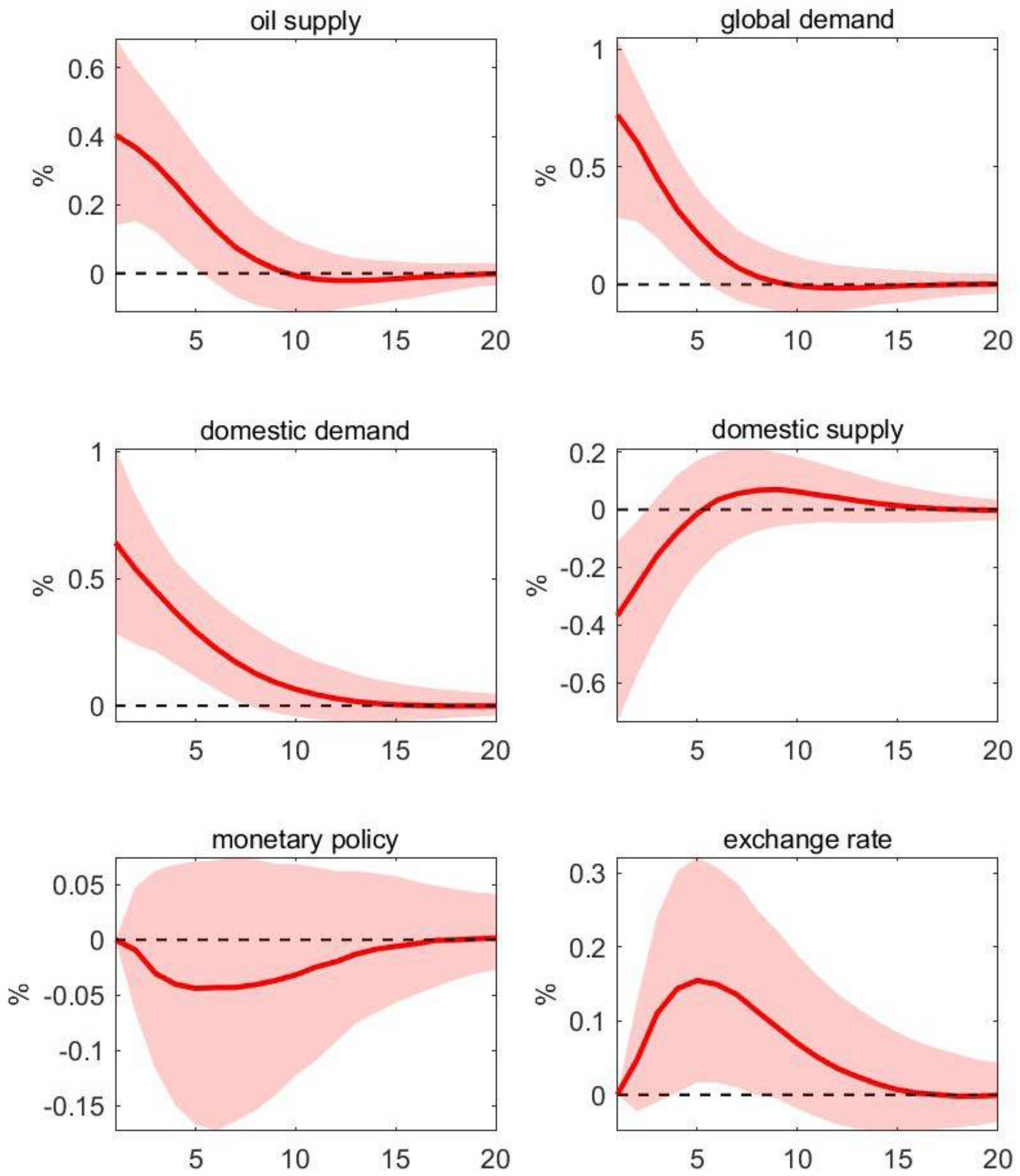
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 11: Impulse Response of GDP Growth – Thailand



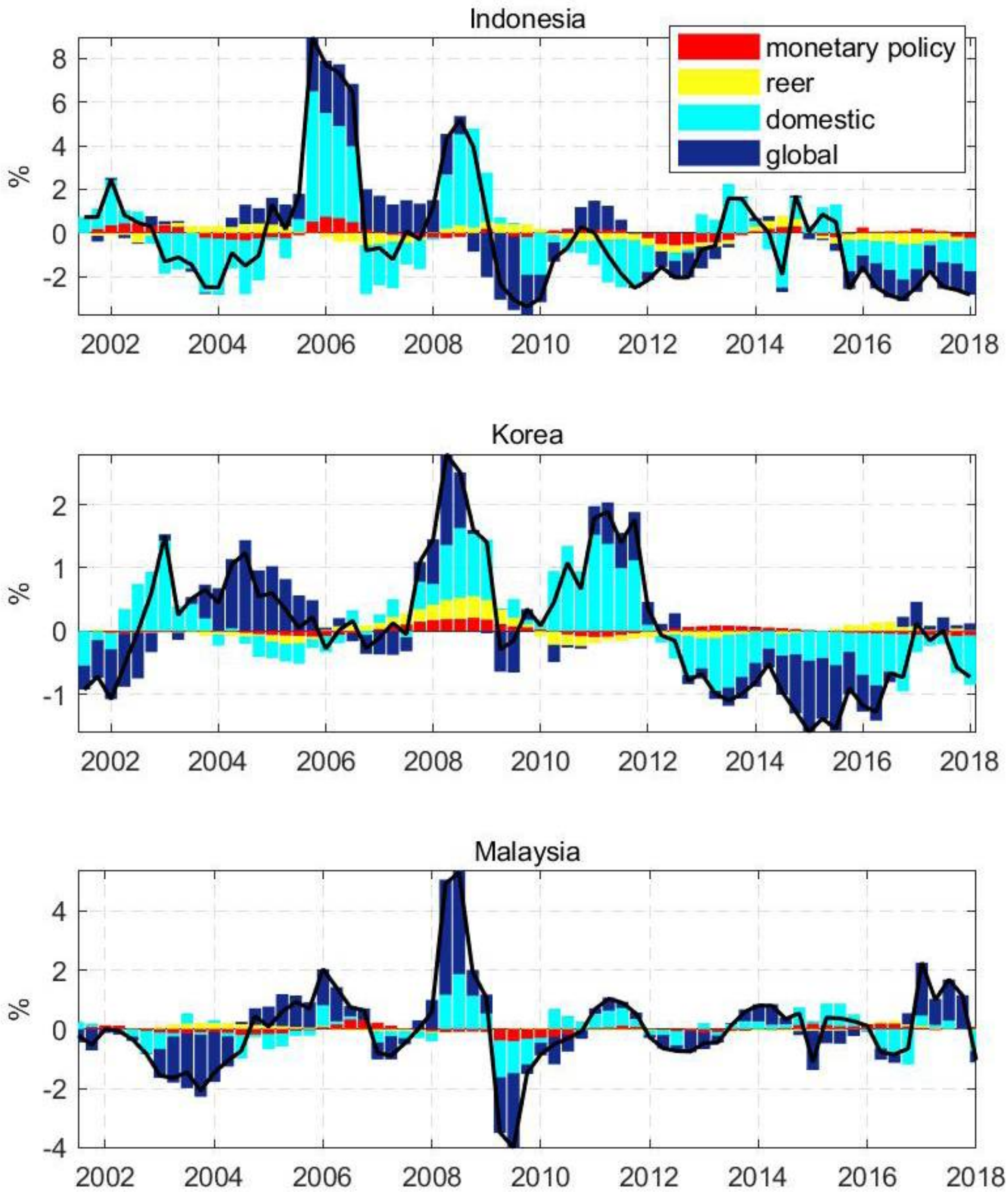
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 12: Impulse Response of Inflation – Thailand



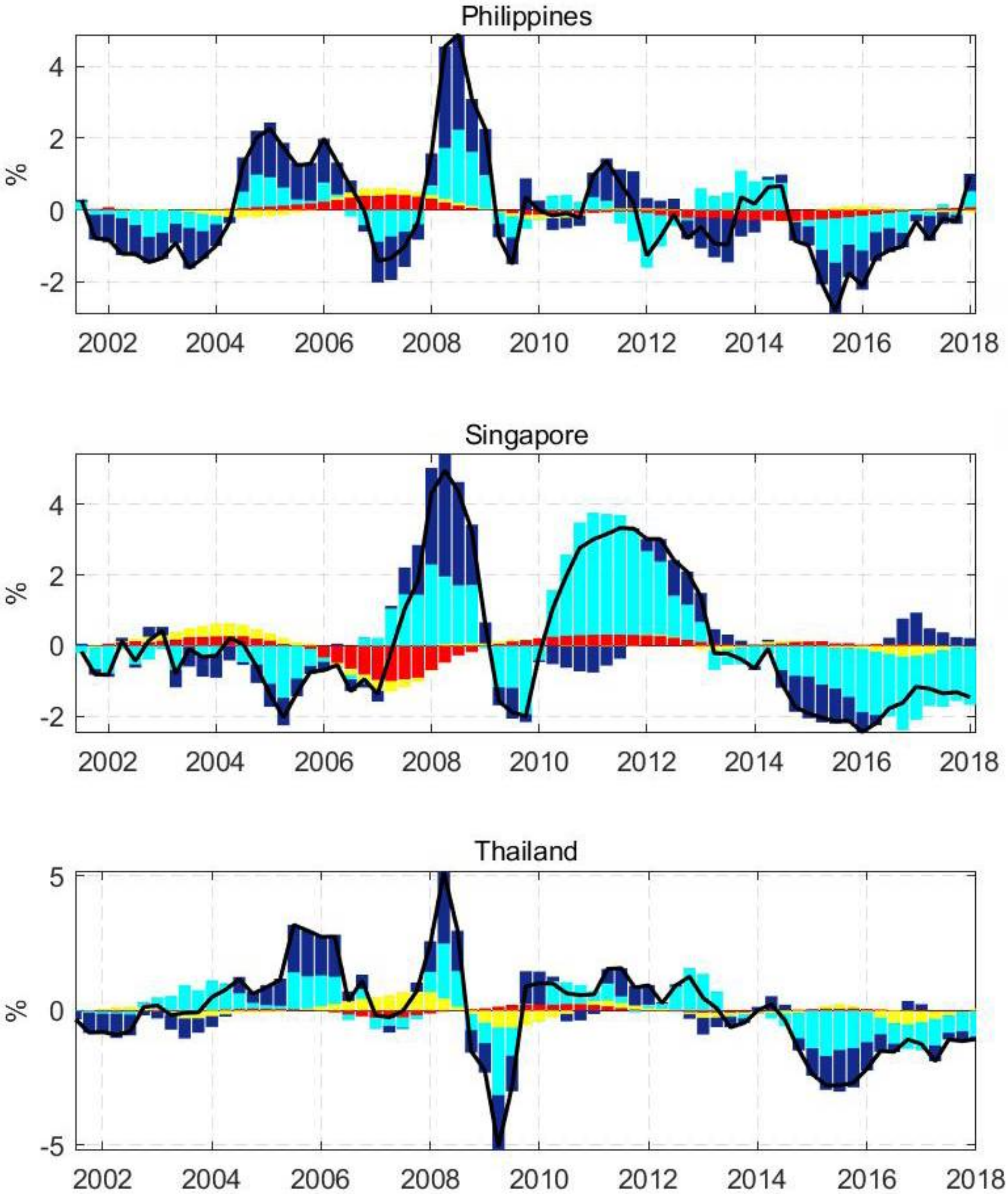
Notes: Median impulse response (red solid path) with 16^{th} and 84^{th} percentiles (red-shaded area). The sign restrictions are imposed on impact only. The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 13: Historical Contribution of Structural Shocks to Inflation for Indonesia, Korea and Malaysia



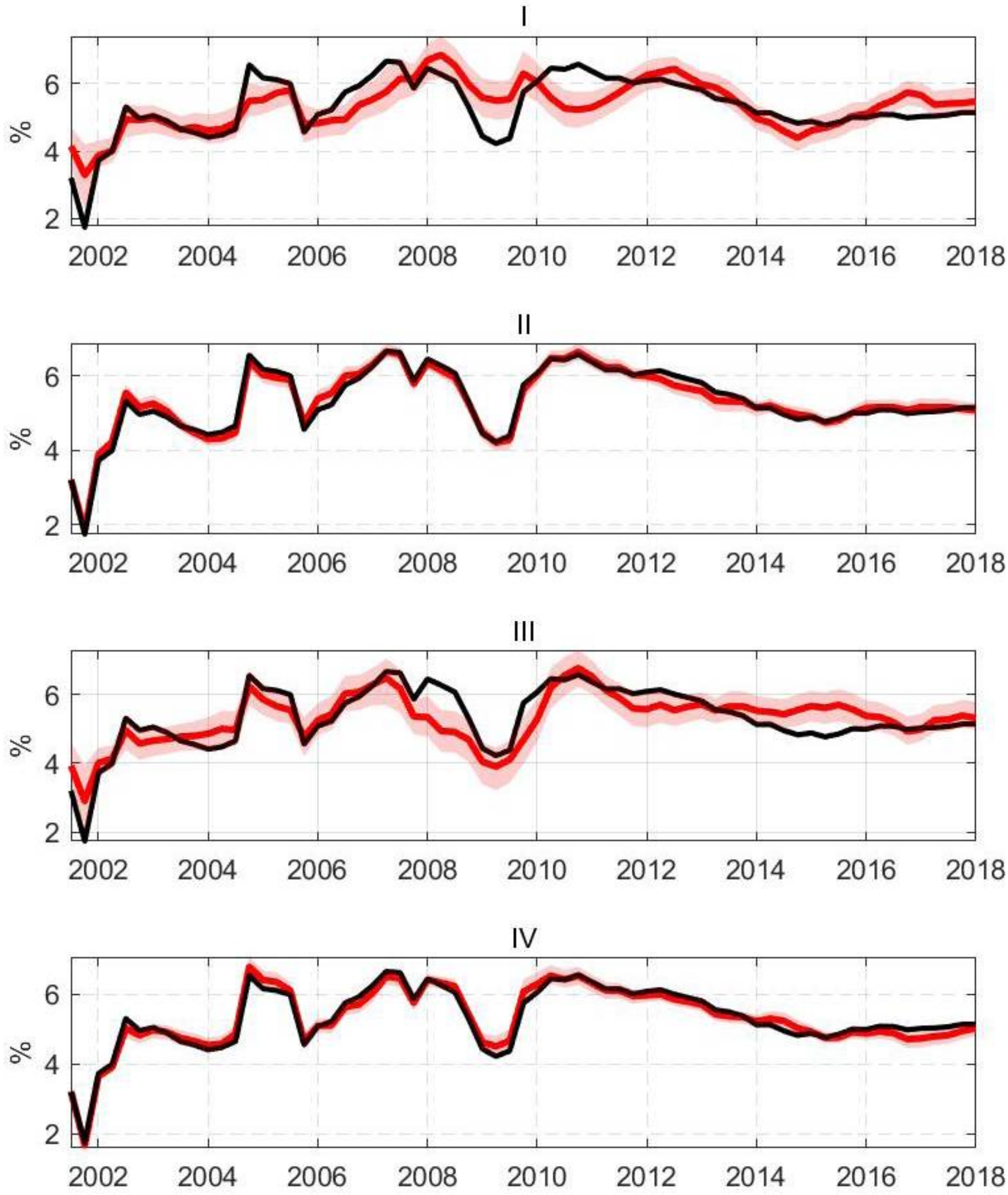
Notes: Median historical contribution of monetary policy shocks (red bars), exchange rate shocks (yellow bars), domestic shocks (teal bars) and global shocks (blue bars) to inflation for the Philippines, Singapore and Thailand. The black path corresponds to the sum of median contributions of all structural shocks. Results rely on identification strategy I.

Figure 14: Historical Contribution of Structural Shocks to Inflation for the Philippines, Singapore and Thailand



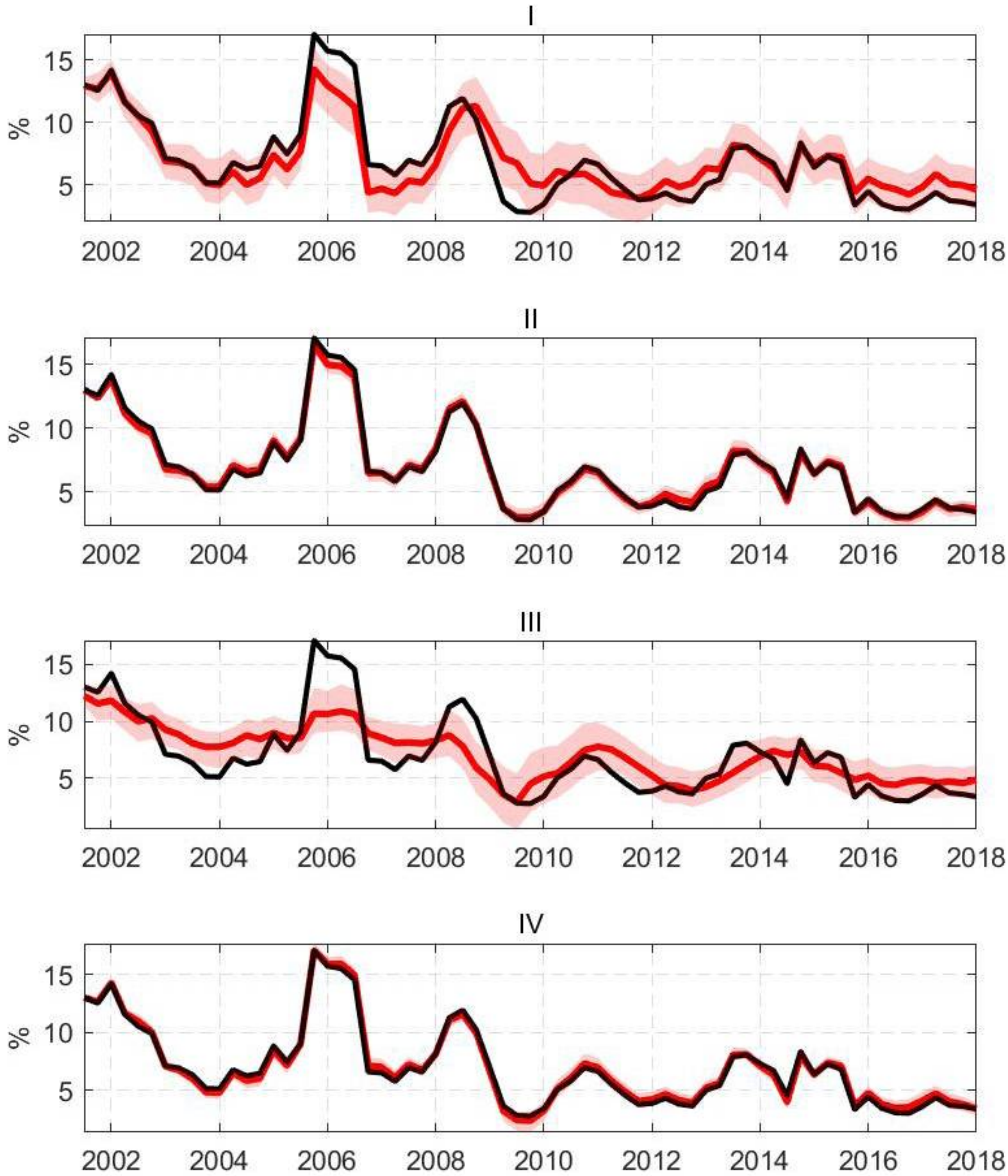
Notes: Median historical contribution of monetary policy shocks (red bars), exchange rate shocks (yellow bars), domestic shocks (teal bars) and global shocks (blue bars) to inflation for the Philippines, Singapore and Thailand. The black path corresponds to the sum of median contributions of all structural shocks. Results rely on identification strategy I.

Figure 15: Counterfactual Paths for GDP Growth with Suppressed Shocks – Indonesia



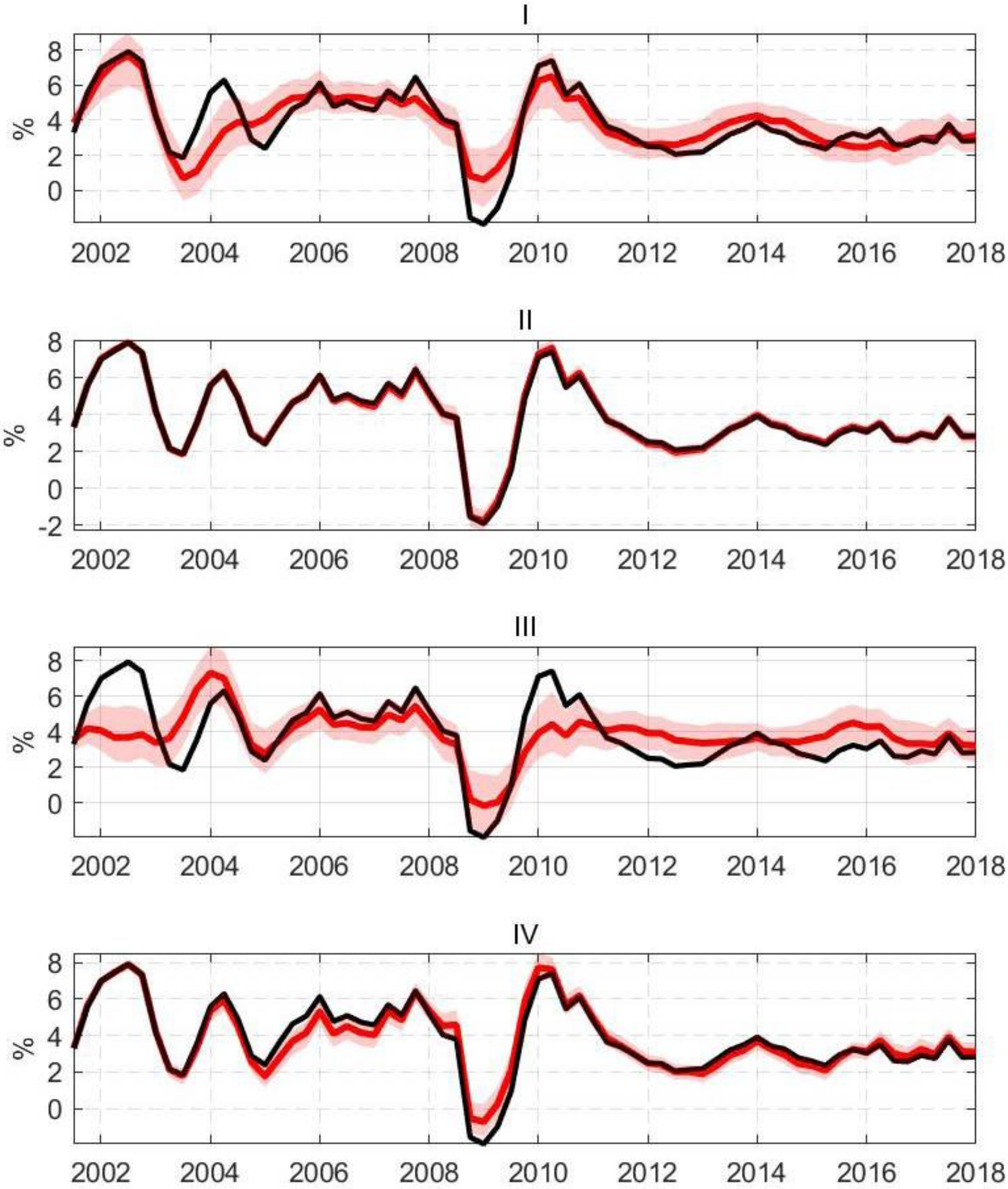
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 16: Counterfactual Paths for Inflation with Suppressed Shocks – Indonesia



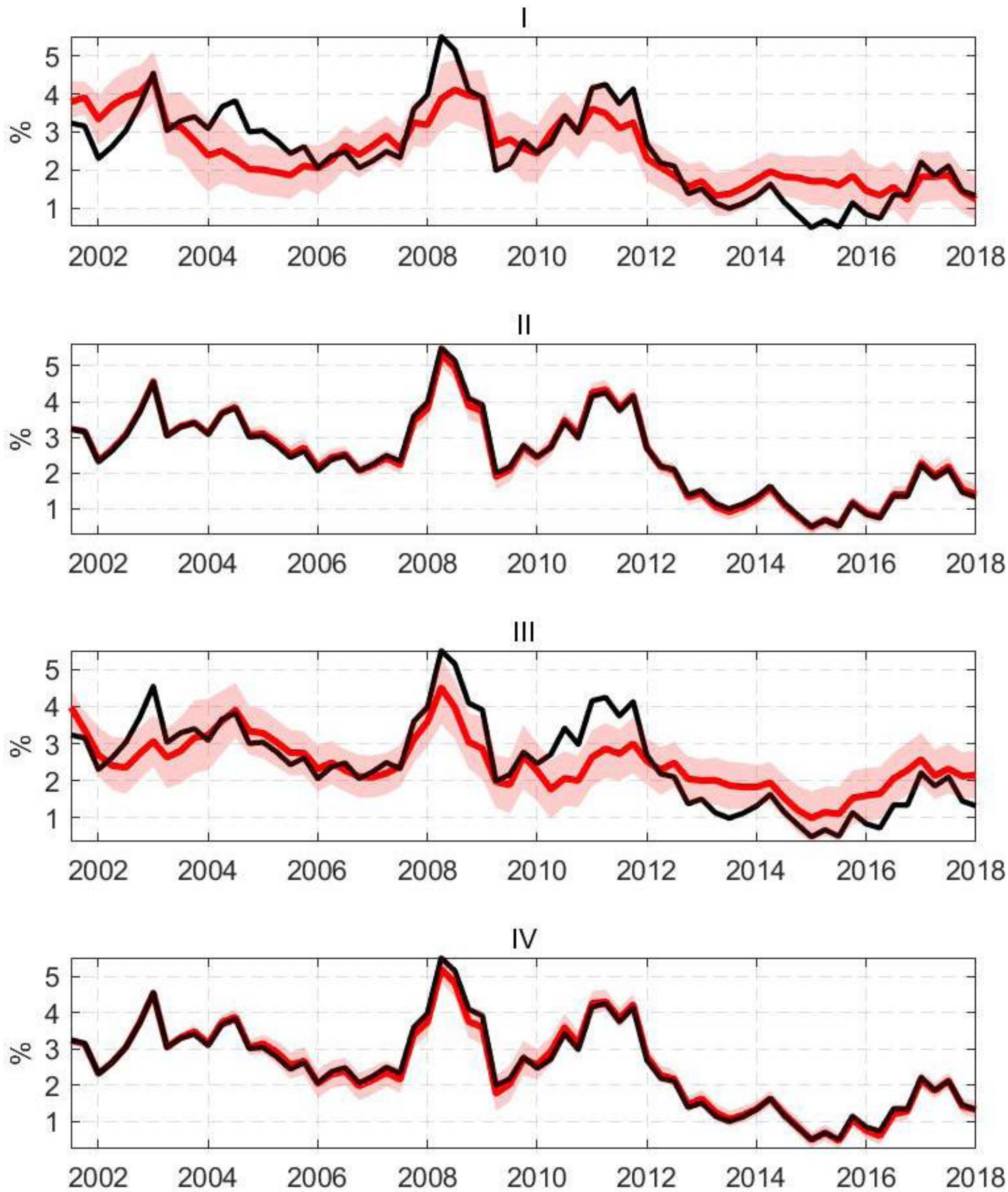
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 17: Counterfactual Paths for GDP Growth with Suppressed Shocks – Korea



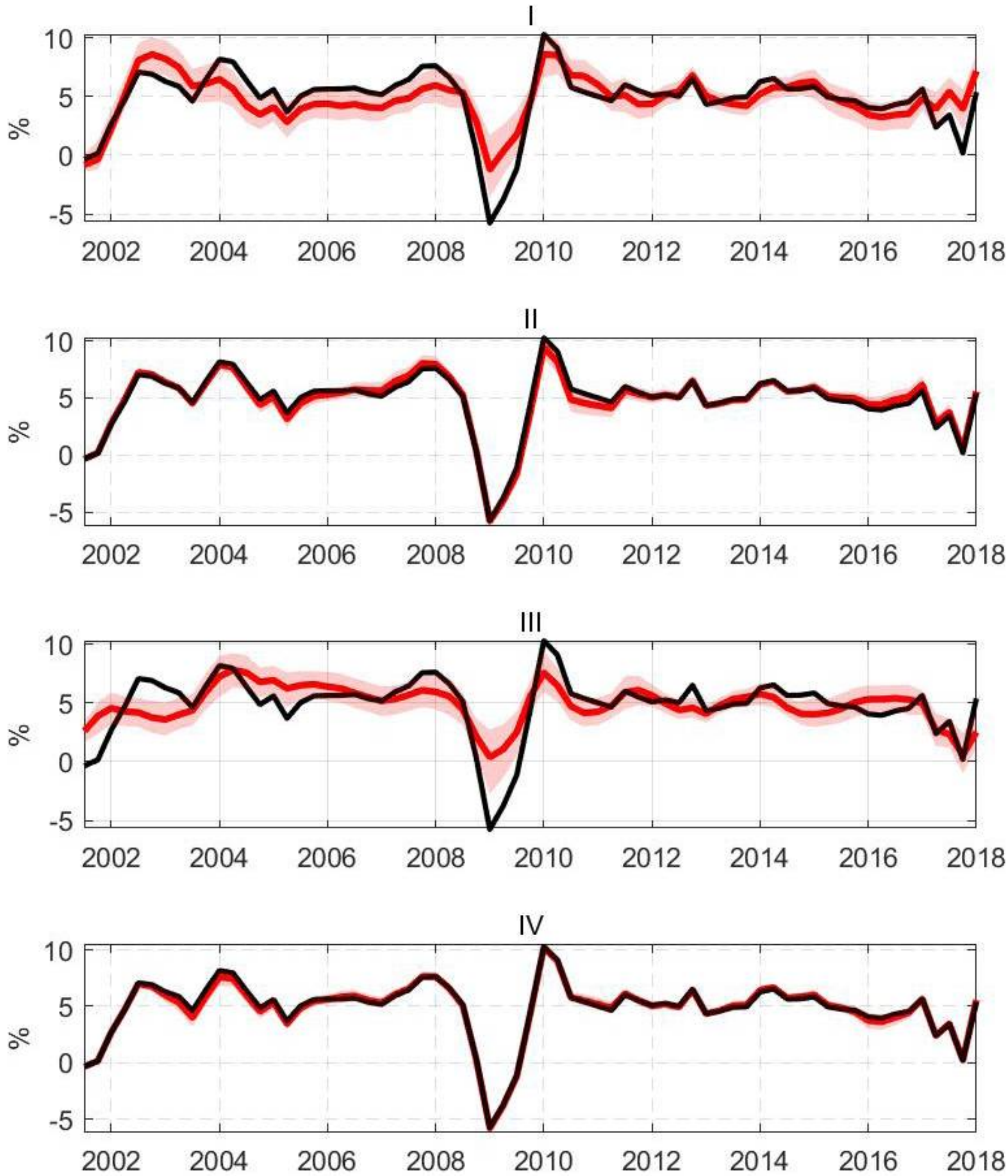
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 18: Counterfactual Paths for Inflation with Suppressed Shocks – Korea



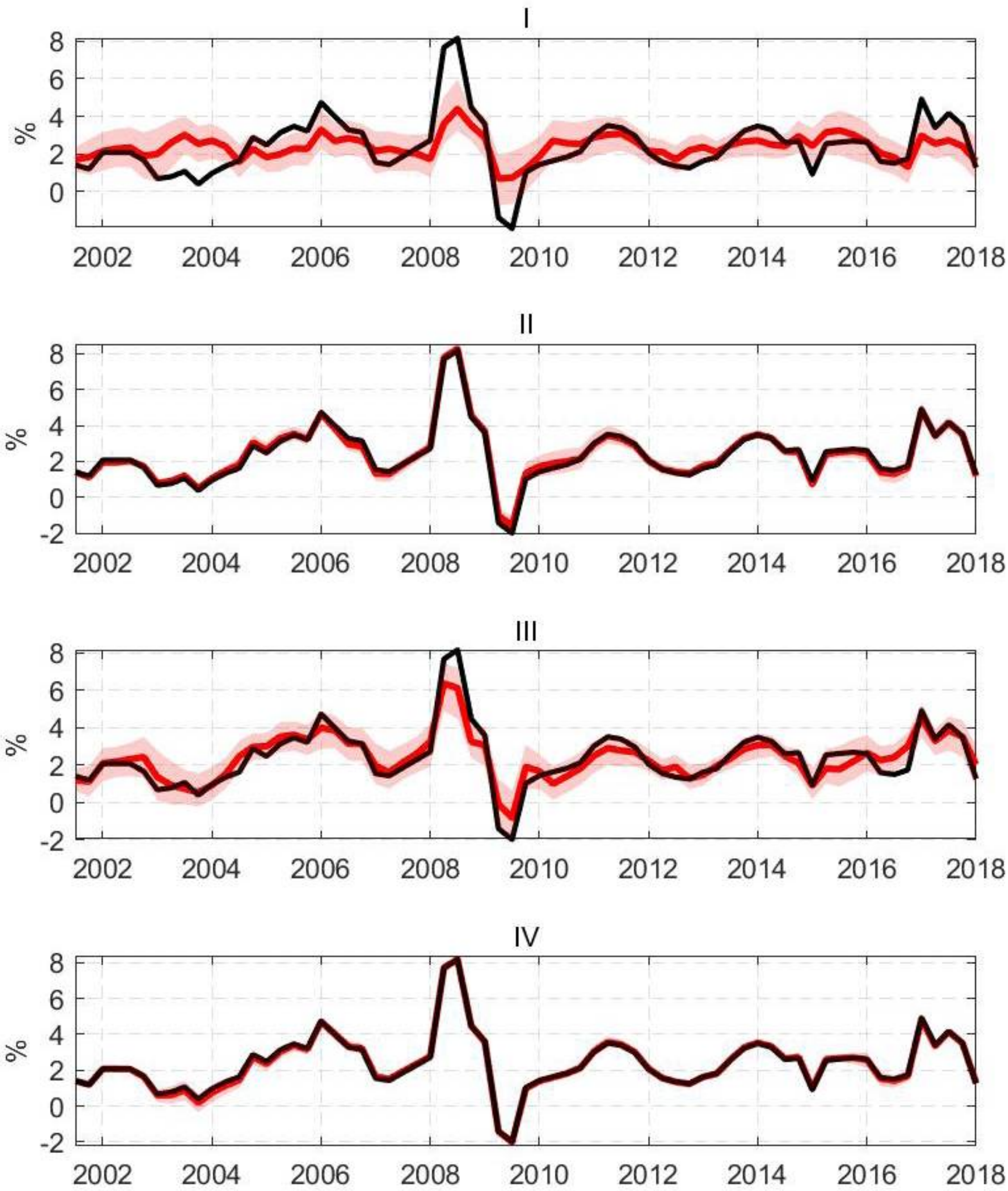
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 19: Counterfactual Paths for GDP Growth with Suppressed Shocks – Malaysia



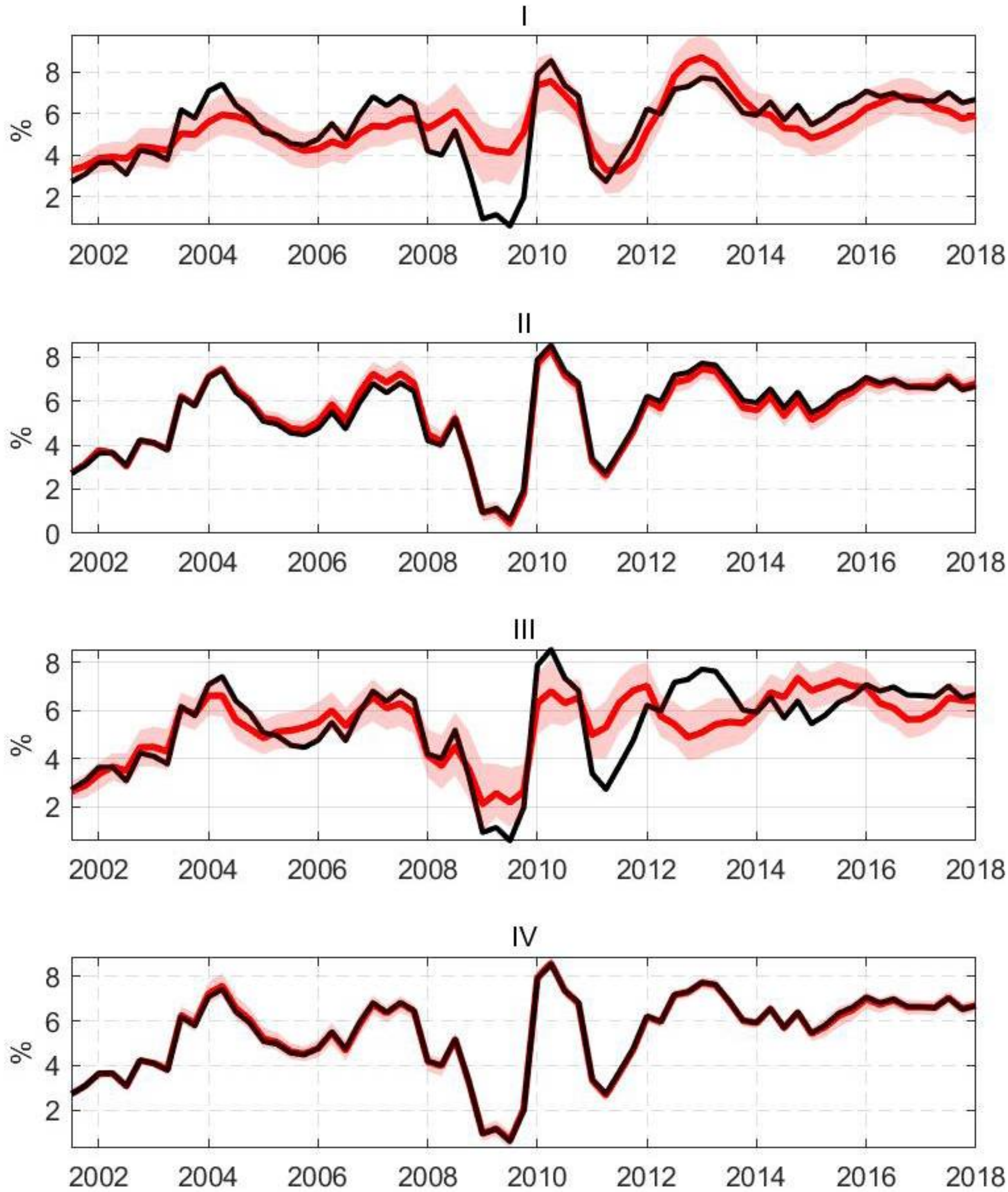
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 20: Counterfactual Paths for Inflation with Suppressed Shocks – Malaysia



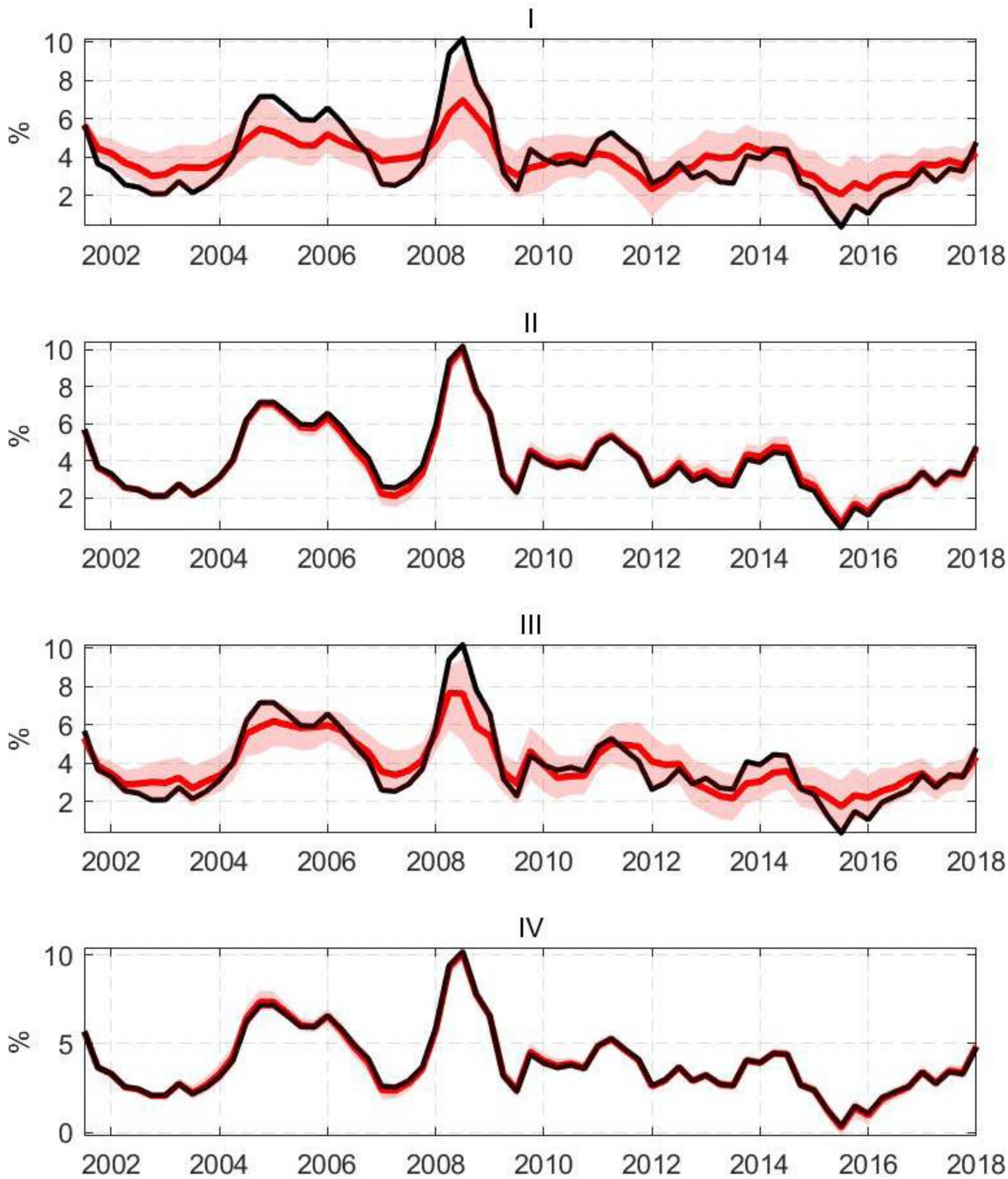
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 21: Counterfactual Paths for GDP Growth with Suppressed Shocks – Philippines



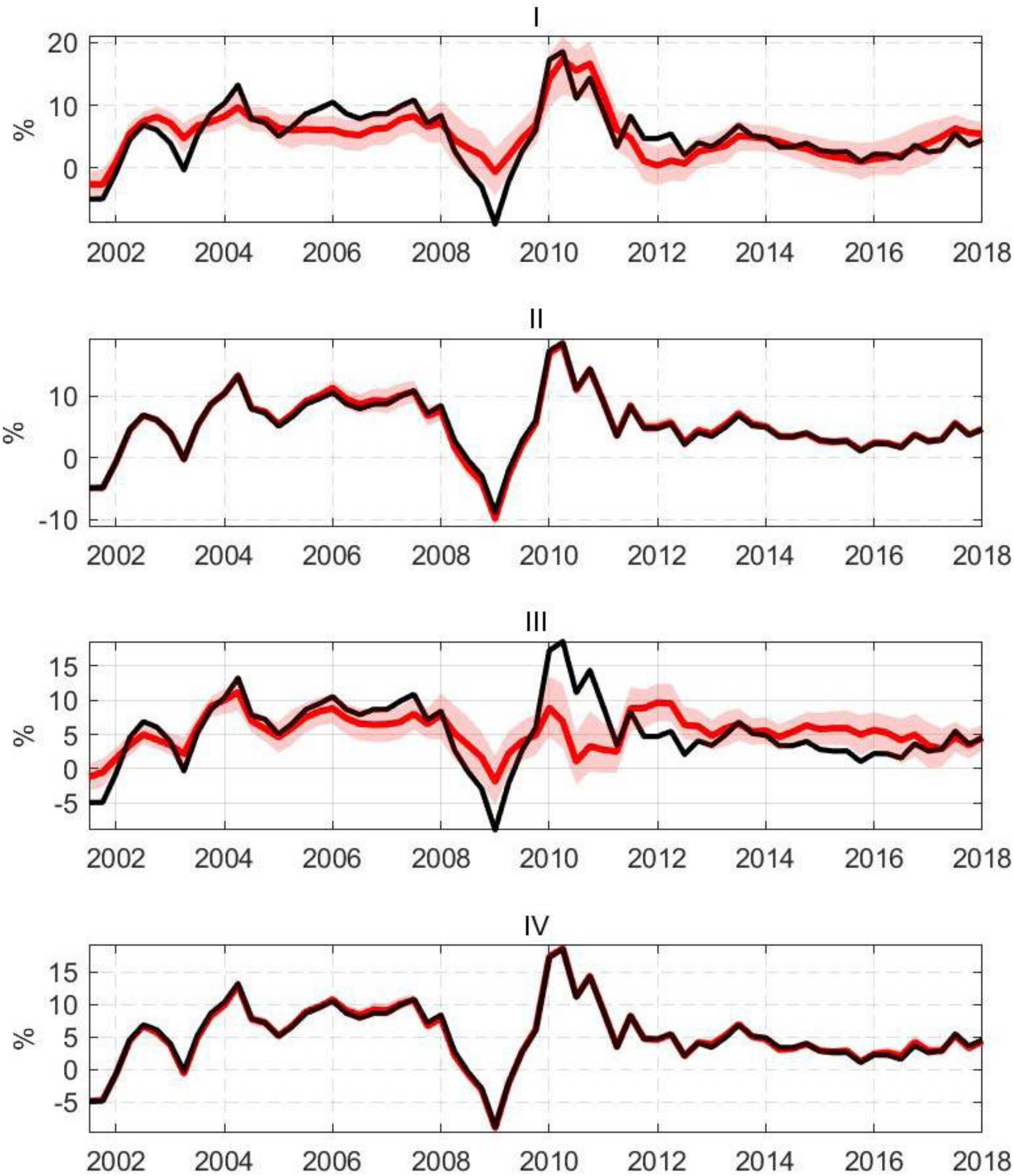
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 22: Counterfactual Paths for Inflation with Suppressed Shocks – Philippines



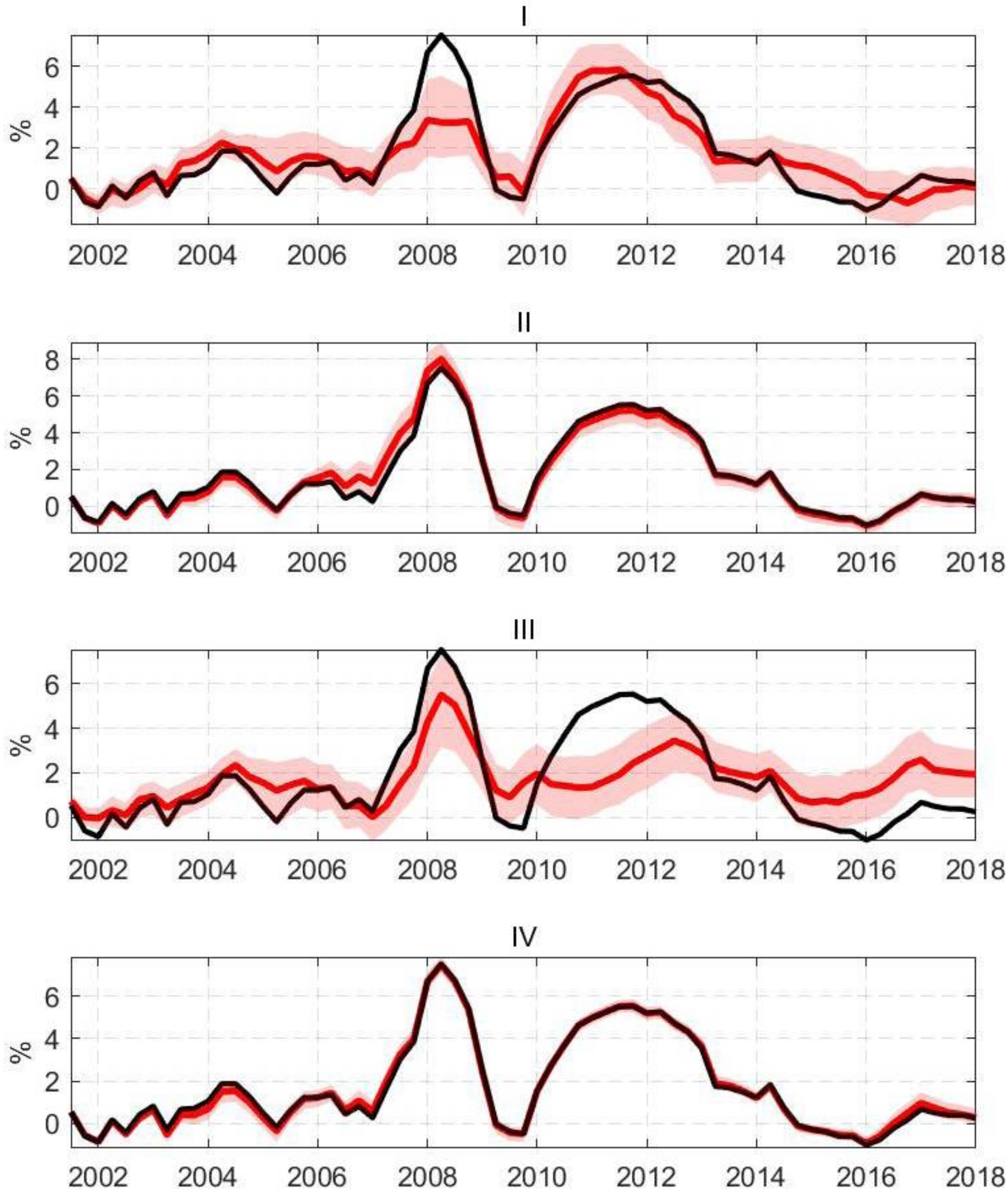
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 23: Counterfactual Paths for GDP Growth with Suppressed Shocks – Singapore



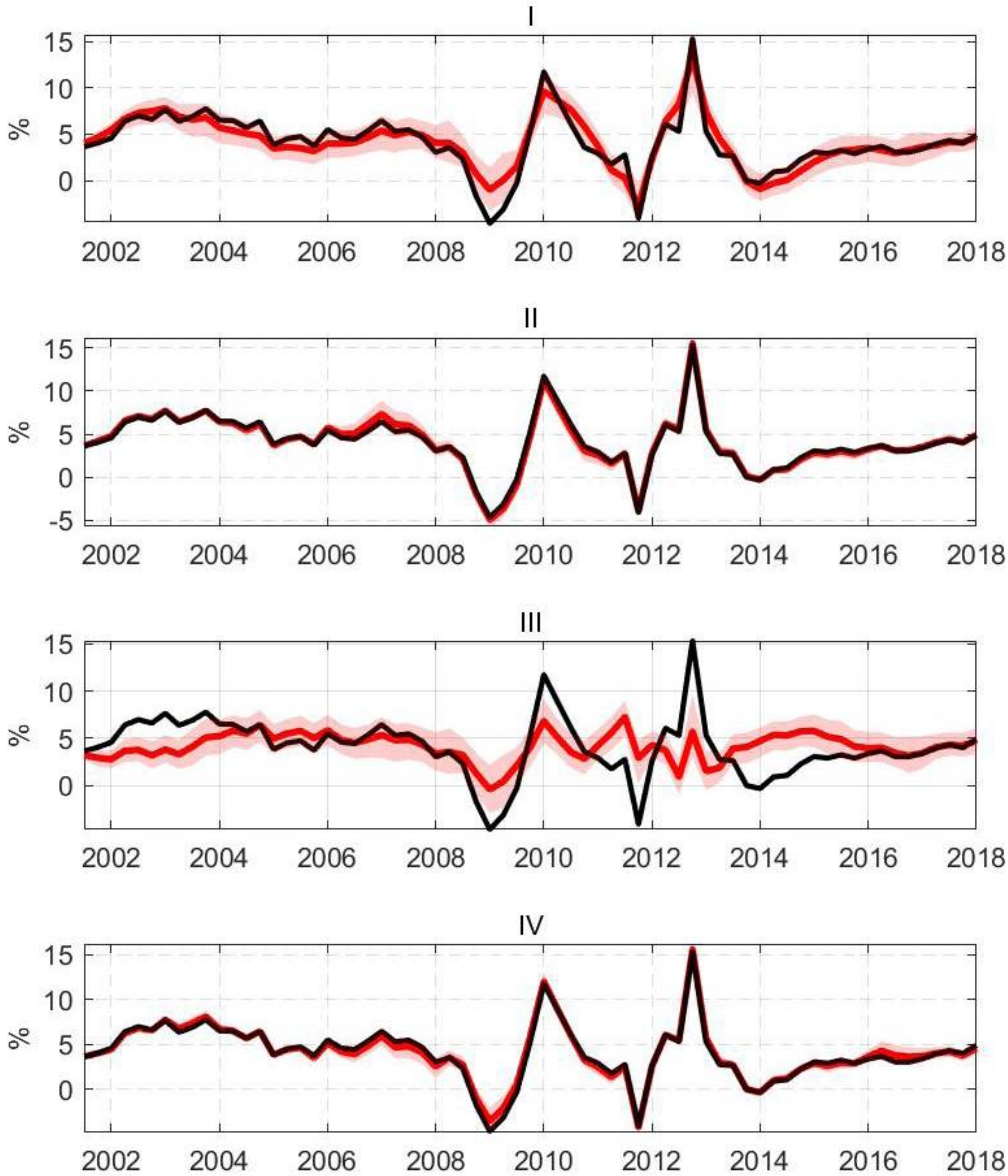
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 24: Counterfactual Paths for Inflation with Suppressed Shocks – Singapore



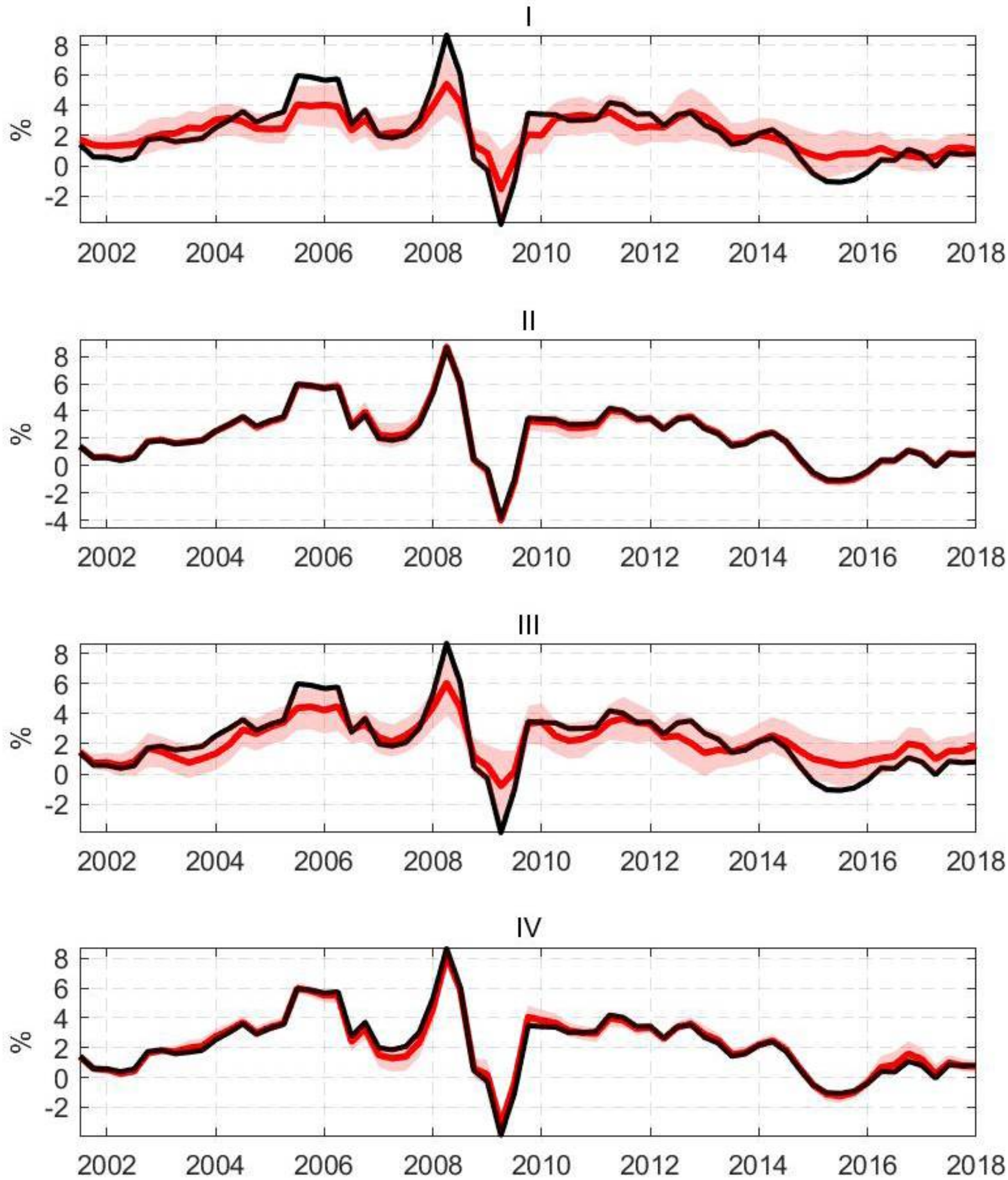
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 25: Counterfactual Paths for GDP Growth with Suppressed Shocks – Thailand



Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.

Figure 26: Counterfactual Paths for Inflation with Suppressed Shocks – Thailand



Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) for the growth rate of domestic real GDP (in %). In I, the counterfactual path corresponds to GDP growth where aggregate global shocks (oil supply shocks and global demand shocks) are suppressed, while the same is done in II with monetary policy shocks, in III with domestic shocks (domestic demand and domestic supply shocks) and in IV (exchange rate shocks). The identification of shocks relies on the Corsetti et al. (2014) identification.