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Monetary Policy Effects on Output and Prices: International Evidence

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Monetary Policy Effects on Output and Prices: International Evidence

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Abstract

This study explores cross-country variations in the effects of a monetary policy shock on output and prices using the sample of 48 countries. The structural vector autoregression model is used to estimate the effects of monetary policy for each country. The results obtained in the first step are thereafter treated as the dependent variable in a cross-country regression. The results suggest that the factors that play an important role for the effects of a monetary policy shock include: trade and financial openness; exchange rate regime; economic size; correlation with global, US, and for European countries with German economy; the size of financial sector; and the share of industry in GDP. (JEL E52, F41)

JEL Classification: E52

Key words: Monetary policy effects; trade openness; financial openness; exchange rate regime; economic size; international interdependence.

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1. Introduction

The ability of monetary policy to influence output and prices in the short-run is broadly accepted in economic theory and well documented by a number of time series analyses of monetary policy transmission. However, the determinants of monetary policy effects are not well understood. Better understanding of these determinants is crucial, not only for understanding how monetary policy works, but also for the efficient conduct of monetary policy.

In an attempt to provide additional insights into this question this study explores the cross-country variations in the short-run effects of a monetary policy shock on output and prices. Our research strategy consists of two steps. First, we employ the structural vector autoregression (SVAR) model to estimate the effects of a monetary policy shock for each of the 48 countries in the sample separately. Thereafter, we treat the results obtained in the first step as the dependent variable in a regression analysis which investigates possible sources of cross-country variations in the responses of output and prices to a monetary policy shock.

Comparable empirical studies have so far concentrated on the effects of financial structure on output and price responses to a monetary policy shock (Cecchetti, 1999; Elbourne and Haan, 2006), and the effects of the share of manufacturing sector on output responses to a monetary policy shock (Carlino and DeFina, 1998; Mihov, 2001). The traditional 'money' view on monetary policy transmission implies that the effect of a monetary policy shock on output and prices depends on the interest rate sensitivity of aggregate demand. The interest rate sensitivity of aggregate demand may be structurally related to the share of manufacturing which is thought to be an interest rate sensitive sector (Carlino and DeFina, 1998). The 'credit' view on monetary policy transmission emphasizes the role of the banking sector in monetary policy transmission. As Bernanke and Blinder (1988), Gertler and Gilchrist (1993) and Bernanke and Geltler (1995) discuss, it concentrates on the effect of a monetary policy shock on the balance sheets of banks and/or bank dependent borrowers. Due to the problem of informational asymmetry these changes affect the prices and availability of loans and, in turn, aggregate demand. This view implies that the effects of a monetary policy shock may vary systematically across countries with differences in the size, concentration, and health of their banking system, and with difference in the availability of primary capital market financing (Cecchetti, 1999).

With the increasing internationalization of economies across the world in recent decades, domestic economic conditions are exposed to a strong influence of foreign factors. In an open economy the exchange rate is one of the relative prices in the monetary transmission process. In such circumstances the closed-economy theoretical framework has become insufficient for the analysis of monetary transmission. Admittedly, the potential relationship between a growing internationalization of national economies and responsiveness of output and prices to a monetary policy shock is complex. It ranges from traditional considerations formulated by the well known exchange rate channel of the monetary policy and Mundell-Fleming model of macroeconomic policy in an open economy to the more recent considerations discussed among others by Rogoff (2003), Ball (2006), Bernanke (2007), Mishkin (2009) and Woodford (2010).

The possible effects of globalization on monetary policy have become one of the important issues for policy makers. Bernanke (2007) emphasizes that anyone who participates in financial markets these days is aware that these markets transcend national borders and are highly sensitive to economic and political developments in the world. Recent empirical studies suggest substantial international spillovers and interdependence between national money, bonds and equity markets and exchange rates (see, Ehrmann and Fratzscher, 2009; Hausman and Wongswan, 2011; Ehrmann, Fratzscher and Rigobon, 2011). Their results stress the United States markets as the main driver of global financial markets. For example, Hausman and Wongswan (2011) find that, on average, a surprise 25-basis point downward revision in the expected path of future US monetary policy is associated with 5 and 8 basis point decline in the short-term and long-term national interest rates, respectively. Baxter and Kouparitsas (2005) and Imbs (2006) show that correlations in the short-run output fluctuations rise with level of financial and trade integration. This growing interdependence can increase the importance of foreign factors for domestic economic conditions and undermine the ability of national central banks to influence domestic aggregate demand.

These considerations give impetus and interest to the question whether the responsiveness of output and prices to a domestic monetary policy shock is systematically related to trade and financial openness, exchange rate regime and interdependence between the national and global economy. To provide a more comprehensive investigation of cross-country variations in the effects of monetary policy, in addition to the effects of financial and industrial structure analyzed by previous literature, we test for the possible relationship between the effects of a monetary policy shock on output and prices and the above mentioned variables. Moreover, we include a number of other variables to account for other possible sources of cross-country variations, such as the structure of aggregate demand, labor market conditions, interest rate level, etc. Finally, our research includes a larger number of countries in comparison to the previous literature. Our sample consists of 48 countries at different stages of development. This enables us to conduct a formal multiple regression analysis of the effects of a monetary policy shock on output and prices. The small number of countries included in previous studies constrained the analysis to simple comparisons, correlations or bivariate regressions.[1] The important exception is Carlino and DeFina (1998) who analyze

[1] Cecchetti's (1999) analysis includes 11 countries, while Mihov's (2001) and Elbourne and Haan's (2006) cover 10 countries.

the effect of monetary policy shock on real personal income of the US regions and states which provided them with enough observations for a multivariate regression analysis.

The paper is organized as follows. Section 2 presents the data and methodology used in both steps of the analysis. Section 3 presents and discusses the most important results. Section 4 concludes.

2. Data research methodology

2.1 Step 1: SVAR model - impulse response analysis

In the first step of our empirical analysis we estimate the response of output and prices to a monetary policy shock for each country in our sample. We use a standard approach and apply a structural vector autoregression (SVAR) model, because it can capture complex dynamic interrelationships among macroeconomic variables quite well, and because it is the common model used in the literature for identifying the effects of a monetary policy shock.

Our starting point is the model used by Kim and Roubini (2000) and Elbourne and Haan (2006). Following them, the variables we include in our model are GDP (Y), consumer price index (CPI), money (M), domestic interest rate (IR), exchange rate (ER), world price of oil (OIL) and the United States federal funds rate (FFR). The first four are well-known variables in the monetary business cycle literature and therefore it is not required to elaborate on them specifically. The next variable, the exchange rate, is included in the model since it plays an important role in affecting the whole economy in a world of liberalized goods and capital markets. The world price of oil serves as a proxy for aggregate supply shocks, while the US federal funds rate approximates the foreign interest rate and, like the world price of oil, captures exogenous monetary policy changes.

According to economic theory we expect the reaction of output and prices to a contractionary monetary policy shock to be negative. In cases of the implausible results with respect to the sign on our variables of interest we modify the initial model, as will be explained below.

Our strategy in choosing the indicators to be included in our model was as follows. For the GDP variable we use index of GDP volume (based in 2005) where possible; otherwise index of industrial production (based in 2005) was used. As for CPI, we used consumer price index (based in 2005) where available and GDP deflator (based in 2005) otherwise. M1 monetary aggregate was used for money where possible; otherwise we used a broader aggregate (M2 or M3). As for IR, we used money market rate as our first choice and deposit rate as the second one in cases where money market rate was unavailable. The nominal effective exchange rate index (based in 2005) was used for ER; if unavailable we used official US dollar exchange rate. Finally, for OIL we used petroleum prices in US dollars per barrel (PETROLEUM: UK BRENT). FFR variable is the US federal funds rate. All the variables, apart from the interest rate, are transformed into logarithms. Following Kim and Roubini (2000), Mihov (2001) and Elbourne and Haan (2006) we use the data in levels.

Quarterly data on all the variables is obtained from the IFS data base (International Monetary Fund, International Financial Statistics data base), which contains the data for 190 countries from 1940. However, due to data limitations, our analysis is restricted to those countries for which the data is available for all the variables specified in our preferred model for at least 50 consecutive quarterly observations. Overall, we managed to construct a data base of 48 lower-middle, upper-middle and high-income countries. The full list of countries used in our analysis, along with the available time periods, is given in Table 1.

Table 1. List of countries

Countries and periods for which SVAR models are estimated							
High Income				Upper Middle Income		Lower Middle Income	
Australia	75Q1-09Q3	Japan	75Q1-09Q3	Brazil	95Q1-09Q4	Bolivia	95Q1-09Q3
Austria	75Q1-97Q4	Korea, Rep.	76Q4-08Q4	Chile	85Q1-09Q3	India	71Q1-92Q4
Belgium	80Q1-98Q3	Netherlands	81Q1-97Q4	Colombia	95Q1-09Q4	Jordan	92Q3-09Q3
Canada	75Q1-09Q3	New Zealand	94Q1-09Q3	Lithuania	96Q4-09Q4	Morocco	94Q1-09Q1
Croatia	94Q2-09Q2	Norway	79Q1-04Q3	Mexico	85Q4-09Q3	Philippines	81Q1-06Q3
Cyprus	96Q1-07Q4	Poland	96Q4-09Q4	Peru	91Q1-09Q2	Senegal	76Q1-03Q4
Czech Republic	94Q1-09Q4	Portugal	79Q4-98Q4	Russia	95Q2-09Q3	Thailand	97Q1-09Q4
Denmark	91Q1-09Q4	Singapore	84Q3-09Q4	South Africa	75Q1-09Q4	Tunisia	93Q1-09Q4
Estonia	93Q4-09Q3	Slovenia	94Q1-06Q4	Turkey	87Q1-09Q4		
Finland	78Q1-98Q4	Spain	75Q1-98Q4				
France	77Q4-98Q4	Sweden	75Q1-04Q3				
Germany	75Q1-98Q4	Switzerland	84Q4-09Q4				
Hungary	95Q1-09Q4	Trinidad and Tobago	91Q1-08Q1				
Ireland	82Q4-98Q4	United Kingdom	75Q1-09Q4				
Israel	83Q4-08Q3	United States	75Q1-09Q4				
Italy	80Q1-98Q4						

Note: Countries are categorized based on the World Bank's 2011 income group classification.

The p-th order SVAR model that we use is given as follows:

$$Ay_t = \Gamma_1 y_{t-1} + \Gamma_2 y_{t-2} + \cdots + \Gamma_p y_{t-p} + B\varepsilon_t \qquad (1)$$

where y_t is a $(m*1)$ vector of m endogenous variables; A represents a $(m*m)$ matrix of instantaneous relations between the left-hand-side variables; $\Gamma j s$ are structural form parameter $(m*m)$ matrices; ε_t is a $(m*1)$ structural form error that is a zero mean white noise process, and B is a $(m*m)$ matrix of contemporaneous relationships among the structural disturbances ε_t. A reduced form of our p-th order SVAR model, then, is:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t \qquad (2)$$

where y_t is a $(m*1)$ vector of m endogenous variables, A represents a $(m*m)$ matrix of reduced-form parameters and e_t is the reduced-form disturbance term. Since the error terms in the reduced SVAR (e_t) are a complicated mixture of the underlying structural shocks, they are not easy to interpret directly unless a direct link can be made to the structural shocks. The system should therefore be restricted so as to recover structural disturbances, ε_t, from observed values of e_t, as $Ae_t=B\varepsilon_t$. In order to identify the structural model it is therefore necessary to impose at least $m^2\text{-}m(m+1)/2$ restrictions on the structural model, m being the number of endogenous variables. Following Elbourne and Haan (2006), who adapt the model applied to industrial countries by Kim and Roubini (2000), the identification scheme we use in SVAR is given below, where $Ae_t = B\varepsilon_t$ is given as:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & a_{16} & 0 \\ a_{21} & 1 & 0 & 0 & 0 & a_{26} & 0 \\ a_{31} & a_{32} & 1 & a_{34} & 0 & 0 & 0 \\ 0 & 0 & a_{43} & 1 & a_{45} & a_{46} & a_{47} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & a_{56} & a_{57} \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & a_{76} & 1 \end{bmatrix} \begin{bmatrix} e_Y \\ e_{CPI} \\ e_M \\ e_{IR} \\ e_{ER} \\ e_{OIL} \\ e_{FFR} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} \end{bmatrix} \begin{bmatrix} \varepsilon_Y \\ \varepsilon_{CPI} \\ \varepsilon_M \\ \varepsilon_{IR} \\ \varepsilon_{ER} \\ \varepsilon_{OIL} \\ \varepsilon_{FFR} \end{bmatrix} \quad (3)$$

In specification (3), e_Y is an output shock, e_{CPI} is a price level shock, e_M is a money demand shock, e_i is a domestic interest rate shock, e_{ER} is an exchange rate shock, e_{OIL} is an oil price shock and e_{FFR} is the foreign interest rate (federal funds rate) shock.

This identification scheme has the following justification. Given that the oil is a crucial input for most economic sectors, the price of oil is assumed to affect prices and the real sector contemporaneously. Prices are, additionally, affected by the current value of output. A usual money demand function is assumed; the demand for real money balances depends on real income (nominal income and prices) and the nominal interest rate. The interest rate is assumed to be set after the monetary authority observes the current value of money, the exchange rate, the world price of oil and federal funds rate, but not the current values of output and the price level. These two variables are assumed not to be available to monetary authorities within the current time period. As for the exchange rate, since it is a forward-looking asset price, we assume that all the variables have a contemporaneous effect on the exchange rate. Finally, the world price of oil is assumed to be contemporaneously exogenous to any variable in the domestic economy, while the federal funds rate is assumed to be contemporaneously exogenous to any variable apart from the oil price.

In choosing the order of SVAR we are lead by the autocorrelation Lagrange multiplier (LM) test, and we use a minimum of 4 lags for each country. In cases where the LM statistics suggests that the null of no correlation can be rejected at 4 lags, we increase the number of lags until the problem is solved. As indicated before, in the interest of parsimony our starting point was to use the same model for each country. However, as noted by Dornbusch et al. (1998), VARs that use the same explanatory variables can be misleading because countries have different economic structures and possibly different reaction functions. Therefore, where the results appeared to be implausible, the model was somewhat modified. These modifications include: increasing the number of lags, adding a trend, using the German interest rate instead of the US federal funds rate for European countries and/or adding dummy variables that take account of a change in the exchange rate regime.

The plots of the estimated cumulative impulse responses of output and prices are reported in the appendix. A precise description of the model estimated for each country, together with the data definitions and sources are provided in a separate appendix, which is available upon request.

Based on the estimated impulse responses we construct a measure of the short-run monetary policy effect on output and prices. Both measures are constructed as an average response to a monetary policy shock (one percentage point increase in the interest rate) over the first 8 quarters.

2.2 Step 2: Cross-country analysis

Estimates of the average responses of output and prices to a monetary policy shock over the first 8 quarters are used as the dependent variable in the second step of our empirical analysis. We estimate the following model,

$$Y_j = Int + \sum_{\substack{j=1 \\ k=1}}^{\substack{j=n \\ k=m}} X_{jk}\alpha_k + u_j \qquad (4)$$

where Y_j represents the estimated effect of a monetary policy shock on output and prices; *Int* stands for the intercept term and X_{jk} stands for k explanatory variables; α_k are coefficients to be estimated; u_j is the regression residual; j = 1, …, n indexes the countries and k = 1, …, m indexes the explanatory variables.

As the estimated impulse responses in the previous section represent the average effects of a monetary policy shock during the sample period under consideration for each country all explanatory variables are constructed as averages over these periods.

To consider the possible relationship between variations in countries' financial structure and cross-country variations in output and prices responses to a monetary policy shock we use the following financial variables: the ratio of deposit money bank assets to GDP, private credit by deposit money banks to GDP, private credit by deposit money banks and other financial institutions to GDP, bank deposits to GDP, financial system deposits to GDP, liquid liabilities to GDP, and the ratio of bank credit to bank deposits. All variables are constructed using Beck, Demirguc-Kunt and Levine's (2010) data base. These variables are traditionally employed in the literature as indicators of the size and importance of financial intermediation in the economy.

To investigate the possible relationship between foreign factors and the effects of a monetary policy shock we employ indicators for trade and financial openness, exchange rate regime and the correlation between national economies and global economy. As a measure of trade openness we use the sum of imports and exports to GDP from Penn World Table 7.0 (PWT) data base. A proxy for financial openness is constructed as sum of total foreign asset and liabilities to GDP, using Lane and Milesi-Ferretti's (2007) estimates of foreign assets and liabilities.[2] The exchange rate regime is another variable which can be important in determining the effects of a domestic monetary policy shock on output and prices. Admittedly, identification of the exchange rate regime is not an easy task. The problem is the existence of mismatches between the officially reported exchange rate regimes, compiled by the IMF's *de jure* classification, and the actually prevailing exchange rate regimes. In order to circumvent this problem we use Ilzetzki, Reinhart and Rogoff's (2008) exchange rate regime classification. Their "fine" classification distinguishes between 14 unified exchange rate systems (with one official exchange rate and no significant "black" or parallel market) and a dual exchange rate market in which parallel data are missing. To each category of unified exchange rate systems Ilzetzki, Reinhart and Rogoff's (2008) assign one number on the 1 to 14 scale, where the least flexible exchange rate arrangements are assigned the lowest values. The dual exchange rate system is assigned number 15. Since it cannot be claimed that dual exchange rate systems are always closer to free floating then to fixed exchange rate regime we use only the data for unified exchange rate systems. We also merge the last two categories of the unified exchange rate systems - free floating (number 13) and free falling (number 14)- into a single category to which we assign number 13.[3] Our proxy for the exchange rate regime is then constructed as an average value of the exchange rate categories over the considered sample periods. To account for the differing degrees of dependence of national

[2] The Lane and Milesi-Ferretti (2007) data unfortunately does not cover the period after 2004, hence, the proxy for financial openness is constructed using observations only for periods before 2005.

[3] There is no clear reason to assume that the free falling exchange rate is a more flexible exchange rate regime than free floating. Free floating and free falling categories are merged into one to obtain an exchange rate classification in which the most flexible exchange rate arrangements are assigned the highest value.

economies on global economic conditions, we include correlation of national with global economic growth as an additional variable. To this end, we use annual real GDP growth rate data from World Development Indicators (WDI) data base and calculate correlation coefficients between national and world growth rates over the considered period for each country.

Since previous studies suggest that cross-country variations in output responses to a domestic monetary policy shock can be related to variations in the shares of interest-sensitive sectors (manufacturing) across countries, we also include the share of industry in GDP among the set of explanatory variables. This variable is calculated from WDI data on the shares of industry value added in a country's GDP.

As our sample includes heterogeneous countries, we also control for the possible relationship between the variations in economic size and development level and cross-country variations in the responses of output and prices to a monetary policy shock. For this purpose we use the data for real GDP and real GDP per capita from WDI data base. Since the analyzed time periods do not match perfectly across countries (see Table 1 above) this data is not directly comparable across countries. The indicators of economic size and level of development are calculated as the ratio of country's real GDP to the world's real GDP and the ratio of country's real GDP per capita to the world's real GDP per capita.

In addition to the above variables, we also use a number of other variables which are described in the following section. The selection of explanatory variables used in our cross-country regression analysis is limited by data availability. With respect to missing data two general principles are adopted in the construction of the data set. In those countries where less than 20 percent of observations are missing for a certain variable, the average values of that variable are still calculated. In cases where more than 20 percent of observations are missing, the country is excluded from the analysis. Another limitation of this empirical approach is that the estimation errors in the first stage can bias the results of cross-sectional analysis. However, specification and identification errors in the SVAR estimation will bias the results of cross-sectional analysis only if these errors are correlated across countries with the regressors in output and price regressions. If these errors are not systematically related to explanatory variables used in the second stage they will only increase regression errors and reduce statistical significance of the estimated coefficients in the cross-section regressions.

3. Results

Tables 2-6 report the results of our cross-country analysis. Because variance inflation analysis displays evidence of substantial multicolinearity when all financial variables are simultaneously included into the regression, we report the models which include only two financial variables at a time. Furthermore, the variables private credit by deposit money banks and other financial institutions to GDP and financial system deposits to GDP are by construction very similar to a somewhat narrower indicators: private credit by deposit money banks to GDP and bank deposits to GDP, respectively. Since the results for these variables are very similar, in order to preserve space, we do not report the results for the first two variables here (available upon request). The data for the share of industry in GDP is missing for one country in the sample (Israel). Therefore, we do not include this variable in our baseline specifications in Table 2; instead we report and discuss these results separately (see Table 6 below).

Standard diagnostic tests and investigative procedures reported in each table reveal that the reported models are well specified with respect to multicolinearity, normality and functional form. According to standard criteria, variance inflation analysis suggests that collinearity is not a problem for either individual variables, or the model as a whole. The Ramsey RESET test is unable to reject the null of no omitted variables or correct functional form at conventional levels of significance. Cameron and Trivedi's test is unable to reject the null hypotheses of no non-normal skewness or kurtosis. In a few models Cameron and Trivedi's test or additionally used Breusch-Pagan test suggest possible heteroskedasticity of residuals. To address this issue we report robust standard errors in all such cases. Finally, the quantile regression estimates (available upon request) provide qualitatively similar results suggesting that the reported results are not driven by outliers.

Our dependent variables measure output or price responses to a monetary policy shock (a one percentage point increase in the interest rate), and these responses are expected to be negative. A negative coefficient on a certain explanatory variable suggests that a particular country characteristic, captured by that variable, is, on average, related to a larger (negative) effect of monetary policy on output and prices. A positive coefficient, on the other hand, suggests that a particular country characteristic is, on average, related to a smaller (negative) effect of monetary policy on output and prices.

Table 2 reports the results for our baseline specifications (models). Columns 1-4 present the results for output responses, while columns 5-8 refer to price responses. Each regression is statistically significant at the 5 percent level, explaining about 65 percent of cross-country variation in average output responses and 38 percent of cross-country variation in price responses to a monetary policy shock.

Table 2. The Results of Cross-country Regressions

Dependent variable:	Average effect on output				Average effect on prices			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deposit money bank assets	-0.0009				-0.0021***			
	(0.0010)				(0.0008)			
Private credit		-0.0012				-0.0025***		
		(0.0012)				(0.0009)		
Bank deposits			-0.0010				-0.0023***	
			(0.0011)				(0.0009)	
Liquid liabilities				-0.0008				-0.0021**
				(0.0011)				(0.0009)
Bank credit to deposits ratio	-0.0031***	-0.0028***	-0.0034***	-0.0030***	0.0007	0.0012	0.0001	-0.0001
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0009)	(0.0009)	(0.0009)	(0.0009)
Exchange rate	-0.0176*	-0.0168*	-0.0177*	-0.0169*[a]	-0.0179**	-0.0163**	-0.0180**	-0.0203**
	(0.0100)	(0.0100)	(0.0100)	(0.0102)	(0.0080)	(0.0081)	(0.0081)	(0.0085)
Trade openness	-0.0042***	-0.0042***	-0.0041***	-0.0042***	-0.0015***	-0.0015***	-0.0014***	-0.0014**
	(0.0007)	(0.0007)	(0.0006)	(0.0007)	(0.0005)	(0.0005)	(0.0005)	(0.0006)
Financial openness	-0.0002	-0.0001	-0.0002	-0.0001	0.0004	0.0004	0.0004	0.0004
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Economic size	-0.0191***	-0.0189**	-0.0184**	-0.0170**	-0.0011	-0.0009	0.0005	0.0002
	(0.0075)	(0.0075)	(0.0076)	(0.0076)	(0.0060)	(0.0061)	(0.0062)	(0.0063)
Level of development	0.0003	0.0003	0.0003	0.0002	0.0002	0.0001	0.0001	0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Corr. with global economy	0.2542**	0.2515**	0.2480**	0.2154*	-0.0676	-0.0719	-0.0815	-0.0779
	(0.1144)	(0.1141)	(0.1148)	(0.1159)	(0.0917)	(0.0928)	(0.0927)	(0.0958)
Constant	0.5660***	0.5369***	0.5918***	0.5543***	0.1311	0.0611	0.1885	0.2317
	(0.1609)	(0.1567)	(0.1692)	(0.1747)	(0.1289)	(0.1274)	(0.1367)	(0.1444)
No. of observations	48	48	48	46	48	48	48	46
R^2	0.65	0.65	0.65	0.66	0.39	0.37	0.38	0.37
F test	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02
Variance Inflation Factor								
Maximum	2.58	2.74	2.45	2.54	2.58	2.74	2.45	2.54
Mean	1.80	1.84	1.75	1.79	1.80	1.84	1.75	1.79
Cameron & Trivedi's test for								
Heteroscedasticity	0.42	0.49	0.40	0.39	0.45	0.35	0.40	0.41
Skewness	0.52	0.53	0.53	0.60	0.77	0.75	0.69	0.55
Kurtosis	0.33	0.30	0.32	0.29	0.23	0.25	0.23	0.25
Breusch-Pagan test for heteroskedasticity	0.10	0.09	0.10	0.07	0.92	0.67	0.71	0.79
Ramsey RESET test using powers of independent var.	0.23	0.20	0.25	0.22	0.99	0.97	0.99	0.97

Notes: *,** and *** indicate the 10%, 5% and 1% levels of significance, while [a] indicates borderline significance at 10% (p=0.108). The reported values for the diagnostic tests are their respective p-values, except for the maximum and mean variance inflation factor.

The coefficients on financial variables (rows 1-5) across all specifications are dominantly negative (13 out of 16 coefficients). 8 out of 13 negative coefficients appear to be statistically significant at the 5 percent level or better. No coefficient is found to be positive at conventional significance levels. In the output regressions statistically significant coefficients are associated with bank credit to deposit ratio. In price regressions, however, the opposite is true. Namely, statistically significant coefficients are associated with the ratio of deposit money bank assets to GDP, private credit by deposit money banks to GDP, bank deposits to GDP and liquid liabilities to GDP. The results for financial variables, in general, suggest that in the countries with a larger financial sector, a monetary policy shock has, on average, a larger effect on output and prices. These results are in line with Cecchetti (1999) and Mihov's (2001) findings on the importance of the financial sector in the monetary policy transmission. However, due to data limitations, the set of explanatory variables does not include indicators of concentration and health of the banking system or differences in the availability of primary capital market finance. Hence, we cannot distinguish between the interest rate and credit channels of the monetary policy transmission. Our results suggest only that a monetary policy shock has a larger effect on output and prices in those countries in which economic agents use more credit (i.e. where they depend more on credit financing). In these countries monetary tightening is, on average, followed by a larger reduction in output and prices. However, our data does not allow us to draw more precise conclusions, i.e. whether this effect comes from a change in credit prices, credit availability or both.

In attempt to deal with these limitations we experiment with different proxies for the availability of primary capital market financing. In particular, we use indicators of stock market development from Beck, Demirguc-Kunt and Levine (2010), which are available for 28 to 30 countries in our sample, namely the ratio of stock market capitalization to GDP, stock market total value traded to GDP, stock market turnover ratio, and the number of listed companies to population ratio. The coefficient on each of these variables appears to be positive, which is in line with the credit channel of monetary policy. However, the estimated coefficients are not statistically significant (the results are available on request).

The results for the baseline specifications in Table 2 suggest the importance of foreign factors in responsiveness of output and prices to a domestic monetary policy shock.

In particular, the coefficient on the exchange rate regime is negative and statistically significant at conventional levels in all specifications. Since our measure of the exchange rate regime is constructed in such a manner that the least flexible exchange rate arrangements are assigned the lowest values, the negative coefficients on this variable suggest that in countries with more flexible exchange rates a monetary policy shock has, on average, a larger effect on output and prices. These results point towards the potential importance of the exchange rate channel in monetary policy transmission. If the exchange rate channel is a functioning channel of monetary policy transmission then, *ceteris paribus*, the effects of a monetary policy shock on output and prices should be weaker in the countries with fixed exchange rates compared to the countries with flexible exchange rates. The results are also in line with Mundell-Fleming model which suggests that the relationship between the exchange rate regime and short run effects of monetary policy depends on the degree of international capital mobility. Most of the countries in our sample can be categorized as financially open economies. An average value of the financial openness variable (the sum of foreign assets and liabilities to GDP) in the sample is 165 percent and the median value is 127 percent. For all the countries except India the value of financial openness variable is larger than 64 percent. In the case of liberalized capital account, a fixed exchange rate regime implies less effective monetary policy compared to the flexible exchange rate regime. This is because any monetary policy shock, in the presence of a fixed exchange rate and international capital mobility, would be shortly offset by the opposite monetary policy reaction in order to maintain the fixed exchange rate.

The coefficients on trade openness are negative and statistically significant at standard levels of statistical significance in all models, suggesting that in countries with larger share of international trade in GDP a monetary policy shock has, on average, a larger effect on output and prices. These results, again, point to the importance of the exchange rate channel in monetary policy transmission. Namely, if a monetary policy shock affects the aggregate demand through the change in imports and exports, then the effects of a monetary policy shock on output and prices should be proportional to the share of imports and exports to GDP.

The coefficients on financial openness variable are not statistically different from zero. Taking into consideration the composition of countries in our sample, these results are potentially in line with the Mundell-Fleming model. If the exchange rate is fixed then increases in the financial openness should reduce the effect of a monetary policy shock on output and prices. With larger international capital mobility a monetary policy shock leads to a larger change in international capital flows, which, in turn, puts domestic currency under larger pressure and increases the necessity of the opposite monetary policy reaction to maintain the exchange rate fixed. The opposite is the case with flexible exchange rates where increases in financial openness should amplify the effects of a monetary policy shock on output and prices. Namely, a monetary policy shock in a more financially open economy should induce a larger change in international capital flows, and consequently a larger change in the currency value. This, in turn, should result in a larger change in net exports and aggregate demand. Given that the countries in our sample have different exchange rate regimes, a negative effect of financial openness in the case of a fixed exchange rate regime, and a positive effect of financial openness in the case of a flexible exchange rate regime may be partially offsetting each other. This issue is addressed further in the next section on page 20.

In output regressions (columns 1-4) two more variables appear to be statistically significant at standard levels. Cross-country variations in output responses to a monetary policy shock appear to be positively related to the differences in the correlation of national economies with the world economy. In other words, the effect of a monetary policy shock on output appears to be, on average, smaller in countries which are more correlated with global economy. This is consistent with considerations that growing international interdependence can increase the importance of foreign factors in the determination of domestic output and, in turn, undermine the ability of national monetary policy to influence domestic output in the short-run. If we presume that the importance of foreign factors in the determination of domestic output is inversely related to the economic size of country, then the significant negative coefficients on the economic size variable point towards the same direction. Namely, the negative coefficients on the economic size suggest that a monetary policy shock has, on average, a larger effect on output in larger economies. At the same time, statistically insignificant and much smaller coefficients on these two variables in the prices regressions (columns 5-8) suggest that foreign factors do not undermine the ability of national monetary policies to influence prices in the short-run.

Robustness checks and additional tests

To check for possible additional explanations as well as the robustness of the above discussed results, we consider various different explanatory variables in Tables 3-6.

The results in Table 2 suggest that the effects of a monetary policy shock are not related to cross-country variations in development. To check the possibility that these findings are a result of the construction of the development indicator, we employ dummy variables for low-middle, upper-middle and high income group of countries instead. The results of these regressions (not reported) reveal that the effects of a monetary policy shock on output and prices are not systematically different for any of these income groups. To check for other possible unobserved characteristics which might influence monetary policy transmission we introduce dummies for Anglo-Saxon countries, South American countries, European countries, Far East countries, Scandinavian countries and East European countries. The regressions' results do not reveal systematically different effects of a monetary policy shock on output and prices for any of these groups. Shares of aggregate consumption, investment and government consumption in GDP are also employed to check whether, due to possible differences in the interest rate elasticity of aggregate demand components, it is different structures of aggregate demand across-countries that are systematically related to variations in the effects of monetary policy. The results, again, do not reveal any significant relationship between the shares of different aggregate demand components and monetary policy effects.

We, furthermore, employ Chinn and Ito's (2006) *de jure* measure of financial openness (for which the data in an updated authors' data base is available up to 2009), as an alternative to our *de facto* measure based on Lane and Milesi-Ferretti's (2007) estimates of foreign assets and liabilities (for which data is available up to 2005). We also use alternative measures of the exchange rate regime. In particular, we construct the exchange rate regime measure analogous to the one employed in Table 2, only this time using Ilzetzki, Reinhart and Rogoff's (2008) "coarse", instead of "fine", classification. Using each of these classifications we also construct new measures of the exchange rate regime calculating the average value of the original exchange rate categories over the considered sample periods (i.e. without deleting the category for dual exchange rate system and without merging the free floating and the free falling regime into a single category as we did in the original measure reported in Table 2). The regression analysis with any of these alternative measures does not reveal any noteworthy discrepancy with respect to the above reported (Table 2) results on financial openness and exchange rate regime.

There are strong theoretical presumptions that the effectiveness of monetary policy depends on the credibility of monetary policy. Even though our measure of monetary policy effects is supposed to provide the effects of an unexpected change in monetary policy on output and prices, and despite a number of data limitations, we experiment with Arnone et al.'s (2009) measure of central bank autonomy. The results do not reveal a significant relationship between our proxy for the credibility of monetary policy and responsiveness of output and prices to a monetary policy shock.

The traditional Keynesian money demand theory suggests that the effects of a monetary policy shock on output and prices may be proportional to the level of interest rate. In the case of a very low interest rate, monetary policy might lose any leverage over aggregate demand due to the so-called liquidity trap. Although our model is not best suited to test for this effect we experiment with the average interest rate variable. Regression coefficients on this variable appear to be negative in all specifications, which is in line with the Keynesian theory of money demand, but statistically insignificant.

To preserve space we do not report the above discussed results; however they are available upon request.

The coefficients on financial openness reported in Table 2 are not statistically different from zero. As argued earlier, given the structure of our sample, which includes countries with different exchange rate regimes, the results on financial openness variable are in line with the Mundell-Fleming model. In order to additionally test these findings, we create a dummy variable for countries with more flexible exchange rates, and construct an interaction variable between this dummy and the financial openness variable (Table 3). Namely, as discussed above, increases in financial openness should enhance the effects of monetary policy in the case of a flexible exchange rate, and vice versa in the case of a fixed exchange rate. When included in the model this variable appears to be statistically insignificant in the price regressions (available on request), but significant in the output regressions. The results of output regressions reported in Table 3 (columns 1-4) reveal that the effect of financial openness on output responsiveness to a monetary policy shock is significantly different for economies with more flexible exchange rate. The negative and statistically significant coefficient on the interaction variable suggests that, among the countries with more flexible exchange rates, the effect of a monetary policy shock on output is, on average, larger for financially more open economies, which is consistent with the Mundell-Fleming model.

Similar results are obtained for the interaction term between the dummy for flexible exchange rates and trade openness variable (Table 3 columns 5-8). Namely, negative coefficients on trade openness in Table 2 point to the importance of international trade for monetary policy transmission. However, the effect of trade openness on monetary policy transmission depends on exchange rate flexibility. When this interaction term is included in the model, the results reveal that the effect of trade openness on output responsiveness to a monetary policy shock is significantly different for economies with flexible exchange rates. In particular, the negative and statistically significant coefficients on trade openness suggest that, in countries with a larger share of international trade in GDP, a monetary policy shock has, on average, a larger effect on output. The negative and statistically significant coefficients on the interaction variable suggest that this hypothesized effect between the share of international trade and output responsiveness to a monetary policy shock is larger for countries with more flexible exchange rate. The coefficients on the interaction terms are again significant only in the regressions that analyze cross-country variation in the average output responses to a monetary policy shock (the results of prices regressions are available on request).

Table 3. The Results of Output Regressions with Interaction Dummies for Flexible Exchange Rates

Dependent variable:	Average effect on output							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deposit money bank assets	-0.0010				-0.0007			
	(0.0009)				(0.0009)			
Private credit		-0.0012				-0.0009		
		(0.0011)				(0.0011)		
Bank deposits			-0.0010				-0.0008	
			(0.0010)				(0.0010)	
Liquid liabilities				-0.0008				-0.0007
				(0.0011)				(0.0010)
Bank credit to deposit ratio	-0.0025**	-0.0023**	-0.0028***	-0.0025**	-0.0026**	-0.0024**	-0.0028***	-0.0025**
	(0.0010)	(0.0011)	(0.0011)	(0.0011)	(0.0010)	(0.0010)	(0.0010)	(0.0011)
Exchange rate	0.0012	0.0017	0.0011	0.0017	0.0089	0.0093	0.0090	0.0086
	(0.0127)	(0.0127)	(0.0127)	(0.0127)	(0.0135)	(0.0134)	(0.0134)	(0.0136)
Trade openness	-0.0032***	-0.0032***	-0.0031***	-0.0033***	-0.0019*	-0.0019*	-0.0018*	-0.0020*
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0010)	(0.0010)	(0.0010)	(0.0010)
Financial openness	0.0000	0.0000	0.0000	0.0001	-0.0002	-0.0002	-0.0002	-0.0001
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Economic size	-0.0152**	-0.0151**	-0.0145*	-0.0129*	-0.0157**	-0.0155**	-0.0150**	-0.0139*
	(0.0074)	(0.0074)	(0.0075)	(0.0075)	(0.0071)	(0.0071)	(0.0072)	(0.0072)
Level of development	0.0003	0.0003	0.0003	0.0002	0.0003*	0.0003*	0.0003*	0.0003
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Corr. with global economy	0.1931*	0.1916*	0.1869*[a]	0.1528	0.1365	0.1356	0.1309	0.1074
	(0.1124)	(0.1122)	(0.1128)	(0.1132)	(0.1146)	(0.1144)	(0.1147)	(0.1154)
Flex. exchange rate dummy x Financial openness	-0.0009**	-0.0009**	-0.0009**	-0.0009**				
	(0.0004)	(0.0004)	(0.0004)	(0.0004)				
Flex. exchange rate dummy x Trade openness					-0.0025***	-0.0024***	-0.0025***	-0.0024***
					(0.0009)	(0.0009)	(0.0009)	(0.0009)
Constant	0.3050	0.2785	0.3320	0.2951	0.1901	0.1706	0.2109	0.1987
	(0.1927)	(0.1901)	(0.1990)	(0.2008)	(0.2036)	(0.1993)	(0.2098)	(0.2120)
No. of observations	48	48	48	46	48	48	48	46
R^2	0.69	0.69	0.69	0.70	0.71	0.71	0.71	0.71
F test	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variance Inflation Factor								
Maximum	2.84	2.85	2.84	2.83	5.16	5.20	5.09	5.32
Mean	2.16	2.20	2.11	2.14	2.67	2.71	2.62	2.65
Cameron &Trivedi test for								
Heteroscedasticity	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Skewness	0.61	0.62	0.62	0.66	0.53	0.55	0.54	0.55
Kurtosis	0.24	0.22	0.23	0.21	0.26	0.25	0.26	0.23
Breusch-Pagan test for heteroskedasticity	0.33	0.30	0.32	0.28	0.60	0.54	0.58	0.45
Ramsey RESET test using powers of independent var.	0.37	0.23	0.36	0.44	0.71	0.67	0.68	0.59

Notes: *,** and *** indicate the 10%, 5% and 1% levels of significance, while [a] indicates borderline significance at 10% (p=0.106). The reported values for the diagnostic tests are their respective p-values, except for the maximum and mean variance inflation factor.

The results in Table 2 also suggest that cross-country variations in output responses to a monetary policy shock are related to differences in the correlation of national economies with the world economy. The recent global crisis as well as the empirical literature underlines the importance of US markets for global financial markets and economy. Within our sample the correlation coefficient between the US's and World's GDP is 0.86. Hence, we also test whether cross-country variations in the effects of monetary policy can be related to differences in the correlation of national economies with the US economy. Thus, instead of using a correlation with the global GDP we use the correlation of national GDP with the US GDP. In all the specifications the estimated coefficients have the same sign as the previously reported coefficients on correlation with the global economy; however they are statistically insignificant and about half the size. Conversely, for European economies plus Turkey, Israel and Jordan, when instead of correlation coefficients with the US economy we include the data for correlation of these economies with Germany, the results change greatly. As the results presented in Table 4 suggest, the coefficients of interest are in this case almost the same as the corresponding coefficients in Table 2. For the output models (Table 4, columns 1-4) all the coefficients on correlation of national economies with the US and Germany are positive, statistically significant at the 5 percent level, and just slightly smaller than the coefficients on correlation of national economies with the world economy in Table 2. These results suggest that it is the correlation of the European economies with Germany, rather than with the US, that is more important for the ability of their monetary policies to influence their output in the short-run. The estimated coefficients in price regressions (Table 4 columns 5-8) are again statistically insignificant, suggesting that the ability of national monetary policies to influence prices in the short-run is not related to the correlation of these economies with the US or Germany.

Table 4. The Results of Regressions with the Correlation of National Economies with the US and Germany

Dependent variable:	Average effect on output				Average effect on prices			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deposit money bank assets	-0.0008				-0.0019**			
	(0.0012)				(0.0009)			
Private credit		-0.0013				-0.0020*		
		(0.0013)				(0.0010)		
Bank deposits			-0.0009				-0.0020**	
			(0.0012)				(0.0010)	
Liquid liabilities				-0.0003				-0.0018*
				(0.0013)				(0.0011)
Bank credit to deposit ratio	-0.0027**	-0.0024**	-0.0030***	-0.0027**	0.0006	0.0010	0.0001	-0.0001
	(0.0011)	(0.0011)	(0.0011)	(0.0011)	(0.0008)	(0.0009)	(0.0009)	(0.0009)
Exchange rate	-0.0088	-0.0079	-0.0090	-0.0096	-0.0210**	-0.0195**	-0.0215***	-0.0232***
	(0.0104)	(0.0103)	(0.0104)	(0.0104)	(0.0083)	(0.0084)	(0.0083)	(0.0087)
Trade openness	-0.0041***	-0.0042***	-0.0041***	-0.0043***	-0.0015***	-0.0015***	-0.0014***	-0.0013**
	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0005)	(0.0005)	(0.0005)	(0.0006)
Financial openness	-0.0002	-0.0002	-0.0003	-0.0001	0.0004	0.0004	0.0003	0.0003
	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Economic size	-0.0306*	-0.0303**	-0.0307*	-0.0314*	-0.0020	-0.0059	-0.0026	-0.0033
	(0.0162)	(0.0125)	(0.0161)	(0.0162)	(0.0130)	(0.0123)	(0.0129)	(0.0134)
Level of development	0.0003*	0.0003*	0.0003	0.0002	0.0002	0.0002	0.0001	0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Corr. with US or Germany	0.2258**	0.2291**	0.2186**	0.2007**	-0.1093	-0.1169	-0.1258	-0.1219
	(0.1026)	(0.1012)	(0.1009)	(0.1007)	(0.0822)	(0.0822)	(0.0811)	(0.0834)
Constant	0.4983***	0.4706***	0.5220***	0.4805***	0.1579	0.0991	0.2098	0.2472*
	(0.1638)	(0.1598)	(0.1735)	(0.1785)	(0.1313)	(0.1298)	(0.1394)	(0.1479)
No. of observations	47	47	47	45	47	47	47	45
R^2	0.66	0.67	0.66	0.68	0.41	0.40	0.40	0.40
F test	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
Variance Inflation Factor								
Maximum	3.04	3.08	2.75	2.62	3.04	3.08	2.75	2.62
Mean	2.00	1.95	1.88	1.90	2.00	1.95	1.88	1.90
Cameron & Trivedi test for								
Heteroscedasticity	0.55	0.55	0.43	0.43	0.41	0.36	0.3	0.43
Skewness	0.74	0.79	0.75	0.69	0.72	0.68	0.58	0.35
Kurtosis	0.29	0.26	0.29	0.28	0.26	0.27	0.26	0.27
Breusch-Pagan test for heteroskedasticity	0.06	0.04	0.06	0.09	0.75	0.62	0.58	0.65
Ramsey RESET test using powers of independent var.	0.62	0.53	0.55	0.27	0.70	0.71	0.55	0.18

Notes: *,** and *** indicate the 10%, 5% and 1% levels of significance, while [a] indicates borderline significance at 10% (p=0.106). The reported values for the diagnostic tests are their respective p-values, except for the maximum and mean variance inflation factor. Robust standard errors are reported in column 2. Variable Correlation with US and Germany includes correlation coefficients between national GDP and Germany GDP for the following European countries: Austria, Belgium, Croatia, Cyprus, Czech Rep., Denmark, Estonia, Finland, France, Hungary, Ireland, Italy, Lithuania, Netherlands, Norway, Poland, Portugal, Russia, Slovenia, Spain, Sweden, Switzerland, UK, plus for Turkey, Israel and Jordan.

The effects of a monetary policy shock on output and prices depend not only on their ability to change aggregate demand, but on the slope of the Phillips curve as well. It is widely perceived that one of the main determinants of this slope is wage flexibility. A low flexibility of wages results in sluggish price responses to a change in the aggregate demand and, consequently, a flatter Phillips curve. Accordingly, a lower wage flexibility should increase the short-run effect of a monetary policy shock on output and reduce its effect on prices, and vice versa. Unfortunately, wage flexibility is not directly observable. Variables which can be used as proxies (such as trade union density, minimum wages, strictness of employment protection, available from the OECD data base, or indices on labor market regulation, available from Fraser Institute) are available only for a small number of countries in our sample. The only variable related to the labor market which is available for a relatively large number of countries in our sample is the unemployment rate. When included in the model the average unemployment rate appears to be negatively related to the effect of a monetary policy shock on output and positively to the effect of a monetary policy shock on prices (Table 5). This indicates that in countries with a higher average unemployment rate a monetary policy shock might have a larger effect on output and a smaller effect on prices. To the extent that the unemployment rate is inversely related to the wage flexibility this is in line with the theoretical expectations. However, these results should be interpreted with caution because only the results for price regressions (columns 5-8) are statistically significant at conventional levels.

Table 5. The Results of Cross-country Regressions with the Unemployment Variable

Dependent variable:	Average effect on output				Average effect on prices			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deposit money bank assets	-0.0019*				-0.0015*			
	(0.0011)				(0.0008)			
Private credit		-0.0026**				-0.0017*		
		(0.0013)				(0.0009)		
Bank deposits			-0.0022*				-0.0017**	
			(0.0012)				(0.0009)	
Liquid liabilities				-0.0023*				-0.0018*
				(0.0012)				(0.0009)
Bank credit to deposit ratio	-0.0026**	-0.0020	-0.0031**	-0.0026*	0.0011	0.0015*	0.0007	0.0006
	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0009)	(0.0009)	(0.0009)	(0.0010)
Exchange rate	-0.0131	-0.0115	-0.0128	-0.0069	0.0027	0.0041	0.0029	0.0040
	(0.0137)	(0.0134)	(0.0137)	(0.0145)	(0.0097)	(0.0097)	(0.0096)	(0.0107)
Trade openness	-0.0046***	-0.0046***	-0.0045***	-0.0045***	-0.0013**	-0.0013***	-0.0012***	-0.0010*
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Financial openness	0.0001	0.0001	0.0000	0.0001	0.0004	0.0004	0.0004	0.0003
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0002)	(0.0003)
Economic size	-0.0188**	-0.0182**	-0.0172**	-0.0157*	-0.0040	-0.0038	-0.0027	-0.0036
	(0.0083)	(0.0082)	(0.0084)	(0.0083)	(0.0058)	(0.0059)	(0.0059)	(0.0061)
Level of development	0.0003	0.0003	0.0003	0.0003	0.0001	0.0001	0.0001	0.0002
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Corr. with global economy	0.2748*	0.2652*	0.2561*	0.2233	0.0889	0.0858	0.0744	0.0822
	(0.1433)	(0.1411)	(0.1438)	(0.1428)	(0.1003)	(0.1014)	(0.1008)	(0.1053)
Unemployment rate	-0.0090	-0.0105	-0.0095	-0.0057	0.0119*	0.0116*	0.0115**	0.0122*
	(0.0097)	(0.0096)	(0.0097)	(0.0097)	(0.0068)	(0.0069)	(0.0068)	(0.0072)
Constant	0.5886**	0.5372**	0.6447**	0.5210*	-0.3193*	-0.3755**	-0.2771	-0.2733
	(0.2701)	(0.2561)	(0.2790)	(0.2907)	(0.1892)	(0.1842)	(0.1956)	(0.2145)
No. of observations	39	39	39	37	39	39	39	37
R^2	0.71	0.72	0.71	0.73	0.41	0.40	0.41	0.40
F test	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.08
Variance Inflation Factor								
Maximum	2.97	3.10	2.74	2.80	2.97	3.10	2.74	2.80
Mean	1.89	1.95	1.84	1.93	1.89	1.95	1.84	1.93
Cameron &Trivedi test for								
Heteroscedasticity	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Skewness	0.09	0.08	0.09	0.07	0.56	0.58	0.57	0.39
Kurtosis	0.78	0.73	0.68	0.46	0.22	0.23	0.24	0.30
Breusch-Pagan test for heteroskedasticity	0.14	0.13	0.16	0.08	0.04	0.02	0.03	0.01
Ramsey RESET test using powers of independent var.	0.62	0.70	0.83	0.26	0.61	0.50	0.68	0.60

Notes: *,** and *** indicate the 10%, 5% and 1% levels of significance. The reported values for the diagnostic tests are their respective p-values, except for the maximum and mean variance inflation factor. Robust standard errors are reported in columns 5-6.

Previous studies furthermore suggest that the variations in output responses to a domestic monetary policy shock can be related to the differences in the share of interest-sensitive sectors. In particular, Mihov (2001) argues that the effect of a monetary policy shock on output is larger in countries with a larger share of manufacturing. Carlino and DeFina (1998) report similar results for the US states. To address this issue we include the share of industry in GDP in the model and report the results in Table 6.[4] The estimated coefficients reveal that the share of industry in GDP is positively and significantly related to the output response to a monetary policy shock (column 1). The results further suggest that the share of industry is positively related to price response to a monetary policy shock, but this coefficient is not statistically significant (column 2). These results are in stark difference to the previous literature because they suggest that in countries with a larger share of industry a monetary policy shock has, on average, a smaller effect on output. Possible sources of these variations can be found in the usage of industrial instead of the manufacturing share and a larger number of countries used in our analysis compared to the previous studies. Namely, due to data limitations we use the share of industry value added in GDP from WDI data base which corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). The industry value added comprises value added in mining, manufacturing, construction, electricity, water, and gas. To trace the sources of variations in the reported results we create a dummy variable for 10 countries analyzed by previous studies (Australia, Austria, Canada, France, Germany, Italy, Japan, Netherlands, UK and US), construct an interaction variable between the dummy for these 10 countries and a share of industry and include this interaction variable in the model. We also replicate the approach applied in Mihov (2001), i.e. estimate bivariate regressions with the share of industry as the only explanatory variable using the sample of the 10 above named countries. The coefficients on the interaction term in multivariate regressions (columns 3 and 4) appear to be negative, but statistically

[4] Table 6 reports the models which simultaneously include bank deposits and bank credit to deposit ratio. Since the results of regression analyses do not reveal any noteworthy discrepancy from models which include other combinations of financial variables, to preserve space we do not report these results, but they are available upon request.

insignificant. This suggests that the relationship between the share of industry and the effects of a monetary policy might be different for the group of countries analyzed by the previous literature, but that the difference is not statistically significant. The coefficients on the share of industry in bivariate regressions (columns 7 and 8) are negative and statistically significant at the 1 percent level, suggesting that in countries with a larger share of industry a monetary policy shock has, on average, a larger effect on output and prices. Thus, the results of bivariate regressions follow the results reported by Carlino and DeFina (1998) and Mihov (2001). This suggests that the discrepancy between ours and the results reported by other papers on the topic probably stems from the differences in the sample of the countries included into analysis.

Accordingly, it seems that the results reported in Table 6 regarding the share of industry imply that, within our group of countries, in countries with a larger share of industry a monetary policy shock has, in general, a smaller effect on output. The results of the bivariate regressions point to the possibility that the relationship between the share of industry and the effects of monetary policy could be different (the opposite) for countries analyzed by the previous literature, but the results of multivariate regressions reveal that this difference is not statistically significant.

Table 6. The Results of Cross-country Regressions with the Share of Industry Variable

Dependent variable: average effect on	output	prices	output	prices	output	prices	output	prices	output	prices
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank deposits	-0.0009	-0.0023***	-0.0006	-0.0022**	-0.0008	-0.0023***				
	(0.0010)	(0.0009)	(0.0010)	(0.0009)	(0.0010)	(0.0009)				
Bank credit to deposit ratio	-0.0032***	0.0001	-0.0031***	0.0001	-0.0030***	0.0001				
	(0.0011)	(0.0009)	(0.0010)	(0.0009)	(0.0010)	(0.0009)				
Exchange rate	-0.0280***	-0.0195**	-0.0300***	-0.0200**	-0.0298***	-0.0196**				
	(0.0104)	(0.0089)	(0.0103)	(0.0091)	(0.0103)	(0.0091)				
Trade openness	-0.0046***	-0.0015***	-0.0048***	-0.0015***	-0.0050***	-0.0015**				
	(0.0007)	(0.0006)	(0.0006)	(0.0006)	(0.0007)	(0.0006)				
Financial openness	0.0001	0.0004	0.0000	0.0004	-0.0001	0.0004				
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)				
Economic size	-0.0141*	0.0006	-0.0117	0.0011	-0.0174**	0.0005				
	(0.0075)	(0.0064)	(0.0075)	(0.0066)	(0.0076)	(0.0067)				
Level of development	0.0002	0.0001	0.0003	0.0002	0.0006*	0.0002				
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0003)				
Corr. with global economy	0.2673**	-0.1103	0.2861**	-0.1061	0.2773**	-0.1101				
	(0.1134)	(0.0970)	(0.1118)	(0.0987)	(0.1115)	(0.0985)				
Share of industry	0.0133**	0.0029	0.0141**	0.0031	0.0133**	0.0029	-0.0048***	-0.0051***	-0.0046***	-0.0040***
	(0.0057)	(0.0049)	(0.0056)	(0.0050)	(0.0056)	(0.0050)	(0.0012)	(0.0013)	(0.0011)	(0.0009)
Mihov's countries dummy x share of industry			-0.0042	-0.0009						
			(0.0026)	(0.0023)						
Old industrial countries dummy x share of industry					-0.0060	-0.0001				
					(0.0038)	(0.0034)				
Constant	0.2273	0.1209	0.2087	0.1167	0.2375	0.1211				
	(0.2222)	(0.1900)	(0.2182)	(0.1925)	(0.2182)	(0.1927)				
Number of observations	47	47	47	47	47	47	10	10	18	18
R^2	0.70	0.39	0.72	0.39	0.72	0.39	0.66	0.64	0.53	0.55
F test	0.00	0.02	0.00	0.03	0.00	0.03	0.00	0.00	0.00	0.00
Variance Inflation Factor: maximum	2.76	2.76	2.91	2.91	8.03	8.03	-	-	-	-
mean	1.83	1.83	1.92	1.92	2.84	2.84	-	-	-	-
Cameron & Trivedi's test for: heteroscedasticity	0.43	0.43	0.43	0.43	0.43	0.43	0.45	0.05	0.07	0.01
skewness	0.79	0.72	0.81	0.74	0.88	0.53	0.19	0.31	0.21	0.02
kurtosis	0.15	0.22	0.12	0.22	0.11	0.22	0.52	0.27	0.97	0.36
Breusch-Pagan test for heteroskedasticity	0.25	0.81	0.38	0.88	0.12	0.81	-	-	-	-

Ramsey RESET test using powers of indep. var.	0.11	0.94	0.20	0.92	0.15	0.98	-	-	-	-

Notes: *,** and *** indicate the 10%, 5% and 1% levels of significance. The reported values for the diagnostic tests are their respective p-values, except for the maximum and mean variance inflation factor. Robust standard errors are reported in columns 7-10. Columns 7 and 8 report results for the sample of the 10 countries analyzed by Mihov (2001). Columns 9 and 10 report results for the sample of the 18 "old" industrial countries. Variable Mihov's countries dummy includes dummies for: Australia, Austria, Canada, France, Germany, Italy, Japan, Netherlands, UK and US. Variable Old industrial countries dummy includes dummies for: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, UK and US.

A more general implication is that these findings warn against the generalization of the results obtained from small samples of countries. Consequently, although our sample includes about one quarter of the world economies, one should be cautious with generalizations of the reported results, and interpret them as findings for the countries in our sample, rather than as findings regarding the effects of monetary policy in general.

Finally, the results on the industry share also pose the question regarding the possible causes of the differences in the relationship between the share of industry and the effects of monetary policy for different groups of countries. A detailed analysis of this issue is beyond the scope of this study; however, in columns 5, 6, 9 and 10 we report very similar results to those reported for a set of the above listed 10 countries, using a group of 18 "old" industrial countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, UK and US).[5] This finding suggests that displacement of industrial production during recent decades from the "old" industrial countries towards the emerging economies might be a useful starting point for a deeper enquiry. Namely, this displacement initially took place when the labor intensive industries moved from the developed to the countries with lower labor costs. The displacement of the labor intensive industry may increase the average capital coefficient of industrial sectors in the "old" industrial countries. If the sectors with a larger capital coefficients are at the same time more interest-sensitive sectors, which seems reasonable to presume, then it is possible that the industrial sector in the "old" industrial countries is, on average, more sensitive to a monetary policy shock compared to the industrial sector in the emerging economies. Hence, a larger share of industry in these countries can be associated with larger effects of a monetary policy shock compared to other countries.

[5] Standard diagnostic tests and investigative procedures indicate that for the last model the null of no-normal skewness can be rejected at the 5 percent level, which suggests that the model in column 10 might not be well specified with respect to normality.

4. Conclusion

This paper contributes to a better understanding of cross-country variations in the effects of a monetary policy shock on output and prices. Our results on trade openness, financial openness and the type of the exchange rate regime are consistent with the exchange rate channel of monetary policy and the Mundell-Fleming model of macroeconomic policy in open economies. The results on the exchange rate regime suggest that in countries with more flexible exchange rates a monetary policy shock has, on average, a large effect on output and prices. Consistently significant coefficients on trade openness reveal that in countries with a larger share of international trade in GDP a monetary policy shock has, on average, a larger effect on output and prices. Moreover, we find that the estimated relationship between trade openness and output responsiveness to a monetary policy shock is larger for countries with more flexible exchange rates. The lack of significance of financial openness is in line with the Mundell-Fleming model, according to which the effects of financial openness differ between fixed and flexible exchange rate regimes. Namely, given that the countries in our sample have different exchange rate regimes these two effects may be canceling each other. Additionally, the results on the interaction term between the dummy for flexible exchange rates and financial openness variable suggest that in countries with more flexible exchange rates the effect of a monetary policy shock on output is, on average, larger for financially more open economies.

The results of the cross-country output regressions suggest that the effect of a monetary policy shock on output is, on average, smaller in countries which are more correlated with the global economy. Further analysis reveals that the ability of national monetary policies to influence output in the short-run is related to the correlation of non-European economies with the US economy, and the correlation of European economies with the German economy. Coefficients on the variable that measures the size of national economies indicate that a monetary policy shock has, on average, a larger effect on output in larger economies. Taken together, coefficients on these two variables are consistent with recent concerns that growing international interdependence may have increased the importance of foreign factors in the determination of domestic output and, in turn, reduced the ability of national monetary policy to influence domestic output in the short-run. At the same time, statistically insignificant and much smaller coefficients on these two variables in the price regressions suggest that foreign factors do not undermine the ability of national monetary policies to influence prices in the short-run.

With respect to the financial variables our results, in general, support Cecchetti's (1999) and Mihov's (2001) findings on the importance of financial sector in the monetary policy transmission. In particular, coefficients on financial variables suggest that in the countries with larger size of financial sector, a monetary policy shock has, on average, a larger effect on output and prices. However, data limitations do not allow us to empirically distinguish between interest rate and credit channel of the monetary policy transmission.

With respect to the hypothesized relationship between the share of interest rate sensitive sectors in the economy and responsiveness of output and prices to a monetary policy shock, our results are the opposite to those suggested by Carlino and DeFina (1998) and Mihov (2001). We find that, on average, in countries with a larger share of industry in GDP a monetary policy shock has a smaller, rather than larger, effect on output. Additional tests suggest that the relationship between the share of industry and the effects of monetary policy may be different for different group of countries; and that the discrepancy between ours and the results reported by previous studies is probably a consequence of the focus of previous studies on a small group of industrial countries. These findings stress the importance of our decision to include a broader range of countries into the analysis.

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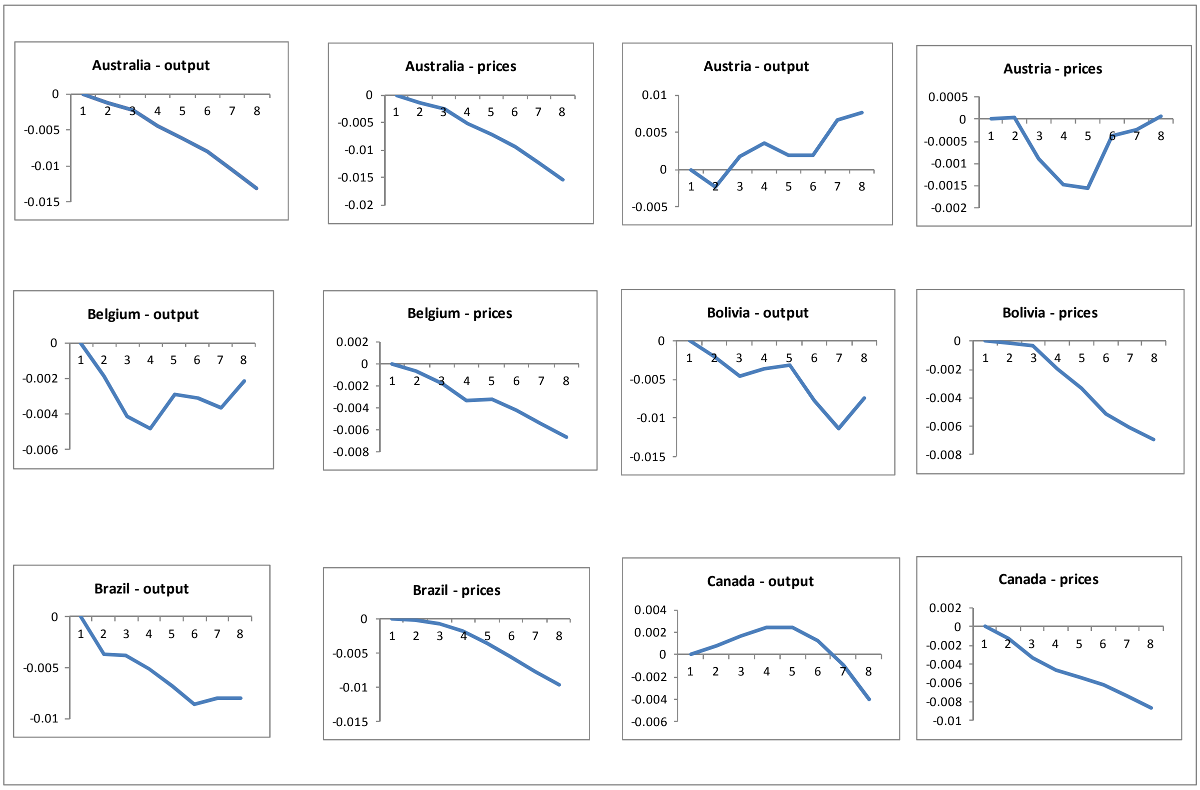
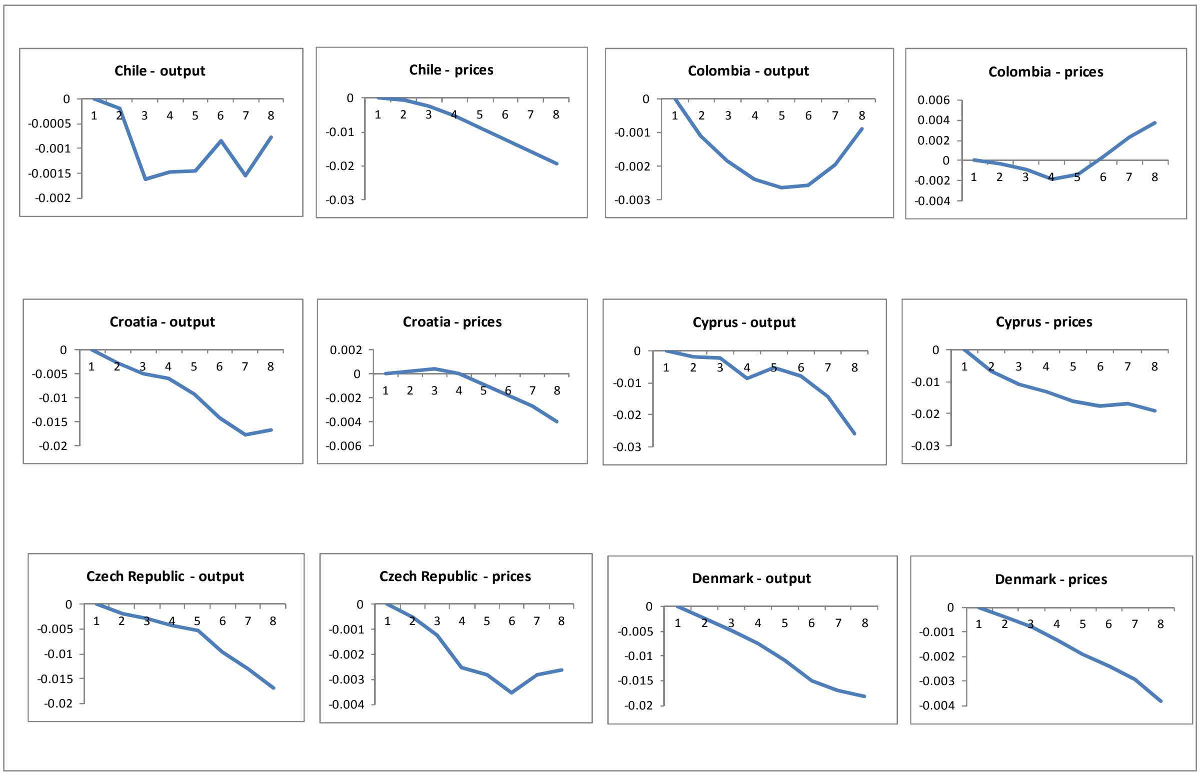
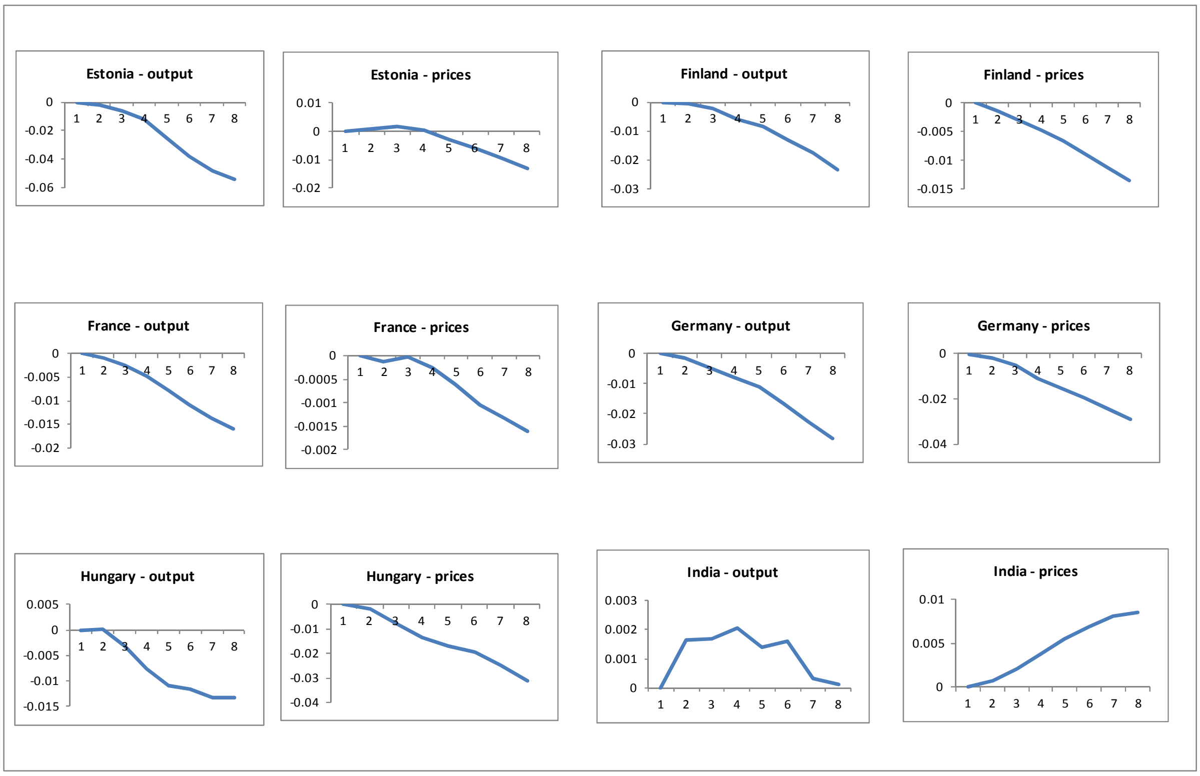
Appendix

The graphs represent the cumulative impulse responses functions of a monetary policy shock (a one percentage point increase in the interest rate) on output and prices.



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0
-0.02
-0.04
-0.06
1 2 3 4 5 6 7 8
Estonia - prices
0.01
0
-0.01
-0.02
1 2 3 4 5 6 7 8
Finland - output
0
-0.01
-0.02
-0.03
1 2 3 4 5 6 7 8
Finland - prices
0
-0.005
-0.01
-0.015
1 2 3 4 5 6 7 8
France - output
0
-0.005
-0.01
-0.015
-0.02
1 2 3 4 5 6 7 8
France - prices
0
-0.0005
-0.001
-0.0015
-0.002
1 2 3 4 5 6 7 8
Germany - output
0
-0.01
-0.02
-0.03
1 2 3 4 5 6 7 8
Germany - prices
0
-0.02
-0.04
1 2 3 4 5 6 7 8
Hungary - output
0.005
0
-0.005
-0.01
-0.015
1 2 3 4 5 6 7 8
Hungary - prices
0
-0.01
-0.02
-0.03
-0.04
1 2 3 4 5 6 7 8
India - output
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0.001
0
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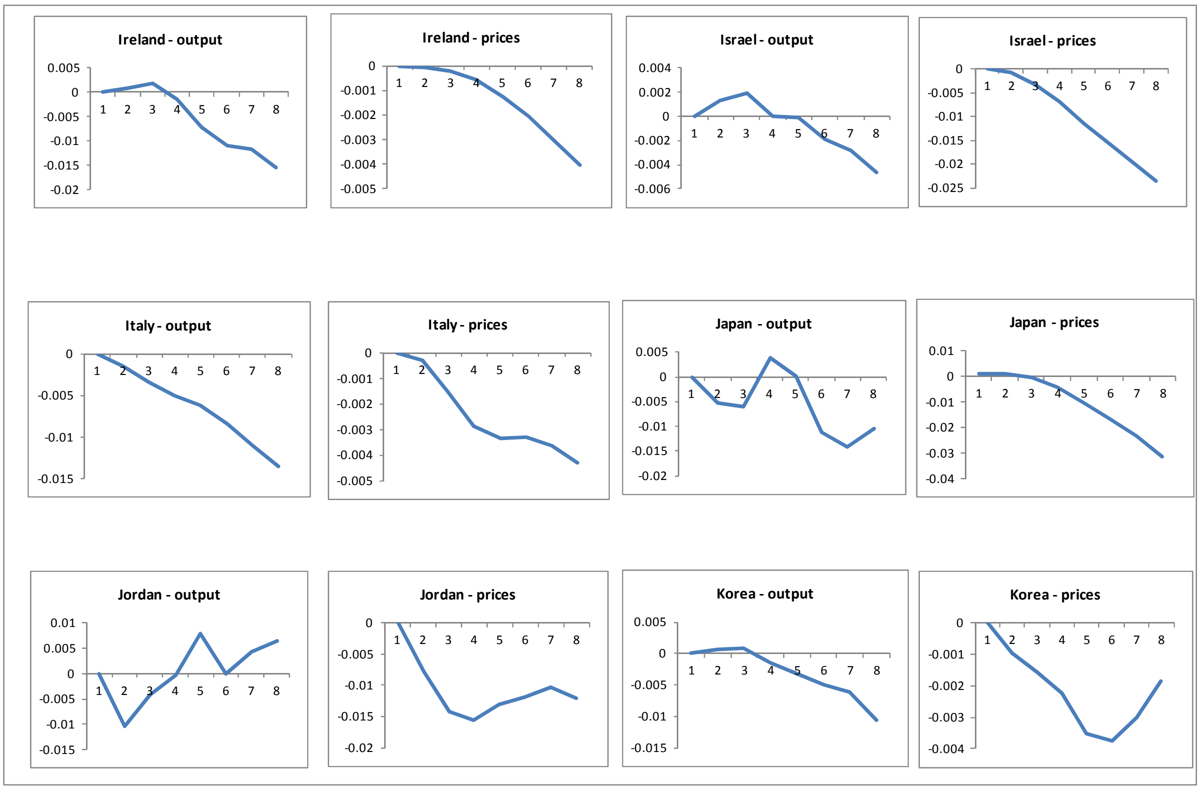
India - prices
0.01
0.005
0
1 2 3 4 5 6 7 8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0
-0.005
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Ireland - prices
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-0.002
-0.003
-0.004
-0.005
1 2 3 4 5 6 7 8
Israel - output
0.004
0.002
0
-0.002
-0.004
-0.006
1 2 3 4 5 6 7 8
Israel - prices
0
-0.005
-0.01
-0.015
-0.02
-0.025
1 2 3 4 5 6 7 8
Italy - output
0
-0.005
-0.01
-0.015
1 2 3 4 5 6 7 8
Italy - prices
0
-0.001
-0.002
-0.003
-0.004
-0.005
1 2 3 4 5 6 7 8
Japan - output
0.005
0
-0.005
-0.01
-0.015
-0.02
1 2 3 4 5 6 7 8
Japan - prices
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Jordan - output
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0
-0.005
-0.01
-0.015
1 2 3 4 5 6 7 8
Jordan - prices
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-0.01
-0.015
-0.02
1 2 3 4 5 6 7 8
Korea - output
0.005
0
-0.005
-0.01
-0.015
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Korea - prices
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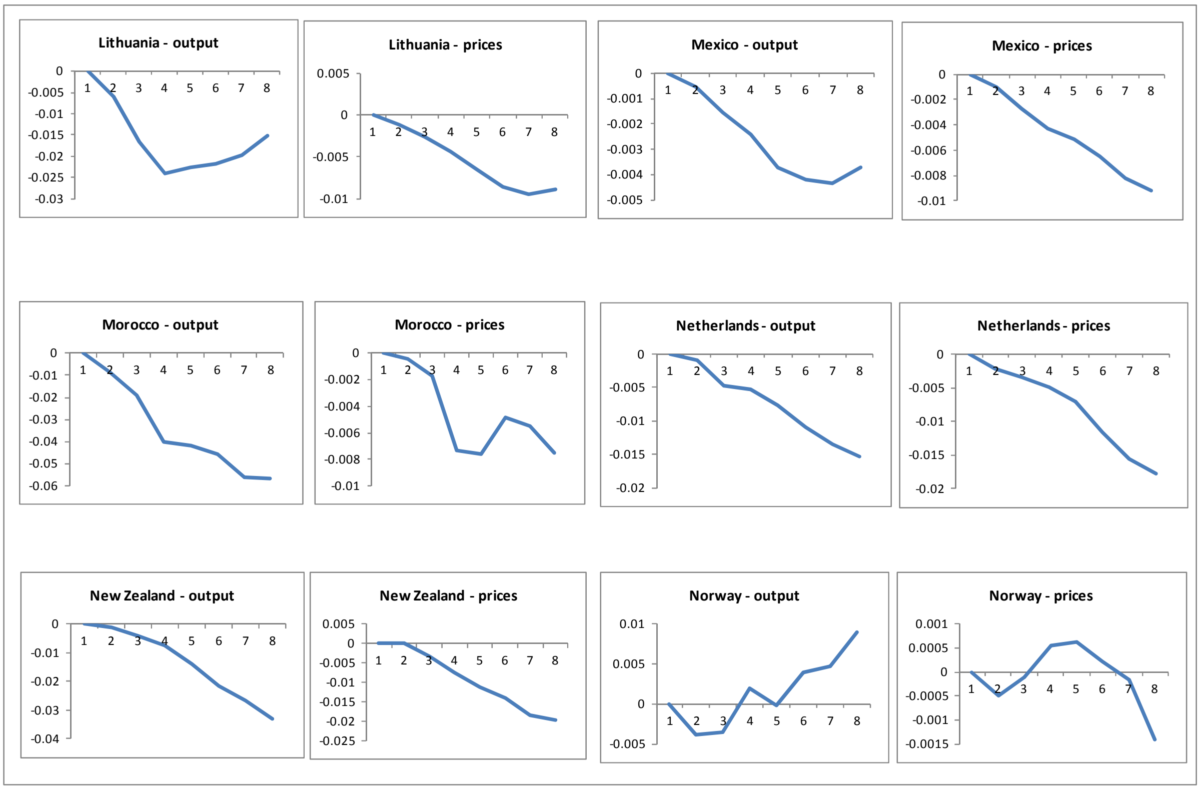
1 2 3 4 5 6 7 8



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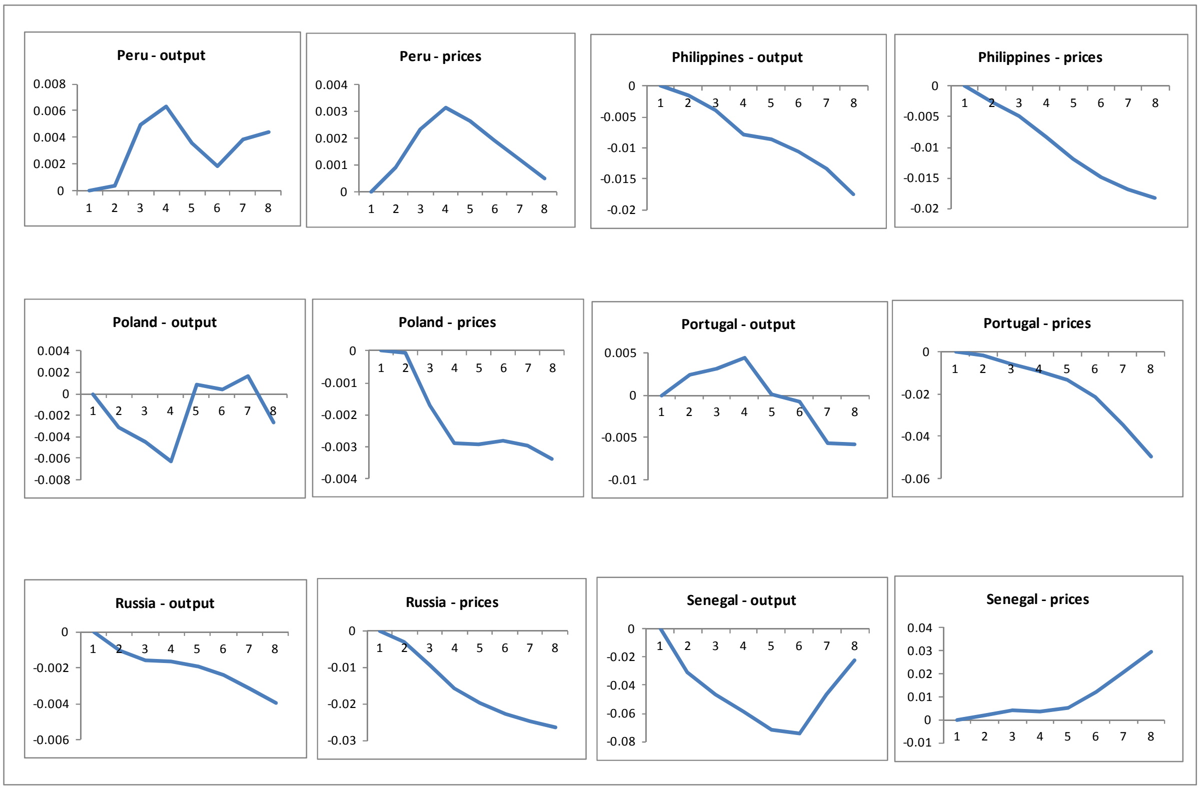
Lithuania - prices
Mexico - output
Mexico - prices
Morocco - output
Morocco - prices
Netherlands - output
Netherlands - prices
New Zealand - output
New Zealand - prices
Norway - output
Norway - prices



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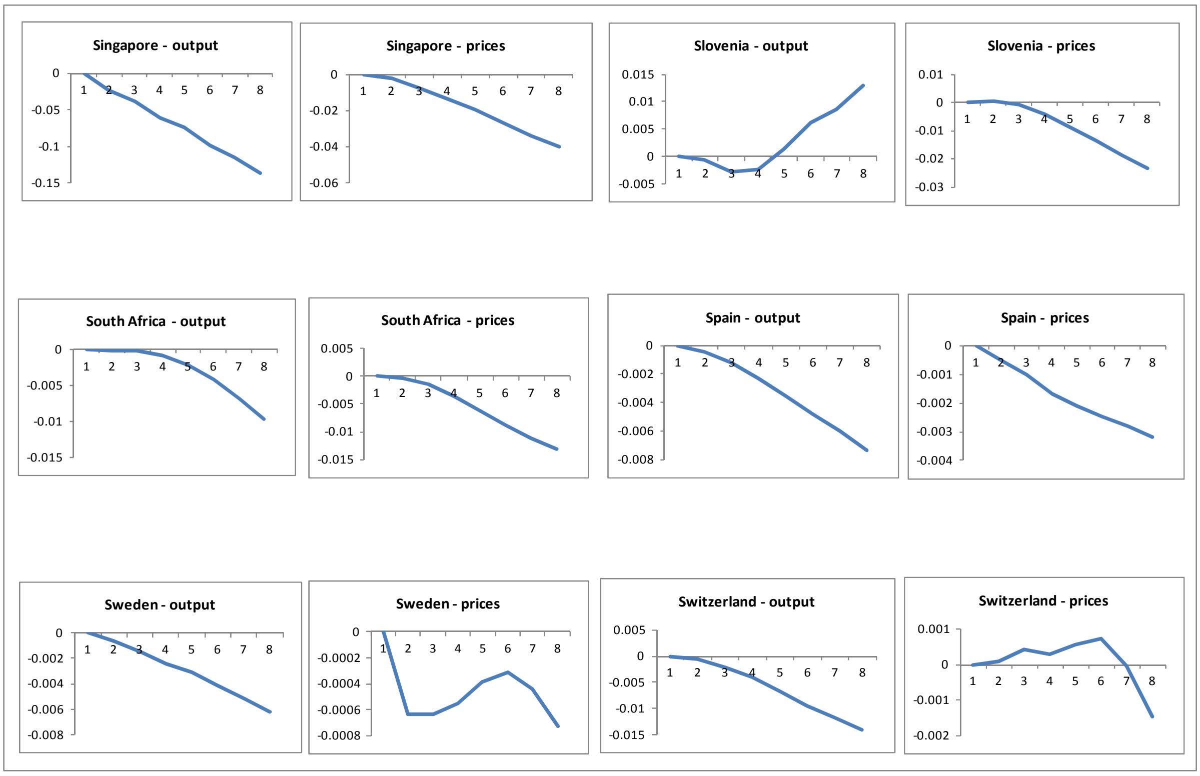
Peru - prices
Philippines - output
Philippines - prices
Poland - output
Poland - prices
Portugal - output
Portugal - prices
Russia - output
Russia - prices
Senegal - output
Senegal - prices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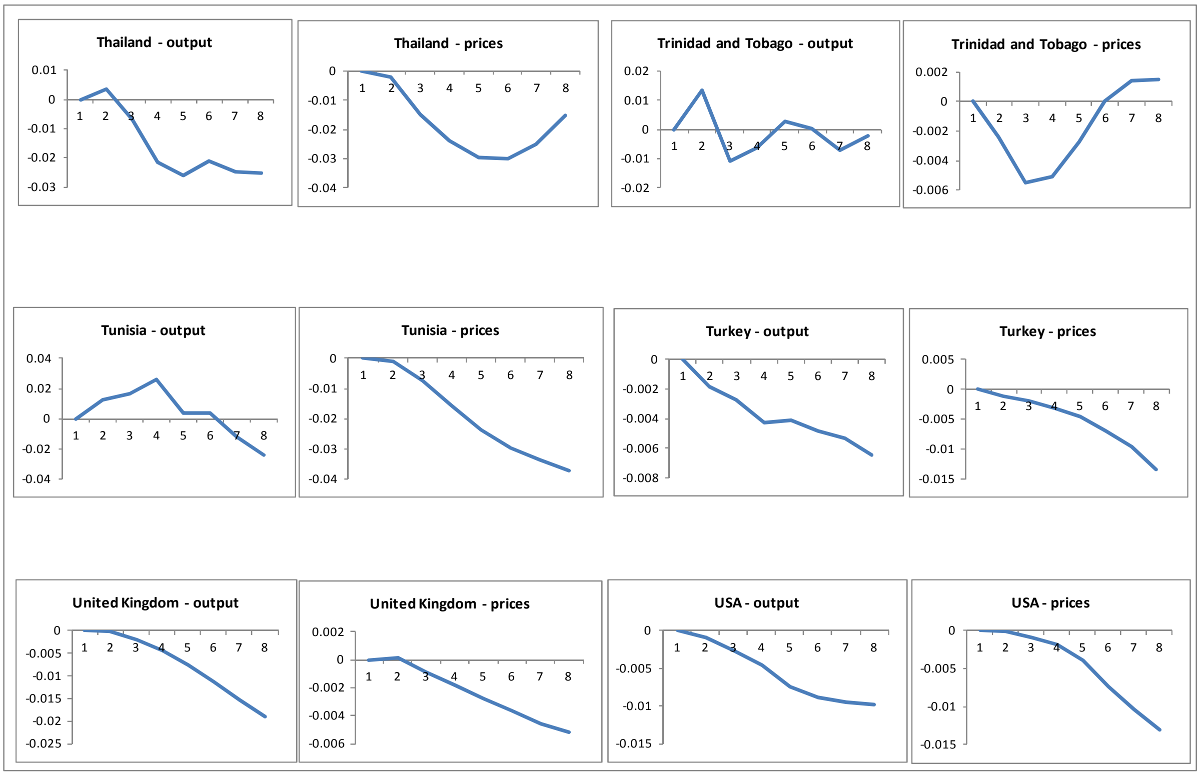
Singapore - prices
Slovenia - output
Slovenia - prices
South Africa - output
South Africa - prices
Spain - output
Spain - prices
Sweden - output
Sweden - prices
Switzerland - output
Switzerland - prices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Thailand - prices
Trinidad and Tobago - output
Trinidad and Tobago - prices
Tunisia - output
Tunisia - prices
Turkey - output
Turkey - prices
United Kingdom - output
United Kingdom - prices
USA - output
USA - prices