National Bank of the Republic of North Macedonia

Working paper No. 2
2019

DISINFLATIONARY SPILLOVERS FROM THE EURO AREA INTO THE COUNTRIES OF SOUTHEASTERN EUROPE*

Gani Ramadani[1]
National Bank of the Republic of North Macedonia, Senior analyst

Predrag Pandiloski[2]
The Wharton School of the University of Pennsylvania, Research assistant

Abstract

We analyze the determinants of the inflation trends in ten Southeast European (SEE) countries. Global cost-related factors and euro area (EA) inflation developments play an important role in explaining inflation dynamics in SEE countries. Changes in world food and energy prices, together with related changes in administered prices, similarly contribute to these trends. In general, we show that disinflationary spillovers from the euro area have been an important factor for fixed exchange rate regime countries, especially those with more trade exchange with countries in the euro area. Furthermore, our heterogeneity analysis shows that countries with less rigid exchange rate regimes but with relatively high exposure of trade exchange to euro area market appear to be susceptible to inflation spillovers from the euro area. Moreover, nominal effective exchange rate plays an important role on inflation process in SEE countries, particularly in floating regime countries. In line with several recent findings about flattening of the Phillips curve in many economies across the world, cyclical unemployment does not appear to be significant in our sample. We conclude with some policy implications of our results.

JEL Classification: *C33, E12, E31*
Keywords: *inflation, Phillips curve, panel data, euro area inflation, commodity prices, Southeast European countries*

February 2018

*An earlier version of this paper has been published in the Journal of Central Banking Theory and Practice, Volume 8 (2019), Issue 3. The views expressed in the paper are those of the author(s) and do not necessarily represent the views of the NBRNM.
[1] e-mail: ramadanig@nbrm.mk
[2] e-mail: ppandilo@wharton.upenn.edu

1. Introduction

Inflation has plummeted in Southeastern Europe (SEE) since 2012, closely following the path of its counterparts in the euro area (EA). The European Central Bank (ECB) has achieved little to reach the 2% inflation goals of the euro area and has struggled with a 12-month inflation growth rates barely above the zero during the 2014-16 period. The "curse" of falling inflation has not spared countries in the periphery of the EU. This trend has even manifested as an unyielding trend of disinflation in many economies in SEE. Bosnia and Herzegovina and Bulgaria have been most affected with falling prices of around 1.2% in both countries since 2013 until the end of 2016, and milder but still notable deflation has occurred in the Republic of North Macedonia for the period 2014-16. Modest deflation has also been noted in Montenegro in 2014 and in Croatia in 2015. Even some larger inflation-targeting economies such as Romania have succumbed to disinflationary pressures and noted falling prices for the 2015-16 period. Other larger economies with floating exchange rate regime such as Serbia and Turkey have been devoid of deflation, with significant disinflation in the former and seemingly no effects in inflationary movements in the latter. Trends of consumer prices are presented in Figure A.1 in the Appendix.

The region-wide simultaneous trend of disinflation poses the question of whether and to what degree is low inflation in the EA, and other common factors, affecting the disinflation in SEE. Using quarterly data for ten SEE countries in the period between 2004 and 2017, we model a hybrid Neo-Keynesian Phillips curve based on a small open economy. Inflation is assumed to be both forward-looking and backward-looking and driven by demand-side factors as well as supply-side, cost-push factors. In the regressions we explicitly model for price pressures from the EA and world commodity prices. Furthermore, cost-push factors within our analytical framework lead to hypothesize significant effects in economies with pegged exchange rate regimes (as opposed to floating exchange rate economies), as well as significant effects of imported disinflation that varies with openness to trade. Therefore, following the de facto classification of exchange rate arrangements and monetary policy frameworks (IMF, 2016), we segregate for hard and soft peg exchange rate regime and economies with floating exchange rate arrangement, and we control for differences in trade with EA countries. Finally, central to our analysis are the effects of world prices of food and energy and, more importantly, the effects of EA price pressures on the disinflationary movements in SEE countries.

The paper unfolds as follows. The next section overviews relevant literature on theoretical approaches and empirical modelling of the hybrid Neo-Keynesian Phillips curve and addresses some potential limitations of this theoretical approach. The third section details our analytical framework and the data used in the estimations. This section focuses on the dynamics of the key drivers of disinflation in the region. The fourth section provides a specification of our methodological approaches, including our regression models, and shows our results. The fifth section checks for robustness of our estimation. The sixth section concludes and offers a discussion of the results as well as some policy implications of the same.

2. Literature review: theory and evidence

In this paper we assume a Neo-Keynesian and a small open economy theoretical and empirical approach to inflation. Literature of inflation is divided on factors determining inflation. While some theory emphasizes demand pressures, a different theoretical camp, which we follow in our approach, puts accent on structural factors such as market imperfection and cost pressures (including those of imported prices). Neo-Keynesians maintain that inflation is caused both by increase in aggregate demand or decrease in aggregate supply, suggesting two sources of inflation: demand-pull inflation and cost-push inflation.

Gali and Gertler (1999) augment the basic Calvo (1983) model to account for inflation inertia which allows for firms and individuals to set prices given a backward-looking rule. In this hybrid Neo-Keynesian Phillips curve, Gali and Gertler assume firms have a probability of *1- θ* of being able to reset prices in a specific period, while a fraction of θ of the firms are said to be "forward-looking". These recent developments of the hybrid Neo-Keynesian Phillips curve are built from the basic models sticky price models of Taylor (1980) and Calvo (1983) adding an element that allows for backward-looking firms in addition to real marginal cost, expected inflation, and future inflation. Gali and Monacelli (2005) expand this hybrid model to account for external factors affecting prices through the trade channel (terms of trade vis-à-vis the rest of the world and the share of imported goods in a household consumption, or in other words, the openness to trade). These two seminal papers by Gali and Gertler (1999) and Gali and Monacelli (2005) are the theoretical foundations to the empirical estimations of the hybrid open-economy Neo-Keynesian Phillips curve we model to estimate disinflationary spillovers.

Although the hybrid Neo-Keynesian Phillips curve is widely accepted and used by academics and policy makers, its empirical implication has been a matter of debate and contestation. In an empirical study of the validity of the hybrid Neo-Keynesian Phillips curve in Estonia, Latvia, and Lithuania, Dabušinskas and Kulikov (2007) find that inflation is largely driven by expectations and past inflation rates, while real marginal cost plays a small role. In a segregated analysis of two groups – new EU member states (NMS) and euro area countries – Franta et al. (2007) find that inflationary movements in the NMS to be comparable to those in their EA counterparts. Vašiček's (2010) analysis of an open economy Phillips curve in 12 transition NMS in Eastern Europe finds both backward-looking and forward-looking components of inflationary movements. Mihailov et al. (2010) base their model on Gali and Monacelli (2005) in their study of 12 transition economies to include both domestic and external factors (terms of trade) driving inflation. They conclude that external and domestic factors are jointly significant in about half of the NMS sample, indicating that inflation dynamics in five of the smaller countries tends to be mainly driven by external factors. Lakić et. al (2016) check negative repercussions of low inflation on the examples of the countries of SEE, in the regimes with fixed and flexible exchange rates, and with different strategies of monetary policy.

Our study has been informed by the empirical approaches of Iossifov and Podpiera (2014) in their IMF Working Paper. They similarly seek to analyze the effects of low core inflation in the EA on the inflationary movements in the non-euro area EU member states. Using panel of quarterly data in the period 2004-2014 they use a hybrid open-economy Neo-Keynesian Phillips curve to control for imported inflation. Their results suggest that falling food and energy prices are the main source of disinflation, but that low core inflation in the EA has also had a significant effect. They find that euro-peggers and countries more open to trade (higher share of foreign value-added in domestic demand) tend to be more exposed and affected by the disinflation in the EA. We hypothesize much the similar results in our own study for SEE, where we focus in all countries from this region, whether they are EU member states or not.

3. Analytical approach and data description

In our analysis of disinflationary spillovers we employ a Neo-Keynesian hybrid Phillips curve within a small open-economy context. Proposed by Gali and Gertler (1999), inflation is exhibiting both forward-looking and backward-looking expectations and is driven by supply-side and demand-side shocks. Our theoretical model assumes the following form:

$$\pi_{it} = \alpha_i + \beta\pi_{it-1} + \gamma\pi_{it}^{e} + \delta\tilde{u}_{it} + z_{it}\theta + w_t\vartheta + \varepsilon_{it} \qquad (1)$$

where i = 1, 2, …, n indexes a country in our sample and t = 1, 2, …, T denotes a quarter. π_{it} is headline inflation and π_{it}^{e} is expectation of future inflation. $\tilde{u}_{it}$ is the country-specific unemployment gap as a measure of demand-side shocks. Finally, z_{it} is a vector of country-specific supply-side shocks while w_t is a vector of common external supply-side shocks, which includes imported inflation.

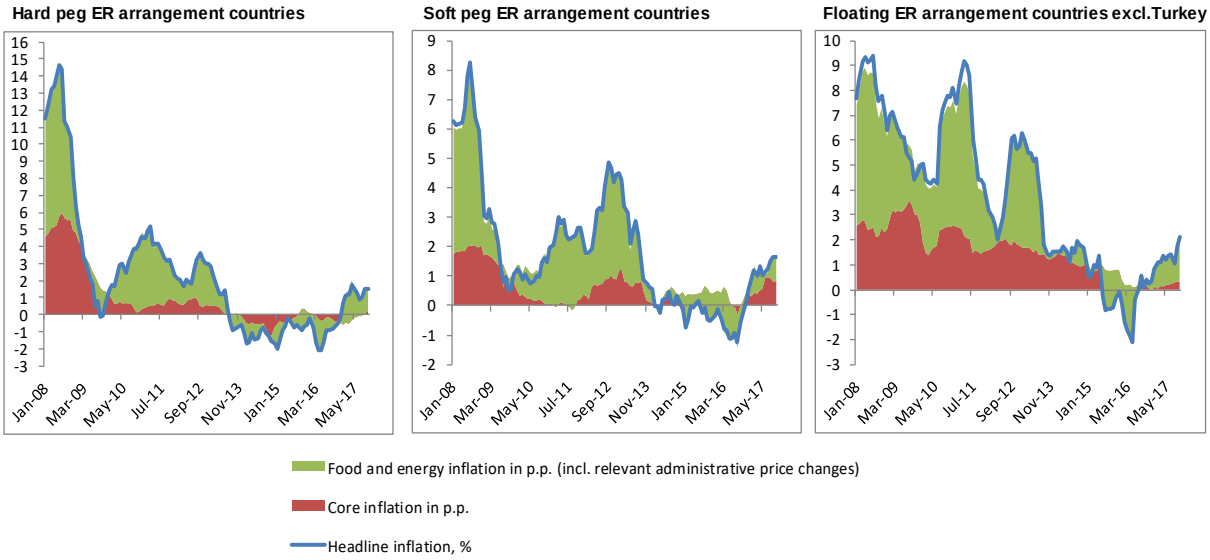
Prior to our econometric analysis, we did not expect demand-side shocks to have played a significant role in the disinflationary movements of the SEE countries in our sample. Unemployment, while significantly rising in most EA countries experiencing disinflation, has noted a variety of trends across the region of SEE. While some EU members such as Croatia and Bulgaria have noted increased and sustained unemployment in the post-recession years, other countries in the regions such as Turkey and Romania have retained steady level of unemployment. On the other hand, significant decrease of unemployment has been noted in several countries in the region, most notably North Macedonia and Montenegro. Detailed graphs of unemployment rates of the ten countries can be wound in Figure A.2 in the Appendix. The reasons for varying records are manifold and country-specific. In North Macedonia for example, which has noted significant disinflation and deflation in the last few years, the government has introduced some extensive employment expansion policies and job creation from new industrial companies that operate in free economic zones as well, which have presumably resulted in a decline of the unemployment rate. Therefore, there is not a unified trend of unemployment rates across the region, leading us to hypothesize a modest, if any, contribution of unemployment rate gap to the disinflationary movements in the region.

Using Gali and Monacelli (2005) we expand the standard inflation-unemployment Phillips curve to include and control for imported inflation which we decomposed into three parts: (1) the impact of the nominal effective exchange rates (NEER), (2) the impact of world food and oil prices, and (3) core inflation in the EA as a major trading partner of all the countries in the region.

NEER movements are likely to affect domestic commodity prices as well as prices of non-energy industry goods and services (Iossifov and Podpiera, 2014). The appreciation of local currencies, most notably those of countries pegging the euro, has contributed to disinflationary pressures from the euro area in the region. ECB President Mario Draghi's "whatever it takes" speech in 2012 has resulted in an appreciation of the euro NEER by around 10% until mid-2014. Although, from mid-2014 there was an episode of currency depreciation followed by the outbreak of the debt crisis in euro area, the depreciation trend of local NEER ended in 2015 following the unconventional monetary policy of ECB, and since 2016 there have been significant currency appreciations, which contributed again with disinflationary pressures (see Figure A.3 in the Appendix).

Price spillovers between trade partners can be an important source of imported inflation. Falling world food and energy prices have had a significant effect on slashing inflation in the region, especially because the share of food and energy in consumer baskets is large relative to some more developed European counterparts. Food comprises an average of around 30% of consumer baskets with up to over 36% in some countries like North Macedonia and Albania. Energy comprises around 15% of the consumer baskets in the region. As shown in Figure 1 below, the food and energy component exhibited large disinflationary pressures for all countries regardless of their FX-regime rigidity. The type of exchange rate arrangement appears to influence only the duration of disinflationary pressures and whether it pushes the core inflation component down.

Figure 1 Contributions to headline inflation
(contributions to y-o-y inflation rate, in p.p.)

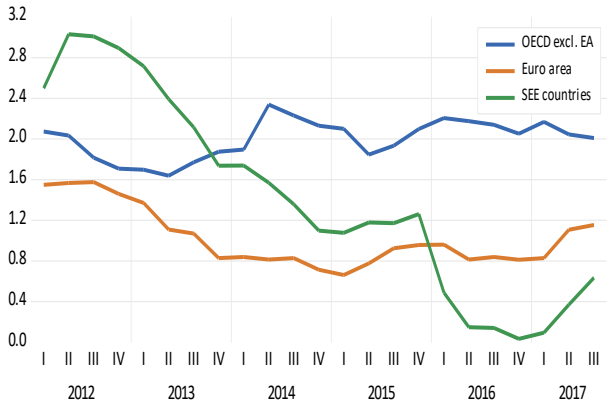


Sources: Eurostat, National Statistics, and authors' estimates.
Note: Hard peg exchange-rate arrangement countries include Bosnia & Herzegovina, Bulgaria, Kosovo and Montenegro; Soft peg exchange-rate arrangement countries include Croatia and North Macedonia; Floating exchange-rate arrangement countries include Albania, Romania, Serbia and Turkey. Plotted data are weighted averages of country observations, using country shares in the 2016 GDP for the region, expressed in euros at actual exchange rates.

The general regional trend of declining core inflation is one that diverges from the world core inflation and consequently implies that disinflationary pressures might be imported from the low core inflation from the EA (Figure 2). The EA countries are major trading partners in the SEE region, accounting for a large percentage of both imports and exports in these countries, most of them above 30 percent of GDP (Figure 3). Therefore, we hypothesize a possible spillover of low inflation from the euro area into the countries of SEE through this trade channel. Moreover, part of the decline in core inflation in this region might come from the impact of energy and food commodity prices on distribution and production costs of other products. Given that the average energy intensity of the region is considerably higher than the one of the EA, core inflation in these countries is especially vulnerable to changes in food and energy prices.

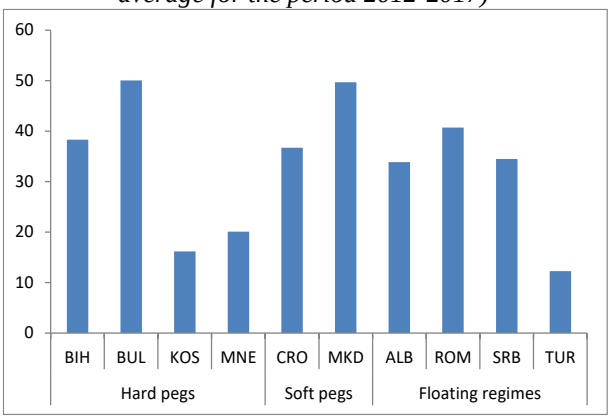
The sensitivity to imported inflation, be it from the NEER, EA core inflation, or world commodity prices, depends mainly on (1) trade openness and (2) the exchange rate regime. We expect that economies that are more open to trade, especially with the EA, be more affected by disinflationary pressures. More integrated economies like the ones in the EU are expected to be more exposed to price pressures from imports. These economies would be more exposed through the channel of trade with the EA and imported inflation through the world commodity prices. Furthermore, economies with more rigid exchange rate regime are expected to be more susceptible to disinflationary pressures from trade partners through their limitation of exchange rate buffer. Therefore, in our model we allow for variations and control for trade openness. Ideally, we would use foreign value-added of domestic demand, as used by Iossifov and Podpiera (2014). However, due to inexistence of such data for all of the countries we observe, we instead proxy by using the ratio of trade exchange with the EA to GDP for each of the nations (imports from and exports to EA as % of GDP). Lastly, we segregate countries by their exchange rate regime: hard peg, soft peg and floating regime (Figure 3).

Figure 2 Core inflation, y-o-y, %



Source: OECD, Eurostat, National Statistics and authors' calculations. Notes: Data for SEE countries and OECD excluding EA countries are weighted averages, using country GDP weights for 2016.

Figure 3 Trade exchange with Euro area (Imports from EA and Exports to EA as % of GDP, average for the period 2012-2017)



Sources: IMF, Direction of Trade Statistics (DOTS); Eurostat; IMF, WEO database; and authors' estimates.

Contributions of administered prices[3] to headline inflation have also been an important factor affecting inflation across the SEE countries. Since 2012, changes in administered prices (mostly of energy) have contributed to the deceleration of domestic price pressures in most countries. Moreover, due to fading out of base effects from previous hikes and subsequent cuts in administered prices of electricity and gas, energy price inflation has eased further in some SEE countries such as Bulgaria, Croatia, North Macedonia, Kosovo, Albania, and Bosnia and Herzegovina. There is a tendency that countries with the sharpest declines in inflation reduce their administered prices of energy by a larger margin.

Survey data of Eastern Europe Consensus Forecasts[4] from the last quarter of 2016 suggest that the risk of unanchoring of inflationary expectations remains low throughout the region, except for Turkey where inflation expectations are elevated. There are important differences in the process of formation of inflationary expectations under pegged and floating exchange rate regimes. In countries with fixed exchange rates, which import the monetary policy stance and credibility of the EA, formation of inflationary expectations are relatively more exogenous with respect to domestic policies and real sector movements. Despite these differences, judging by indicators of inflationary expectations, the odds of a self-feeding loop between inflationary expectations and increasing inflation currently appear low throughout the region. Projections by professional forecasters for SEE countries from October–December 2016 put one-year ahead inflation below the ECB target of 2% and below their country-specific inflation targets (see Figure A.4 in the Appendix). In most SEE countries projections for one-year ahead inflation is under 2%, in Albania and Serbia inflation is projected under 3% (below their inflation targets), whereas only in Turkey inflation projection is higher (around 8%) which overshoots its inflation target set to 5%.

[3] Prices that are directly set or influenced to a significant extent by the government, including regulated energy prices for households.
[4] Eastern Europe Consensus Forecasts is a comprehensive monthly survey of over 180 prominent forecasters published by Consensus Economics Inc.

4. Empirical analysis

We estimate an open-economy Neo-Keynesian Phillips curve using quarterly panel data for the period of 2004-2017 for ten SEE countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Kosovo, North Macedonia, Montenegro, Romania, Serbia and Turkey. All variables used in the regressions are expressed in a year-on-year percentage change (annual rate of change), except for gap variables (unemployment and output gap) and for interaction terms such as trade openness with EA and the weights of food, energy and administered prices in consumer baskets which are expressed in ratios. The data comes from various sources including Eurostat; IMF (IFS, DOTS, WEO Database); National Statistical Offices; National Central Banks; Consensus Economics etc. Detailed sourcing and information on all used variables is listed in Table A.1 in the Appendix.

Considering that inflation series usually exhibit strong inertia, we include sufficient number of lags of the dependent variable to relieve the problem of residual autocorrelation. For a country *i*, the regression takes the specific form:

$$\pi_{it} = \alpha_i + \sum_{p=1}^{2} \beta_p \pi_{it-p} + \gamma \pi_{it}^{e} + \delta \tilde{u}_{it} + \zeta_i \pi_t^{EA} + z_{it}\theta + w_t \vartheta + \varepsilon_{it} \qquad (2)$$

π_{it} – headline inflation;
π_{it}^{e} – expectation of future inflation;
$\tilde{u}_{it}$ – unemployment gap as a measure of demand-side shocks (we expect $\delta < 0$)
π_t^{EA}– measure of price pressures in the EA (we expect the country-specific coefficients $\zeta_i \geq 0$)
z_{it} – vector of country-specific supply-side shocks;
w_t – vector of common external supply-side shocks, including imported inflation

Our regression specification captures the average response of headline inflation across SEE countries to a set of external and domestic factors, while allowing for country-specific euro area inflation spillovers. Moreover, we try to explain cross-country differences in the elasticity of domestic inflation with respect to euro area price pressures. Drawing from the stylized facts presented in section 3 and economic intuition, we examine the possible role of the degree of rigidity of the exchange rate regime and exposure to foreign price developments, or more precisely exposure to EA market. This is achieved by interacting the proxy for euro area price pressures in equation (2) with the share of trade exchange with euro area to GDP (x_i) and allowing for exchange-rate regime specific elasticities (*j)* with respect to the interaction term. This would represent a more parsimonious parameterization of the link between euro area and inflation in SEE countries of the form ($\zeta_i = \zeta_j x_i$) than allowing for country-specific elasticities.

Based on equation (2) we run different regression models using fixed-effects OLS. The dependent variable is the headline (total) inflation in SEE countries. Details on the construction of explanatory variables can be found in Table A.1 in the Appendix. Our baseline specification includes proxies for expected inflation, unemployment gap, exchange rate appreciation/depreciation, contribution of administered prices to inflation, and time fixed effects (to control for variables that are constant across countries but vary over time). Results in Table 1, Model 1 show that all explanatory variables have coefficients with signs consistent with our predictions. Almost all coefficients of explanatory variables are statistically significant at the 99% level of confidence, except the coefficient of the unemployment gap. Moreover, time effects are jointly statistically significant at the 99 percent level of confidence, and can be interpreted as a whole substitute for global factors common across countries within each time period.

In the analysis, we allow for differentiated impact of EA price pressures on domestic inflation in SEE countries. First, we start by replacing the set of time dummies with world food and energy prices and EA core inflation (Table 1, Model 2). World food and energy prices are interacted with the country weights of energy and food in their consumer baskets to allow for differentiated impact across countries. We take EA core inflation as our preferred proxy for EA price pressures, as it excludes the effect of imported food and energy prices. The R-squared of the new model is only slightly lower than the one of Model 1 with common time effects, suggesting that global commodity prices and EA core inflation explain large share of the variance of relevant common factors. Moreover, the coefficients of these three additional variables are statistically significant at the 99 percent level of confidence with expected positive sign, whereas the sign and statistical significance of the coefficients from our base specification remained unchanged.

Next, we are interested and allow for country-specific coefficients of euro area core inflation (Table 1, Model 3). In this specification we replace the stand-alone EA core inflation variable and we interact it with country dummies. Results suggest that Serbia, Bulgaria, and North Macedonia are most susceptible to price spillovers from the EA, followed by Croatia and Bosnia and Herzegovina. Four of these countries have currencies pegged to the euro, while all of them have high trade exchange with euro area. Again, the signs and statistical significance of the coefficients from previous specifications remain almost identical. In order to achieve a more parsimonious parameterization of the link between inflation in euro area and SEE countries, in the last step of the analysis we check whether we can use this information (related with countries pegged currencies and exposure to EA market).

Finally, we interact the euro area core inflation with (1) exchange-rate regime dummy variables (Table 1, Model 4), and (2) simultaneously with the exchange-rate regime dummy variables and the share of trade exchange with euro area (Table 1, Model 5). With the Model 4, we retrieve the results from the previous specification in a more parsimonious way. Results from Model 5, which additionally accounts for variability in exposure to the EA market, confirm that the degree of rigidity of the exchange rate regime, and exposure to EA market explain well the cross-country differences in inflation elasticities regarding euro area core inflation. The R-squared of these models are the same as the one of the regression with unrestricted, country-specific coefficients of euro area core inflation. Thus, the last regression, Model 5 represents our preferred specification.

Almost all of the coefficients of country specific factors and global factors in our preferred specification are statistically significant at 99% level of confidence and virtually unchanged from the previous specifications. As expected, the only insignificant factor is the unemployment gap. In addition, all explanatory variables have coefficients with signs consistent with economic theory. The coefficients for the lags of the dependent variable are below unity, which ensure dynamic stability of the regression specification. The positive coefficient of inflation expectations, partially, captures second-round effects on total inflation of food and energy prices. As defined in ECB (2010), second-round effects arise when food and energy prices impact on wages and profit margins and they trigger on inflation expectations. The unemployment gap coefficient, as we mentioned above, has the expected sign, but it's not statistically significant at the 90% confidence level. Judging by its insignificance and the size of the coefficient, the limited impact of the cyclical unemployment seems consistent with the flattening of the Phillips curve according to BIS (2017) and IMF (2013). Moreover, Blanchard et. al. (2015) argue that since 1990 there is no statistically significant slope to a price Phillips curve in many countries.

The nominal effective exchange rate (NEER) appears to be a significant factor of inflation. The coefficient of NEER is statistically significant at the 99 percent confidence level and its appreciation leads to lower inflation in SEE countries. Based on this, in the last few years, the nominal effective exchange rate has

played a large role on disinflation developments, reflecting the appreciation of many regional currencies in the aftermath of ECB President Draghi's "whatever it takes" speech in July 2012 and the effects of the unconventional monetary policy by ECB from the end of 2015.

Table 1 Fixed-effects estimation of expectations-augmented Phillips curve[5]

	Headline Inflation				
	(1)	(2)	(3)	(4)	(5)
Country specific factors:					
Inflation (-1)	0.846***	0.876***	0.831***	0.874***	0.871***
	(0.0441)	(0.0379)	(0.0376)	(0.0381)	(0.0387)
Inflation (-2)	-0.258***	-0.286***	-0.272***	-0.284***	-0.289***
	(0.0368)	(0.0334)	(0.0327)	(0.0335)	(0.0333)
Inflation expectations (1-year ahead)	0.324***	0.342***	0.344***	0.345***	0.329***
	(0.0295)	(0.0263)	(0.0264)	(0.0266)	(0.0284)
Unemployment gap	-0.0264	-0.0177	-0.0219	-0.0199	-0.0433
	(0.0273)	(0.0282)	(0.0279)	(0.0284)	(0.0305)
Contribution of administered prices	0.372***	0.223***	0.295***	0.233***	0.272***
	(0.0861)	(0.0813)	(0.0853)	(0.0840)	(0.0813)
Nominal effective exchange rate	-0.0517***	-0.0279***	-0.0311***	-0.0275***	-0.0272***
	(0.00965)	(0.00921)	(0.00910)	(0.00924)	(0.00943)
Global factors:					
Time dummies	Yes	No	No	No	No
Global energy inflation * weight of energy in consumer baskets		0.0751***	0.0783***	0.0743***	0.0815***
		(0.0152)	(0.0148)	(0.0152)	(0.0155)
Global food inflation * weight of food in consumer baskets		0.0614***	0.0657***	0.0620***	0.0585***
		(0.0140)	(0.0137)	(0.0141)	(0.0142)
Euro Area core inflation:					
Stand-alone		0.446***			
		(0.144)			
Interacted with country dummies:					
Albania			-0.0563		
			(0.328)		
Bosnia and Herzegovina			0.631*		
			(0.368)		
Bulgaria			1.152***		
			(0.362)		
Croatia			0.661**		
			(0.328)		
Kosovo			-0.0345		
			(0.336)		
Macedonia			0.760**		
			(0.328)		
Montenegro			-0.275		
			(0.586)		
Romania			0.164		
			(0.367)		
Serbia			2.130***		
			(0.376)		
Turkey			-0.332		
			(0.342)		
Interacted with FX-regime dummy variables:					
Hard peg				0.370*	
				(0.219)	
Soft peg				0.649***	
				(0.243)	
Floating				0.363*	
				(0.200)	
Interacted with FX-regime dummy variables and the share of trade exchange with EA:					
Hard peg * trade exchange with EA					1.621***
					(0.577)
Soft peg * trade exchange with EA					2.273***
					(0.653)
Floating * trade exchange with EA					0.784
					(0.660)
Number of countries	10	10	10	10	10
Observations	475	475	475	475	460
R-squared	0.931	0.909	0.917	0.910	0.913
Time dummies (joint significance)	t= 4.65 (0.00)***				
Fixed effects (joint significance)	F(9, 407)=2.49 (0.0088)***	F(9, 456)=1.69 (0.088)*	F(9, 447)=4.27 (0.000)***	F(9, 454)=1.64 (0.101)	F(9, 439)=3.57 (0.0003)***

Notes: standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample 2004q1-2017q1.

[5] All estimations of expectations-augmented Phillips curve are performed in statistical software package Stata 15.

According to the coefficients based on our preferred regression model (Table 1, Model 5), world food and energy price changes together with related changes in administered prices, also seem to be important determinants of headline inflation across SEE countries. As we mentioned in Section 3, most administered prices are related to energy, thus our results further show that global factors related with commodity prices have a strong effect and are prominent drivers of domestic inflation dynamics across SEE countries.

Finally, our main explanatory variable – disinflationary spillovers from the euro area – seems to be an important factor for countries with fixed exchange rate regime against euro and high trade exchange with euro area. The coefficients of imported price pressures from the euro area are positive and statistically significant at the 99 percent confidence level for both hard and soft pegged FX-regime countries. In addition, EA consumer prices have positive impact to headline inflation in countries with floating regime, but they appear statistically insignificant.

Table 2 provides a summary of the country-specific impact of a one percentage point change in euro area core inflation on domestic total inflation, segregated by trade share as fraction of GDP and exchange rate regime. In general, countries with more rigid exchange rate arrangements and higher trade openness with euro area tend to import more inflation from the euro area. This holds for two hard peg countries (Bulgaria and Bosnia and Herzegovina) and for two soft peg countries (Croatia and North Macedonia). EA core inflation does not seem to affect the other two countries with hard peg exchange rate regime, such as Kosovo and Montenegro, which might be explained by their lower trade exchange with the EA. In addition, inflation spillovers from the EA have even a larger effect on inflation in countries with a floating currency regime which simultaneously have a relatively high trade with EA (Albania and Serbia). It is important to note that these countries in last five years had small nominal effective exchange rate variability. The effects of EA price increases in Romania are relatively small even though the trade openness with EA is high, likely because of the greater exchange rate flexibility of the Romanian leu. Lastly, the disinflationary spillovers from the euro area to Turkey are negative and insignificant owing to smaller trade exchange with euro area and greater exchange rate flexibility of Turkish lira.

Table 2 Impact of one percentage point increase in euro area core inflation on domestic headline inflation

		Trade exchange with EA (percent)		
		0-20	21-35	36-50
Exchange rate regime	Hard peg	-0.2 (KOS, MNE)		0.8*** (BIH, BUL)
	Soft peg			0.7** (CRO, MKD)
	Floating	-0.3 (TUR)	0.9*** (ALB, SRB)	0.1 (ROM)

Source: Table 1, Model 5.

*Notes: Statistical significance: * p<0.1; ** p<0.05; *** p<0.01. Countries are grouped according to the classification of their de facto exchange rate arrangements circa April 2016 in IMF (2016) and their share of trade exchange with EA to GDP (average for the period 2012-2017).*

5. Robustness checks

We test the stability of our preferred regression specification by conducting the following checks: (1) excluding Turkey from the sample, (2) adding global core inflation outside the euro area as an explanatory variable, (3) using EA output gap as an alternative measure of EA price pressures, (4) using EA unemployment gap as an alternative measure of EA price pressures, (5) using instrumented EA inflation as an alternative measure of EA price pressures, and (6) substituting output gap instead of unemployment gap

in the part of country-specific explanatory variables (Table 3). Furthermore, we check for the robustness of our results by using a system two-stage least squares (2SLS) and system three-stage least squares (3SLS) estimations as an alternative to our fixed-effects OLS specifications (Table 4).

Table 3 Fixed-effects estimation of expectations-augmented Phillips curve with alternative measures of euro area inflationary pressures and alternative domestic demand variable

	Headline Inflation					
	(1)	(2)	(3)	(4)	(5)	(6)
	Euro area core inflation w/o Turkey	Euro area core inflation w/ world core (ex euro area)	Euro area output gap	Euro area unemployment gap	Euro area inflation instrumented [1/]	Output gap instead of unemployment gap
Country specific factors:						
Inflation (-1)	0.891***	0.865***	0.841***	0.857***	0.854***	0.867***
	(0.0416)	(0.0396)	(0.0389)	(0.0390)	(0.0390)	(0.0389)
Inflation (-2)	-0.304***	-0.284***	-0.254***	-0.268***	-0.286***	-0.287***
	(0.0372)	(0.0341)	(0.0330)	(0.0331)	(0.0331)	(0.0333)
Inflation expectations (1-year ahead)	0.326***	0.330***	0.328***	0.334***	0.341***	0.331***
	(0.0287)	(0.0285)	(0.0277)	(0.0280)	(0.0280)	(0.0283)
Unemployment gap	-0.0414	-0.0410	-0.0376	-0.0174	-0.0551*	
	(0.0305)	(0.0307)	(0.0303)	(0.0314)	(0.0305)	
Output gap						0.0393*
						(0.0223)
Contribution of administered prices	0.301***	0.276***	0.362***	0.330***	0.276***	0.295***
	(0.0872)	(0.0816)	(0.0798)	(0.0802)	(0.0803)	(0.0824)
Nominal effective exchange rate	-0.0192	-0.0282***	-0.0348***	-0.0316***	-0.0286***	-0.0295***
	(0.0121)	(0.00954)	(0.00997)	(0.00970)	(0.00951)	(0.00959)
Global factors:						
Global energy inflation * weight of energy in consumer baskets	0.0690***	0.0818***	0.0915***	0.0950***	0.0458**	0.0807***
	(0.0161)	(0.0155)	(0.0153)	(0.0156)	(0.0183)	(0.0154)
Global food inflation * weight of food in consumer baskets	0.0701***	0.0621***	0.0373**	0.0428***	0.0498***	0.0558***
	(0.0154)	(0.0151)	(0.0152)	(0.0150)	(0.0145)	(0.0144)
Global core inflation (excl. euro area)		0.112				
		(0.163)				
Proxies for Euro Area price pressures interacted with FX-regime dummy variables and the share of trade exchange with EA:						
Euro Area core inflation:						
Hard peg * trade exchange with EA	1.520***	1.541***				1.511***
	(0.564)	(0.588)				(0.580)
Soft peg * trade exchange with EA	2.209***	2.181***				2.145***
	(0.635)	(0.667)				(0.657)
Floating * trade exchange with EA	0.918	0.689				0.595
	(0.661)	(0.675)				(0.671)
Euro Area output gap:						
Hard peg * trade exchange with EA			0.792***			
			(0.173)			
Soft peg * trade exchange with EA			0.661***			
			(0.194)			
Floating * trade exchange with EA			0.260			
			(0.195)			
Euro Area unemployment gap:						
Hard peg * trade exchange with EA				-1.441***		
				(0.385)		
Soft peg * trade exchange with EA				-1.080**		
				(0.431)		
Floating * trade exchange with EA				-0.610		
				(0.426)		
Euro Area instrumented headline inflation:						
Hard peg * trade exchange with EA					0.909***	
					(0.237)	
Soft peg * trade exchange with EA					0.898***	
					(0.244)	
Floating * trade exchange with EA					0.591**	
					(0.263)	
Number of countries	9	10	10	10	10	10
Observations	408	460	460	460	459	460
R-squared	0.925	0.913	0.915	0.913	0.913	0.913
Fixed effects (joint significance)	F(8, 388)=3.84	F(9, 438)=3.29	F(9, 439)=2.24	F(9, 439)=1.94	F(9, 438)=3.70	F(9, 439)=3.35
	(0.0002)***	(0.0007)***	(0.019)**	(0.0443)**	(0.0002)***	(0.0006)***

Notes: standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample 2004q1-2017q1.

[1/] Conditional forecast derived from estimating model (2) in Table 1 for the Euro Area without Euro Area core inflation RHS variable.

Excluding Turkey from the sample, the largest country and structurally different economy from other SEE countries, has no substantial effect on regression coefficients (Table 3, Model 1). The only difference in this specification is that the coefficient of the nominal effective exchange rate becomes statistically insignificant, while the sign of the coefficient remains unchanged. Global or more precisely OECD core inflation outside the euro area, when added to our preferred regression specification, is not statistically significant, while the effects of EA core inflation is retained (Table 3, Model 2). This is in line with the stylized fact of decoupling of SEE and EA core inflation from developments in the rest of OECD countries.

We substitute EA core inflation sequentially with the euro area output gap, unemployment rate gap, and instrumented euro area inflation, presented in Table 3, Model 3, Model 4, and Model 5 respectively. The results show that our findings remain unchanged. In our next specification, in the part of country-specific factors, we replace the unemployment gap with output gap as a measure of domestic slack or demand-side factors of inflation dynamics across SEE countries. The results show that the sign of the coefficient of output gap is consistent with economic theory and has statistically significant effect on countries headline inflation (Table 3, Model 6), which was not the case with the unemployment gap used as primary variable for domestic slack measure in our preferred model (Table 1, Model 5). Furthermore, we adjust the standard errors using the Huber-White sandwich estimator to account for possible heteroskedasticity in the data. The statistical significance of the coefficients of our preferred model remains unchanged (results are not reported).

Following the approach of Iossifov and Podpiera (2014), we check the robustness of our findings for possible endogeneity bias in estimated coefficients. Fixed-effects OLS are usually inconsistent in the presence of endogenous explanatory variables and a lagged dependent variable. As shown in Table 4[6], we estimate our specification from Model 5 in Table 1 by System Two-Stage Least Squares (2SLS) and System Three-Stage Least Squares (3SLS). According to Iossifov, Cihák, and Shanghavi (2008), these estimators are less prone to endogeneity biases. Moreover, the System 3SLS estimator is more efficient because it uses the additional information contained in the covariance structure of the errors in the different equations of the system.

The System 2SLS and 3SLS estimators evaluate the system of simultaneous equations formed by stacking the Phillips curves for every country in our sample. The model is estimated with country-specific intercepts and cross-equation restrictions on the other coefficients to make them equal across countries or group of countries. Given the structure of the system, the number of suitably lagged explanatory variables that can serve as potential instruments greatly exceeds the degrees of freedom of each equation in the system (for details, see Iossifov, Cihák, and Shanghavi, 2008). To overcome this problem, we use as instruments (for all equations in the system) the third lags of the euro area output gap, euro area core inflation, OECD core inflation excluding euro area, as well as the first two principal components of the country-realizations in our sample of domestic inflation, unemployment gap, output gap, nominal effective exchange rate and the contribution of administered prices to inflation. This gives us 13 instruments on each equation in the system, of which 8 instruments that we use as explanatory variables in the model (6 country specific and 2 global factors) and 5 instruments that we just listed before. To ensure exogeneity of instruments with respect to system's error terms, they are lagged by three periods.

[6] The more commonly used Arellano-Bond dynamic-panel GMM estimator is not appropriate in the case of our database with 10 countries, because in order to be able to rely on its asymptotic properties, the cross-sectional unit dimension of the data must be very large.

The results in Table 4 from the System 2SLS and 3SLS estimations of our preferred model, in general, reiterate the importance of disinflationary spillovers from the euro area to SEE countries. The system 2SLS estimates of all regression coefficients remained similar in magnitude with their fixed-effects OLS counterparts and statistically significant at the 99 percent level of confidence for all explanatory variables, except for unemployment gap which is statically insignificant in both estimates. Moreover, the system 2SLS confirms that soft peg fixed exchange rate regimes and hard peg fixed exchange rate regimes explain the different elasticities of domestic inflation in SEE countries with respect to EA core inflation. Results from system 3SLS are slightly different in the magnitude of all regression coefficients. Moreover, all coefficients in system 3SLS remained statistically significant in line with the fixed-effects OLS findings, except administered prices, and unemployment gap turn to be significant at 1% level. EA core inflation interacted with the FX-regime and trade exchange with EA has the expected positive impact for SEE economies in system 3SLS estimates, but is not statistically significant.

Table 4 System 2SLS and 3SLS estimation of preferred regression specification

	Headline Inflation	
	(1)	(2)
	System 2SLS	System 3SLS
Country specific factors:		
Inflation (-1)	0.869***	0.959***
	(0.0391)	(0.0566)
Inflation (-2)	-0.288***	-0.233***
	(0.0336)	(0.0362)
Inflation expectations (1-year ahead)	0.323***	0.131*
	(0.0292)	(0.0758)
Unemployment gap	-0.0476	-0.128***
	(0.0309)	(0.0391)
Contribution of administered prices	0.285***	0.0633
	(0.0846)	(0.0888)
Nominal effective exchange rate	-0.0298***	-0.0784***
	(0.00967)	(0.0111)
Global factors:		
Global energy inflation * weight of energy in consumer baskets	0.0878***	0.0955***
	(0.0158)	(0.0165)
Global food inflation * weight of food in consumer baskets	0.0573***	0.0419***
	(0.0143)	(0.0152)
Euro Area core inflation interacted with FX-regime dummy variables and the share of trade exchange with EA:		
Hard peg * trade exchange with EA	1.558***	0.205
	(0.580)	(0.268)
Soft peg * trade exchange with EA	2.253***	0.236
	(0.654)	(0.280)
Floating * trade exchange with EA	0.644	0.427
	(0.674)	(0.333)
	452	458
	0.9131	0.9222
	10	10

Notes: standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; sample 2004q1-2017q1.

6. Conclusion and policy implications

Global cost-related factors and euro area inflation developments play an important role in explaining inflation dynamics in ten SEE countries. Changes in world food and energy prices, together with related changes in administered prices, account for important determinants of inflation trends in this region. In general, we show that disinflationary spillovers from the euro area have been an important factor for fixed exchange rate regime countries, especially those with high exposure of trade exchange to euro area market. Furthermore, country-specific analysis shows that countries with less rigid exchange rate regimes but with relatively high exposure of trade exchange to euro area market appear to be susceptible in large extent to inflation spillovers from the euro area due to their smaller exchange rate volatility. This is a case for two countries in our sample, such as Albania and Serbia. Thus, we can confirm that the rigidity of the exchange rate regime, and exposure to euro area market explain well cross-country differences in inflation elasticities regarding euro area core inflation. Moreover, the dynamics of nominal effective exchange rates are statistically significant determinant and play an important role on inflation process in SEE countries, particularly in floating regime countries. In line with several recent findings about flattening of the Phillips curve in many economies across the world, cyclical unemployment does not appear to be significant in our sample.

Monetary policy response to inflation in SEE countries needs to weigh the risk of (dis)inflationary expectations, bearing in mind the second-round effects of world food and energy prices to labor costs adjustments that they trigger on inflation expectations. SEE countries with floating exchange rate regime have larger flexibility for monetary policy response. Euro peggers do not have monetary autonomy for policy reactions except countries with imperfect capital mobility with the rest of the world, which allows them for a certain amount of monetary policy autonomy. Correspondingly, the ECB monetary policy stance has important implications for inflation developments in SEE countries.

REFERENCES

Bank for International Settlements (BIS) (2017). *87th Annual Report.* BIS, Basel.

Blanchard, O., Cerutti, E. and Summers, L. (2015). Inflation and Activity – Two Explorations and their Monetary Policy Implications, International Monetary Fund, IMF working paper 15/230.

Calvo, G. (1983). Staggered prices in a utility-maximizing framework, *Journal of Monetary Economics*, 12(3), 383-398.

Dabušinskas, A. and Kulikov, D. (2007). New Keynesian Phillips curve for Estonia, Latvia and Lithuania, Bank of Estonia, Bank of Estonia Working Papers 2007-07.

European Central Bank (ECB) (2010). *Energy Markets and the Euro Area Macroeconomy, Structural Issues Report 2010*. European Central Bank.

Franta, M., Saxa, B. and Smidkova, K. (2007). Inflation persistence: euro area and new EU Member States, European Central Bank, Working Paper Series 810.

Galí, J. and Gertler, M. (1999). Inflation dynamics: A structural econometric analysis, *Journal of Monetary Economics*, 44(2), 195-222.

Galí, J. and Monacelli, T. (2005). Monetary Policy and Exchange Rate Volatility in a Small Open Economy, *Review of Economic Studies,* 72, 707-734.

International Monetary Fund (IMF) (2013). *The Dog That Didn't Bark: Has Inflation Been Muzzled or was it just Sleeping?*. World Economic Outlook, Chapter 3, April, IMF.

International Monetary Fund (IMF) (2016). *Annual Report on Exchange Arrangements and Exchange Restrictions.* IMF.

Iossifov, P., Cihák, M. and Shanghavi, A. (2008). Interest Rate Elasticity of Residential Housing Prices, International Monetary Fund, IMF Working Paper 08/247.

Iossifov, P. and Podpiera, J. (2014). Are Non-Euro Area EU Countries Importing Low Inflation from the Euro Area?, International Monetary Fund, IMF Working Paper 14/191.

Lakić, S., Šehović, D. and Drašković, M. (2016). Relevance of Low Inflation in the Southeastern European Countries, *Journal of Central Banking Theory and Practice*, 2, 41-63.

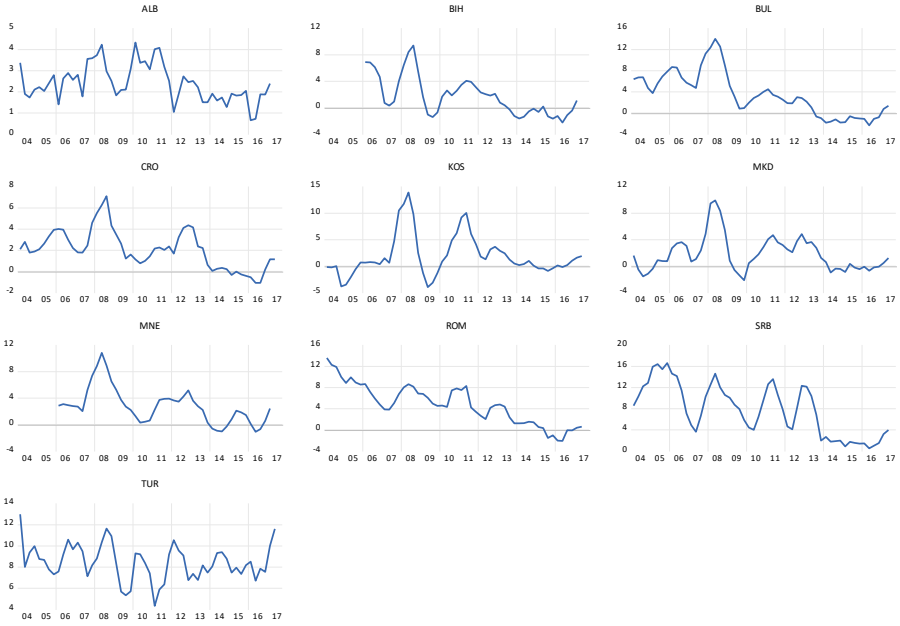
Mihailov, A., Rumler, F. and Scharler, J. (2010). Inflation Dynamics in the New EU Member States: How Relevant Are External Factors?, University of Reading, School of Economics, Working Paper 85.

Taylor, J. (1980). Aggregate Dynamics and Staggered Contracts, *Journal of Political Economy*, 88(1), 1-23.

Vašíček, B. (2010). Monetary policy rules and inflation process in open emerging economies: evidence for 12 new EU members. *Eastern European Economics*, 48(4), 37–58.

Appendix

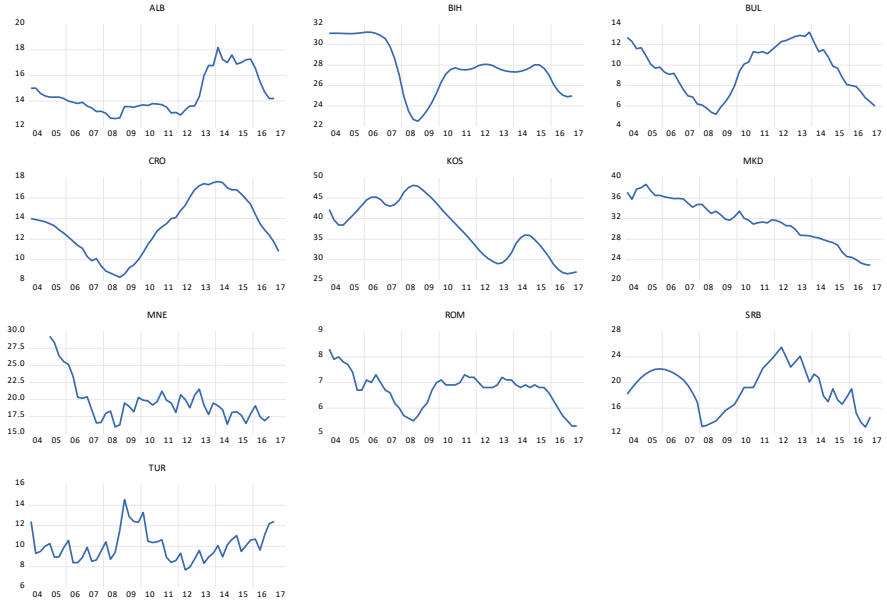
Figure A.1 Consumer prices (percent, year-on-year)



Sources: IMF, International Financial Statistics; and Eurostat.

Note: National CPI indices for Albania (ALB), Bosnia and Herzegovina (BIH), Kosovo (KOS), North Macedonia (MKD), and Montenegro (MNE). HICP data are shown for Bulgaria (BUL), Croatia (CRO), Romania (ROM), Serbia (SRB), and Turkey (TUR).

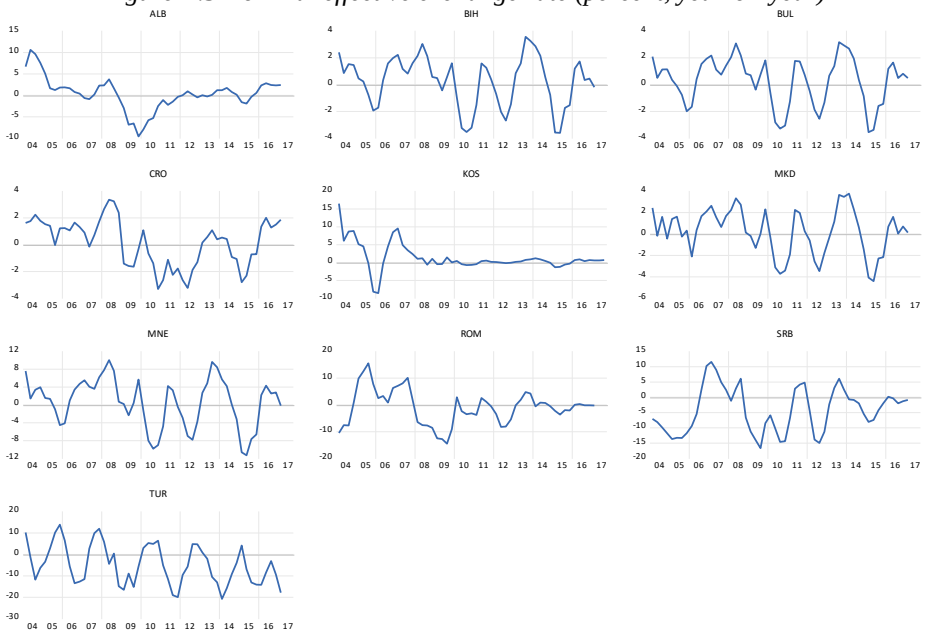
Figure A.2 Unemployment rate, percent



Sources: IMF, International Financial Statistics; Eurostat; and National Statistical Offices.

Note: Series for Bosnia & Herzegovina (BIH) and Kosovo (KOS) for the entire sample period, and for Serbia (sample before 2008Q1) are interpolated with Chow- Lin method using annual data from IMF, WEO Database. Seasonally adjusted data, not calendar adjusted data for Bulgaria, Croatia and Romania.

Figure A.3 Nominal effective exchange rate (percent, year-on-year)

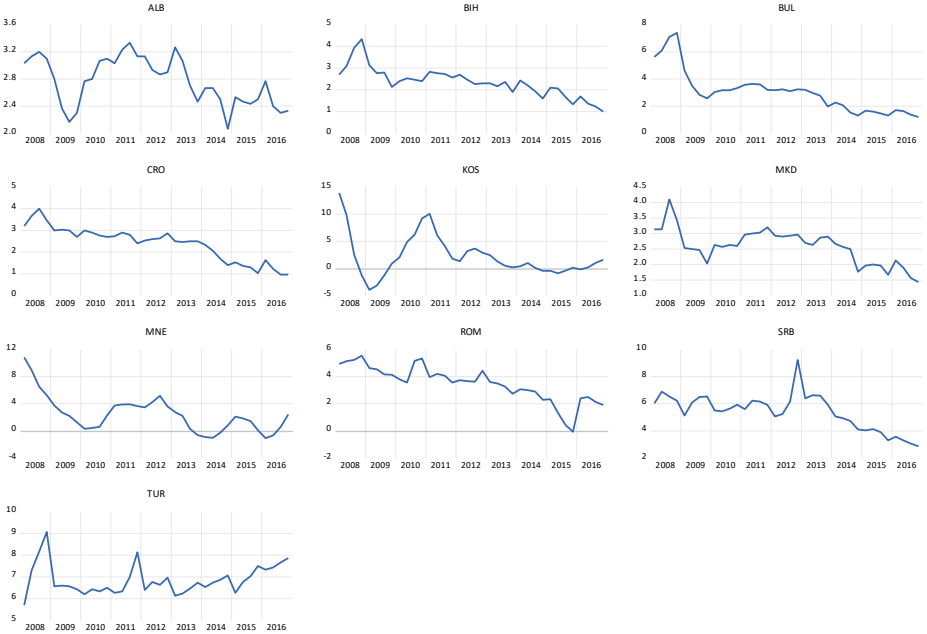


Sources: www.bruegel.org.

An increase denotes appreciation of the national currency.

Note: Source for Kosovo is Central Bank of Kosovo. We use euro area NEER from Bruegel as proxy for Montenegro NEER.

Figure A.4 Consensus Forecasts of inflation one-year ahead (percent)



Source: Eastern Europe Consensus Forecasts, Consensus Economics Inc.

Note: In a given quarter, the plotted observation is the mean forecast of average annual inflation one year ahead (e.g., in 2015Q4 the forecast for 2016 is plotted, and in 2016Q1 -that for 2017). Data before 2008Q1 is one period ahead of actual inflation. One period ahead of actual inflation for the entire sample is used for Kosovo and Montenegro, as these two countries are not included in Consensus Forecasts reports.

Table A.1: Data definitions and sources (variables with italic are those that are directly used in the models)

Variable	Transformation	Source(s)	Frequency	Notes
Headline inflation	Year-on-year, percent change	IMF, International Financial Statistics; and Eurostat	Quarterly	Computed using Consumer Price Index or Harmonized Index of Consumer Prices (2010=100). National CPI indices for Albania, Bosnia and Herzegovina, Kosovo, North Macedonia and Montenegro. HICP data are used for Bulgaria, Croatia, Romania, Serbia and Turkey.
Expected inflation		Eastern Europe Consensus Forecasts, Consensus Economics Inc.	Monthly	Proxy for expectations of future inflation by the mean forecasts of average annual inflation one-year ahead. Data before 2008Q1 is one period ahead of actual inflation. One period ahead of actual inflation for the entire sample is used for Kosovo and Montenegro, as these two countries are not included in Consensus Forecasts monthly reports.
Unemployment rate		IMF, International Financial Statistics; Eurostat; and National Statistical Offices	Quarterly	Series for Bosnia & Herzegovina and Kosovo (entire sample period), and for Serbia (sample before 2008Q1) are interpolated with Chow-Lin method using annual data from IMF, WEO Database. Seasonally adjusted data, not calendar adjusted data for Bulgaria, Croatia and Romania.
Unemployment rate gap		Authors' calculations	Quarterly	Cyclical unemployment rate is extracted with the Hodrick-Prescott filter applied to seasonally adjusted quarterly unemployment rate series. For the Hodrick-Prescott filter we use the typical for quarterly data smoothing parameter _λ = 1600.
Contribution of administered and regulated prices to headline inflation	contributions to year-on-year inflation, in p.p	Eurostat; and National Statistical Offices.	Quarterly	Data source of administered prices for Bulgaria, Croatia and Romania is Eurostat. Data for North Macedonia and Montenegro are from National Statistical Offices. "Housing, water, electricity, gas and other fuels" (4th component of national CPI indices) is used as proxy of administered prices for Albania, B&H, Kosovo, Serbia and Turkey, as most of the administered prices input comes from this component (source: National Statistical Offices). Contribution to headline inflation is calculated using corresponding item weights to CPI and year-on-year percent change of corresponding administered prices.
Nominal effective exchange rate appreciation /depreciation	Year-on-year, percent change	www.bruegel.org.	Quarterly	The NEER series are calculated against 41 trading partners (for more information see the REER dataset in bruegel.org). Computed using nominal effective exchange rate index (2010=100). An increase denotes appreciation of the national currency. Source for Kosovo is Central Bank of Kosovo. We use euro area NEER from Bruegel as proxy for Montenegro NEER.
World energy prices	Year-on-year, percent change	IMF, Primary Commodity Prices	Monthly	Computed using the quarterly average of monthly indices of Energy price index (in US dollars, 2010=100)

World food prices	Year-on-year, percent change	IMF, Primary Commodity Prices	Monthly	Computed using the quarterly average of monthly indices of Food price index (in US dollars, 2010=100)
Energy weight		Eurostat; and National Statistical Offices.	Yearly	Energy weight in consumer baskets. Data for Bulgaria, Croatia, Romania, Serbia and Turkey are from Eurostat. Energy weight for the remaining countries is calculated using the following CPI items: "04.5 Electricity, gas and other fuels" and "07.2.2 Fuels and lubricants for personal transport equipment". Yearly data are assumed the same throughout the quarters of the respective year. Countries like Montenegro and Kosovo did not have long series on weights, but data on broader disagregated groups was available, such as "04 Housing, water, electricity, gas and other fuels" weight, and we used average derivatives from countries with similar weights.
Food weight		Eurostat; and National Statistical Offices.	Yearly	Food weight in consumer baskets (CPI item "01.1 Food" is used). Data for Bulgaria, Croatia, Romania, Serbia and Turkey are from Eurostat, for the remaining countries National Statistical Offices. Yearly data are assumed the same throughout the quarters of the respective year. Countries like Montenegro and Kosovo did not have long series on weights, but data on broader disagregated groups was available, such as "01 Food and non-alcoholic beverages" weight, and we used average derivatives from countries with similar weights.
Euro are core inflation	Year-on-year, percent change	Eurostat	Monthly	Computed using the quarterly average of the monthly index of Overall index excluding energy, food, alcohol and tobacco (2015=100)
Exchange rate regime dummies		IMF		Based on the classification of exchange rate regimes in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (IMF, 2016). 1=hard peg (No separate legal tender; and Currency board arrangement); 2= soft peg (Stabilized arrang.; and Crawl-like arrang); 3=floating (Floating arrang.). Hard peg exchange-rate arrangement countries include B&H, Bulgaria, Kosovo and Montenegro; Soft peg exchange-rate arrangement countries include Croatia and North Macedonia; Floating exchange-rate arrangement countries include Albania, Romania, Serbia and Turkey.
Trade exchange with Euro area to nominal GDP (Trade openness with EA)		IMF, Direction of Trade Statistics (DOTS); IMF, IFS; Eurostat; IMF, WEO database; and authors' estimates.	Quarterly	Computed using Value of Exports of Goods to Euro area (Free on board - FOB, US Dollars) and Value of Imports of Goods from Euro area (Cost, Insurance, Freight - CIF, US Dollars) over nominal GDP expressed in US dollars at actual exchange rates. Quarterly data for GDP (current prices, million units of national currency, unadjusted) are downloaded from Eurostat. Quarterly GDP series for Albania (sample before 2008Q1), B&H (sample before 2012Q1),

				Kosovo and Montenegro (sample before 2010Q1) are interpolated with Chow-Lin method using GDP annual data from IMF, WEO Database. Exchange rate data are from IFS, taken as domestic currency per US dollar, period average, rate.
Real GDP		Eurostat; IMF, WEO database; and authors' estimates.	Quarterly	Chain linked volumes (2010), million units of national currency, unadjusted, downloaded from Eurostat. Series for Albania (sample before 2009Q1), B&H (sample before 2012Q1), Kosovo and Montenegro (entire sample) are interpolated with Chow-Lin method using real GDP annual data from IMF, WEO Database.
Output gap		Authors' calculation	Quarterly	Percentage deviation of actual real GDP from its potential (trend). Cyclical component is calculated by applying Hodrick-Prescott filter to quarterly real GDP data (seasonally adjusted using Census X-12). For the Hodrick-Prescott filter we use the typical for quarterly data smoothing parameter $\lambda = 1600$.
Global core inflation (excl. euro area)	Year-on-year, percent change	OECD	Quarterly	Computed using Consumer price indices excluding food and energy (2010=100) of OECD and Euro area. We subtract form OECD core inflation the Euro area core inflation. Euro area accounts for ¼ of OECD Consumer Prices Indices weights in 2010.
Euro area real GDP		Eurostat	Quarterly	Seasonally and calendar adjusted data. Chain linked volumes (2010), million euro
Euro area output gap		Authors' calculation	Quarterly	Percentage deviation of actual real GDP from its potential (trend). Cyclical component is calculated by applying Hodrick-Prescott filter to quarterly real GDP data. For the Hodrick-Prescott filter we use the typical for quarterly data smoothing parameter $\lambda = 1600$.
Euro area unemployment rate		Eurostat	Quarterly	Percentage of active population. Seasonally adjusted data, not calendar adjusted data.
Euro area unemployment rate gap		Authors' calculation	Quarterly	Cyclical unemployment rate is extracted with the Hodrick-Prescott filter applied to seasonally adjusted unemployment rate.
Euro area instrumented headline inflation		Authors' calculation	Quarterly	Conditional forecast derived from estimating model (2) in Table 1 for the Euro Area without Euro Area core inflation as right-hand side variable in regression specification.
PC1		Authors' calculation	Quarterly	First principal component of the country-realizations in our sample of domestic inflation, unemployment gap, output gap, exchange rate appreciation/depreciation, and the contribution of administered prices to headline inflation
PC2		Authors' calculation	Quarterly	Second principal component of the country-realizations in our sample of domestic inflation, unemployment gap, output gap, exchange rate appreciation/depreciation, and the contribution of administered prices to headline inflation.