Global or domestic? Which shocks drive inflation in European small open economies?*

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Abstract

In the paper we investigate, which shocks drive inflation in small open economies. We proceed in two steps. First, we use the SVAR approach to identify the global shocks. In the second step we regress the disaggregated price indices for selected European economies - the Czech Republic, Poland and Sweden - on the global shocks controlling for the domestic variables. Our results show that in two out of three analyzed countries the fluctuations of inflation are to the largest extent determined by the cyclical movements of the domestic output gap with the commodity shock being also the important source of inflation variability while for the third country the contribution of the commodity shock dominates over the output gap in explaining inflation variability. We find that the direct impact of the global demand shock on the price dynamics is negligible, while it affects the country's inflation mainly through the domestic output gap. The role of the non-commodity global supply shock is less prominent, however, this shock, interpreted to some extent as a globalization shock, for most of the analyzed period lowers the prices of semi-durable and durable goods and therefore the inflation. Nonetheless, in the aftermath of the global financial crisis, this shock reversed what may be interpreted as a weakening of the globalization process.

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1 Introduction

The experience of the last decades reveals the growing role of the global factors in determining the inflation in many small open economies. This phenomenon may be attributed to the ongoing integration of the world economy, accompanied by the liberalization of international trade and capital flows. For a long time this process was disinflationary. The shifting of the production to low-cost production countries moderates prices of tradable - both final and intermediate - goods. Lower prices of imported goods decrease the production costs but also put pressure on the domestic producers through competition to lower its mark-up or increase productivity. It also leads to the removal of firms with higher production costs from the market. Moreover, when facing competition from abroad, domestic producers are more reluctant to increase the wages what contributed to the declining share of wages in GDP. All in all, the globalization process led to a substantial decline of inflation in many developed and emerging economies in the 1990s and the first half of the 2000s – the process called by Rogoff (2003) the "global disinflation". As pointed out by Borio and Filardo (2007), the intensification of the globalization process results in the weakening of the traditional relationship, rooted in the Phillips curve framework, between the measures of domestic slack and inflation in several advanced and emerging economies. They emphasize the shift in the determinants of inflation from country-specific towards global ones and argue for the flattening of the country-specific Phillips curves. This flattening materializes due to the more prominent role of the global excess demand and the global output gap in affecting domestic inflation via the trade and financial channel.

The second source of the global shocks, to some extent related to globalization process, which influenced strongly the inflation in both developed and emerging economies during last years, can be attributed to the commodity markets. The rapid growth of energy and non-energy commodity prices observed since the beginning of 2000-ies and lasting until the onset of global financial crises (with another peak in 2011) heightened the inflation all over the world. Since 2011 the structural changes on the energy market related to the exploration of unconventional sources of natural gas and oil accompanied by weaker demand for energy commodities led to the substantial drop of energy prices pushing the inflation down in many economies. All in all during the last decades inflation started to be a global phenomenon and role of the global shocks in affecting inflation in various economies increased substantially.

In our paper we investigate to what extent inflation in small open economies is driven by global demand and supply shocks and to what extent it is determined by domestic factors. We focus on European economies remaining outside the euro area but tightly integrated with this area via the trade and financial channel and due to their involvement in global value chains strongly affected by the globalization process. The most of research related to the propagation of global shocks into the small open economies deal with the aggregated data. Our analysis aims to provide the results from disaggregated data. We propose a two-step approach. In the first step we form a small SVAR model, which contains three global variables: the volume of world import, the real commodity prices and consumer inflation. Then by imposing the recursive restrictions we extract three structural shocks. They are interpreted as global demand shock, commodity-specific shock and

non-commodity supply shock, which to some extent may be associated with the globalization process. In the second step we regress the disaggregated price indices for selected EU economies (the Czech Republic, Poland and Sweden) on the global shocks identified in the previous step, controlling for the domestic output gap and the exchange rate. This approach allows us to select at a relatively high level of disaggregation these groups of goods and services, which prices react the most to the global shocks in particular to non-commodity supply shock. This latter shock contributed to a large extent in maintaining low inflation in several small open economies in the 1990s and in the first half of the 2000s, as argued by Borio and Filardo (2007) and Rogoff (2003).

Our main finding is that nowadays the low inflation in the examined countries results not only from the positive shocks to commodity prices, but also from the weak demand pressure both domestic and abroad, however, this outcome is more evident for the Czech Republic and Poland than for Sweden. We also find that for two out of three examined countries, the domestic output gap remains the main source of inflation fluctuations despite of their relative high openness. Furthermore, we confirm that the exchange rate channel is also effective in shaping inflation, however, its strength differs across the countries. Finally we recognize that the non-commodity supply shock, which contributed to low inflation over the long term, reversed after the global financial crisis which may be interpreted as a sign of the weakening of the globalization process.

The remaining structure of the paper is as follows. Section 2 reviews the relevant literature. In Section 3 we describe the method and data we use. In Section 4 we present the empirical results while Section 5 concludes.

2 Literature review

The impact of globalization on the inflation development gained a lot of attention in the middle of 2000-ies. Several authors raise the issue of flattening of the Phillips curve, which relates the inflation to various measures of the domestic slack (Kohn, 2006, Pain et al., 2006 , IMF, 2006, Borio and Filardo, 2007, White, 2008). In this stream of literature Borio and Filardo (2007) evidence the role of the global output gap in determining inflation in various developed economies. They also advocate for the declining influence of the nominal exchange rate fluctuations on the inflation process.

While Borio and Filardo (2007) in their theoretical considerations emphasize the increasing relevance of both global demand and supply factors stemming from the globalization process, they do not fully differentiate between both shocks in the empirical analysis. Several other authors investigate the impact of globalization on domestic prices as well. Pain et al. (2006) find that for the group of OECD countries since the middle of the 1990s the importance of import prices in muting consumer inflation has increased. They also point out that globalization lowers inflation but in the longer run it may also lead to an increase in commodity prices and further inflation, because countries with low cost of production are usually more commodity-intensive. They conclude, however, that the drop of manufacturing and tradable prices dominates over the opposite effect stemming from the upward pressure on commodity prices. Wynne and Kersting (2007), investigating the link between globalization and inflation, find a negative correlation between open-

ness and long-term inflation across the analyzed countries. They also conclude that the foreign output gap matters for inflation in the US economy. Martinez-Garcia and Wynne (2010) show that bilateral agreements lead to the increasing influence of import prices on domestic inflation. The more open the country, the flatter the Phillips curve. However, they emphasize the role of potential nonlinearities. The slope of the curve may be time varying depending on the speed of the process of opening up the country. Such nonlinearities may explain why it is difficult to obtain a significant correlation between the slope of the Phillips curve and the degree of the country's openness. On the contrary, for the sample of 11 industrial countries, Ihrig et al. (2010) do not find any support for the hypothesis about the significant role of the foreign output gap in determining domestic inflation.

The role of common global shocks in determining inflation in various developed economies is investigated by Ciccarelli and Mojon (2010), who find that nearly 70% of inflation variability in OECD countries is driven by one common global factor. However, the authors do not analyze the sources of this inflation commonality in more detail and conclude that it is not clear whether it is a common global factor or whether domestic monetary policy in the OECD countries has become similar and synchronized. Additionally, Hakkio (2009) who examines various inflation measures for the OECD countries states that "the commonality of (...) inflation rates reflects the commonality of the determinants of inflation". In contrast, in his analysis of the price dispersion in the EU economies, Rogers (2007) attributes the price convergence in the euro area countries to harmonization of VAT rates and a decline in income dispersion rather than to increased trade flows.

It is worth noting that globalization affects inflation in small open economies not only via trade and competitiveness channels. One should also account for an indirect impact of globalization on the inflation process via global financial and monetary policy spillovers affecting the overall macroeconomic conditions and consequently, inflation in small open economies. Several authors emphasize the role of financial markets integration in the propagation of monetary policy shocks from the major central banks to other countries. Kamin (2010) argues that the central banks in countries with floating exchange rate regimes may to some extent realize an independent interest rate policy, but the financial conditions in those countries due to the aforementioned spillovers are vulnerable to external shocks, making the conducting of appropriate monetary policy more difficult. There is a broad stream of literature dealing with the propagation of monetary policy shocks from one economy (usually the US or the euro area) to other economies, including both advanced and emerging countries. Eichenbaum and Evans (1993) focus on the impact of US monetary policy shocks to the nominal and real US exchange rate against several other currencies, Grilli and Roubini (1995) investigate the liquidity transmission channel, while Kim (2001) analyzes the effect of US monetary policy shocks on foreign long-term yields. In the research related to the globalization of the financial markets, Ehrmann and Fratzscher (2009) find that Federal Reserve announcements influence stock prices in foreign countries and the strength of reaction depends on the level of the financial market's openness.

When analyzing the impact of the global shocks on inflation one needs to account for commodity markets shocks, with the prominent role of the oil market. According to Hamilton (2008), nine out of ten recessions

were preceded by soaring oil prices. Moreover, as pointed out by Kilian (2008) the nature of changes of oil prices is different than of other goods due to three reasons. Firstly, energy price increases are often abrupt and materialize at times which are not typical for other goods and services prices. Secondly, usually those increases affect the domestic and global economy more than rises in other components of inflation as the demand for energy is relatively sticky. Thirdly, oil prices' fluctuations are often for external reasons (e.g. political tensions in the Middle East). Kilian (2009) and Peersman and Robays (2009) analyze the impact of oil shocks on large developed economies and show that the responses of the US and the euro area economies to oil price shocks depend on the source of the oil shock. However, in comparison to the US economy, in the euro area inflation reacts more to second round effects, i.e. through wage increases (partially due to the automatic indexation mechanism in several member countries). Peersman and Robays (2009) find that in the US the pass-through of the oil price surge on inflation is more direct – through increasing prices of energy and rising production costs. Furthermore, Jääskelä and Smith (2013) as well as Charnavoki and Dolado (2014) analyze the impact of the shocks to commodity prices on countries, which unlike the US and the euro area, are perceived to be small open economies (Australia and Canada) and find that the commodity shock accounts for a large share of inflation variability in these economies[1].

The broad strand of literature investigates the direct and indirect effect of global demand and supply shocks on inflation in small open economies using the SVAR and FAVAR methodology. Aastveit et al. (2011) examine the influence of global and regional factors on inflation and other key macroeconomic variables for selected advanced economies (Canada, New Zealand, Norway and the UK) using the FAVAR model. They find that world shocks dominate the variability of inflation and account for 50-80% of its variance[2]. Maćkowiak (2007) analyzes, using structural VAR, the importance of external shocks for emerging market economies. He finds that external shocks play important role in the fluctuations of the main macroeconomic variables in several emerging economies (Chile, Hong Kong, Korea, Malaysia, Mexico, Philippines, Singapore and Thailand). According to these estimates nearly 50% of the variation in the price level can be explained by external shocks.

Globan et al. (2015) in the research on the non-eurozone new EU member states inflation, divide inflation determinants into domestic and global ones. The results, in general, indicate that the short-run inflation dynamic is mainly explained by the domestic factors whereas in the medium-run foreign shocks become a major drivers of inflation in these countries. Additionally they argue that the more import-oriented country is the more relevant role of the foreign shocks for inflation. Also Vašicek (2011), analyzing inflation in four central European countries (the Czech Republic, Hungary, Poland and Slovakia) using New Keynesian Phillips curve, argues that inflation in these countries seems to be driven mostly by the external factors.

[1]It is worth noting that there are in general two opposing views as to whether globalization of the financial markets and financialisation led to the rise of the commodities prices and its higher volatility. On the one hand some authors show that there is a growing correlation between commodity price returns and stock market returns (Lombardi, 2013). Such a correlation reflects the higher sensitivity of commodity prices to the sentiment and risk aversion of global financial investors than to the fundamentals. The second strand of the literature argues that there are no convincing proofs that the higher activity of the financial institutions led to higher volatility of commodity prices. Sanders and Irwin (2010) document that increased participation of the investment funds on the agricultural markets did not lead to the increase of price volatility.

[2]Kaufmann and Lein (2013) argue that for the disaggregated price indices the share of their variance explained by common macroeconomic shocks may be lower than for aggregated inflation.

As pointed out by Brada and Kutan (2002) the declining import prices contributed to large extent in the disinflation process in CEE countries in 1990-ies.

In the research on the propagation of global shocks in the small open economy the common approach is to form a two-block SVAR or FAVAR model (see Boivin and Giannoni, 2007, Maćkowiak, 2007, Jääskelä and Smith, 2013, Aastveit et al., 2011, Charnavoki and Dolado, 2014 or Globan et al., 2015), where the first block consists of global variables, while the second block captures the domestic ones. The variables in the foreign block are assumed to be exogenous in respect to the domestic block. The economic interpretation is assigned to the global shocks usually by imposing the recursive or sign restrictions on the impulse response functions within the global block in the model. The pattern of the remaining unrestricted impulse responses is used to conclude about the relationship between global shocks and domestic variables. Importantly, the globalization shock is usually associated with the non-commodity global supply shock, which increases the economic activity and lowers inflation of manufactured or tradable goods (see Jääskelä and Smith, 2013, Filardo and Lombardi, 2014).

In our paper we use an alternative two-step approach, which allows us to investigate the inflation in the analyzed countries at higher level of disaggregation. In the first step we extract the global shocks from the small SVAR model. In the second step we regress the disaggregated prices indices for selected small open economies on the global shocks controlling for some domestic variables. In the next section we describe this method in more details.

3 Data and model

3.1 SVAR model

Initially we specify a three-dimensional VAR model with a set of global variables, which we use to identify the global shocks contributing to inflation variability in selected small open economies. Following the literature, we form a model with the variables reflecting the level of global economic activity, real commodity prices and global inflation. More specifically, we choose the following variables: (1) the growth of global import (*world imp*), which corresponds to both the level of economic activity and the globalization process reflected in the shifting of output to countries with low production costs, (2) the index of commodity prices in the real terms (*cp*) and (3) the global CPI inflation (*inf*). We apply the recursive identification scheme as suggested by Charnavoki and Dolado (2014) and impose the zero restrictions on the contemporaneous impact matrix. In the recursive identification, the global import is ordered first followed by real commodity prices and global inflation. The scheme of the recursive identification has been presented in Table 1. We interpret the first shock as a global demand shock (GD), the second shock as a commodity-specific shock (GC), which reflects the unanticipated changes in the supply of energy and non-energy commodities and the third one as a global non-commodity supply shock (GS). According to the proposed ordering, the global economic activity (reflected by global import) reacts to commodity-specific (GC) shock and non-commodity supply (GS) shock

with a lag. Moreover, the non-commodity supply (GS) shock does not have a contemporaneous effect on the real commodity prices. Formally the three-dimensional SVAR model can be written in the following form:

$$A_0 y_t = u + \sum_{i=1}^{p} A_i y_{t-i} + e_t, \tag{1}$$

where $y_t = \left[\begin{array}{ccc} world\,imp_t & cp_t & inf_t \end{array} \right]'$ is a vector of endogenous variables, while e_t represents a three-dimensional vector of uncorrelated structural shocks. The reduced-form VAR can be expressed as:

$$y_t = A_0^{-1} u + \sum_{i=1}^{p} \Phi_i y_{t-i} + \varepsilon_t, \tag{2}$$

where $\Phi_i = A_0^{-1} A_i$, $\varepsilon_t = B e_t$ and $B = A_0^{-1}$, while ε_t is a vector of reduced-form error terms. We identify the structural shocks by imposing zero restrictions on the matrix B. We assume that the matrix B is a lower diagonal matrix such as $\Sigma = E(\varepsilon_t \varepsilon_t') = BB'$, where Σ is a covariance matrix of reduced-form error terms ε_t. The proposed restrictions can be expressed as follows:

$$\left[\begin{array}{c} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{array} \right] = \left[\begin{array}{ccc} b_{11} & 0 & 0 \\ b_{21} & b_{22} & 0 \\ b_{31} & b_{32} & b_{33} \end{array} \right] \left[\begin{array}{c} e_t^D \\ e_t^C \\ e_t^S \end{array} \right] \tag{3}$$

We interpret the innovations e_t^D, e_t^C, e_t^S as demand, commodity-specific and non-commodity supply shocks respectively.

3.2 Country by country regressions

In the second step we regress the disaggregated price indices for the analyzed economies (the Czech Republic, Poland and Sweden) on the global shocks identified in the previous step, controlling for domestic output gap and exchange rate. We formulate separate models for individual price indices and for all examined countries, where inflation in subsequent categories of goods and services depends on its own lag, the contemporaneous values of the global shocks, the economy-wide domestic output gap[3] and the real effective exchange rate. Accordingly the individual equation for price category i for country k takes the form:

$$\pi_{i,t}^{(k)} = \alpha_{0,i}^{(k)} + \alpha_{1,i}^{(k)} \pi_{i,t-1}^{(k)} + \beta_{1,i}^{(k)} e_t^D + \beta_{2,i}^{(k)} e_t^C + \beta_{3,i}^{(k)} e_t^S + \gamma_{1,i}^{(k)} \bar{y}_{t-h}^{(k)} + \gamma_{2,i}^{(k)} reer_{t-1}^{(k)} + \xi_{i,t}^{(k)} \tag{4}$$

[3]According to microfoundations of the NKPC a price set by an individual firm depends on its marginal cost, which after aggregation allows to rewrite the overall inflation as a function of marginal cost for the whole economy, which is usually approximated by an economy-wide output gap (Gali and Gertler, 1999). Therefore, from a theoretical point of view when investigating the reaction of the disaggregated price indices to changes in domestic economic activity, it would be more convenient to relate the price indices to disaggregated output gaps corresponding to categories of goods and services covered by these indices. However, the structure of the CPI basket is specified on the basis of households' budgets survey and the prices in the CPI are calculated using the individual quotations of particular services and goods in retail trade. On the other hand, the economy-wide output gap is usually measured using GDP, industrial production or some labour market variables, which after disaggregation do not match with the structure and methodology of the CPI basket. For that reason we decided to relate the individual price indices to an economy-wide output gap.

where $\pi_{i,t}^{(k)}$ is a quarterly inflation in i-th category of goods and services for country k, $\bar{y}_t^{(k)}$ stands for domestic economy-wide output gap for country k, $reer_t^{(k)}$ is a real effective exchange rate while e_t^D, e_t^C, e_t^S are global shocks defined in Section 3.1. Due to the relatively short sample, we specify the model to be rather parsimonious in terms of regressors' lags. We find one lag of inflation sufficient to account for the inflation inertia and autocorrelation. As far as the output gap is concerned, we decide to include into the individual regressions only one lag of this variable – the same for all price indices for the subsequent countries. The lag for the output gap is chosen to maximize the average adjusted R2 across the disaggregated regressions. We find the appropriate lag equal to three for Sweden and one for the Czech Republic and Poland which for the latter stays in line with the results for the aggregated Phillips curve (see for example Przystupa and Wróbel, 2009). The lag for the exchange rate is set to one for all price indices and for all countries, which fit the empirical data to the largest extent. In the regressions we take into account only the contemporaneous values of the global shocks. We estimate the parameters of equation (4) with the LS using Newey-West correction to make the results robust to potential autocorrelation and heteroscedasticity[4]. We classify the categories of goods and services as price sensitive to respective exogenous variables (the global shocks, domestic output gap and exchange rate) if the variable was statistically significant in the regression at 15% significance level.

We use these results to decompose the overall inflation variability in respect to the influence of the subsequent shocks. Therefore we aggregate the respective components on the right-hand side of equation (4) for the disaggregated price indices. The global demand component of inflation in country k in period t can be calculated as: $GD_t^{(k)} = \sum_{i=1}^{n} w_{i,t}^{(k)} \beta_{1,i}^{(k)} e_t^D$, where $w_{i,t}^{(k)}$ are the weights of subsequent price indices in the CPI basket for country k and time t (the weights are changing over time). The other components of inflation variability are derived as: global commodity-specific component: $GC_t^{(k)} = \sum w_{i,t}^{(k)} \beta_{2,i}^{(k)} e_t^C$, global non-commodity supply component: $GS_t^{(k)} = \sum_{i=1}^{n} w_{i,t}^{(k)} \beta_{3,i}^{(k)} e_t^S$, domestic output gap component: $Gap_t^{(k)} = \sum_{i=1}^{n} w_{i,t}^{(k)} \gamma_{1,i}^{(k)} \bar{y}_{t-h}^{(k)}$ and exchange rate component: $ExRate_t^{(k)} = \sum_{i=1}^{n} w_{i,t}^{(k)} \gamma_{2,i}^{(k)} reer_t^{(k)}$. However, one should keep in mind that while the global shocks are orthogonal to each other, they may be correlated to the domestic output gap and exchange rate.

3.3 Data

The data we use in the decomposition of the global shocks within the SVAR framework come from the OECD and IMF databases. The growth of global import is calculated as changes in volume of world import in goods and services, which include both import from the developed and emerging markets and relies on the OECD estimates[5]. As a proxy for global inflation we use quarterly seasonally adjusted [6] inflation in OECD countries published by the OECD. The last global variable is a primary commodity price index calculated by the IMF[7]. This index captures market prices of food and beverages, agriculture raw materials, metals and

[4]While we deal with price indices disaggregated to COICOP 3-digit level the potential endogeneity problem that might have implied the use of GMM seems rather unlikely.

[5]http://stats.oecd.org/

[6]All time series, unless otherwise stated, are seasonally adjusted using TRAMO-SEAT procedure implemented in the Demetra+ program.

[7]http://www.imf.org/external/np/res/commod/index.aspx

energy commodities. The weights in the commodity basket reflect the structure of the international trade.

In the disaggregated analysis we use price indices collected from the Eurostat[8] database. The quarterly HICP price indices disaggregated into 3-digits COICOP[9] cover the period 1Q2000 – 2Q2014. For each country we obtain 39 time series, except for Sweden, where disaggregation of communication services is not available therefore we use only 37 indices. All time series are seasonally adjusted. The country specific output gaps are derived with the Hodrick–Prescott (HP) filter. The GDP data used in the calculation of the output gaps are the Eurostat's chain linked index 2005=100 seasonally adjusted. The real effective exchange rates (REER) for the examined countries come from the Bank of International Settlement calculations[10]. The descriptive statistics for the disaggregated price indices are shown in Table 2.

4 Estimation results

4.1 Identification of the global shocks

We start with specifying the SVAR model for the set of the global variables as proposed in equation (2). At the beginning, we estimate consistently the reduced form VAR with the OLS. We choose the number of lags on the basis of the AIC criterion, which takes the minimum value for the lag order equal to 6. Next we impose zero restrictions on the contemporaneous impact matrix B. We find the remaining unconstrained elements of B matrix statistically significant at 10% significance level (Table 3).

Figure 1 displays the impulse response functions for the structural shocks followed by the two standard errors bands. The first panel contains the responses of the respective macroeconomic variables to the global demand shock. The positive global demand shock raises world import as well as real commodity prices and inflation. While the real commodity prices go up, the nominal commodity prices rise stronger in reaction to the demand shock rather than CPI inflation. The impact of the global demand shock on the world import diminishes after approximately one year, as does the effect for the real commodity prices. In contrast, the response of the CPI inflation to the demand shock is more persistent and long lasting; it dies out after seven quarters. All responses to the global demand shock are statistically significant at 10% significance level.

The second panel summarizes the responses to the commodity-specific shock. The commodity-specific shock raises immediately real commodity prices and CPI inflation while a substantial share of the CPI basket constitutes unprocessed food and energy. The initial reaction of the world import is somewhat puzzling while the import goes up in the first quarter. However, this peak proves to be statistically insignificant and after two quarters the response turns out to be negative and statistically significant, as suggested by the literature (see Kilian, 2009). The decline of world import in reaction to commodity-specific shock reaches its maximum after four quarters and fades out after seven quarters.

In the longer run the slump in economic activity reflected by the decline of the world import leads to

[8] http://ec.europa.eu/eurostat/data/statistics-a-z/abc

[9] COICOP stands for Classification of Individual Consumption According to Purpose (http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=5)

[10] http://www.bis.org/statistics/eer/

a drop of real commodity prices and CPI inflation. These two variables return to their initial levels after approx. 7-8 quarters. All in all, the accumulated response of the world import to a positive commodity-specific shock is slightly negative while the accumulated responses of real commodity-prices and CPI inflation are close to zero.

The last examined shock is the non-commodity supply shock, which lowers world import and real commodity prices and raises CPI inflation. Based on the impulse response functions of the three examined variables we may interpret this shock as a reversed globalization shock, which can be associated with the technological progress and the reallocation of production to countries with lower production costs. The ongoing globalization process results in the growth of global trade and the decrease of the prices of tradable (mostly manufacturing) goods, leading also to the higher demand for commodities and increasing their prices. The growth of nominal commodity prices and the simultaneous fall of consumer inflation (due to lower prices of tradable goods) translates into an increase of real commodity prices.

The shape of the impulse response functions in the last panel remains broadly in line with the abovementioned (but reversed) mechanism. In response to a positive non-commodity supply shock (adverse globalization shock) the world import and real commodity prices go down with the peak occurring after 2-3 quarters. This effect fades away after one year. For both variables this fall in response to the shock is statistically significant. In contrast the CPI inflation increases immediately, but due to the simultaneous drop of economic activity reflected in the contraction of world import, CPI starts to decline after two quarters. The positive direct effect on CPI inflation via prices of tradable goods (unfavorable supply/globalization shock) and negative effect stemming from lower economic activity offset each other and the inflation very quickly returns to its initial level.

The Figure 2 shows the structure of the identified shocks all over the sample. The non-commodity supply shock (the reversed globalization shock) was strongly negative over the years 2002-2007 and was lowering global inflation despite the fact that the global output gap was in general positive. In this period the globalization process intensified, while the emerging economies gained in importance in the global production and trade chains. After the onset of the global financial crisis in 2008, the globalization process slowed down and the supply shock reversed.

The global demand shock is identified to be mainly positive until 2007 (with the exception of the period 2002-2003), which corresponds to the positive sign of the global output gap calculated by the IMF[11]. The outbreak of the crises in 2008 led very quickly to a drop of global demand, which translated into persistent negative global demand shock and only temporarily reversed to positive in years 2010-2011. Since 2011, the global demand shock has again been negative what is reflected by negative global output gap.

The commodity-specific shock was in general negative in the first half of the 2000s and turned out to be positive around 2007. This positive commodity shock lasted until 2012 (with the one-off negative value in Q4 2008) and was strengthened by the massive growth of liquidity on the global financial markets provided by the major central banks in advanced economies within quantitative easing policy (Hamilton, 2009). This positive

[11] http://www.imf.org/external/pubs/ft/weo/2014/02/weodata/index.aspx

commodity shock heightened inflation despite the weakening global economic activity. The exploration of new unconventional sources of gas and oil in the US and Canada led to a substantial increase in energy commodities supply, which is captured by a presence of persistent negative commodity shock, occurring since 2012 and lasting until the end of the sample, deepening the decline of global inflation.

4.2 Disaggregated analysis

Having extracted the structural global shocks from the SVAR model we regress the disaggregated prices indices for the examined countries on the global shocks controlling for the domestic output gap and exchange rate, as proposed in Section 3.2. The results collected in Tables 4, 5 and 6 show that for the subsequent groups of goods and services there are some similarities among analyzed countries in their price reaction, but we can also spot some discrepancies.

First of all, according to our expectations the energy prices in all examined countries respond positively to the commodity-specific shock. In the Czech Republic (Table 4, part A) this impact is stronger than in Poland (Table 5, part A) and Sweden (Table 6, part A) as measured by the respective regression coefficient and its standard error. This weaker reaction of energy prices (expressed in domestic currency) to the global commodity-specific shock in Poland is to some extent offset by the relatively strong reaction to the changes in the exchange rate, which is not seen in the other two countries.

Food products are price-sensitive to the global commodity-specific shock only in the Czech Republic (Table 4, part A). In two other economies, Poland and Sweden, they are determined rather by the domestic supply and also by demand conditions while they respond positively (and statistically significant) to domestic output gap (Tables 5, 6, part A). The results for Poland stay in line with the findings of Hałka and Kotłowski (2014) who dealing with price indices at higher disaggregation level find that the prices of almost half of the food categories in the Polish HICP basket react to changes in aggregated domestic demand.

As pointed out in Section 4.1, we attribute the non-commodity supply shock to the technological progress and globalization process, which leads to enhanced competition and the decline of prices. That is why we would expect the prices of appliances, tools and telephone equipment as well as clothing and footwear to be affected by the supply shock. Indeed, the prices of clothing and footwear in all examined countries react to the global supply shock (Tables 4, 5, 6, part B). In the Czech Republic and Poland a noticeable downward trend in the prices of these two categories has been observed since the beginning of the 2000s. This long lasting decline in prices of clothing and footwear stopped with the onset of the global financial crises when the substantial depreciation of the exchange rate caused a temporary reverse of this downward trend. However, despite the possible weakening of the globalization process in the aftermath of the global financial crisis, as reflected by the change of the sign of the non-commodity supply shock (Figure 2), the price dynamic of these two groups of products remained negative in Poland, while in the Czech Republic it reached positive (to some extent due to introducing the exchange rate floor) but still very low numbers. In Sweden we did not observe such a distinct trend, while the prices of clothing and footwear were fluctuating between -5 and 6%

y-o-y however, in particular after the outbreak of the global financial crisis, the trend in prices of clothing and footwear became more tightly correlated with GDP growth responding stronger to the domestic output gap.

For other durable and semi-durable goods (Tables 4, 5, 6, part B and C), perceived usually as being influenced by the globalization process, the impact of the non-commodity supply shock is not as clear as in the case of clothing and footwear. In the analyzed countries the prices of most of the semi-durable goods respond to the supply shock, but the range of these goods varies across the countries. However, such country-specific discrepancies in the composition of goods, which prices are determined by the global non-commodity supply shock, may be to some extent explained by the fluctuations of the exchange rate. While these goods are mostly tradable goods, they may also react to fluctuations of the exchange rate. That is why in groups of semi-durables, which prices are insensitive to the non-commodity supply shocks, the exchange rate is an important driver of the price development.

As far as prices of services are concerned most of them in the Czech Republic and Poland are affected by the domestic output gap (Tables 4, 5, part D). Nevertheless, when taking into account the ongoing globalization of the services sector, it should not be surprising that there is also a substantial group of services, which prices are influenced by the external shocks, although less than domestic ones. Sweden is an exception, while prices of only four out of 15 services groups respond to the cyclical changes in domestic economic activity reflected by the movements of the domestic output gap (Table 6, part D).

While assessing the relative importance of global and domestic factors in affecting the price dynamics, we find that their role differ across the examined countries (Table 7). In Poland the impact of the domestic output gap is the most substantial one – the cyclical fluctuations of domestic economic activity reflected by the changes in domestic output gap affect the prices of approx. 55 per cent of the analyzed groups of goods and services. The second important source of inflation variability in the Polish economy are the movements of the real effective exchange rate, which transmit into almost half of the disaggregated price indices. When accounting for weights of the respective groups of goods and services in the HICP basket, the findings stemming from this analysis remain broadly unchanged.

The disaggregated analysis of the inflation drivers in the Czech Republic reveals slightly different picture. The cyclical fluctuations of the domestic output gap are still the most important source of inflation development, however this factor affects prices of smaller number of categories of goods and services than in the case of Poland. Withal the prices in several categories are affected directly by the global demand shock. The direct impact of the exchange rate on the inflation is not so prominent, the movements of the exchange rate pass through into the prices of only few categories of goods in the inflation basket. On the contrary the prices of relatively large fraction of goods and services are affected by the global supply shock – this group is larger than in the case of Poland. However, when we account for the size of the shocks (adjusted additionally with the HICP basket components' weights) it turns out that apart from the domestic output gap, the second important source of overall inflation variability in the Czech Republic is a global commodity-specific shock with global supply and demand shocks as well as exchange rate being less relevant.

The inflation development in Sweden diverge from the pattern identified for Poland and also for the Czech Republic. As far as the number of price categories is concerned, the most important source of inflation variability is still the output gap. However, the external shocks, both demand and supply, as well as changes in the exchange rate, are relatively more important for the inflation variability. The role of the exchange rate is less pronounced than for Poland but more important than in the case of the Czech Republic. Nevertheless, if we account for the relative size of the shocks and the weights in the HICP basket it proves that the shocks to commodity prices followed by the non-commodity supply shock and subsequently the output gap are the main drivers of inflation variability.

To sum up, while investigating the relative role of global and domestic factors in determining inflation in the three analyzed countries, all of them being small open economies, we may conclude that in one country (Poland) the dynamics of prices is shaped mostly by the changes in domestic economic activity, in one mainly by the external factors (Sweden) while the third country may be classified somewhere in-between (the Czech Republic).

Next we discuss briefly the historical decomposition of inflation variability as shown on Figures 3, 4 and 5. In Poland (Figure 4) the most important factor driving inflation throughout the whole analyzed period was the domestic output gap. The positive output gap contributed to a large extent to the substantial and long-lasting positive deviation of the inflation from the inflation target in the years 2007-2008. With the outbreak of the global financial crisis and rapid deterioration of economic activity, the positive impact of the output gap reversed very quickly. However, the inflation remained heightened due to the strong depreciation of the Polish złoty, which accounted substantially for inflation variability that time. At the end of 2008 we can also recognize the negative contribution of the external shocks (supply and demand) to inflation development when the world economy fell into the recession. Moreover, the commodity-specific shock turned from pro-inflationary to disinflationary as the commodity prices started to fall sharply after Lehmann Brothers collapse. As we mentioned before, the only pro-inflationary factor (but a very strong one) was an exchange rate which was soaring during that period[12].

The more recent evolution of inflation (in fact deflation) in Poland can be attributed to a large extent to the changes in the domestic output gap, which still remains negative and does not set inflationary pressures. In addition to that, we are facing declining commodity prices, both energy and food products due to the persistent negative commodity-specific shock. The only factor that reveals a slight pro-inflationary pressure is a non-commodity supply shock, which can be attributed to the weakening of the globalization process (reflected by a drop in global trade) and a fall in R&D expenditures as a result of the long-lasting economic slowdown facing several developed and emerging economies.

Since the beginning of the global financial crisis, the global demand shock has mainly a negative contribution to the inflation process in Poland, i.e. it adds to lower inflation with only temporary reversion in the years 2010-2011. However when investigating the role of the global demand shock in affecting inflation, one should keep in mind that in our approach we do not impose the orthogonality condition on the domestic

[12]Since mid-2008 till the beginning of 2009 it depreciated by more than 50%

output gap in respect to global demand shock. For that reason, the movements in the domestic output gap may be to some extent related to the propagation of the global demand shock, which transmits sooner or later into the domestic output gap. However, Kolasa (2013) argues that synchronization of business cycles in euro area and non-euro area countries, despite ongoing convergence, is still not very high. Nevertheless, the overall importance of the global demand shock in determining the inflation process in Poland, but also in two other examined economies (the Czech Republic and Sweden), may be larger than if accounting only for its direct impact reflected by the regression coefficient. Thus, in the period covered by our research the demand shocks (both global and domestic - reflected by the country's output gap) played in Poland a more important role in inflation development than supply shocks.

We get a rather similar picture when looking at the decomposition over time of the factors driving inflation in the Czech Republic (Figure 3) with the prominent role of the domestic output gap. The most substantial discrepancy among the countries is that in the Czech Republic the commodity prices shock is more important in affecting the overall inflation variability. In contrast the exchange rate channel seems to be less relevant. Additionally the role of the declining commodity prices in lowering inflation was more significant than in Poland. Such an outcome may be less surprising when we bear in mind that the Polish economy is less reliant on the import of energy commodities such as oil or natural gas[13]. Moreover, in the Polish economy, the agriculture sector contributes substantially to the GDP, thus making Poland a relevant exporter of food products and the domestic conditions play more prominent role. Therefore for Poland the shock to world commodity prices is less important in determining the domestic consumer food prices. The findings, which point to a lower contribution of the exchange rate fluctuations to the inflation variability in the Czech Republic after the beginning of the global financial crisis, may be attributed to some extent to the fact that in the first phase of the crisis the Czech koruna depreciated less than the Polish zloty[14].

The decomposition of the global shocks determining the inflation in the Swedish economy in the analyzed period is somewhat different (Figure 5). The shock, which contributed the most to overall inflation variability, is a commodity-specific shock. It is worth noting that, as compared to two other examined countries, the output gap playes a significant role in explaining the inflation development in the period from mid-2006 until mid-2010, when the fluctuations of the domestic demand were substantial. Before the Lehman Brothers collapse, the Swedish output gap was adding to the price growth, while after the beginning of the financial crisis it changed its sign, muting the inflation. Definitely for Sweden the commodity and non-commodity supply shocks are of the biggest importance as their influence on the inflation in the whole sample is sizable. Additionally, a relatively small fraction of goods and services reacts to the global demand shock and exchange rate, both playing less prominent role in explaining the inflation variability in Sweden.

Apart from the issue of the proper measurement of the output gap with the HP filter, this phenomenon may be attributed to some extent to lower variability of consumer prices in Sweden at both aggregated and

[13]E.g. in Poland natural gas dependence is 73.8% and in the Czech Republic 89%, also Poland imports less oil and both countries are coal net exporters (Eurostat data: year 2014).

[14]The Polish złoty depreciated by 50%, whereas the Czech koruna by 25%.

disaggregated levels as compared to the Czech Republic and Poland (Table 2) and their higher rigidity[15]. Also, the firmly anchored inflation expectations may pose to more muted reaction of prices to the fluctuations of aggregated demand. It is worth noting that contrary to the demand shocks (both global and domestic), the role of the non-commodity supply shock in affecting (mainly lowering) inflation in the analyzed period in Sweden is comparable to other examined economies.

5 Conclusions

The globalization process was supportive for the central banks in maintaining low inflation for almost two decades. It contributed to better anchoring of inflation expectations and therefore helped the central banks to gain the credibility. However nowadays the central banks face the problem of too low inflation, which is especially difficult for the countries in which monetary policy has hit the zero lower bound (like the Czech Republic or Sweden). These countries are trying to cope with the problem of too low inflation and subdued growth by applying several unconventional monetary policy measures, such as quantitative easing (Sweden) or the exchange rate floor (the Czech Republic).

Bearing that in mind, we think that the results of our research may be useful for the monetary authorities. We believe that the identification of the sources of the low inflation (or even deflation) may help central banks to design and implement the proper policy actions.

Our main finding is that the low inflation in the examined countries: the Czech Republic, Sweden and Poland, nowadays results not only from the favorable shock to commodity prices but also from the weak demand pressure, both domestic and external, however, this outcome is more evident for the Czech Republic and Poland than for Sweden.

Additionally, we find that for two out of the three examined countries, the domestic output gap matters for the inflation developments despite their relatively high openness. The issue not discussed in the paper is to what extent the monetary policy in those countries remains autonomous, meaning it may influence the domestic inflation via affecting the domestic output gap. Furthermore we confirm that the exchange rate channel is also effective in affecting inflation however its strength differs across the countries.

Finally, we recognize that the non-commodity supply shock which contributed to low inflation over a long time reversed after the outbreak of the global financial crisis which may be interpreted as a weakening of the globalization process.

[15] Apel et al. (2005) point out the relatively high rigidity level of the prices set by the Swedish firms – the median firm adjusts the price once a year.

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Tables and figures

Table 1: Recursive restrictions on the contemporaneous impact matrix.

Variable	Demand shock (GD)	Commodity-specific shock (GC)	Supply shock (GS)
Word import	x	0	0
Real commodity prices	x	x	0
Global inflation	x	x	x

Note: By symbol x we denote the unrestricted elements of the contemporaneous impact matrix B in SVAR model (1).

Table 2: HICP descriptive statistics.

	The Czech Republic	Poland	Sweden
mean	2,3	3,2	1,6
median	2,1	2,9	1,4
std. dev.	1,8	2,5	1,0
min	-0,6	-0,2	-0,4
max	7,1	10,5	4,2

Source: Eurostat data. Own calculations.

Table 3: Estimated contemporaneous impact matrix.

Equation\Shock	Demand shock (GD)	Commodity-specific shock (GC)	Supply shock (GS)
Word import	0.01407	0.00000	0.00000
	(0.00131)	(0.00000)	(0.00000)
Real commodity prices	0.02761	0.05480	0.00000
	(0.00764)	(0.00509)	(0.00000)
Global inflation	0.00075	0.00177	0.00185
	(0.00034)	(0.00029)	(0.00017)

Note: Standard errors in parentheses.
Source: Own calculations.

Table 4: Estimation results - the Czech Republic.

HICP component	GAP		Exchange rate		Demand shock		Commodity shock		Supply shock	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
A. Non-durables										
Food	0.13	0.380	-0.10	0.329	0.01	0.971	**0.42**	**0.077**	0.08	0.816
Alcoholic beverages	-0.01	0.849	0.02	0.572	-0.16	0.165	0.12	0.152	**0.21**	**0.028**
Tobacco	**0.37**	**0.054**	-0.09	0.324	0.3	0.388	-0.36	0.337	**0.92**	**0.018**
Maintenance, repair of the dwelling	0.06	0.332	0.02	0.270	0.04	0.729	0.02	0.816	-0.11	0.299
Electricity, gas and other fuels	**0.46**	**0.004**	0.06	0.468	-0.23	0.559	0.20	0.423	-0.10	0.742
Medical products, appliances, equip.	0.19	0.317	0.17	0.252	0.08	0.743	**0.32**	**0.128**	-0.53	0.217
Operation of personal transport equip. (fuels)	-0.58	0.042	-0.02	0.839	0.21	0.746	**1.60**	**0.003**	0.21	0.659
Newspapers, books and stationery	**0.06**	**0.142**	-0.02	0.582	0.05	0.684	0.03	0.824	-0.11	0.267
B. Semi-durables										
Clothing	**0.06**	**0.105**	0.00	0.908	0.01	0.888	-0.20	0.050	**0.17**	**0.023**
Footwear	0.04	0.602	-0.04	0.239	-0.10	0.533	-0.08	0.730	**0.25**	**0.030**
Household textiles	0.03	0.389	0.04	0.051	0.08	0.351	0.08	0.207	0.01	0.907
Glassware, tableware, house. utensils	0.05	0.163	-0.03	0.290	-0.01	0.862	0.11	0.311	**0.13**	**0.148**
Goods, serv. for routine house. maint.	0.05	0.375	0.04	0.108	0.03	0.728	-0.06	0.481	0.06	0.446
Other recrea. items, equip., garden, pets	0.02	0.617	0.00	0.879	0.02	0.775	0.00	0.979	0.07	0.530
Personal care	0.05	0.395	0.01	0.690	0.00	0.978	-0.03	0.752	0.04	0.691
C. Durables										
Furnit., furnish., carpets, floor coverings	**0.09**	**0.000**	-0.01	0.380	0.03	0.567	-0.02	0.589	0.02	0.673
Household appliances	**0.05**	**0.076**	-0.03	0.151	-0.06	0.223	0.03	0.631	**0.08**	**0.104**
Tools and equipment for house, garden	-0.07	0.377	-0.02	0.613	-0.09	0.682	0.00	0.996	0.21	0.348
Purchase of vehicles	0.02	0.912	**-0.11**	**0.058**	**0.33**	**0.144**	0.29	0.533	-0.15	0.414
Telephone and telefax equipment	0.10	0.541	**-0.35**	**0.001**	-0.19	0.675	-0.03	0.931	**0.78**	**0.054**
AV, photo., inform. processing equip.	-0.06	0.388	-0.05	0.220	0.00	0.979	0.09	0.493	-0.11	0.448
Other major durables for recrea., culture	0.01	0.981	0.02	0.839	0.38	0.240	-0.81	0.276	0.58	0.219
Personal effects n.e.c.	**0.04**	**0.123**	-0.01	0.322	**0.08**	**0.048**	0.06	0.213	0.05	0.353
D. Services										
Actual rentals for housing	**0.17**	**0.000**	-0.01	0.777	-0.05	0.358	-0.07	0.352	-0.11	0.046
Water sup., serv. relat. to dwelling	**0.08**	**0.029**	-0.02	0.770	0.03	0.849	0.10	0.405	-0.14	0.361
Out-patient services	0.81	0.185	0.72	0.099	0.32	0.525	0.98	0.202	-1.44	0.277
Hospital services	**2.35**	**0.131**	2.35	0.061	1.65	0.381	**4.14**	**0.068**	-4.49	0.265
Transport services	**0.21**	**0.042**	0.03	0.568	**0.32**	**0.094**	0.12	0.506	-0.36	0.130
Postal services	0.15	0.755	0.73	0.021	**-1.35**	**0.085**	0.43	0.611	-1.57	0.227
Telephone and telefax services	-0.1	0.635	0.25	0.013	0.53	0.338	-0.7	0.188	-0.15	0.529
Recreational and cultural services	0.05	0.552	0.07	0.068	0.23	0.152	-0.08	0.628	0.28	0.363
Package holidays	0.08	0.515	-0.02	0.879	0.14	0.618	-0.19	0.454	0.70	0.262
Education	0.00	0.980	0.01	0.592	-0.12	0.553	-0.05	0.603	0.01	0.892
Catering services	0.03	0.649	0.01	0.645	**0.13**	**0.061**	0.05	0.749	0.02	0.898
Accommodation services	**0.19**	**0.054**	0.05	0.277	**0.22**	**0.088**	-0.27	0.068	-0.47	0.086
Social protection	0.20	0.248	0.03	0.763	**0.34**	**0.135**	-0.36	0.397	**0.72**	**0.065**
Insurance	**0.10**	**0.003**	-0.02	0.297	0.09	0.281	-0.03	0.64	-0.03	0.646
Financial services n.e.c.	-0.32	0.132	0.01	0.969	0.28	0.313	-0.05	0.872	0.20	0.798
Other services n.e.c.	0.53	0.238	0.69	0.033	0.39	0.328	0.62	0.395	-0.68	0.442

Note: The p-values for the respective variables have been calculated with HAC standard errors. The coefficients (for demand, commodity and supply shocks multiplied by 100) and p-values related to variables statistically significant at 15% level (with correct sign) are bolded.
Source: Own calculations.

Table 5: Estimation results - Poland.

HICP component	GAP		Exchange rate		Demand shock		Commodity shock		Supply shock	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
A. Non-durables										
Food	**0.50**	**0.003**	**-0.10**	**0.000**	0.12	0.586	-0.07	0.776	**0.35**	**0.104**
Alcoholic beverages	**0.30**	**0.036**	0.02	0.755	-0.04	0.686	-0.07	0.600	-0.08	0.532
Tobacco	0.23	0.304	0.00	0.990	0.24	0.186	0.01	0.962	0.04	0.843
Maintenance, repair of the dwelling	**0.33**	**0.018**	-0.04	0.298	0.10	0.400	-0.39	0.227	**0.26**	**0.133**
Electricity, gas and other fuels	**0.36**	**0.006**	0.04	0.072	-0.19	0.237	**0.25**	**0.056**	-0.24	0.182
Medical products, appliances, equip.	0.17	0.214	0.00	0.884	-0.01	0.925	0.06	0.624	0.14	0.490
Operation of personal transport equip. (fuels)	-0.44	0.312	**-0.17**	**0.061**	0.64	0.323	**1.12**	**0.012**	0.50	0.482
Newspapers, books and stationery	0.25	0.162	-0.01	0.526	-0.03	0.873	-0.30	0.076	0.17	0.152
B. Semi-durables										
Clothing	-0.05	0.335	-0.01	0.538	0.01	0.884	0.03	0.592	**0.15**	**0.080**
Footwear	-0.07	0.115	**-0.02**	**0.069**	-0.01	0.871	0.07	0.166	**0.13**	**0.007**
Household textiles	0.03	0.289	**-0.01**	**0.004**	-0.05	0.214	0.04	0.403	0.05	0.298
Glassware, tableware, house. utensils	**0.13**	**0.001**	**-0.01**	**0.021**	0.03	0.340	0.01	0.787	0.00	0.851
Goods, serv. for routine house. maint.	**0.11**	**0.000**	**-0.01**	**0.047**	0.04	0.172	**0.06**	**0.091**	**0.10**	**0.001**
Other recrea. items, equip., garden, pets	**0.18**	**0.000**	**-0.03**	**0.006**	0.00	0.919	-0.03	0.318	**0.07**	**0.119**
Personal care	**0.08**	**0.000**	**-0.02**	**0.041**	0.03	0.498	0.03	0.355	0.04	0.237
C. Durables										
Furnit., furnish., carpets, floor coverings	**0.16**	**0.022**	-0.01	0.390	-0.02	0.750	0.06	0.483	0.08	0.341
Household appliances	**0.06**	**0.060**	**-0.02**	**0.030**	0.01	0.735	-0.05	0.461	**0.08**	**0.060**
Tools and equipment for house, garden	**0.18**	**0.010**	**-0.02**	**0.089**	0.05	0.305	-0.09	0.496	0.07	0.197
Purchase of vehicles	0.11	0.491	**-0.19**	**0.001**	0.11	0.550	-0.15	0.585	-0.13	0.596
Telephone and telefax equipment	-0.06	0.614	**-0.06**	**0.011**	0.07	0.531	0.02	0.898	-0.30	0.176
AV, photo., inform. processing equip.	0.07	0.476	**-0.06**	**0.099**	-0.01	0.956	-0.27	0.040	-0.12	0.240
Other major durables for recrea., culture	0.30	0.236	-0.03	0.520	0.27	0.154	0.03	0.896	-0.39	0.285
Personal effects n.e.c.	**0.13**	**0.010**	**-0.03**	**0.010**	0.03	0.517	0.06	0.261	**0.07**	**0.144**
D. Services										
Actual rentals for housing	0.03	0.278	0.00	0.644	-0.02	0.495	-0.01	0.727	0.02	0.467
Water sup., serv. relat. to dwelling	**0.21**	**0.129**	-0.01	0.803	0.03	0.893	-0.03	0.813	0.08	0.717
Out-patient services	**0.05**	**0.016**	**-0.01**	**0.016**	0.00	0.792	**0.04**	**0.044**	0.00	0.917
Hospital services	0.02	0.858	0.06	0.280	-0.09	0.562	0.00	0.981	0.12	0.413
Transport services	**0.35**	**0.043**	0.03	0.259	0.05	0.789	-0.04	0.791	-0.05	0.845
Postal services	0.12	0.437	0.06	0.346	-0.07	0.819	-0.47	0.102	-0.57	0.392
Telephone and telefax services	**0.59**	**0.099**	**-0.10**	**0.045**	0.19	0.677	-0.09	0.544	0.78	0.245
Recreational and cultural services	0.07	0.644	-0.03	0.354	-0.04	0.866	-0.26	0.107	-0.09	0.564
Package holidays	**0.27**	**0.001**	-0.02	0.251	0.03	0.711	-0.09	0.314	-0.09	0.463
Education	**0.17**	**0.059**	0.01	0.264	**0.19**	**0.068**	0.07	0.385	-0.04	0.741
Catering services	**0.18**	**0.000**	-0.01	0.439	-0.01	0.859	**0.10**	**0.070**	0.00	0.940
Accommodation services	**0.25**	**0.000**	0.02	0.178	-0.03	0.635	**0.09**	**0.099**	0.08	0.205
Social protection	**0.67**	**0.004**	-0.01	0.600	**0.42**	**0.143**	0.13	0.348	-0.21	0.251
Insurance	0.12	0.601	0.06	0.164	-0.16	0.608	-0.14	0.595	0.09	0.577
Financial services n.e.c.	**0.33**	**0.113**	**-0.19**	**0.036**	**0.84**	**0.024**	**0.58**	**0.086**	-0.49	0.153
Other services n.e.c.	0.46	0.284	-0.03	0.648	-0.44	0.576	-0.56	0.165	0.22	0.565

Note: The p-values for the respective variables have been calculated with HAC standard errors. The coefficients (for demand, commodity and supply shocks multiplied by 100) and p-values related to variables statistically significant at 15% level (with correct sign) are bolded.
Source: Own calculations.

Table 6: Estimation results - Sweden.

HICP component	GAP		Exchange rate		Demand shock		Commodity shock		Supply shock	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
A. Non-durables										
Food	**0.16**	**0.053**	0.04	0.409	0.13	0.405	0.10	0.518	0.16	0.293
Alcoholic beverages	0.02	0.525	-0.01	0.817	-0.03	0.541	0.15	0.279	0.02	0.779
Tobacco	**0.43**	**0.044**	0.23	0.065	**0.68**	**0.019**	-0.24	0.624	-0.06	0.900
Maintenance, repair of the dwelling	0.09	0.218	-0.01	0.947	0.06	0.657	0.04	0.815	0.08	0.633
Electricity, gas and other fuels	0.03	0.860	0.12	0.467	0.11	0.749	**0.91**	**0.017**	0.33	0.498
Medical products, appliances, equip.	0.02	0.663	-0.03	0.389	-0.01	0.869	-0.09	0.277	0.18	0.209
Operation of personal transport equip. (fuels)	-0.16	0.342	-0.08	0.570	0.20	0.641	**1.56**	**0.001**	-0.05	0.905
Newspapers, books and stationery	0.01	0.861	-0.02	0.809	-0.41	0.191	0.03	0.875	-0.19	0.387
B. Semi-durables										
Clothing	-0.05	0.607	-0.09	0.350	0.08	0.693	0.15	0.565	**0.39**	**0.122**
Footwear	-0.29	0.079	**-0.26**	**0.041**	-0.02	0.957	0.50	0.273	**0.70**	**0.060**
Household textiles	0.06	0.562	0.01	0.864	0.06	0.852	-0.17	0.450	**0.35**	**0.087**
Glassware, tableware, house. utensils	**0.19**	**0.019**	-0.03	0.633	-0.22	0.149	-0.26	0.102	0.10	0.605
Goods, serv. for routine house. maint.	-0.02	0.852	-0.04	0.410	-0.09	0.687	0.00	0.986	0.12	0.173
Other recrea. items, equip., garden, pets	-0.01	0.805	-0.04	0.254	-0.04	0.704	0.07	0.453	**0.21**	**0.027**
Personal care	0.01	0.802	0.00	0.786	-0.05	0.516	0.09	0.222	0.09	0.183
C. Durables										
Furnit., furnish., carpets, floor coverings	**0.19**	**0.001**	0.05	0.135	**0.18**	**0.068**	-0.03	0.749	0.03	0.827
Household appliances	-0.05	0.642	**-0.14**	**0.105**	-0.01	0.956	-0.02	0.929	0.16	0.583
Tools and equipment for house, garden	0.01	0.881	0.00	0.949	-0.02	0.911	0.12	0.472	0.10	0.615
Purchase of vehicles	-0.11	0.008	-0.06	0.321	0.08	0.522	0.01	0.956	-0.04	0.741
AV, photo., inform. processing equip.	0.02	0.826	-0.02	0.771	0.01	0.929	-0.02	0.899	**0.35**	**0.022**
Other major durables for recrea., culture	-0.03	0.600	**-0.09**	**0.032**	-0.05	0.674	0.12	0.272	**0.27**	**0.010**
Personal effects n.e.c.	-0.12	0.198	**-0.28**	**0.001**	0.20	0.345	**0.33**	**0.051**	0.00	0.988
D. Services										
Actual rentals for housing	0.02	0.163	0,00	0.988	-0.07	0.102	0.01	0.704	-0.03	0.373
Water sup., serv. relat. to dwelling	**0.05**	**0.125**	0.01	0.851	-0.06	0.561	-0.20	0.013	0.06	0.526
Out-patient services	-0.26	0.191	-0.13	0.210	-0.05	0.864	-0.14	0.468	-0.30	0.304
Hospital services	0.01	0.981	-0.59	0.325	-5.09	0.248	-0.48	0.467	1.73	0.248
Transport services	**0.10**	**0.11**0	0.02	0.603	0.02	0.851	0.07	0.708	0.16	0.304
Postal services	**0.09**	**0.096**	-0.03	0.788	0.14	0.606	0.17	0.391	-0.21	0.258
Recreational and cultural services	0.03	0.359	-0.03	0.555	0.09	0.593	0.04	0.669	0.09	0.414
Package holidays	-0.11	0.387	-0.16	0.323	-0.41	0.277	-0.24	0.652	0.26	0.490
Education	-0.09	0.307	0.11	0.450	-1.45	0.104	0.05	0.860	-0.32	0.272
Catering services	0.04	0.385	0,00	0.998	0.11	0.215	0.04	0.636	-0.08	0.214
Accommodation services	**0.13**	**0.113**	0.20	0.006	**0.42**	**0.045**	0.11	0.427	-0.15	0.440
Social protection	-0.01	0.927	0.02	0.819	-0.22	0.314	0.34	0.450	0.09	0.781
Insurance	0.07	0.601	-0.00	0.987	**0.57**	**0.080**	0.04	0.870	-0.12	0.488
Financial services n.e.c.	0.06	0.425	-0.04	0.158	**0.14**	**0.068**	-0.06	0.635	0.07	0.443
Other services n.e.c.	-0.10	0.644	**-0.36**	**0.077**	0.42	0.208	0.17	0.278	0.45	0.393

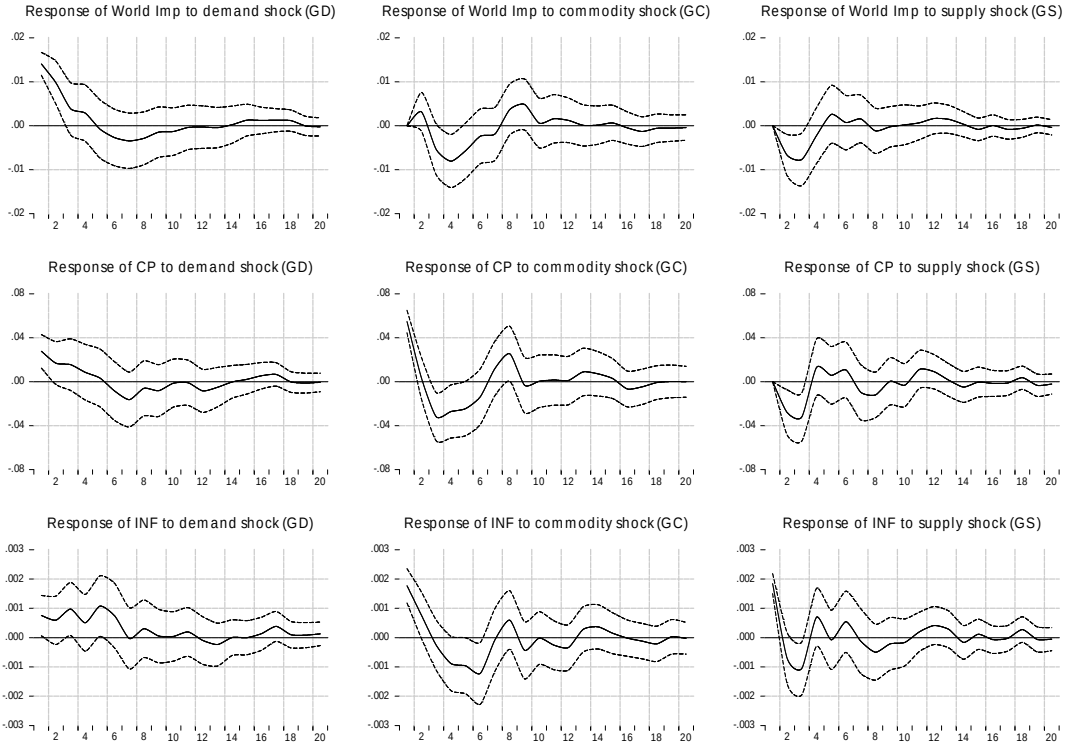
Note: The p-values for the respective variables have been calculated with HAC standard errors. The coefficients (for demand, commodity and supply shocks multiplied by 100) and p-values related to variables statistically significant at 15% level (with correct sign) are bolded.
Source: Own calculations.

Table 7: The share of the categories of goods and services price sensitive to respective shocks.

Country	GAP	exchange rate	demand shock	commodity shock	supply shock
The Czech Republic	33.3	5.1	15.4	10.3	20.5
Poland	56.4	43.6	7.7	17.9	20.5
Sweden	21.6	13.5	13.5	8.1	16.2

Note: The numbers in the table reflect the share of the categories of goods and services price sensitive to the respective shocks or variables.
Source: Own calculations.

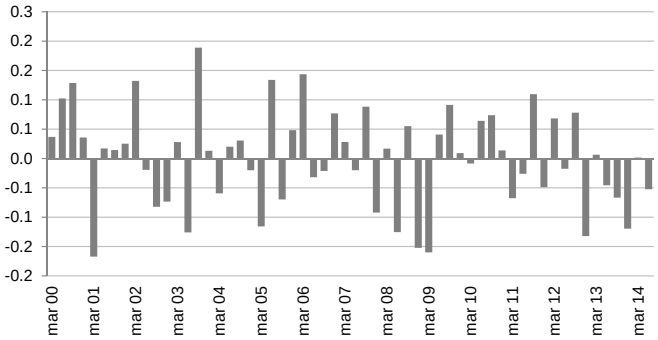
Figure 1: Impulse responses of world variables to global shocks.



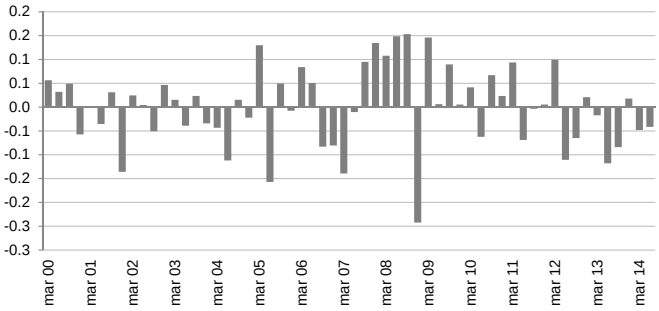
Note: The plots display the impulse responses of world variables to global shocks extracted from the SVAR model followed by respective confidence bands. World Imp, CP and INF stand for volume of world import, real commodity prices and global inflation respectively. GD, GC and GS are global demand, global commodity-specific and global non-commodity supply shocks.
Source: Own calculations.

Figure 2: The global shocks.

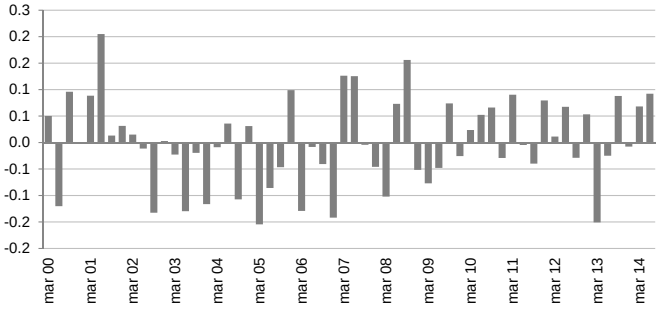
a) Global demand shock (GD)



b) Global commodity-specific shock (GC)

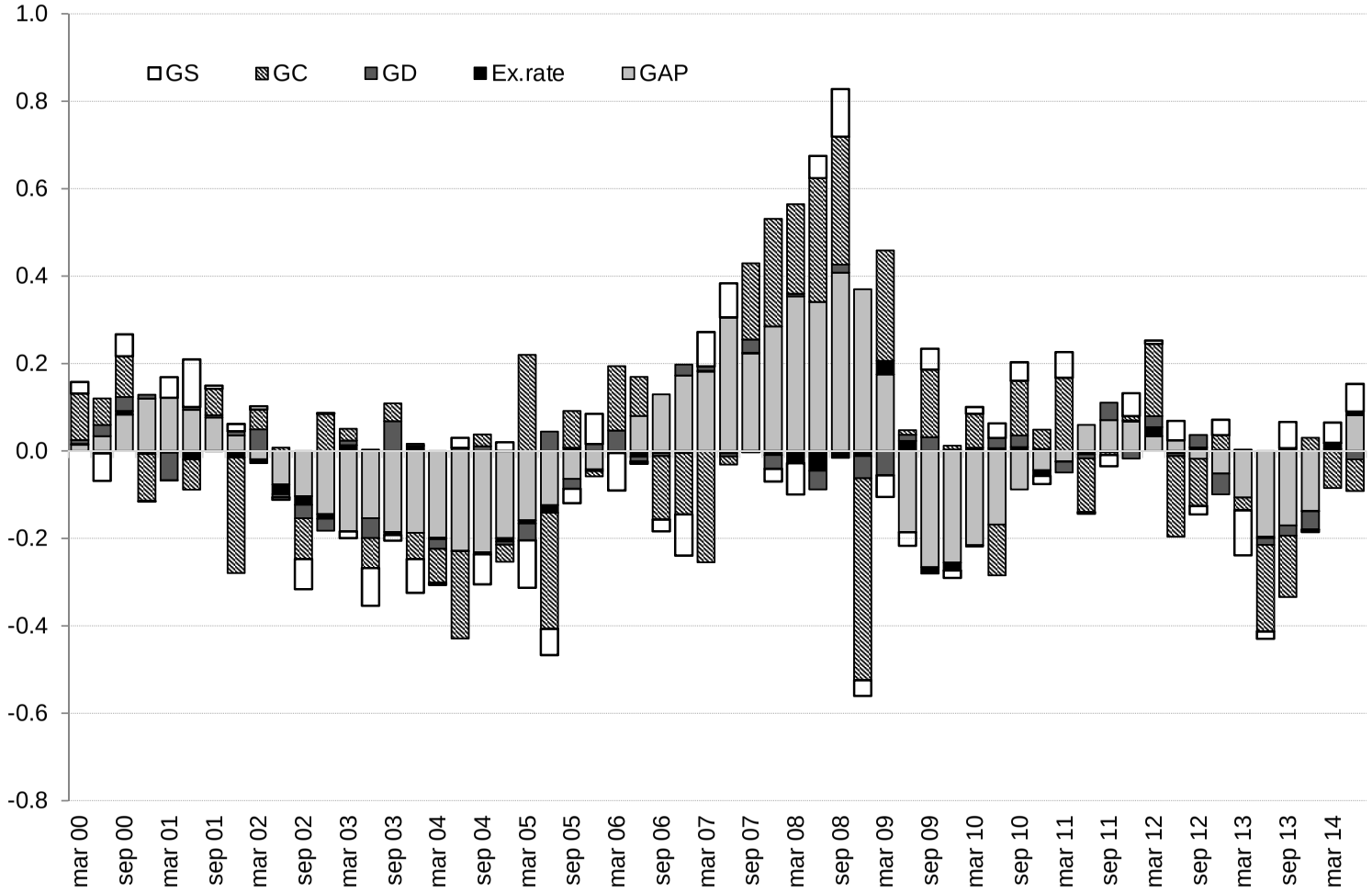


c) Global non-commodity supply shock (GS)



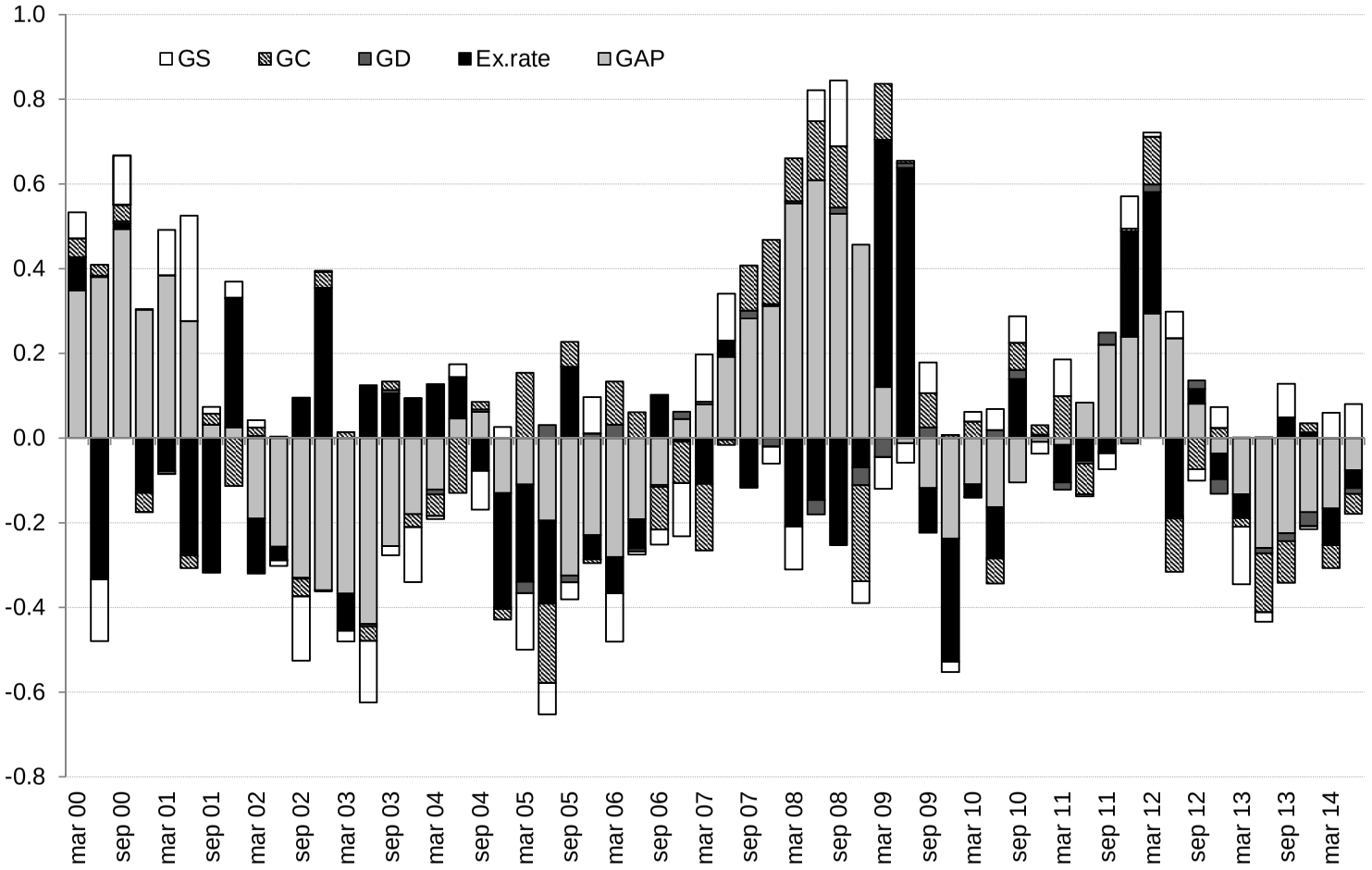
Source: Own calculations.

Figure 3: The decomposition of inflation drivers - the Czech Republic.



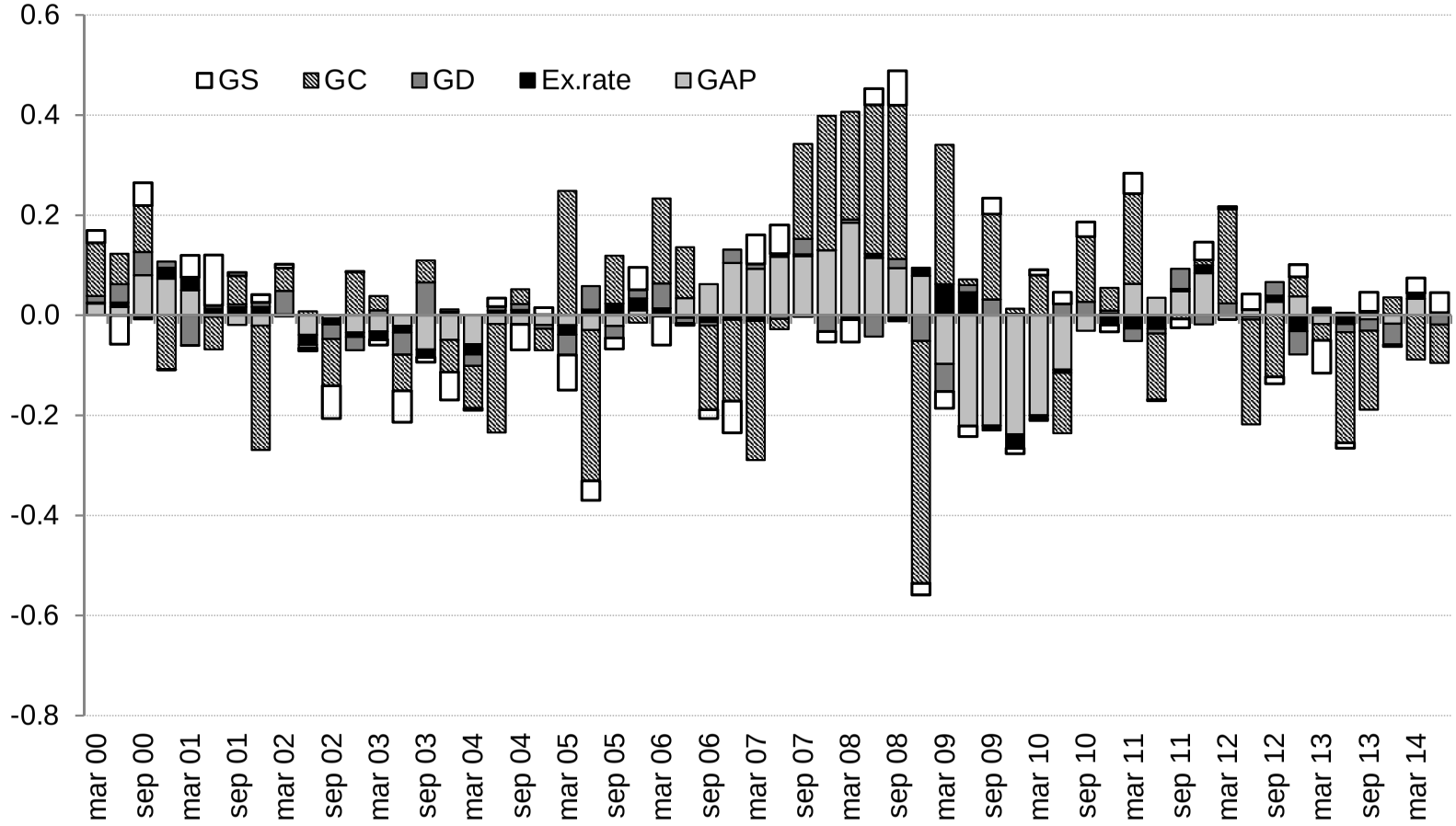
Note: The figure displays the decomposition of inflation in the Czech Republic into the contributions of global demand shock (GD), global commodity-specific shock (GC), global non-commodity supply shock (GS), exchange rate (Ex.rate) and domestic output gap (GAP).
Source: Own calculations.

Figure 4: The decomposition of inflation drivers - Poland.



Note: The figure displays the decomposition of inflation in Poland into the contributions of global demand shock (GD), global commodity-specific shock (GC), global non-commodity supply shock (GS), exchange rate (Ex.rate) and domestic output gap (GAP).
Source: Own calculations.

Figure 5: The decomposition of inflation drivers - Sweden.



Note: The figure displays the decomposition of inflation in Sweden into the contributions of global demand shock (GD), global commodity-specific shock (GC), global non-commodity supply shock (GS), exchange rate (Ex.rate) and domestic output gap (GAP).
Source: Own calculations.