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The Role of Global and Domestic Shocks for Inflation Dynamics: Evidence from Asia*

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Abstract

This article studies inflation dynamics and the output−inflation trade-off in small open economies. We estimate a series of VAR models for a set of six Asian emerging market economies, in which we identify a battery of domestic and global shocks using sign restrictions. We find that global shocks explain large parts of inflation and output dynamics. A series of counterfactuals support these findings and suggest that the role of monetary policy is limited. We estimate reduced-form Phillips curve regressions based on alternative decompositions of output into global and domestic components. For most countries, we find a positive and significant correlation between inflation and the fraction of GDP driven by domestic shocks only. While including the output component driven by oil prices seems to 'flatten' the Phillips curve, though the effect is not significant, the component driven by global demand shocks 'steepens' the inflation−output nexus.

I. 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 appeared 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, a large literature studies the changing nature of inflation dynamics and, in particular, the shifting relationship between inflation and economic activity. This research agenda is often 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 consequences for monetary policy. For given inflation expectations, the argument goes, a flatter Phillips curve would require a deeper recession in order to bring high inflation back to the target.

JEL Classification numbers: E3, E5, F4.

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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 forces explain inflation is not straightforward. In her survey article, Forbes (2019) 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.

In this article, we add to this literature and study six Asian emerging market countries: Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. These countries are prototypical small open economies that are well integrated into the world economy.[1] In addition, all six economies explicitly or implicitly have a monetary policy mandate for maintaining price stability.[2] 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 shed new light on the determinants of inflation by disentangling domestic and global driving forces based on a series of counterfactuals. For example, we split GDP growth into the component that reflects domestic shocks and the part that is driven by global demand shocks. These decompositions show that GDP driven by domestic shocks elicits a Phillips curve relationship that differs from the relationship between inflation and the part of GDP driven by global shock.

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 to apply several structural analyses in order to address the role of the structural shocks on inflation and on the growth rate of real GDP. In doing so, we focus on four categories of shocks, i.e. global, domestic, monetary policy and residual 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 by exogenous shocks to other variables in the system. 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

[1] 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.
[2] See Volz (2015) for a discussion of the experience with inflation targeting in Asia.

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.

We run counterfactual simulations in order to derive the hypothetical effects of shocks in the past on today's outcomes. By changing the history of selected structural shocks, this exercise summarizes the results of the historical decomposition and shows how our endogenous variables would have evolved in the absence of these shocks. 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, i.e. the components of economic activity driven by global demand and supply shocks. We study the inflation−output correlation using this decomposition of GDP.[3] 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 reduced-form Phillips curve specification if the coefficient on the components of real GDP growth driven by oil supply shocks and global demand shocks equal the one on the domestic component.

Our results suggest that the nature of global shocks matters. We see that global supply shocks seem to flatten the Phillips curve throughout our set of countries, though the effect is not statistically significant, while the opposite is true for global demand shocks. Importantly, we get similar results when we use an alternative identification strategy.

Our article 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 economies 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

[3]The growth rate of GDP is just one possible indicator of slack in the economy. Alternative indicators are the output gap, i.e. the difference between the levels of actual and potential GDP, real marginal cost or measures incorporating information from the tightness of the labour market. Krause and Lubik (2007), Faccini, Millard and Zanetti (2013), Thomas and Zanetti (2009), Zanetti (2011) and Trigari (2009) show the relevance of slack derived from labour market conditions for inflation dynamics.

some countries, these authors find global factors to be the dominant drivers of inflation. Supportive evidence for advanced economies is provided by Milani (2009, 2010) and others, while Ihrig *et al.* (2010) cannot find evidence in favour of the ‘globalization of inflation’ hypothesis. Bems *et al.* (2018) include additional global variables into an otherwise standard New Keynesian Phillips curve estimated for 19 emerging market economies. The authors show that domestic factors are the most important drivers of inflation. Okuda, Tsuruga and Zanetti (2019) use sectoral data from Japan to show that an increase in the heterogeneity of shocks contributes to a weaker response of inflation to real economic activity.

The concept of global output gaps often used in the literature, however, is not without flaws (see Tanaka and Young, 2008, and Gerlach, 2011). Jasova, Moessner and Takats (2020) 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 article, 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, Dedola and Leduc (2014) and Bobeica and Jarocinski (2019) propose a set of sign restrictions that allows us to quantify the response to orthogonal domestic and global shocks, respectively. Conti, Neri and Nobili (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 article is organized as follows. Section II 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 III. Section IV examines the Phillips curve trade-off based on the domestic and global components of output. Section V draws conclusions for monetary policy. An Online Appendix contains additional results.

II. Empirical framework

The empirical analysis in this article is based on an identified VAR model, as pioneered by Sims (1980). Much of the analysis that follows is based on the interpretation 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.

The VAR model

Our model can be written as

$$\mathbf{y}_t = \mathbf{c} + \mathbf{B}_1\mathbf{y}_{t-1} + \cdots + \mathbf{B}_p\mathbf{y}_{t-p} + \mathbf{u}_t, \quad t = p+1, \ldots, T, \tag{1}$$

where $\mathbf{y}_t$ is an $n \times 1$ vector of endogenous variables, which in our case will include key macroeconomic time series. Furthermore, $\mathbf{B}_1, \ldots, \mathbf{B}_p$ are $n \times n$ matrices capturing the VAR coefficients and $\mathbf{u}_t$ is an $n \times 1$ vector of residuals, which is assumed to follow a multivariate normal distribution $\mathbf{u}_t \sim \mathcal{N}(0, \boldsymbol{\Sigma})$.

A major challenge when dealing with impulse responses from VAR models with $\boldsymbol{\Sigma}$ being unrestricted a priori is that they arise from shocks that are correlated. Put differently, the variance-covariance matrix $\boldsymbol{\Sigma}$ 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 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 orthogonal shocks.

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

$$\mathbf{A}_0\mathbf{y}_t = \boldsymbol{\mu} + \mathbf{A}_1\mathbf{y}_{t-1} + \cdots + \mathbf{A}_p\mathbf{y}_{t-p} + \boldsymbol{\varepsilon}_t, \tag{2}$$

where $\boldsymbol{\varepsilon}_t \sim \mathcal{N}(0, \boldsymbol{\Gamma})$ is the vector of structural shocks we are interested in. Notice that the VAR is now augmented by $\mathbf{A}_0$ such that $\boldsymbol{\Gamma}$ will be a diagonal identity matrix, i.e. the structural disturbances in $\boldsymbol{\varepsilon}_t$ are mutually independent. This is reasonable from the view 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 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. In our benchmark model, we use $p = 2$ lags. The priors for the VAR coefficients in $\mathbf{B}_1, \ldots, \mathbf{B}_p$ as well as for $\boldsymbol{\Sigma}$ are both centred around the OLS estimates. As regards the prior for the VAR coefficients, we assume a multivariate normal distribution coupled with a Minnesota prior where the autoregressive coefficients are set to 0.8. The prior for $\boldsymbol{\Sigma}$ follows an inverse Wishart distribution. As regards the choice of hyperparameters, we choose an overall tightness of $\lambda_1 = 0.1$ and a lag decay of $\lambda_3 = 2$.[4] Each country-specific benchmark estimation relies on 5,000 draws, where the first 3,000 draws are discarded because the first draws of the joint posterior are likely to be not representative for the target distribution we are looking for. In the Online Appendix, we report various diagnostic statistics for the convergence properties of the sampler.

[4]We have repeated the estimation for each country and performed a grid search in which the hyperparameters are selected optimally. To do so, we specified minimum and maximum values for each hyperparameter and a step size for the grid search. In the next step, we estimated the marginal likelihood for each possible combination on the grid. We then chose the combination of hyperparameters for which the marginal likelihood is maximized. We find that our results, available on request, are unaffected by the choice of hyperparameters.

TABLE 1
Identification of structural shocks

Variable \ Shock	*Oil supply*	*Global demand*	*Domestic demand*	*Domestic supply*	*Monetary policy*	*Residual*
I. Baseline sign restrictions (Corsetti et al., 2014)						
Oil price	+	−				0
GDP share		+	−	−	0	0
Real GDP	−	−	−	−	0	0
Inflation	+	−	−	+	0	0
Interest rate	0		−	+	+	0
Exchange rate						+
II. Alternative sign restrictions						
Oil price	+	−				0
GDP share		+	−	−	−	0
Real GDP	−	−	−	−	−	0
Inflation	+	−	−	+	−	0
Interest rate	0		−	+	+	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.

Data and shock identification

We estimate the model separately for six Asian emerging market economies: Indonesia (IDN), Korea (KOR), Malaysia (MYS), 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.[5] All variables other than the share in world GDP and the interest rate are expressed as year-on-year growth rates in percentage points. The data cover the sample period 2001Q1 to 2018Q1 and the frequency is quarterly.

Our choice of year-on-year growth rates is motivated by the Chinese New Year, which imposes a seasonal pattern on the data, which are different compared with advanced economies. Using year-on-year rates allows us to ignore seasonal adjustment. The share in world GDP is included in differences (percentage point change from the year before). An increase in the real effective exchange rate corresponds to a real appreciation of the domestic currency.[6]

To identify structural shocks, we use two sets of alternative restrictions, see Table 1. Both sets impose alternative sign restrictions onto the variables, while the difference between both sets lies in the identification of monetary policy shocks.

[5]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 are not available for all six countries under consideration.

[6]The data on GDP, prices and the interest rate are 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) to quarterly frequency.

I. Baseline sign restrictions

Our first identification strategy broadly 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. We implement sign restrictions as in Arias, Rubio-Ramirez and Waggoner (2018). 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 decrease both domestic prices as well as domestic real GDP. The imposed negative sign on the GDP share means that domestic real GDP decreases 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 to an increase in the share of domestic real GDP relative to the rest of the world GDP, implying 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 decrease.

In order to further distinguish global demand shocks from domestic demand shocks, we also assume that a global demand shock leads to a decline 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 remain unrestricted with respect to the response of the oil price, but the interest rate is assumed to decrease in order to fight deflationary 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 the domestic short-term interest rate is restricted to zero.[7] This is due to the fact that the central bank does not contemporaneously respond to oil shocks.[8]

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 decrease 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 1 month delay to an increase in the interest rate.

We include the exchange rate in our VAR model because we are studying small open economies. The residual shock accounts for fluctuations of the exchange rate, which are not explained by all other domestic and global shocks. Hence, following Bobeica and Jarocinski (2019), a residual shock is a surprise change in the exchange rate that contemporaneously keeps all other variables unchanged.[9]

II. Alternative sign restrictions

An alternative set of sign restrictions follows Bobeica and Jarocinski (2019), who adopt a mixture of the sign restrictions proposed in Corsetti *et al.* (2014) and Baumeister and

[7]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.

[8]For a further discussion, see Corsetti *et al.* (2014) and Bobeica and Jarocinski (2019).

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

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. That is, following an unexpected increase in the policy rate, inflation and real GDP growth are assumed to fall. 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.

The restrictions are imposed on impact only. This is because we want to keep the restrictions as light as possible. Since imposing restrictions on the impact period only suffices for our purpose, we refrain from imposing addition structure on the model. All results reported throughout this article are based on the baseline identification strategy I, i.e. the Corsetti *et al.* (2014) identification. The results based on identification strategy II will not be shown in order to save space but are available in the Online Appendix. We find that most of our results remain unchanged under the alternative identification.

III. Results

This section reports the main results of our article. We first start with the results for a variance decomposition of the forecast errors. We then discuss the results from a historical decomposition and from counterfactual experiments, where the latter serve as input for our exercise in section four. Both for the historical decomposition and for the counterfactuals, we summarize the contributions of all shocks into four main categories: (i) monetary policy shocks; (ii) residual shocks; (iii) domestic shocks; and (iv) global shocks. Thereby, we use ‘domestic shocks’ as the umbrella term for both domestic demand as well as domestic supply shocks. Meanwhile, ‘global shocks’ summarize both global demand shocks and oil supply shocks, while monetary policy shocks and residual shocks are the remainder.

Forecast error variance decomposition

A structural 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.

Table 2 reports the results of the forecast error variance decomposition for GDP growth for different horizons, i.e. for $h = 4, 8$ and 12. Our results imply that both domestic and global demand as well as domestic and global supply shocks in particular are the main drivers of real GDP growth. For our research question, the role of global shocks is of major interest. For $h = 4$, we find that oil supply shocks can explain between 10% (KOR) and 35% (PHL) of the variance of forecast errors. Global demand shocks also seem to be particularly important for our six countries, with an explanatory power ranging from 14% (PHL and SGP) to 49% (IDN). Interestingly, the explanatory power is relatively constant across the forecast horizons. For all six countries, our results imply

TABLE 2

Forecast error variance decompositions for real GDP growth

		IDN	*KOR*	*MYS*	*PHL*	*SGP*	*THA*
$h = 4$	Residual	5	3	1	1	1	1
	Monetary policy	4	0	1	1	0	1
	Oil supply	9	10	16	35	18	18
	Global demand	49	39	29	14	14	16
	Domestic demand	5	39	46	14	38	36
	Domestic supply	29	9	7	35	29	28
$h = 8$	Residual	9	6	2	2	2	2
	Monetary policy	6	1	2	2	1	1
	Oil supply	10	13	21	37	21	19
	Global demand	42	33	26	13	17	16
	Domestic demand	7	35	40	16	32	33
	Domestic supply	27	12	8	29	27	28
$h = 12$	Residual	9	7	3	2	2	3
	Monetary policy	6	1	3	3	2	2
	Oil supply	10	13	20	36	20	19
	Global demand	40	34	26	14	17	17
	Domestic demand	8	34	38	17	33	32
	Domestic supply	27	12	9	28	26	27

Notes: Median shares (in %) of forecast error variance for GDP growth due to structural shocks for different forecast horizons. All results rely on the Corsetti *et al.* (2014) identification and rounded to integers.

that both the monetary policy shock as well as the residual shock play a minor role only.[10]

For the inflation rate, see Table 3, we also find that global shocks can explain a large part of the variance of the forecast error, but the contributions are more heterogeneously distributed than for real GDP growth. For $h = 4$, our results imply that the oil supply shock is most important for Malaysia (50%) as well as for the Philippines (62%). For Indonesia, oil supply shocks can explain only 5% of the variance of the forecast error. Global demand shocks are most important for Singapore, with an explanatory power of 46%. For all other countries, the values range between 13% and 27%. We also find that the contributions become more convergent as the forecast horizon becomes longer. Overall, we find that global shocks are an important driver of inflation in our small open economies.

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 how much of the historically observed fluctuations of a variable is explained by one

[10]We also estimate a Panel VAR with the alternative set of sign restrictions and the same prior specification as for our single country estimations. While details are provided in the Appendix, our pooled estimates suggest that global shocks explain 30% of the fluctuation over 2 years. For GDP growth, global shocks are even more important. They account for 52% of fluctuations of real economic activity over the 2-year horizon. See the Online Appendix for details.

TABLE 3

Forecast error variance decompositions for inflation

		IDN	*KOR*	*MYS*	*PHL*	*SGP*	*THA*
$h = 4$	Residual	1	1	1	1	1	1
	Monetary policy	1	0	1	0	1	0
	Oil supply	5	26	50	62	13	16
	Global demand	15	21	23	13	46	27
	Domestic demand	34	32	10	19	31	46
	Domestic supply	43	19	16	6	8	9
$h = 8$	Residual	2	2	2	2	2	3
	Monetary policy	2	1	2	2	3	1
	Oil supply	8	20	43	55	13	16
	Global demand	22	24	25	15	30	24
	Domestic demand	29	36	12	17	35	44
	Domestic supply	36	17	17	9	17	11
$h = 12$	Residual	3	3	2	2	3	4
	Monetary policy	3	2	2	2	4	1
	Oil supply	9	19	42	53	13	16
	Global demand	24	23	25	15	28	24
	Domestic demand	29	36	13	18	33	43
	Domestic supply	33	17	17	9	20	12

Notes: Median shares (in %) of forecast error variance for inflation due to structural shocks for different forecast horizons. All results rely on the Corsetti *et al.* (2014) identification and rounded to integers.

specific shock. Even though our results so far suggest that both global and domestic shocks are important drivers of inflation and GDP growth, we do not know 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 structural 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 $\mathbf{y}_t$ into a vector of contributions from deterministic variables $\mathbf{d}^{(t)}$ and historical contributions of structural shocks. Considering variable i, the historical decomposition reads

$$\mathbf{y}_{i,t} = \mathbf{d}_i^{(t)} + \sum_{j=1}^{n}\sum_{k=0}^{t-1}\widetilde{\boldsymbol{\psi}}_{k,ij}\boldsymbol{\varepsilon}_{j,t-k}. \tag{3}$$

This expression states that $\mathbf{y}_{i,t}$ is the sum of the deterministic component $\mathbf{d}_i^{(t)}$ and the sum of contributions of all $j = 1, \ldots, n$ structural shocks on variable i from period $k = 0$ to $t - 1$ back in the past, where $\boldsymbol{\varepsilon}_{j,t-k}$ is the structural shock j in period $t - k$ and $\widetilde{\boldsymbol{\psi}}_{k,ij}$ is the corresponding entry in row i and column j of the structural impulse response function matrix $\widetilde{\boldsymbol{\Psi}}_k$, i.e. it corresponds to the impact of shock j on variable i. The historical

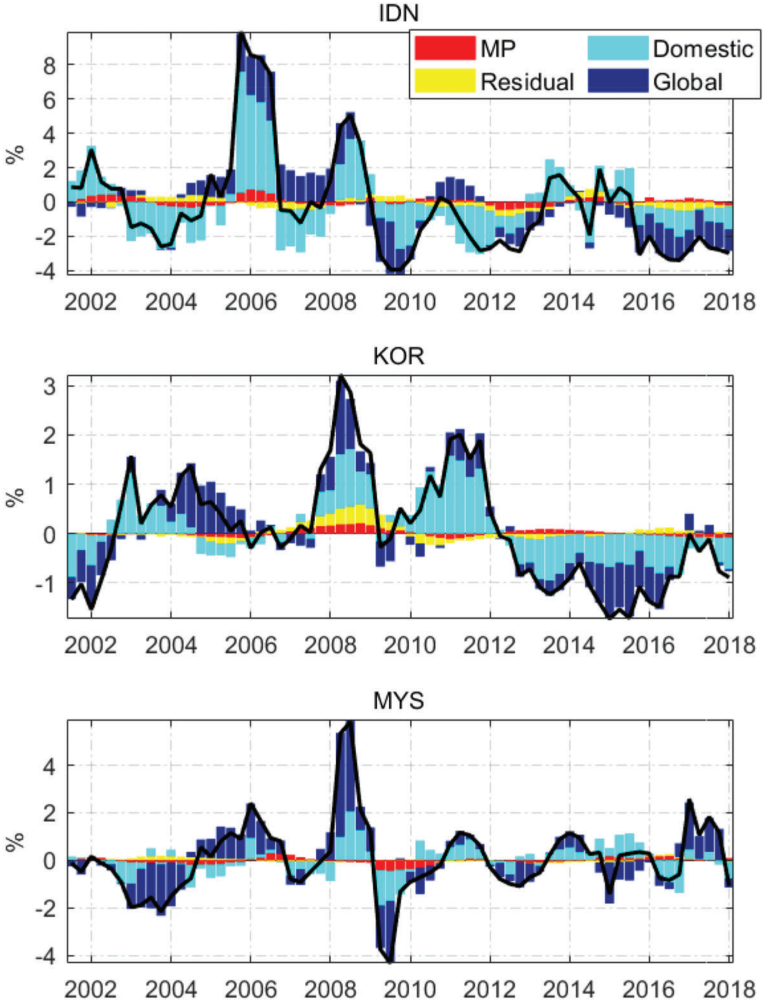

Figure 1. Historical contribution of structural shocks to inflation for Indonesia, Korea and Malaysia
Notes: Median historical contribution of monetary policy shocks (red bars), residual shocks (yellow bars), domestic shocks (teal bars) and global shocks (blue bars) to inflation for Indonesia, Korea and Malaysia. The black path corresponds to the sum of median contributions of all structural shocks. Results rely on identification strategy I

decomposition in (3) shows that, for example, a positive contribution of structural shock j to variable i means that shock j pushes variable i above the deterministic component, i.e. the unconditional forecast in the absence of any shocks.

Figures 1 and 2 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 coloured 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 periods of disinflation, but negative contributions

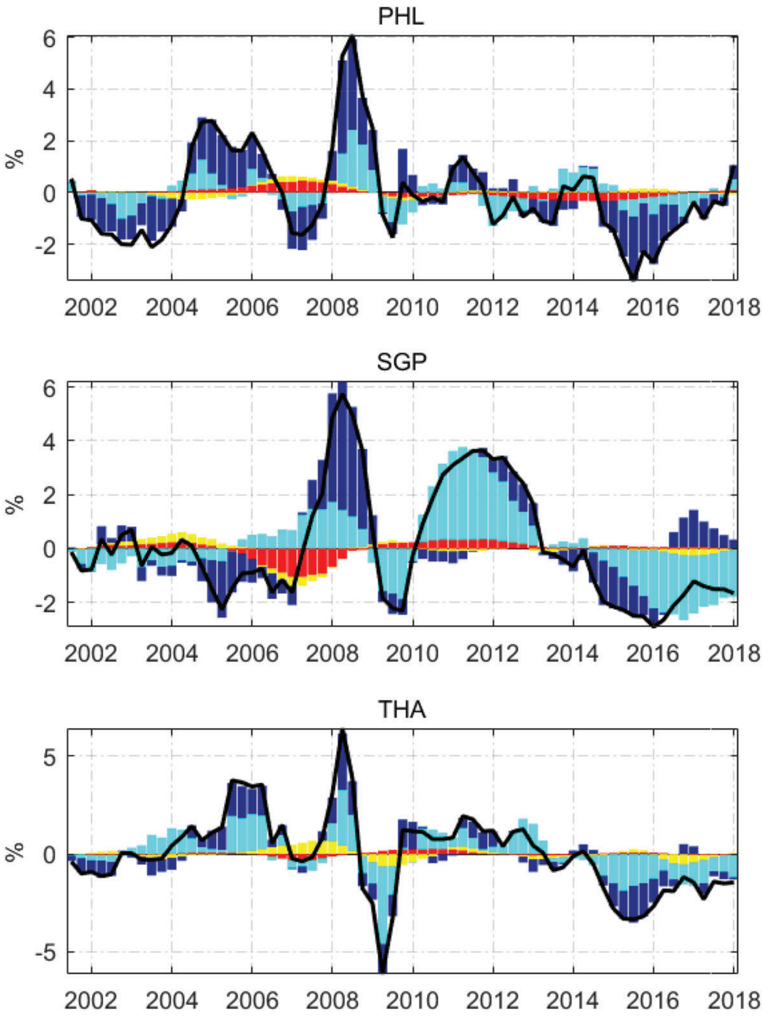

Figure 2. Historical contribution of structural shocks to inflation for the Philippines, Singapore and Thailand
Notes: Median historical contribution of monetary policy shocks (red bars), residual shocks (yellow bars), domestic shocks (teal bars) and global shocks (blue bars) to inflation for the Philippines, Singapore and Thailand. The black path corresponds to the sum of median contributions of all structural shocks. Results rely on identification strategy I

that push the inflation rate below the deterministic component, which is non-negative for all countries throughout the entire sample.[11]

Four key results stand out for all countries.[12] First, while for some countries the effect of domestic shocks dominates, global shocks (as contributions of oil supply shocks plus

[11] 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.

[12] It is worth noting that identification strategy II yields very similar results, although we find that the role of monetary policy shocks is more important for most countries, a finding that is qualitatively similar to the results in Bobeica and Jarocinski (2019). Nevertheless, also here we find that global shocks are very important for the fluctuation of both the inflation rate and the growth rate of real GDP.

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. 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 forces. In Korea, Singapore and Thailand, global shocks put downward pressure on inflation after 2014.

Fourth, both residual and monetary policy shocks contribute 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 in the dynamics of inflation in Malaysia and Thailand. This result suggests that central banks 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 residual shocks play a small role is consistent with the notion of central banks are effective in stabilizing inflation in light of exchange rate movements.

We would expect the cross-country correlation between global shocks (both supply and demand) to be positive, since these shocks stem from abroad and, for each country, are identified by the same co-movement between domestic and foreign variables. The Appendix shows that the correlation of global supply shocks is high across countries. The correlation is always positive and in most cases above 50%. It is not surprising that the correlation of global demand shocks is slightly lower than for global supply shocks. The reason is that, as for the demand shock, we separate domestic from global demand shocks by exploiting the co-movement of domestic real GDP relative to real GDP of the rest of the world. This is not the case for the global supply shock, which is identified as an oil supply shock. This shock is assumed to hit all countries equally and we do not restrict the response of real GDP of a single country relative to real GDP of the rest of world.

Summing up, our historical decompositions support our findings from the FEVDs insofar as global and domestic shocks seem to be the main drivers of inflation across countries.[13] However, they also uncover that global shocks are primarily important in

[13] Also the results from our Panel VAR support the finding that global and domestic shocks are the main drivers of inflation dynamics in our six countries. However, the Panel results suggest that global shocks are more important than domestic shocks, while also the role of both monetary policy shocks and residual shocks is more important than in our individual VARs.

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.

Counterfactual analysis

Now that we already have first impressions of the contributions of our structural shocks, we use these results and visualize the importance of our structural shocks even further in counterfactual scenarios. We run a battery of counterfactual experiments in order to shed light on the role of alternative drivers 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 residual shocks. The previous analysis provides us with everything we need 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 the first scenario, we study inflation in the absence of selected structural shocks. For that purpose we suppress (1) both the global demand and oil supply shock, (2) the monetary policy shock, (3) both the domestic demand and the domestic supply shock, and (4) the residual shock.

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 II) 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]

Remember that each variable of our vector $\mathbf{y}_t$ of endogenous variables can be rewritten as

$$\mathbf{y}_{i,t} = \mathbf{d}_i^{(t)} + \sum_{j=1}^{n}\sum_{k=0}^{t-1}\widetilde{\boldsymbol{\psi}}_{k,ij}\boldsymbol{\varepsilon}_{j,t-k} \tag{4}$$

We can then simulate counterfactual paths by setting the sequence of an arbitrary shock to zero or, equivalently, subtracting the contribution of this shock. Suppressing shock $s \in j = 1, .., n$ over all periods therefore results in the counterfactual path

[14]Note that in a historical decomposition, usually only the median (or mean) estimates are shown, so that uncertainty is ignored. However, this is usually the choice of the researcher and even in a historical decomposition one could easily show uncertainty if one wanted to.

[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 $\mathbf{A}_0$ as section II. Then derive the vector of structural shocks $\boldsymbol{\varepsilon}_t$. Setting different structural shocks to zero results in a vector $\widetilde{\boldsymbol{\varepsilon}}_t$ that can be used to construct the counterfactual paths. This is done by simulating the vector of counterfactual data as $\mathbf{y}_t^{cf} = \mathbf{c} + \mathbf{B}_1\mathbf{y}_{t-1}^{cf} + \cdots + \mathbf{B}_p\mathbf{y}_{t-p}^{cf} + \mathbf{A}_0^{-1}\widetilde{\boldsymbol{\varepsilon}}_t$. Finally, note that we are interested here in the role of structural shocks over the full sample. One can still perform interesting experiments and, for example, simulate away or change only a subsequence of the shocks. In this case, the counterfactual has to be simulated as described above.

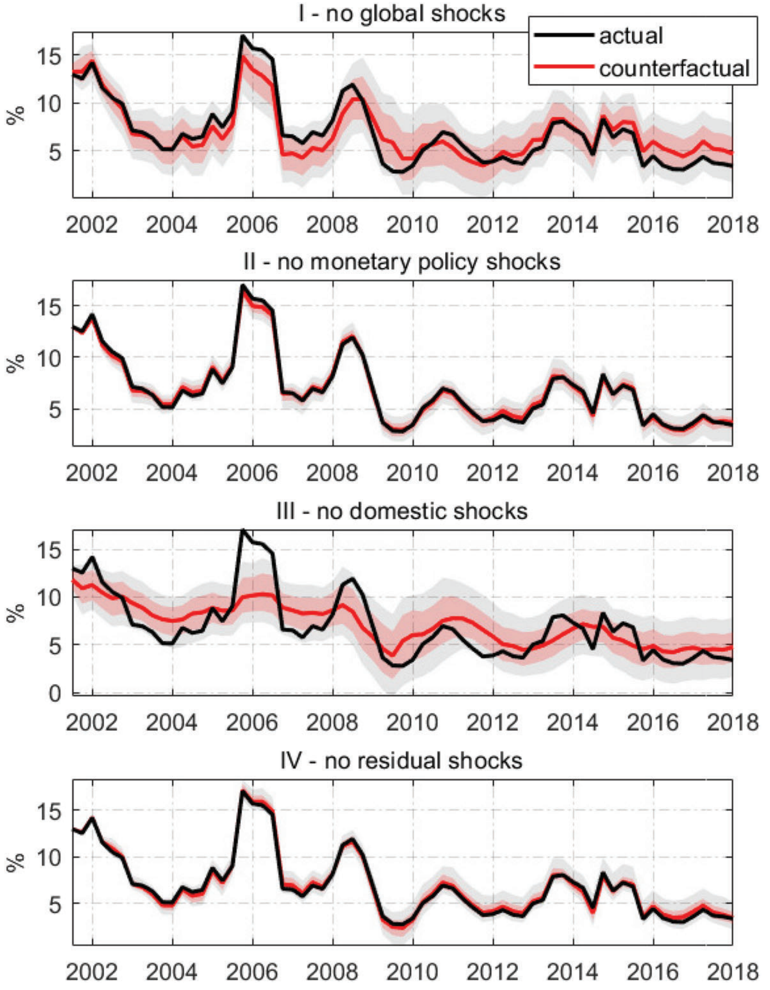

Figure 3. Counterfactual paths for inflation with suppressed shocks – Indonesia
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) as well as the 5th and 95th percentiles (grey-shaded area) for inflation (in %). In I, the counterfactual path corresponds to the inflation rate 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 (residual shocks). The identification of shocks relies on the Corsetti *et al.* (2014) identification

$$\mathbf{y}_{i,t}^{cf} = \mathbf{d}_i^{(t)} + \sum_{j=1, j\neq s}^{n} \sum_{k=0}^{t-1} \widetilde{\boldsymbol{\psi}}_{k,ij} \boldsymbol{\varepsilon}_{j,t-k}. \tag{5}$$

We construct counterfactual paths for inflation and GDP growth by separately suppressing (1) both the global demand and oil supply shock, (2) the monetary policy shock, (3) both the domestic demand and the domestic supply shock, and (4) the residual shock.

In order to save space, we discuss the counterfactuals for inflation only, see Figures 3–8, which depict the simulated paths for inflation in hypothetical scenarios in which the

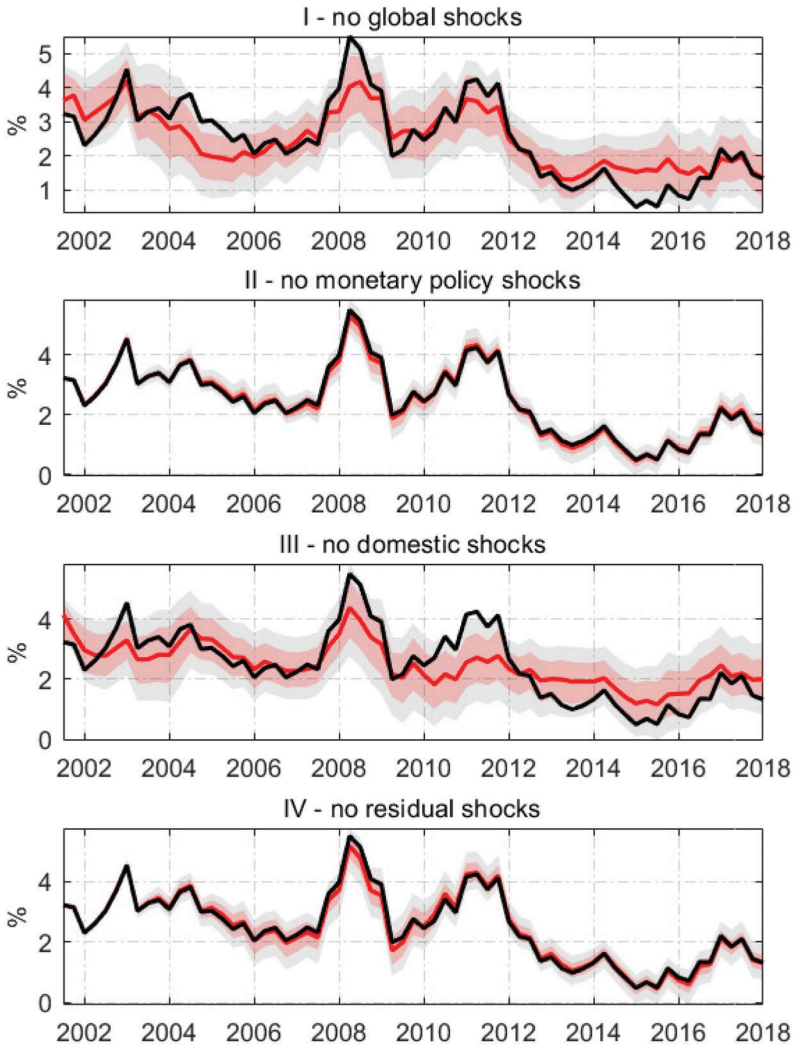

Figure 4. Counterfactual paths for inflation with suppressed shocks – Korea
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) as well as the 5th and 95th percentiles (grey-shaded area) for inflation (in %). In I, the counterfactual path corresponds to the inflation rate 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 (residual shocks). The identification of shocks relies on the Corsetti *et al.* (2014) identification

aggregate global shock, the monetary policy shock, the aggregate domestic shock as well as the residual rate shock are suppressed.[16] The red solid paths correspond to the median counterfactual path over all samples, while the shaded areas enclose the 16th and 84th (red-shaded) percentiles as well as the 5th and 95th (grey-shaded) percentiles, respectively.

[16]The counterfactual paths for GDP growth are available in the Online Appendix.

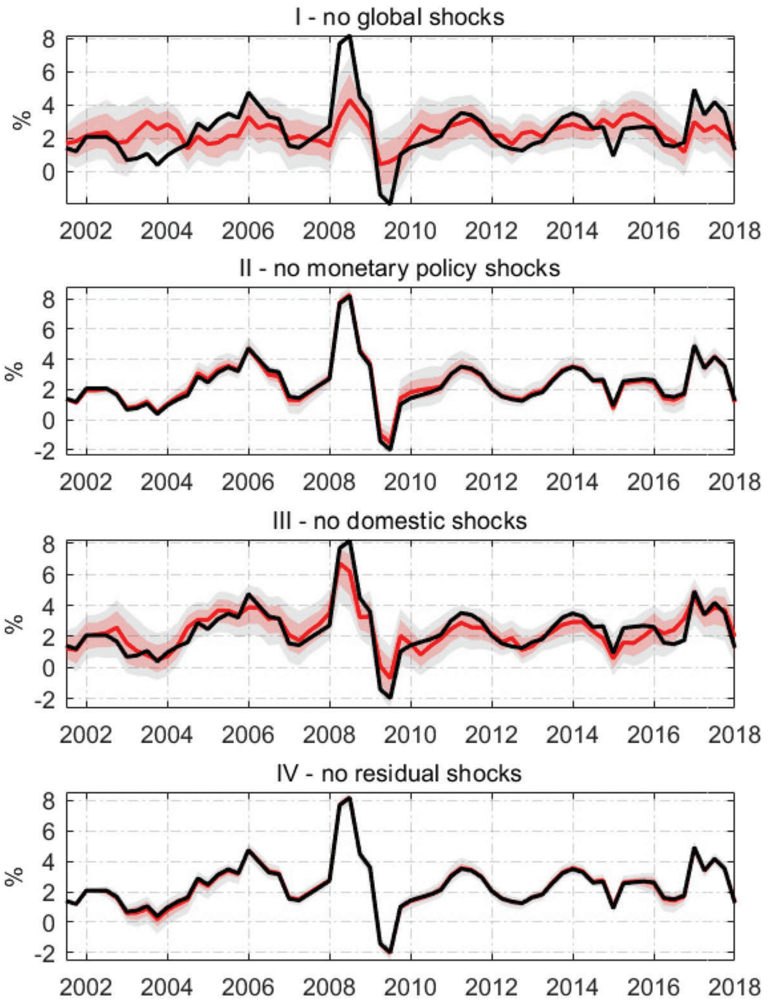

Figure 5. Counterfactual paths for inflation with suppressed shocks – Malaysia
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) as well as the 5th and 95th percentiles (grey-shaded area) for inflation (in %). In I, the counterfactual path corresponds to the inflation rate 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 (residual shocks). The identification of shocks relies on the Corsetti *et al.* (2014) identification

Take Korea as an example. Three findings are noteworthy. First, suppressing either the global shocks or the domestic shocks does make a difference. Our results suggest that in the absence of global shocks, we would have observed lower inflation rates between 2004 and 2006, saying that global shocks had inflationary pressure during that period. Global shocks also put inflationary pressure on Korea immediately before the onset of the Great Recession. We can see this from the fact that without global shocks, the inflation rate would have been significantly lower during this period. This is not surprising and reflects the boom phase immediately before the crisis. Note that this result is qualitatively very

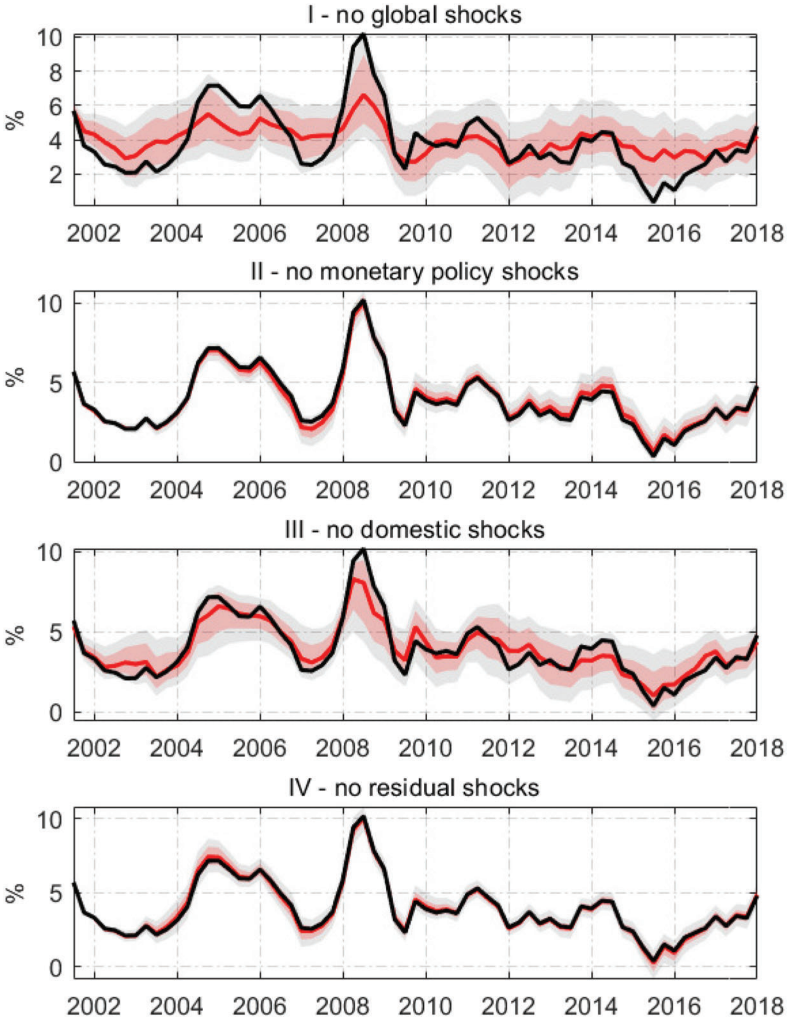

Figure 6. Counterfactual paths for inflation with suppressed shocks – Philippines
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) as well as the 5th and 95th percentiles (grey-shaded area) for inflation (in %). In I, the counterfactual path corresponds to the inflation rate 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 (residual shocks). The identification of shocks relies on the Corsetti *et al.* (2014) identification

consistent with the results from Bobeica and Jarocinski (2019) for the euro area as well as for the United States.

Second, we find that we would have observed lower inflation rates in the absence of domestic shocks around 2008. Thus, domestic shocks were inflationary during this period. As in the case of global shocks, we also find that adverse shocks were deflationary between 2014 and 2016. Note that this finding perfectly mirrors our result from the historical decomposition, where we saw that, especially around the Great Recession, global and domestic shocks pushed inflation in the same direction.

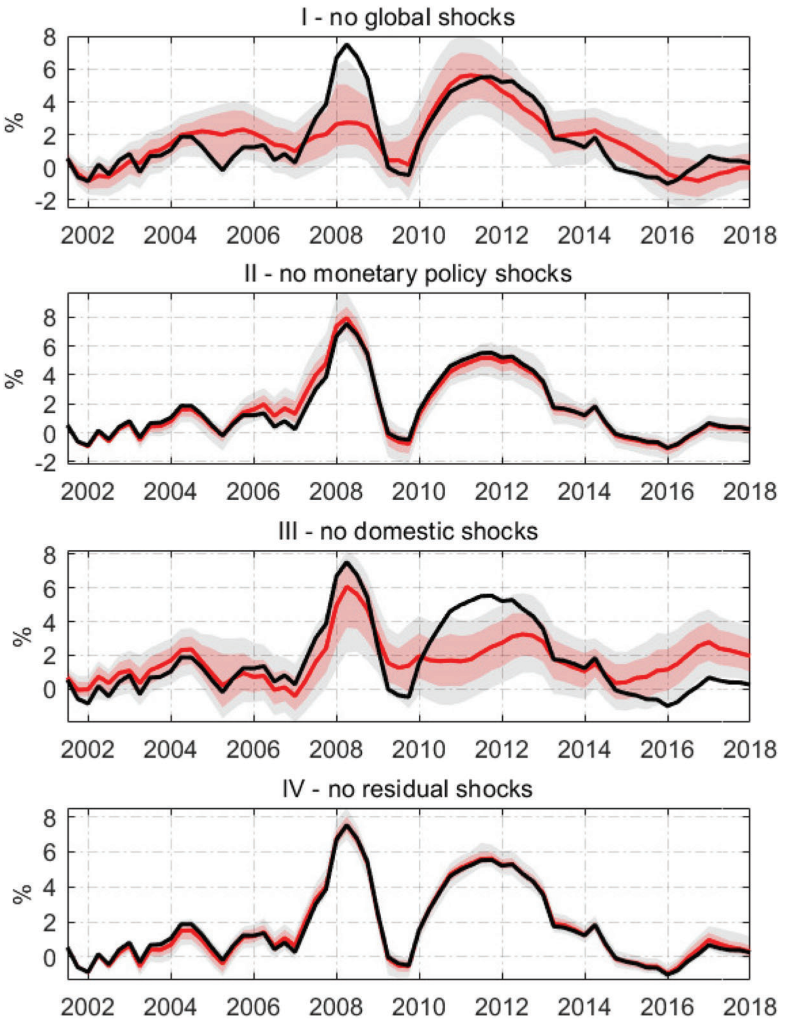

Figure 7. Counterfactual paths for inflation with suppressed shocks – Singapore
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) as well as the 5th and 95th percentiles (grey-shaded area) for inflation (in %). In I, the counterfactual path corresponds to the inflation rate 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 (residual shocks). The identification of shocks relies on the Corsetti *et al.* (2014) identification

The third finding pertains to the remaining shocks. These shocks seem to play a small role for Korean inflation as the actual inflation rate is indistinguishable from the counterfactual path for which monetary shocks (panel II) or residual shocks (panel IV) are suppressed.

Summarizing the results for Korean inflation, we conclude that global shocks as well as domestic demand seemed to play a more important role than monetary policy shocks and residual shocks. Importantly, the findings from the counterfactuals and the role of domestic and global shocks around 2008 are consistent for all countries.

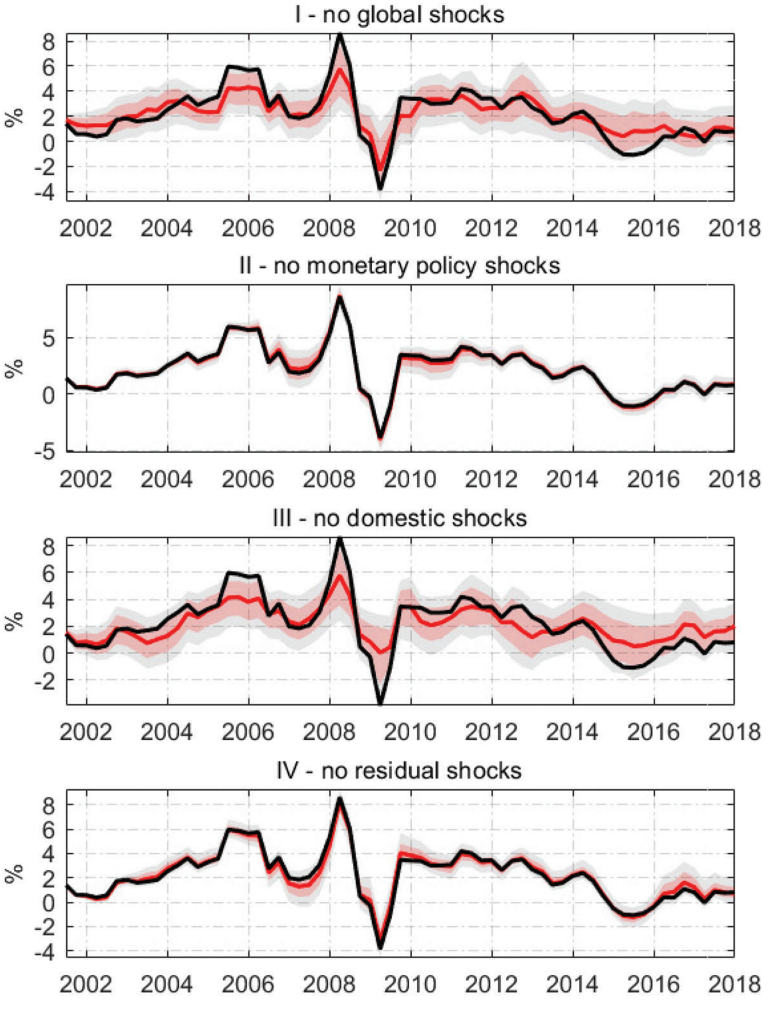

Figure 8. Counterfactual paths for inflation with suppressed shocks – Thailand
Notes: Median counterfactual paths (red solid path) with 16th and 84th percentiles (red-shaded area) as well as the 5th and 95th percentiles (grey-shaded area) for inflation (in %). In I, the counterfactual path corresponds to the inflation rate 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 (residual shocks). The identification of shocks relies on the Corsetti et al. (2014) identification

Robustness check

So far, our results suggest that monetary policy shocks have little effects 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 behaviour on the information available to the central bank within the quarter. Recall that under our benchmark identification strategy, both structural demand and supply disturbances have simultaneous effects on the interest-rate equation. In order to impose an alternative systematic monetary policy behaviour, we therefore restrict the corresponding coefficients in the structural matrix $\mathbf{A}_0$ 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 confirms our previous results, i.e. that departures from the policy rule have only limited effects on inflation dynamics.

In our baseline model, we include the oil price as an endogenous variable. From the perspective of small open economies, however, the oil price is often considered exogenous such that it may not be explained by the lags of the endogenous domestic variables. We treat the oil price as endogenous as we need the oil price in order to identify global supply shocks in the VAR model. The estimated coefficients on the lagged endogenous variables in the oil price equation will be zero if oil is indeed exogenous, thus mitigating concerns of a potential misspecification.

In order to rule out remaining concerns, we re-estimate our models with the restriction that domestic variables have no effect on the oil price by means of block exogeneity. We set a prior of zero on the coefficients of all lagged domestic variables in the oil price equation in combination with a prior variance of $\lambda_5 = 0.001$.[17] This ensures that the oil price is not driven by domestic variables and that it nevertheless can be exploited to identify a global supply shock. For all six countries, we find that the posterior distribution is very much centred around zero, i.e. the median, the 5th and 95th percentiles for all domestic variables are equal to 0.00. As regards our main results, we find no qualitative differences compared with our original approach. In the Online Appendix, we can see that in this case we get the same oil supply shocks as in our baseline case. The corresponding impulse responses, not shown for space reasons but available on request, also look very similar.

IV. How global shocks affect the Phillips curve

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 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 the inflation–output nexus for our six countries under investigation and see if the Phillips curve is still ‘alive’. We investigate whether the sensitivity of inflation to output depends on the nature of shocks that are driving GDP. In contrast to much of the literature, we do not add additional variables to the Phillips curve such as oil prices or measures of global output gaps in order to assess these variables’

[17]Note that block exogeneity is not possible with a Normal Wishart prior. The reason is that the Kronecker structure for the variance of the prior for the VAR coefficients causes instability. Instead, we choose a Minnesota prior for this comparison, which is closest to the Normal Wishart prior and with which block exogeneity is possible. With the Minnesota prior, the results remain exactly unchanged if we compare the model with and without the assumption of block exogeneity.

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 affect the Phillips curve correlation equally.

It is important to stress that we do not offer a systematic analysis of structural shifts in the Phillips curve relationship. Our sample is too short relative to the number of VAR parameters to be estimated in order to accomplish that. Shifts in the slope of the Phillips curve could result from changes in the price-setting power of firms, changes to the conduct of monetary policy and changes in the nature of shocks that hit the economy. Occhino (2019) and Jacob and van Florenstein Mulder (2019) conduct system studies on the role of each of these factors. In contrast to these studies and in line with the first part of this article, we focus on the global versus domestic nature of shocks driving GDP in order to decompose the inflation−output correlation. We treat the Phillips curve as an empirical regularity that describes a positive correlation between inflation and real economic activity, not as a structural relationship.

We exploit our counterfactual paths, which are functions of structural (past) shocks that we identify. This being said, our poor-man's approach is easy to implement and has several advantages. First, we estimate the Phillips curve using a decomposition of GDP in terms of cumulative historical decompositions of structural shocks. That is, the model allows different domestic and global components to enter the Phillips curve with different coefficients and potentially different signs. The model therefore nests the conventional Phillips curve specification if the coefficient on the global component equals the one on the domestic component. Second, by decomposing economic growth into domestic and global components, we can avoid an econometric problem faced by studies that 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.*, 2020). That is, the studies have difficulties separating the true effects from domestic and global forces. Instead, our decomposition is based on functions of orthogonal structural shocks.

Note that up to now, we bundled 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 now account for this possibility by splitting up the global component into its parts, i.e. the parts that stem from oil supply shocks and global demand shocks.

We start by estimating a reduced-form Phillips curve with observable GDP growth as the determinant of inflation

$$\pi_t = c + \beta x_t + \gamma \pi_{t-1} + \varepsilon_t, \qquad \text{(model A)}$$

where π_t is the year-on-year inflation rate and x_t is the observed growth rate of real GDP. We add past inflation as a proxy for today's expectations of future inflation. Table 4 reports the results for this specification. We find a significantly positive slope of the Phillips curve for Korea, Malaysia, Singapore and Thailand. For Indonesia and the Philippines, the estimated slope coefficient is insignificantly different from zero.

We now include the counterfactual path of GDP growth. Consequently, the slope coefficient β is split into the coefficient on domestically-driven GDP and the coefficient

TABLE 4
Regression results for model A

	IDN	*KOR*	*MYS*	*PHL*	*SGP*	*THA*
c	1.15	−0.09	−0.06	0.34	−0.58	0.02
	[0.68]	[−0.43]	[−0.16]	[0.54]	[−3.94]	[0.08]
β	−0.01	0.12	0.16	0.05	0.13	0.12
	[−0.05]	[3.52]	[2.92]	[0.61]	[7.03]	[2.45]
γ	0.83	0.83	0.71	0.84	0.95	0.75
	[11.92]	[14.36]	[7.85]	[11.49]	[24.52]	[9.98]
# OBS	67	67	67	67	67	67
R^2	0.70	0.76	0.48	0.69	0.90	0.63

Notes: Estimation results for the specification with observable GDP growth. The growth rate of GDP enters with the coefficient β, while γ is the coefficient on lagged inflation. The values in square brackets correspond to the $t-$statistic testing the null that the corresponding coefficient is equal to zero.

on globally determined GDP. The baseline regression reads

$$\pi_t = c + \beta_j x_t^j + \beta_{cf(j)} x_t^{cf(j)} + \gamma \pi_{t-1} + \varepsilon_t, \qquad \text{(model B)}$$

where $x_t^{cf(j)}$ is the counterfactual path of the growth rate of domestic real GDP in which we suppress shock j. Hence, x_t^j for $j = \{oil, dem\}$ denotes the contribution of either oil supply shocks or global demand shocks to the growth rate of real GDP. Technically, this contribution corresponds to the distance between the actual data and the counterfactual path in our simulation exercise where we simulated global shocks away, see Figures 3–8. For the case where $\beta_{cf(j)} = \beta_j$, the distinction between domestic and global components of activity becomes obsolete. Hence, the model nests the conventional specification, which regresses inflation on observable output growth.

The Phillips curve regression as explained before suffers from a generated regressors problem.[18] The reason is that the regressors x_t^j and $x_t^{cf(j)}$ are themselves results from a regression model. Hence, the estimation uncertainty surrounding these regressors must not be ignored. We address this problem as follows: instead of running a single regression using the median from the historical decomposition, we estimate the Phillips curve for each single draw we have available from our VAR estimation. By doing so, we carry uncertainty from the first stage, i.e. the VAR estimation, into the second state, i.e. the Phillips curve regression. For all coefficients, inference is based on the 16th and 84th percentiles of the $t-$statistics from this exercise.

Our estimation results are reported in Table 5. The upper half of the table focuses on the role of oil supply shocks, i.e. global supply shocks. For Korea, Malaysia, Singapore and Thailand, the domestic growth component, i.e. GDP growth in the absence of global supply shocks, enters with a positive coefficient. In these cases, the Phillips curve trade-off remains valid and has the expected sign. An increase in the domestic part of growth is inflationary. This stands in contrast to the inflation-impact of growth driven by global supply shocks. For four countries, GDP driven by oil supply shocks enters with a negative sign, such that the inflation–output correlation is lower once the component driven by

[18] We are grateful to an anonymous referee for this point as well as the proposed solution.

TABLE 5
Regression results for model B

	IDN	*KOR*	*MYS*	*PHL*	*SGP*	*THA*
Oil supply shock						
c	1.03	−0.09	−0.05	0.26	−0.60	−0.01
	[0.03, 0.85]	[−0.93, 0.06]	[−0.31, 0.12]	[−0.81, 0.99]	[−5.08, −3.44]	[−1.36, 0.77]
β_{oil}	−0.64	−0.02	0.14	−0.27	0.07	-0.18
	[−2.21, 0.31]	[−2.19, 1.41]	[−0.90, 2.47]	[−4.64, 0.34]	[0.18, 3.42]	[−3.52, 0.13]
$\beta_{cf(oil)}$	0.01	0.13	0.16	0.11	0.13	0.14
	[−0.18, 0.62]	[3.36, 4.71]	[2.35, 3.48]	[0.69, 3.23]	[6.74, 8.48]	[2.33, 4.58]
γ	0.83	0.82	0.70	0.80	0.94	0.72
	[11.04, 12.29]	[12.26, 14.59]	[6.59, 7.94]	[9.14, 12.54]	[20.80, 26.10]	[8.69, 10.76]
# OBS	67	67	67	67	67	67
R^2	0.71	0.77	0.49	0.73	0.91	0.67
Global demand shock						
c	3.37	−0.02	0.11	0.53	−0.49	0.18
	[0.90, 3.09]	[−0.48, 0.73]	[−0.18, 1.10]	[0.53, 1.87]	[−4.22, −2.86]	[−0.05, 2.37]
β_{dem}	0.46	0.17	0.30	0.26	0.25	0.47
	[0.43, 2.76]	[2.17, 4.18]	[1.97, 4.27]	[0.47, 3.40]	[4.03, 9.75]	[1.93, 6.39]
$\beta_{cf(dem)}$	−0.35	0.11	0.13	0.03	0.11	0.11
	[−2.56, −0.29]	[1.60, 3.45]	[1.04, 2.87]	[−0.76, 0.62]	[5.62, 7.84]	[0.98, 2.85]
γ	0.79	0.83	0.69	0.83	0.94	0.71
	[9.23, 11.94]	[13.22, 14.62]	[7.15, 8.08]	[10.32, 11.71]	[24.01, 29.56]	[8.04, 10.57]
# OBS	67	67	67	67	67	67
R^2	0.72	0.77	0.51	0.70	0.92	0.67

Notes: The values for the estimated coefficients (as well as for the coefficient of determination R^2) correspond to their median value over all 2000 draws. In the first block, β_{oil} represents the coefficient on the component of real GDP growth driven by oil supply shocks, while in the second block β_{dem} represents the coefficient on the component of real GDP growth driven by global demand shocks. In both blocks, $\beta_{cf(j)}$ for $j = \{oil, dem\}$ represents the coefficient on the counterfactual path of real GDP growth that excludes either the component driven by oil supply shocks (first block), or the component driven by global demand shocks (second block). The lagged domestic inflation rate enters with the coefficient γ. For all coefficients in both blocks, the values in square brackets correspond to the 16th and 84th percentile of the $t-$statistic testing the null that the corresponding coefficient is equal to zero. All results rely on the Corsetti *et al.* (2014) identification.

global supply shock is included in GDP. This effect, however, remains insignificant for all countries.

Turning to global demand shocks, our results suggest that global demand shocks steepen the Phillips curve for Korea, Malaysia, Singapore and Thailand. For these countries, the estimated β_{dem} is significantly positive. For all countries, the slope coefficient on growth driven by domestic demand shocks is higher than the slope coefficient on the counterfactual growth series suppressing global demand shocks. Put differently, ignoring the fraction of GDP growth driven by global demand shocks leads to a flatter Phillips curve. Consequently, the coefficient on the counterfactual in the lower half of Table 5 is smaller than the coefficient on observable growth reported in Table 4.

As a third specification, we include both global components of GDP separately, i.e. x_t^{oil} and x_t^{dem}. The counterfactual $x_t^{cf(glo)}$ reflects GDP growth in the absence of both types of global shocks

$$\pi_t = c + \beta_{oil}x_t^{oil} + \beta_{dem}x_t^{dem} + \beta_{cf(glo)}x_t^{cf(glo)} + \gamma\pi_{t-1} + \varepsilon_t. \qquad \text{(model C)}$$

TABLE 6

Regression results for model C

	IDN	*KOR*	*MYS*	*PHL*	*SGP*	*THA*
c	3.04	−0.03	0.13	0.46	−0.51	0.13
	[0.42, 3.23]	[−0.94, 1.00]	[−0.31, 1.20]	[−0.49, 2.28]	[−4.89, −2.33]	[−0.99, 2.61]
β_{oil}	−0.91	−0.04	0.09	−0.34	0.05	−0.19
	[−2.71, 0.14]	[−2.55, 1.32]	[−1.49, 2.33]	[−5.40, −0.55]	[−0.81, 3.53]	[−4.02, 0.16]
β_{dem}	0.50	0.18	0.31	0.36	0.26	0.48
	[0.35, 3.02]	[2.2, 4.73]	[1.87, 4.62]	[0.62, 4.66]	[4.15, 10.98]	[1.99, 7.19]
$\beta_{cf(glo)}$	−0.29	0.12	0.13	0.08	0.12	0.13
	[−2.62, 0.18]	[1.78, 4.08]	[1.00, 3.04]	[−0.08, 2.79]	[5.53, 8.68]	[1.26, 4.46]
γ	0.78	0.80	0.67	0.76	0.92	0.66
	[8.59, 11.94]	[11.46, 14.75]	[6.501, 8.12]	[8.17, 12.84]	[21.07, 30.24]	[7.38, 11.09]
# OBS	67	67	67	67	67	67
R^2	0.73	0.78	0.54	0.76	0.93	0.73

Notes: The values for the estimated coefficients (as well as for the coefficient of determination R^2) correspond to their median value over all 2000 draws. β_{oil} represents the coefficient on the component of real GDP growth driven by oil supply shocks, while β_{dem} represents the coefficient on the component of real GDP growth driven by global demand shocks. $\beta_{cf(glo)}$ represents the coefficient on the counterfactual path of real GDP growth that excludes the component driven by both global supply shocks and global demand shocks. The lagged domestic inflation rate enters with the coefficient γ. For all coefficients, the values in square brackets correspond to the 16th and 84th percentile of the $t-$statistic testing the null that the corresponding coefficient is equal to zero. All results rely on the Corsetti *et al.* (2014) identification strategy.

Table 6 reports the estimated coefficients. Again, the fraction of GDP driven by oil supply shocks remains an insignificant driver of inflation. The occurrence of global demand shocks, in contrast, contributes to a steeper inflation−output nexus for Korea, Malaysia, Singapore and Thailand.

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 do not affect the Phillips curve, global demand shocks steepen the inflation−output correlation.[19]

V. Conclusions

This article 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.

[19]Our results are qualitatively very similar when using the counterfactuals from the alternative identification strategy. These regression results are available in the Online Appendix.

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 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 the sensitivity of inflation to output depends on the nature of shocks driving the real economy.

Our results suggest that including the components of growth due to oil price shocks and global demand shocks, respectively, changes the inflation−output correlation. GDP growth due to oil supply shocks seem to flatten the Phillips curve in most countries, though the effect is not statistically significant. The contrary is true for the fraction of GDP due to global demand shocks. The Phillips curve correlation increases once we include the part of GDP driven by global demand. Hence, we show that global integration affects the Phillips curve and that the nature of global shocks determines whether the curve steepens. It should be noted that the focus of this article is on the role of global vs domestic drives of inflation dynamics and their effects on the slope of the Phillips curve. In principle, we could use a similar framework to address the role of demand vs supply shocks to study the slope of the Phillips curve conditional on demand shocks only. We leave this for future research.

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.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Supplementary Material