The external and domestic drivers of inflation: the case study of Hungary

Erzsébet Éva Nagy and Veronika Tengely[1]

Abstract

Factors that have tended to result in declining inflation rates worldwide since 2013 include subdued global economic activity, declining energy and commodity prices, technological innovation and inflation expectations that are anchored at historically low levels around the world. The relationship between globalisation and inflation is a popular research topic among economists. According to much of the literature, the influence of globalisation and external factors on national inflation rates has increased in recent years. In this paper we investigate how external and domestic drivers affect inflation in Hungary. The country is an interesting case study, since its openness has grown significantly. Indeed, Hungary is now one of the most open economies in the EU. The Hungarian experience could thus be interesting for countries with an increasing trend towards openness. Using several statistical methods, we examined and analysed the impact of external and domestic drivers of Hungarian inflation, and how these external factors and their effect on inflation have varied in time. Our results show that the role of external factors in domestic inflation developments has strengthened in recent years. Especially after 2012, changes in inflation in Hungary were influenced mainly by external effects.

Keywords: external factors, globalisation, inflation, Phillips curve, principal components, SVAR models.

JEL classification: C53, E31, E37, F02, F41, F62.

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Introduction

Factors that have favoured declining inflation rates at global level since 2013 include subdued global economic activity, declining energy and commodity prices, technological innovation and inflation expectations anchored at historically low levels around the world. As a result of rising commodity prices at end-2016 and in early 2017, inflation rates have moved away from close-to-zero levels, but are still tending to fall short of central bank targets.

In contrast to global inflation rates, economic performance has varied from region to region after the crisis, which is also corroborated by the significantly different levels of unemployment in the European Union (Graph 1, left-hand panel). **After 2012, the standard deviation of unemployment rates increased remarkably**. Despite the different phase of the labour market cycle, **no divergence could be detected in inflation dynamics; indeed, inflation rates have tended to remain at generally low levels in recent years** (Graph 1, right-hand panel). In this regard, the question is what role might global common factors play in these developments.

Standard deviations of unemployment rates and inflation rates in the EU — Graph 1

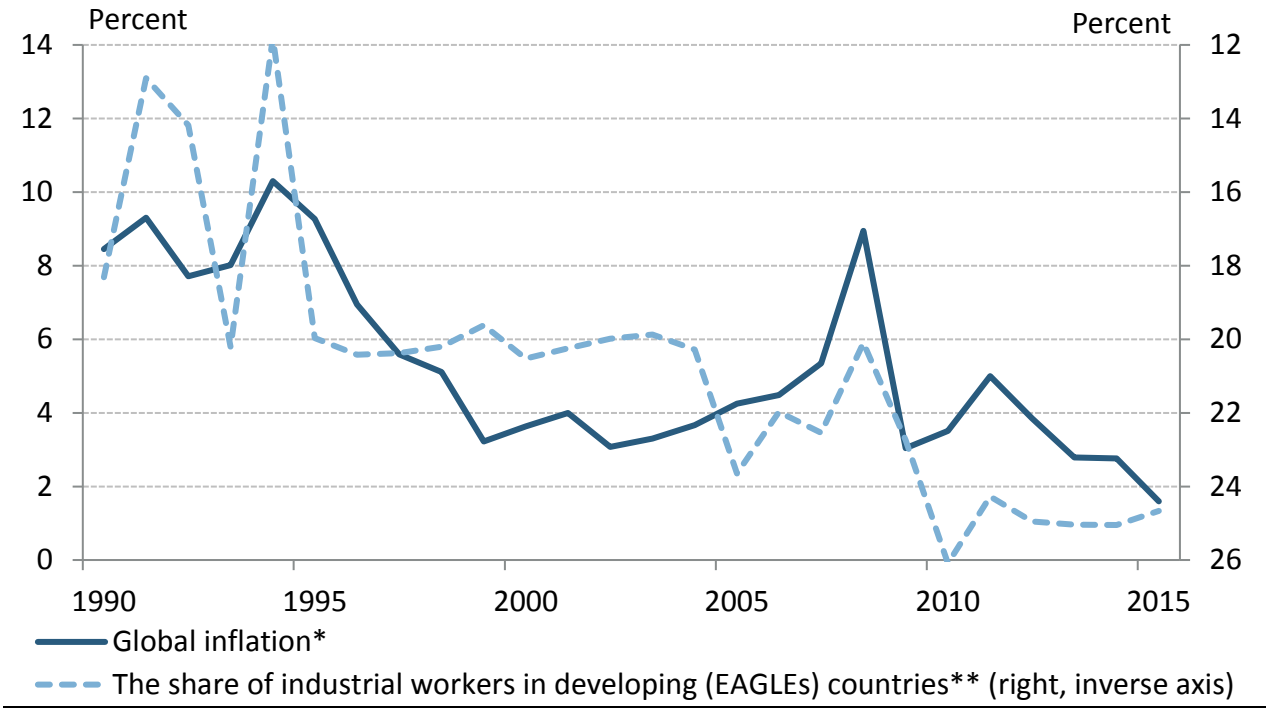
Sources: Eurostat, MNB.

The most common reasons for the growing correlation between inflation rates are globalisation and integration into global production processes (the role of global value chains), which may have amplified the impact of international business cycles on inflation. The effect of globalisation is felt through various channels. **Increased trade openness, higher competition as a result of economic integration, the global division of labour and the appearance of new**

low-cost labour in the production chains all result in more restrained price dynamics and increased co-movement of national inflation rates. As a stylised fact, we can mention the increasing share of industrial workers in developing countries, which lowers global inflation (Graph 2). The process was remarkable mainly in the pre-crisis period, when the developing countries became even more integrated into international trade, and as a result, the availability of low-cost labour rose dramatically.

Global inflation and the share of industrial workers in developing countries

Graph 2



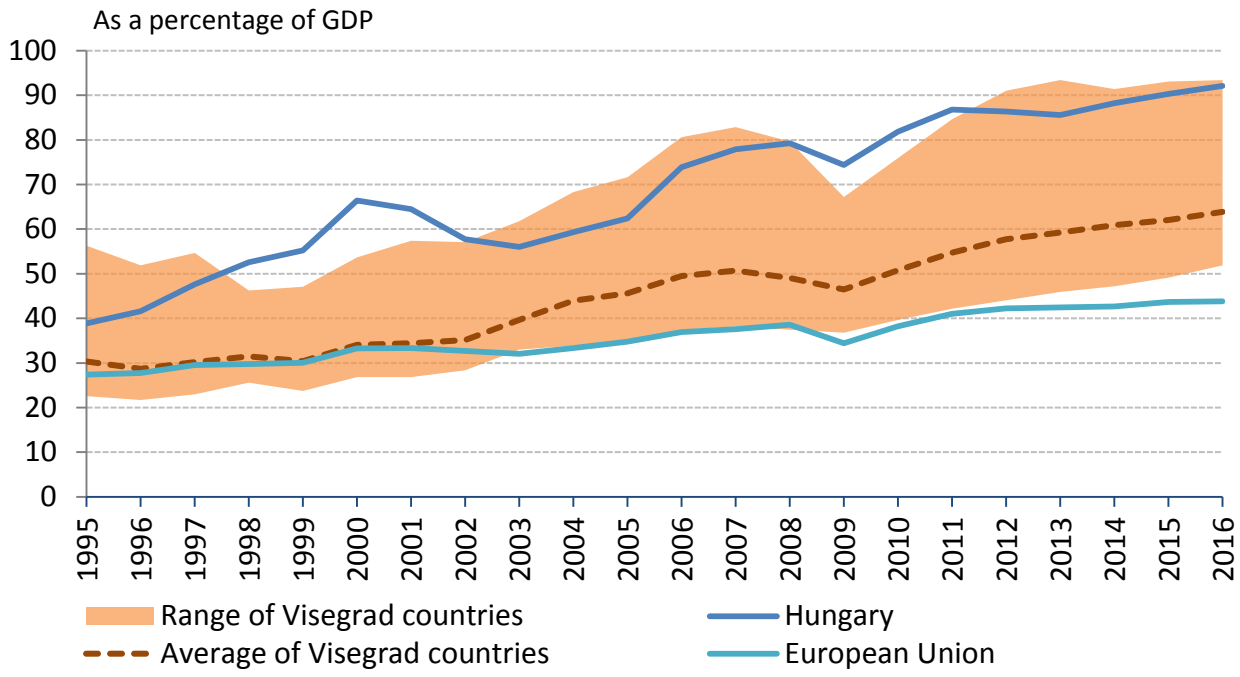
Note: *Annual change. **EAGLEs stands for emerging and growth-leading economies and includes the countries whose contribution to global economic growth exceed the average of the G7 economies excluding the United States. The EAGLE economies are Brazil, India, Indonesia, China, Mexico, Russia and Turkey.

Source: World Bank.

This paper is a case study on Hungary, a small open economy. **Since Hungary has become extremely open in the last two decades, it demonstrates how trade openness alters inflation dynamics**. The export-to-GDP ratio is currently above 90%, which is well above the average of the European Union and of the Visegrad countries (Graph 3). **As Hungary became more and more open, according to our hypothesis the role of the external factors driving the Hungarian economy increased.** In this paper, we investigate the effects of these external factors on one of the most important economic indicators, the inflation rate.

Trade openness in Hungary, in the region and in the European Union

Graph 3



Note: The band indicates the range of export-to-GDP ratio of the Visegrad countries, namely the Czech Republic, Poland and Slovakia.

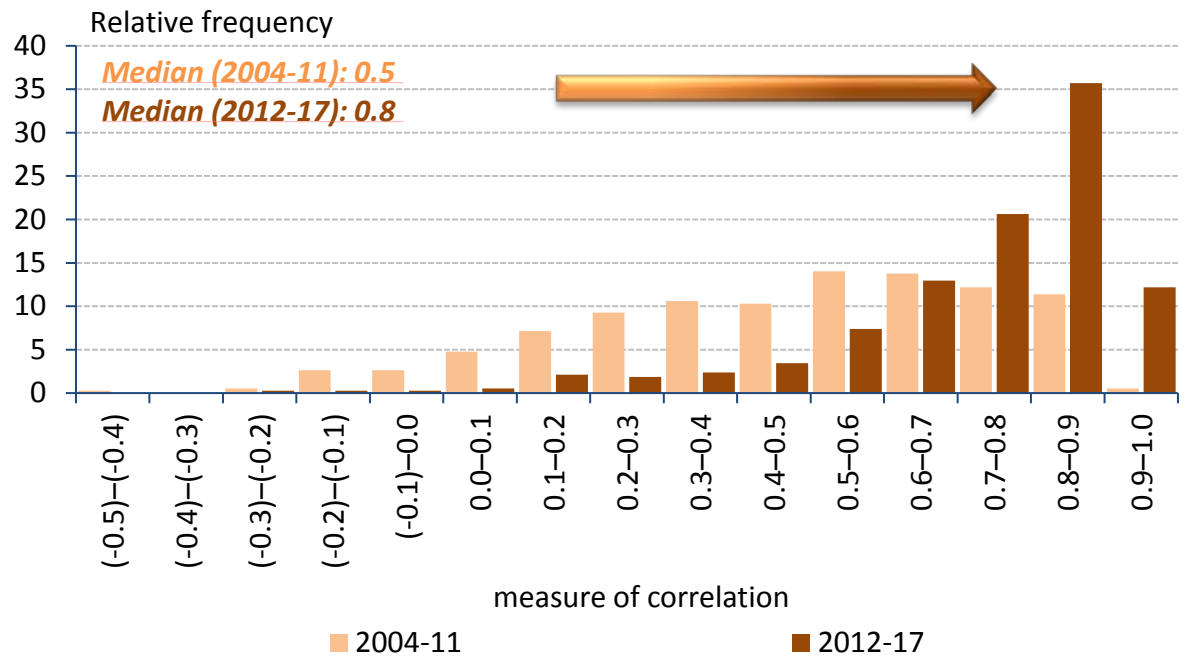
Source: Eurostat.

In the case of Hungary, the European Union represents the narrower global environment, as approximately 80% of Hungary's foreign trade is with the EU. Therefore, it is worth examining historical developments in EU inflation rates. We can conclude that the Hungarian example is not unique. Correlation among the price indices of the EU countries has increased considerably in recent years (Graph 4). While the median of the distribution of partial correlations was moderate before 2012, the correlation coefficient rose to above 0.8 after that year.

The remaining structure of the paper is as follows. First, there is a review of the relevant literature. After that we describe the methodology and present the estimation results. Then we conclude.

Distribution of correlations by pair between the inflation rates of the countries of the European Union

Graph 4



Note: Relative frequency. The graph shows the distribution of pairwise correlations between the EU countries. For example the 0.8–0.9 correlation should be interpreted such that, while in 2004–11 some 11.4% of the pairings were characterised by a correlation between 0.8 and 0.9, this ratio rose to 35.7% after 2012.

Sources: Eurostat, MNB.

Literature review

The impact of common – or global – factors on national inflation rates has attracted growing attention in recent years. According to Guerrieri et al (2010), globalisation and economic integration affect inflation through various channels. On the one hand, because of globalisation, **inflation is less sensitive to internal capacity constraints**: this means that a sudden growth in demand can increase imports without raising prices. On the other hand, **economic integration enhances global competition**, which can hold back price dynamics. These statements are in line with the results supporting the **flattening of the Phillips curve after the financial crisis**. Taking the wage Phillips curves into account, international results vary significantly (Bulligan and Viviano (2016), Muto and Shintani (2014)). According to these authors, in Germany the connection between wage inflation and unemployment weakened, while in France, Italy and Spain it strengthened. In Hungary, the slope of the wage Phillips curve has been relatively stable over time: after the crisis it increased slightly, but since 2014 it has become weaker.

The traditional Phillips curve represents the connection between inflation and domestic economic slack. It does not reflect global factors, so that the inflationary effect of the external economic environment appears only indirectly. This makes such

a model too country-specific. **Due to the enhanced effect of globalisation, common factors should be taken into consideration directly. The new-style Phillips curves are Phillips curves augmented with external factors** so as to measure the effects of global economic slack.

These new Phillips curve estimations show that **common factors not only have greater inflationary effects but they reduce national inflation rates while increasing the correlation between them**. The evolution of commodity prices – especially crude oil prices – probably contributes to the latter result, but this distorting effect can be easily removed with the use of the core inflation rate (or, at a minimum, an inflation rate that excludes fuel prices).

The role of global factors in inflation developments increased mainly after the financial crisis, but there are pre-crisis estimates (see Morimoto et al (2003), Ciccarelli and Mojon (2005), Bean (2006), Fisher (2006), Mumtaz and Surico (2008), Yellen (2006) and Bernanke (2007)) that indicated the importance of common factors even before the crisis especially in the case of developed countries. Borio and Filardo (2007) estimated a Phillips curve for 16 developed countries, which contained, in addition to the domestic output gap, the so-called global output gap, oil prices and import prices to measure the change in the inflation processes.

In the post-crisis period, the literature emphasising the role of global factors increased further (see Ciccarelli and Mojon (2010), Caruana (2012), Carney (2015), Fischer (2015), Jordan (2015), Draghi (2016) and Poloz (2016)). Those who subscribe to the theory of the globalisation of inflation point at the role of global value chains (see Auer et al (2017), Borio et al (2017) and Nickel (2017)). **Global value chains help to strengthen the co-movement of inflation rates, because international input-output linkages synchronise not only the national inflation rates with each other, but also with global processes as well.** According to the globalisation of inflation hypothesis, geographically more fragmented global production processes made the spread of new technologies possible and reduced or abolished trade barriers. **In economies with greater trade openness, wage and price dynamics are more sensitive to the external effects, which enhances the role of common factors. In parallel with the gaining momentum of the global value chains, domestic factors have only a limited effect on inflation.**

Besides the role of global value chains, Borio (2017) emphasises that **globalisation's influence on inflation may be underestimated**. According to Borio, because of well-anchored inflation expectations and greater competition via more integrated product, labour and capital markets, **the link between domestic slack and inflation has become weak and elusive**. This indicates that globalisation has two types of effect on inflation: the symmetrical effect is that inflation is more sensitive to global slack, and the asymmetrical effect is the secular downward pressure on inflation stemming from lower-cost producers and cheaper labour.

According to ECB (2017), **the role of global factors depends heavily on the estimation sample and on the measurement of the output gap. Thus, it is not surprising that the literature provides contradictory results as well**. For example, in the case of developed countries, Borio and Filardo (2007) and, in the case of the United States, Milani (2009) proved the increasing role of global factors. Yet Calza (2008), Gerlach et al (2008), Ihrig et al (2010), Martínez-García and Wynne (2010), as well as Eickmeier and Pijnenburg (2013), could not find any significant explanatory power in these factors. The ECB (2017) study applies a Phillips curve, which implies

inflation expectations as a forward-looking part. They found that global factors drove euro area inflation only in 2008–09, but in 2012–15 domestic factors were predominant.

Methodology and estimation results

According to the literature, the role of global – or common – factors may have become increasingly important in domestic inflation developments. In order to find out whether this is also true in the case of Hungary, we made estimates using several different methods.[2]

Determining the drivers of the Hungarian inflation using principal component analysis

Principal component analysis (PCA) is a useful statistical technique to investigate the effect of a phenomenon or a variable that is either unobservable or largely so. In the case of Hungary, as we are unable to measure the common as well as the regional factors, we generated these latent variables with the help of the inflation time series of the EU member states. **Using PCA, we were able to decompose the variance of the Hungarian inflation into global, regional and country-specific effects.** Global factors capture the impact of EU member countries' inflation rates on the domestic price index and also include the effect of the changes in oil prices. Regional factors capture the inflationary effects stemming from the Visegrad countries other than Hungary (the Czech Republic, Poland, Slovakia). All other effects unexplained by the global and regional factors are idiosyncratic or country-specific components.

For the decomposition, we used the methodology developed by Krusper (2012) based on Stock and Watson (2002). **The external and country-specific factors are constructed consistently with a two-step procedure.** First, all inflation time series are used to estimate the common factor. Then we subtract the global component by regressing the common factor on inflation, and take the residuals. Second, we calculate the regional factor with another PCA using the residual time series only. After that, to compute the idiosyncratic component, we simply regress the common and regional factors on the inflation time series. The equation stated with estimated common and regional factors for domestic inflation is:

$$\pi_t = \beta_1 g_t + \beta_2 r_t + \varepsilon_t \qquad (1.)$$

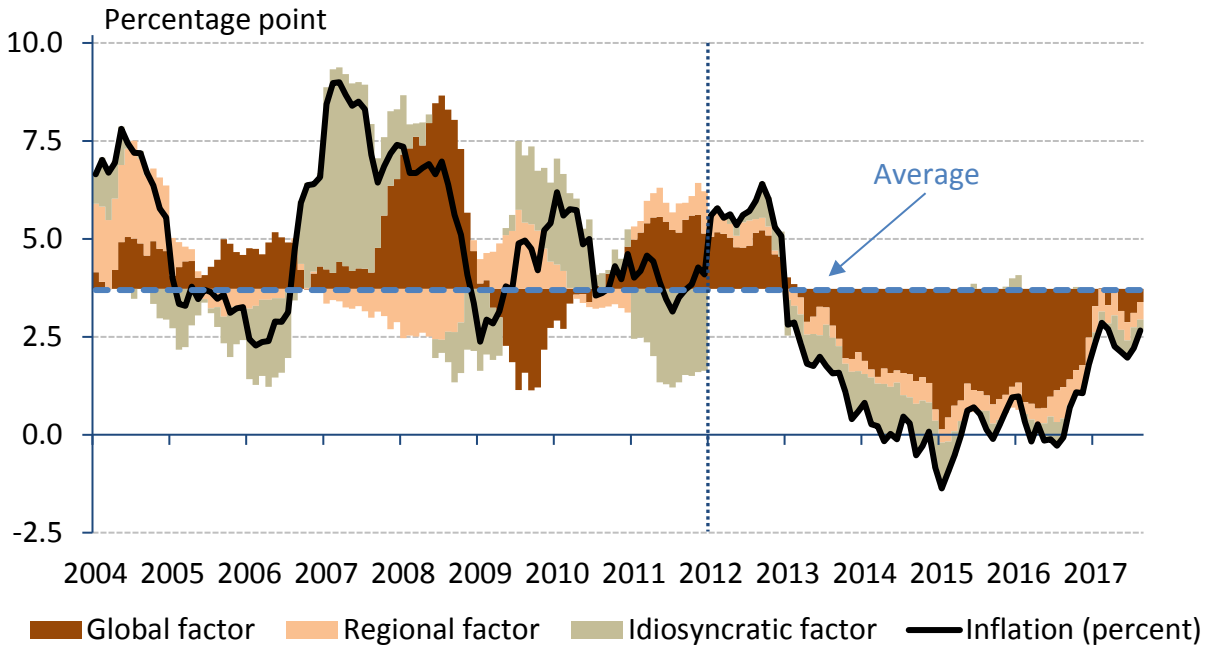
where π_t is the actual, standardised domestic inflation,[3] g_t indicates the common factor, r_t the regional factor and ε_t the country-specific factor. This methodology is a useful tool to separate the contributions of individual factors to inflation. At the same time, it does not provide a structural explanation for developments in inflation, as it analyses the correlation between various inflation time series.

[2] An extract of these estimates was published in MNB (2017).

[3] We used the Harmonised Index of Consumer Prices (HICP).

Decomposition of inflation according to global, regional and idiosyncratic factors

Graph5



Note: Annual change. The factors explain the deviation of actual inflation (HICP) from its average during 2004–17.

Sources: Eurostat, MNB.

The deviation of inflation from its long-term average was primarily explained by global factors in the past years; the significance of country-specific and regional effects is much lower. The impact of regional factors was perceived to a greater extent in the period of joining the EU. The contribution of country-specific factors is explained mainly by changes in taxes and regulated prices,[4] although their effect has declined significantly in recent years. **Since 2012, domestic inflation developments have been determined mainly by global factors (up to 70–80%), in line with the stronger co-movement of international inflation rates** (Graph 5). We estimated this model using time series for the Czech Republic, Poland and Slovakia. In the case of these Visegrad countries, we saw the dominance of global factors after 2012 (see Graphs 8, 9 and 10 in the Appendix). For the variance decomposition in the estimation period (2004–17) see Table 2 in the Appendix.

[4] There was a general VAT increase in January 2004, September 2006 and July 2009. In September 2006 there was also an increase in overhead expenses. Hungary experienced a general VAT cut only once, in January 2006.

Identifying the external drivers of domestic inflation using a SVAR approach

To identify the external drivers of the Hungarian inflation, we applied a two-step estimation method on disaggregated inflation data.[5] First, **we estimated a SVAR model to get the time series of the selected external shocks.** Second, **we regressed the disaggregated price indices of the main inflation groups on the identified global shocks and on some domestic variables controlling for the prevailing inflation target of the MNB**. Finally, we constructed the overall external and internal – or domestic – effects on Hungarian inflation by excluding regulated prices and the effect of indirect taxes.[6]

We made the estimation using quarterly frequency data – both levels[7] and quarterly changes – between Q1 2003 and Q2 2017. As mentioned in Section 1, the external environment in the case of Hungary is the European Union, or rather the euro area. **In order to estimate the impact of external shocks, we formed a model with** variables reflecting the euro area cyclical position (as **a demand shock**), global commodity prices (as **a commodity-specific shock**), euro area inflation (as **a supply shock**) and interest rates in the euro area (as **a monetary policy or interest rate shock**). The variable used to capture the external demand shock was the output gap of the euro area based on the European Commission's estimation.

The four-dimensional Bayesian SVAR model with one period lag was estimated using sign restrictions (Appendix, Table 3) according to the statistical method developed by Dieppe et al (2016). These **sign restrictions were needed to avoid infringing the classical economic relationships between demand and supply changes, or between inflation and interest rates**. The results of the estimation – the time series of the external shocks and the impulse responses – can be seen in the Appendix (Graphs 11 and 12).

After we obtained the time series of the external shock variables, we formed different OLS-regression models in the case of the main inflation groups: food, industrial goods, services and fuel. The equation stated with estimated external shocks for domestic inflation of the selected groups:

$$\pi_{i,t} = c + \beta_1 \pi_{i,t-1} + \beta_2 e^D + \beta_3 e^C + \beta_4 e^S + \beta_5 e^R + \beta_6 \gamma_{t-h} + \beta_7 \pi_t^e + \varepsilon_t \quad (2.)$$

where $\pi_{i,t}$ is the quarterly inflation in the i-th group, c is the constant in the case of food, industrial goods and fuel, and the prevailing inflation target of the central bank in the case of services. The external demand, commodity-specific, supply and interest rate shocks are indicated by e^D, e^C, e^S and e^R. The variable γ_{t-h} indicates the cyclical position of Hungary. This is the output gap for the industrial goods, and the consumption gap in the case of food and services. The lag of the gap variable (h) was chosen to maximise the average adjusted R^2 across the regressions. According to the

[5] A similar estimation method was used by Hałka and Kotłowski (2016) on Czech, Polish and Swedish inflation data.

[6] We have chosen this inflation indicator because indirect taxes and regulated prices depend on government decisions, which we cannot explain either as an external or internal variable.

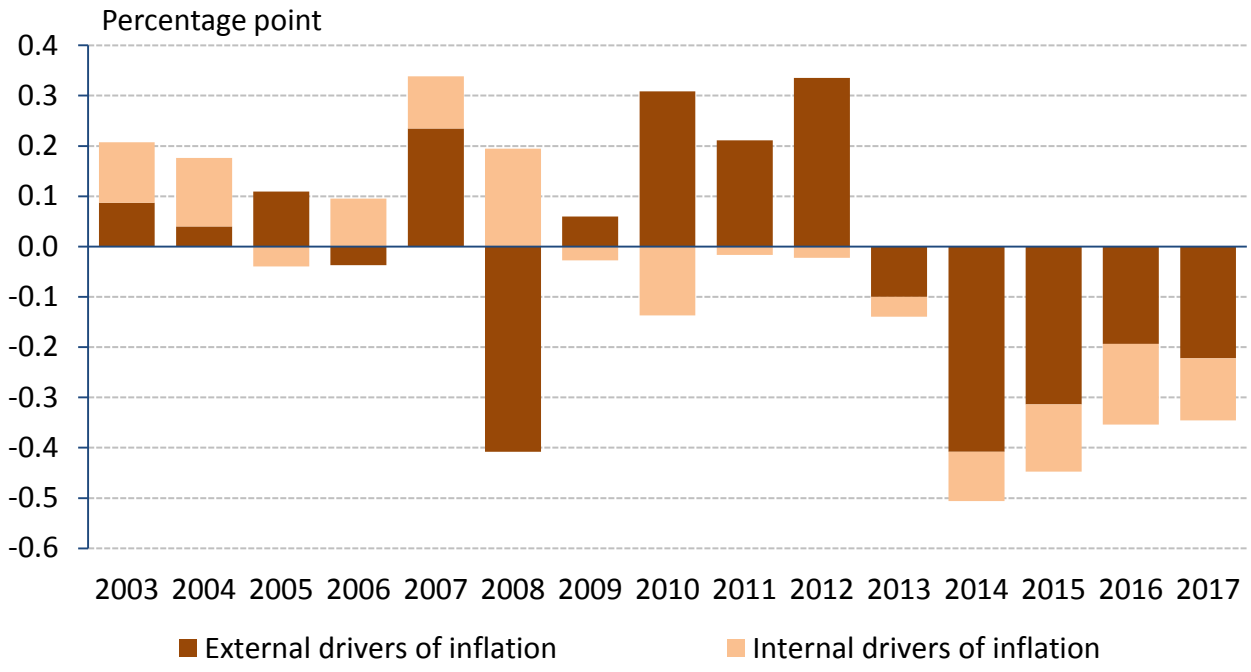
[7] In the case of the output gap and the service sector's expectations.

estimations $h = 3$ was the best choice. In the equation, π_t^e represents Hungarian domestic inflation expectations, or in the case of services the service sector's expectations.

In all of the regressions we used only the significant explanatory variables at 15% significance level. After that we were able to decompose our inflation indicator. Graph 6 shows the decomposition of Hungary's external and domestic inflation drivers.

The decomposition of inflation drivers

Graph 6



Note: The inflation indicator is the quarterly change in inflation excluding regulated prices and the effect of indirect taxes. External drivers are the effects of shocks to external demand, commodity prices, supply and interest rates. Internal drivers include the effects of domestic slack and domestic inflation expectations.

Source: MNB.

In Graph 6, we can see the average effects of external and internal drivers on the average quarterly change of inflation during 2003–17. Over the whole sample, the effect of the external drivers is stronger than the effect of the internal drivers on inflation. The whole sample can be divided into two subsamples: **between 2004 and 2011 the ratio of the effect of both drivers on inflation is nearly equal, but after 2012, the dominance of external drivers is obvious – their weight is more than twice as much as that of the domestic drivers** (Table 1). These results are in line with the literature and the results of our PCA estimation.

Average ratio of the external and internal drivers' effect on inflation (percent) Table 1

	External drivers	Internal drivers
2004–11	59.3	40.7
2012–17	72.6	27.4

Source: MNB.

Augmenting the traditional Phillips curve specification with measures of global slack

The Phillips curve is a standard framework for analysing developments in domestic inflation. The traditional Phillips curve focuses on the empirical relationship between domestic slack and inflation. In recent years, **the flattening of the Phillips curve can be observed worldwide, suggesting that the influence of domestic slack on price developments has fallen**. At the same time, in many countries domestic inflation has become more sensitive to global factors.

Therefore, we examine whether globalisation has increased the sensitivity of domestic inflation to the global output gap. Based on the existing studies we use an **external factors-augmented Phillips curve approach, which employs measures relating to global slack and global inflation**. We therefore study both the domestic and global drivers for Hungarian inflation, and examine whether and how their relative importance has changed over time.

Our empirical analysis is based on quarterly data from Q1 2001 to Q2 2017. In contrast to the above applied methods, **with the use of the external factors-augmented Phillips curve approach, we investigated the underlying inflationary processes**. Therefore, in the estimation we examined core inflation excluding indirect taxes, as total inflation contains many volatile components. The cyclical position of the domestic economy is measured by the consumption or the output gap in all estimated models. As the latter variable is highly correlated with the foreign output gap used in the equations, their joint use in the same regression is not recommended because of the distorting effect of multicollinearity. **A result was obtained using a Phillips curve in which both domestic and global factors are represented by variables related to the cyclical position of the economy and which also contains the inflation expectations of the market services sector**:

$$\pi_t^{core} = \pi_t^{target} + \beta_1 \pi_{t-1}^{core} + \beta_2 \hat{c}_{t-1} + \beta_3 \hat{y}_{t-2}^{eu} + \beta_4 e_{t-2} + \beta_5 \pi_t^{e,corp} + u_t \quad (3.)$$

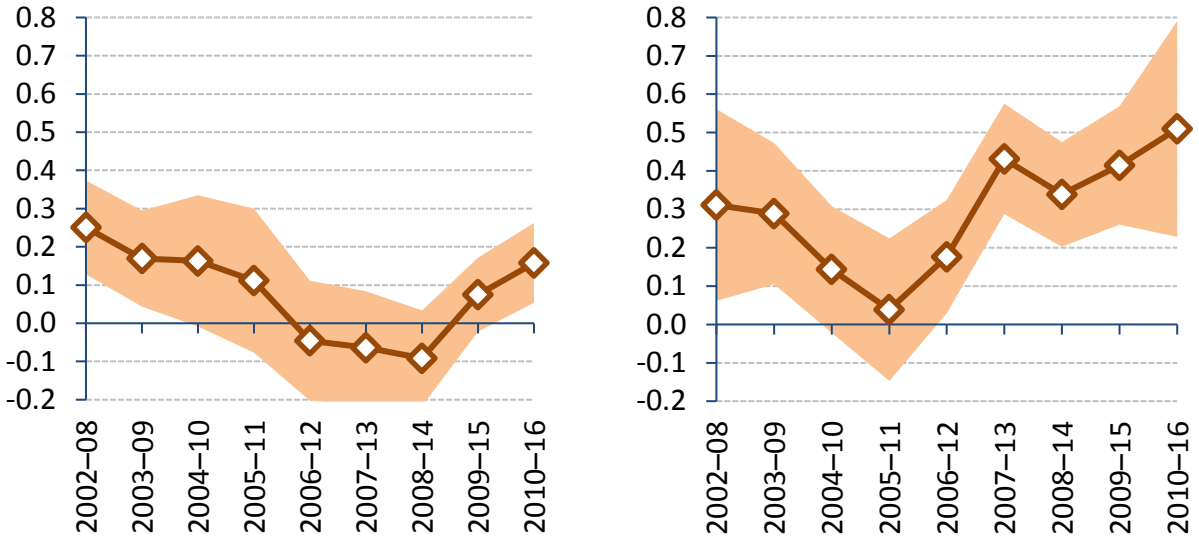
where π_t^{core} is the annualised quarter-on-quarter change in the core inflation excluding indirect tax effects. Variables π^{target}, $\hat{y}^{eu}$ and $\hat{c}$ are the prevailing inflation target, the output gap of the European Union and the domestic consumption gap respectively, all expressed in levels. In the equation, e indicates the quarterly change in the EURHUF nominal exchange rate, and $\pi^{e,corp}$ indicates the inflation expectations

of the market services sector, capturing the forward-looking nature of our Phillips curve specification.

The strengthening role of external factors is confirmed by a rolling window estimation of the Phillips curve (Graph 7). The coefficient of the domestic consumption gap is not significant in most of the cases, suggesting that country-specific effects are losing their importance in core inflation processes. This is in line with the flattening of the Phillips curve estimated using Hungarian data for the period following the crisis. **For the whole sample, the coefficient of the EU output gap – capturing global effects – is significantly stronger than the coefficient of the domestic consumption gap, ie domestic inflation is more sensitive to global factors. Based on the estimation, if the output gap of the European Union increases by 1 percentage point, core inflation without tax effects increases by 0.1–0.2 percentage points** (Appendix, Table 4). In order to check the robustness of the results, further specifications were estimated, which resulted in similar coefficients concerning the role of external factors (Appendix, Table 5).

Rolling window estimation – changes in the coefficients of the domestic consumption gap (left panel) and the EU output gap (right-hand panel) estimated for domestic core inflation

Graph 7



Note: The seven-year rolling window regression was estimated on annualised quarterly data. The uncertainty of the estimation indicates one unit of standard deviation.

Sources: European Commission, Eurostat, HCSO, MNB.

Besides OLS estimations the above-specified **Phillips curve was also estimated with the generalised method of moments** (Hansen (1982)), in order to address the risk of endogeneity of some explanatory variables.[8] We consider four lags

[8] Similar estimations were made by Mikolajun and Lodge (2016) for 19 advanced economies, but they found little support for the existence of direct effects of global economic slack on domestic inflation.

of the domestic consumption gap and the EU output gap, three lags of Hungarian inflation expectations and one lag of the EURHUF exchange rate and the core inflation as instruments in the GMM. The lag order is selected based on two information criteria,[9] allowing for a maximum lag of four quarters. Heteroskedasticity and Autocorrelation Consistent (HAC) estimates were used with a Bartlett kernel and an automatic Newey–West bandwidth selection. **The sensitivity of the domestic inflation to global factors is also confirmed by the GMM estimation. The coefficient of the EU output gap is significant and higher than the coefficient of the domestic consumption gap on the whole sample** (Appendix, Table 6).

Conclusion

Inflation rates have been declining at the global level since 2013. As a result of rising commodity prices at end-2016 and in early 2017, inflation rates have moved away from close-to-zero levels, but they have still tended to fall short of central bank targets. Economic performance has varied from region to region after the crisis, which is also corroborated by the significantly different levels of unemployment in the EU. However, despite the different phase of the labour market cycle, no divergence could be detected in inflation dynamics. Indeed, inflation rates have tended to remain at generally low levels in recent years.

The strengthening correlation between inflation rates may be explained by globalisation and integration into global production processes (the role of global value chains), which may have amplified the impact of international business cycles on inflation. **Correlation among the price indices of the EU countries has increased considerably in recent years**. In the case of Hungary, these are important findings, because the European Union represents the effective global environment, as approximately 80% of Hungary's foreign trade is with the EU. Since Hungary became extremely open in the last two decades, we examined the impact of external and domestic drivers of the Hungarian inflation, and we analysed how these external factors varied in time and how their effect on the domestic inflation has changed.

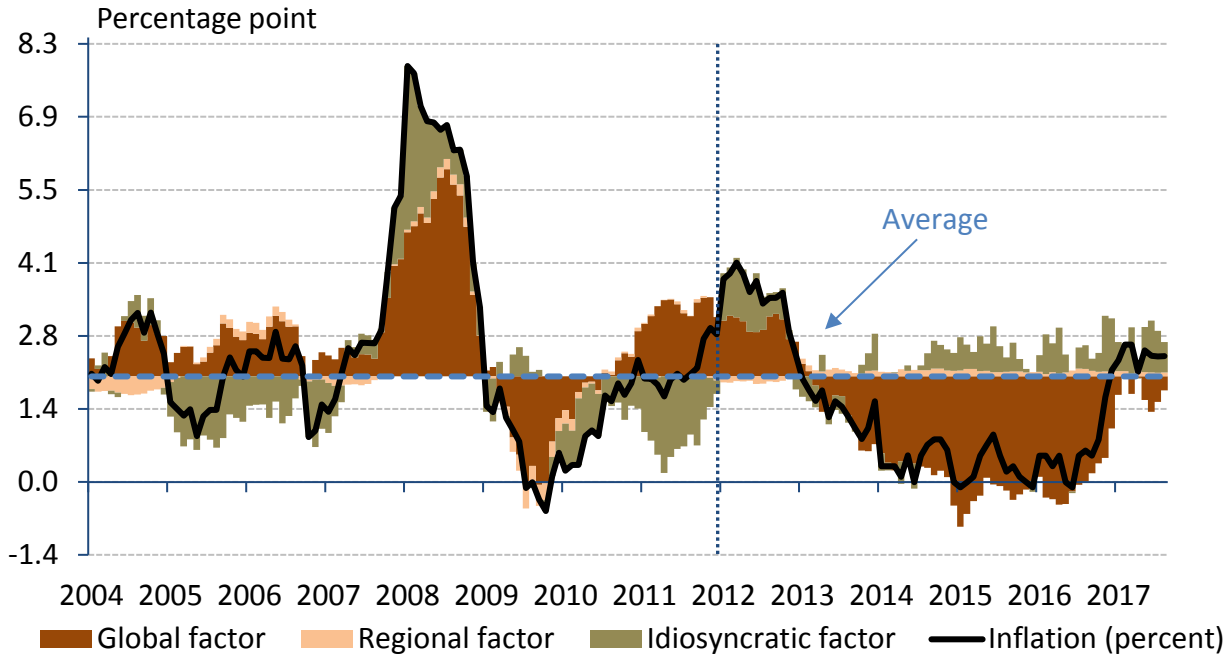
On the whole, based on the results of the principal component analysis and the two-step SVAR approach, **the role of external factors in domestic inflation developments has recently strengthened, and after 2012, the changes in inflation in Hungary have been influenced mainly by global effects**. The growing role of external factors is also confirmed by the changes in the coefficients of the external factors-augmented Phillips curve estimation. This is in line with the flattening of the Phillips curve estimated using Hungarian data for the period following the crisis. For the whole sample, the **coefficient belonging to the output gap of the European Union capturing global effects is significantly stronger than the coefficient of the domestic consumption gap, ie domestic inflation is more sensitive to global factors.**

[9] Schwarz's information criterion and the Hannan–Quinn information criterion.

Appendix

Decomposition of Czech inflation according to global, regional and idiosyncratic factors

Graph 8

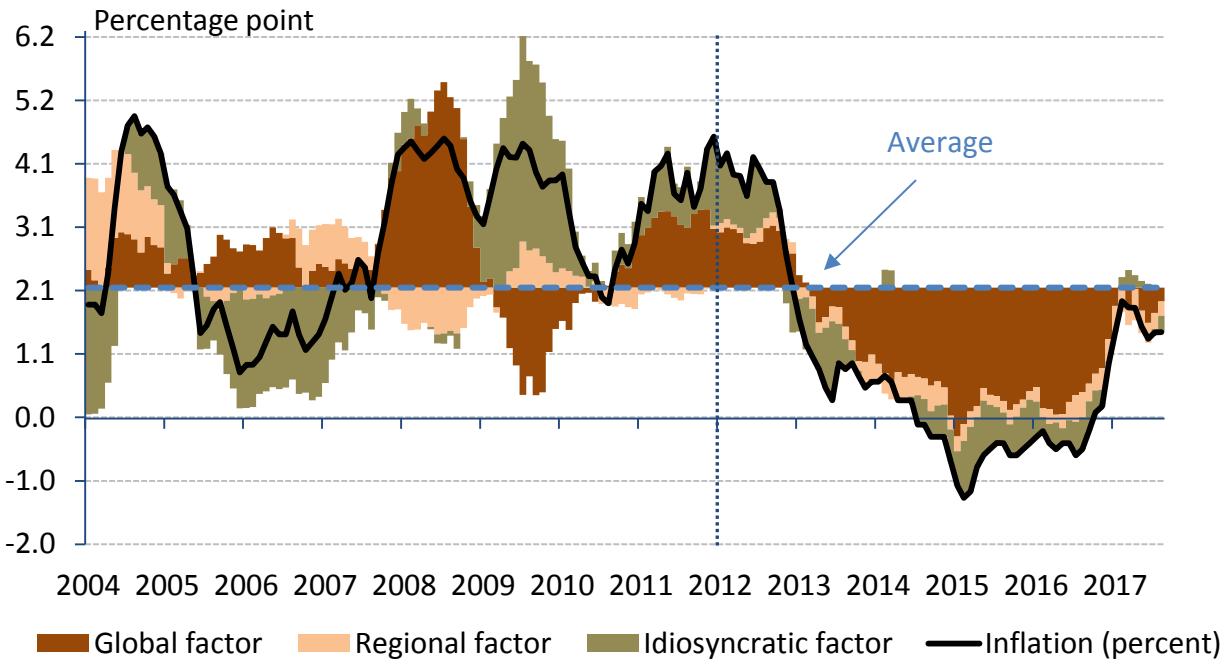


Note: Annual change. The factors explain the deviation of actual inflation (HICP) from its average between 2004–17.

Sources: Eurostat, MNB.

Decomposition of Polish inflation according to global, regional and idiosyncratic factors

Graph 9

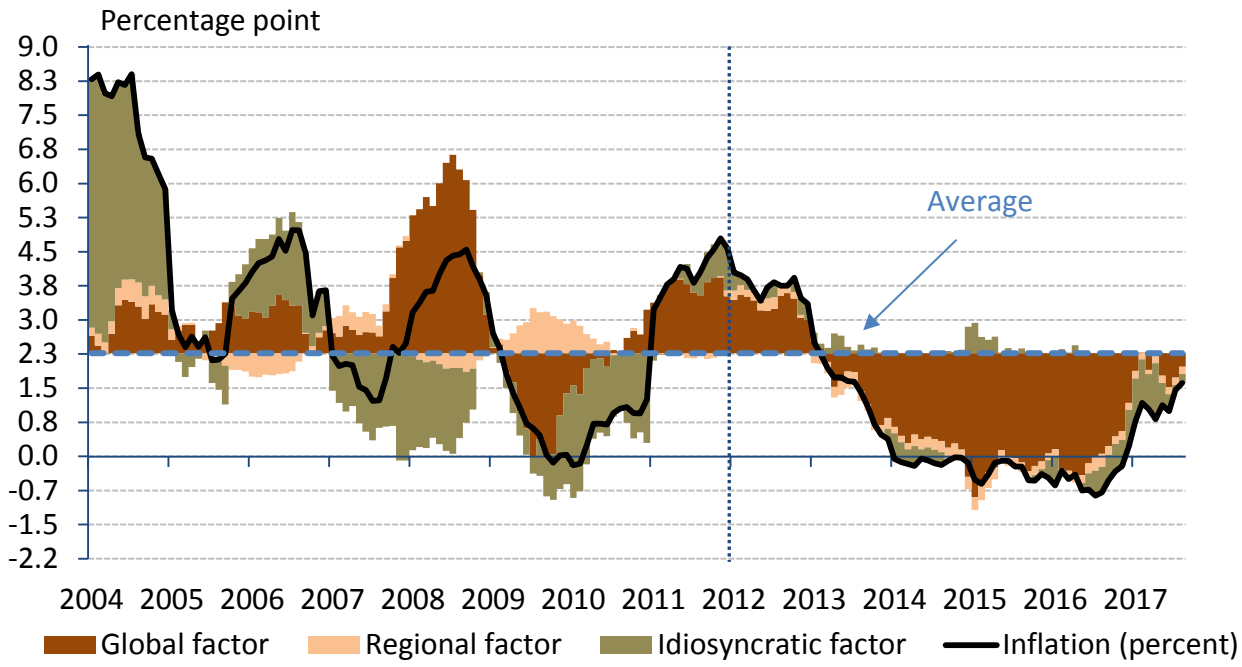


Note: Annual change. The factors explain the deviation of actual inflation (HICP) from its average between 2004–17.

Sources: Eurostat, MNB.

Decomposition of Slovak inflation according to global, regional and idiosyncratic factors

Graph 10



Note: Annual change. The factors explain the deviation of actual inflation (HICP) from its average between 2004–17.

Sources: Eurostat, MNB.

Variance decomposition in the estimation period (2004–17, percent)

Table 2

	Global factor	Regional factor	Idiosyncratic factor
Hungary	51	10	39
Czech Republic	76	1	23
Poland	52	7	41
Slovakia	53	2	45

Source: MNB.

Sign restrictions used in the SVAR estimation

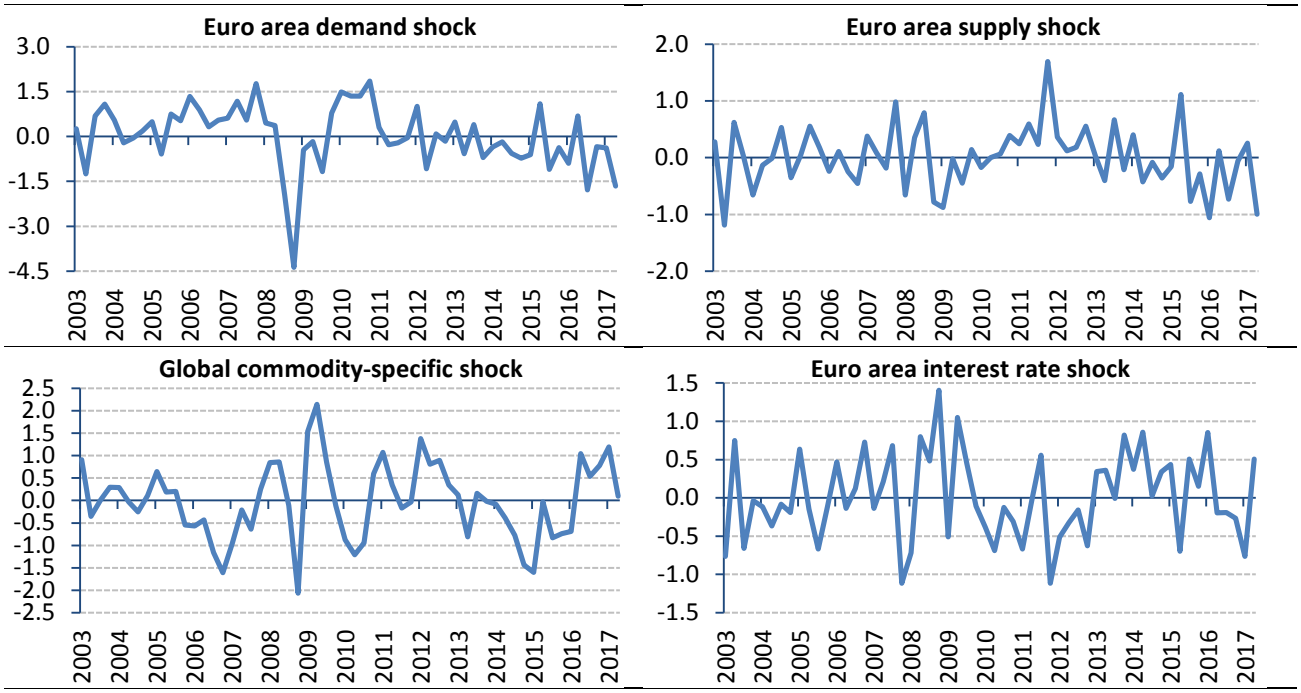
Table 3

Variable	Euro area output gap	Global commodity price index	Euro area HICP	Euro area interest rates
Euro area output gap	+	-	-	-
Global commodity price index		+		
Euro area HICP	+	+	+	-
Euro area interest rates			+	+

Source: MNB.

Shocks of the SVAR estimation

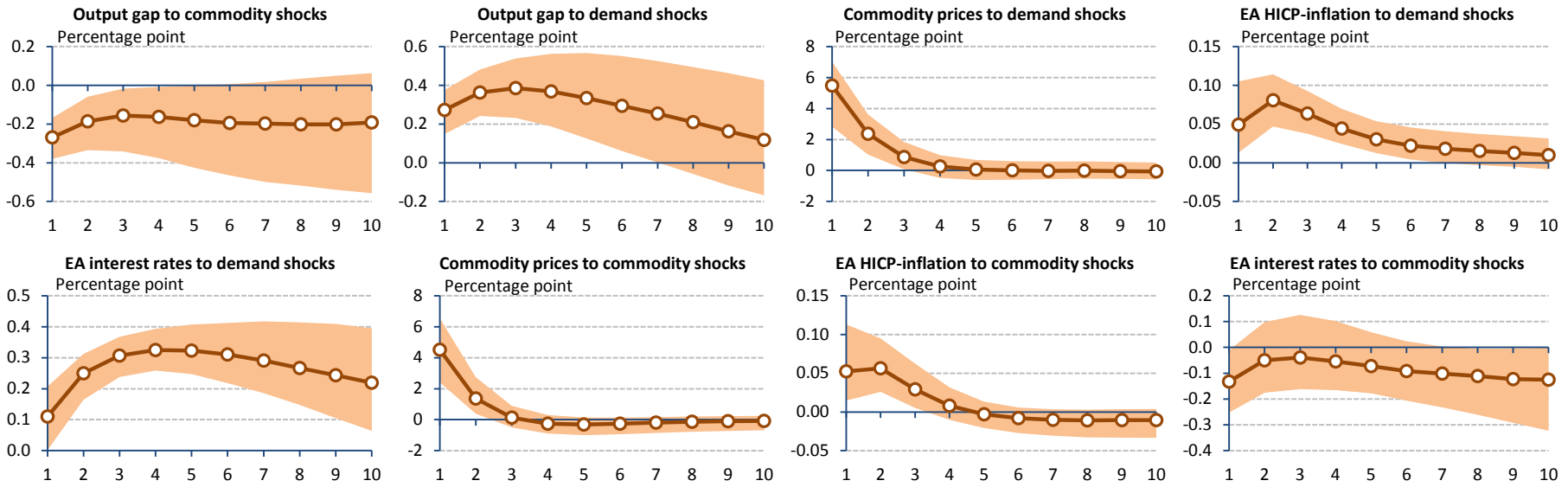
Graph 11



Source: MNB.

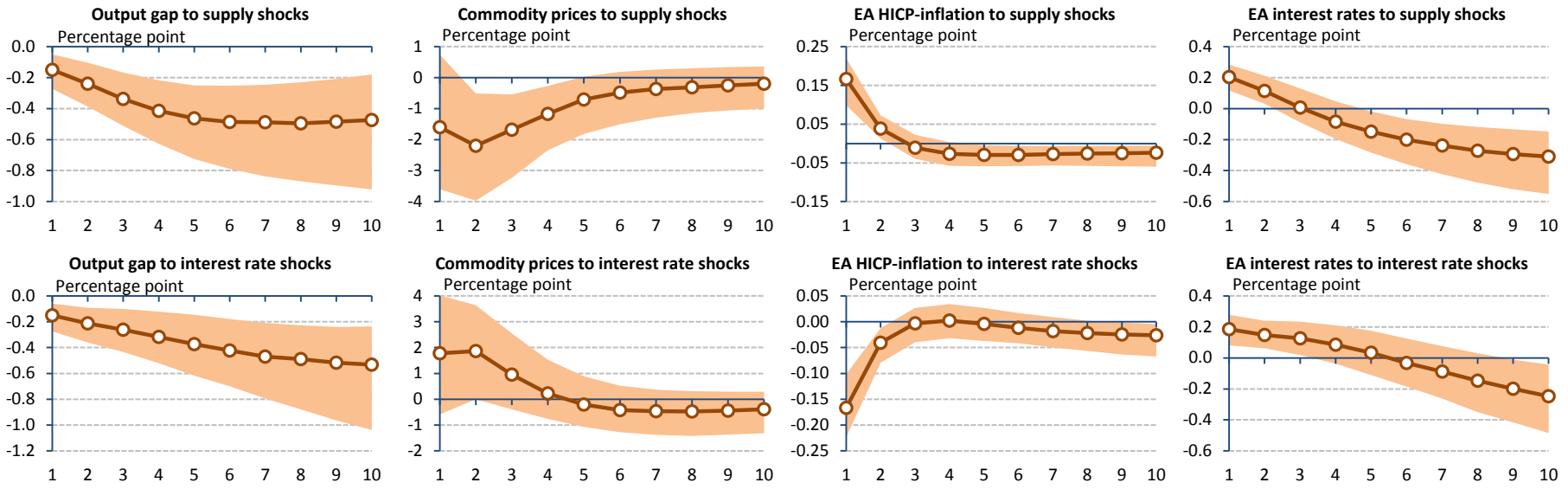
Impulse responses of euro area variables to external shocks

Graph 12



Impulse responses of euro area variables to external shocks (con't)

Graph 12



The specification of our baseline Phillips curve estimation

Table 4

Explanatory variables	Coefficient	Std. Error
Inflation target	0.43***	0.11
Core inflation excluding indirect taxes (–1)	0.36***	0.12
Consumption gap (-1)	**0.09***	**0.06**
Output gap of the European union (–2)	**0.15***	**0.10**
HUF/EUR exchange rate (–2)	0.02*	0.01
Inflation expectations	0.04*	0.02
R2	**0.62**	
Akaike information criterion	**2.89**	
Schwarz information criterion	**3.11**	

Note: Number of lags in parenthesis after the names of the explanatory variables. *, ** and *** denote statistical significance at 15%, 5% and 1% levels.

Sources: European Commission, Eurostat, HCSO, MNB.

The specification of our alternative Phillips curve estimations

Table 5

	Model 1	Model 2	Model 3	Model 4
Inflation target	0.09 (0.10)	0.35 (0.09)***	0.10 (0.09)	0.26 (0.10)**
Core inflation excluding indirect taxes (-1)	0.49 (0.10)***	0.56 (0.11)***	0.37 (0.11)***	0.21 (0.13)*
Consumption gap (–1)		0.08 (0.06)		
Consumption gap (–2)				0.11 (0.06)*
Consumption gap (–3)			0.06 (0.05)	
Domestic output gap (–3)	0.08 (0.07)			
Core inflation of the EU	0.85 (0.23)***		0.81 (0.21)***	
Core inflation of the EU (–1)				0.65 (0.28)**
Output gap of the EU (–2)		0.16 (0.08)*		
EURHUF exchange rate (–1)	0.03 (0.01)***	0.03 (0.01)***	0.03 (0.01)***	
EURHUF exchange rate (–2)				0.02 (0.01)**
Inflation expectations			0.04 (0.02)***	0.05 (0.02)***
R2	0.70	0.67	0.73	0.65
Akaike information criterion	2.63	2.76	2.55	2.81
Schwarz information criterion	2.80	2.93	2.76	3.03

Note: Number of lags in parenthesis after the names of the explanatory variables. *, ** and *** denote statistical significance at 15%, 5% and 1% levels.

Source: European Commission, Eurostat, HCSO, MNB

GMM estimates of the Phillips curve

Table 6

Explanatory variables	Coefficient	Std. Error
Intercept	2.12***	0.24
Consumption gap (–1)	0.18***	0.05
Output gap of the European Union (–2)	0.22**	0.1
Inflation expectations	0.06***	0.02
EURHUF exchange rate (–2)	0.04***	0.01
P-value of the J-test	0,86	
R-squared	0,59	
Number of observations	55	

Note: Dependent variable is core inflation excluding indirect tax effects. GMM estimation. Instruments include four lags of the domestic consumption gap and the EU output gap, three lags of the Hungarian inflation expectations, one lag of EURHUF exchange rate, and one lag of the core inflation. *, ** and *** denote statistical significance at 15%, 5% and 1% levels.

Sources: European Commission, Eurostat, HCSO, MNB.

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