Monetary policy, exchange rates and labor unions in SEE and the CIS during the financial crisis*

Branimir Jovanovic

University of Rome "Tor Vergata", Italy

branimir.jovanovic@uniroma2.it

Marjan Petreski

University American College Skopje, Macedonia

marjan.petreski@uacs.edu.mk

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ABSTRACT

The objective of this paper is to assess whether the levels of unionization and the rigidity of exchange rates represent a constraint for the monetary policy in South-Eastern Europe and the Commonwealth of Independent States, with a particular focus on the recent economic crisis. Towards that end, a New Keynesian model with price and wage rigidities is used. The results point out that monetary policy responded counter-cyclically during the crisis only in countries with weak trade unions and countries with flexible exchange rates, which indicates that fixed exchange rates and strong trade unions constrain monetary policy in countries in these regions. Also, the findings

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point out that the main driver of the price inflation in these countries is not economic activity, but wages, which are affected to a large extent by the trade unions. Therefore, trade unions should be active partners in the decision making processes in these countries.

JEL classification: E52, F0, J51, P20

Keywords: monetary policy; fixed exchange rate; wages; unionization; SEE; CIS; crisis

I. Introduction

Different regions in the world faced the recent economic crisis differently. Countries in the Commonwealth of Independent States (CIS) and South-Eastern Europe (SEE), which were growing faster than those in many other regions in the world before the crisis, were severely hit in 2009, but also reverted to growth rapidly in 2010. Still, there are many differences in the growth records between different countries within these groups, which are, to some extent, a reflection of how authorities responded to the crisis. Some may be limited in their ability to respond to negative shocks by prevailing legal and institutional frameworks. For instance, take monetary policy. The ability of a country's central bank to support the domestic economy during crises may be limited by the exchange rate regime: under fixed exchange rates, the efforts of the central bank to support the domestic economy during crises by lowering the interest rate may result in capital outflows and may jeopardize the chosen exchange rate regime, bringing more damage than benefit. Five of the SEE and CIS countries maintain a fixed exchange rate, ten have a rather limited flexibility, and only Romania, Serbia, Tajikistan and Turkey can be classified as floaters. That the exchange rate regime might have served as a constraint during the crisis can be seen from the fact that countries with fixed regimes actually increased their interest rates during the crisis instead of lowering them.[1]

Constraints can emerge from other sources as well, such as wage rigidities. Wage rigidities can create inflationary pressures during crises and may force central banks to increase interest rates in order to fight inflationary pressures instead of lowering them in order to support domestic economic activity. That wages might have indeed served as shock propagators in SEE and the CIS, rather than as shock absorbers during the crisis, can be seen from the observation that real wages

1. It is worthwhile to recognize that although the peg may be constraining policy in those countries during the crisis, neither its choice earlier in the transition has been random (see e.g. De Grauwe and Schnabl, 2008) nor flexible rates have been found to be consistently better than pegs (Petreski, 2009).

continued to grow during the crisis in 11 of the 19 SEE and CIS countries. The main source of such wage rigidities is trade unions. SEE and CIS countries continue to have strong trade unions even today, twenty years after the break-up of the socialist system; 41% of the workers are members of unions, compared to 26% in the European Union (EU).

The objective of this paper is to assess whether the levels of unionization and the rigidity of exchange rates represent a constraint for the monetary policy in South-Eastern Europe and the Commonwealth of Independent States, with a particular focus on the recent economic crisis. In doing so, the research aims to disentangle how the rigidity of the exchange rate and the degree of unionization in these countries potentially affected the conduct of monetary policy and the real economy. To achieve this objective, the study utilized a version of the New Keynesian model with embedded price and wage rigidities, whereby the monetary policymaker faces trade-offs in stabilizing wage inflation, price inflation and the output gap. Trade unions enter the model through the labor wedge, arising from monopolistic competition in the labor market, i.e. trade unions might affect the equilibrium-restoring mechanism in the wage dynamic. The exchange rate enters the model directly as a term in the monetary policy function. A panel GMM technique was used to estimate the model for 19 SEE and CIS countries over the period from January 2002 to March 2011. The model was estimated for different sub-groups of countries (SEE vs. the CIS, fixed exchange rate vs. floating, strong vs. weak unions) and for different time periods (before the crisis vs. during the crisis[2]), and the conclusions drawn are based on these comparisons. Since the panel of countries is rather heterogeneous, the results should not be interpreted as valid for all (or any) of the analyzed countries, but only as general.

Several findings emerged from the analysis. First, the output gap is found not to depend on the real interest rate in accordance with the low level of development of the financial markets in these economies. Second, inflation is found not to depend on the output gap, but on the wage gap. The insignificance of the output gap may not be surprising finding in the empirical literature on the New Keynesian Phillips curve (see, e.g. Mihailov et al., 2011), and may be due to its correlation with the wage gap, but since monetary policy in this model affects inflation through the output gap, and trade unions through the wage gap, this points to the fact that labor unions

2. We chose to use the wording "during the crisis", not "after the crisis", for 2009-2011 since it is difficult to argue that the crisis was over in this period, despite the GDP growth in some of the countries for which an analysis was undertaken during 2010.

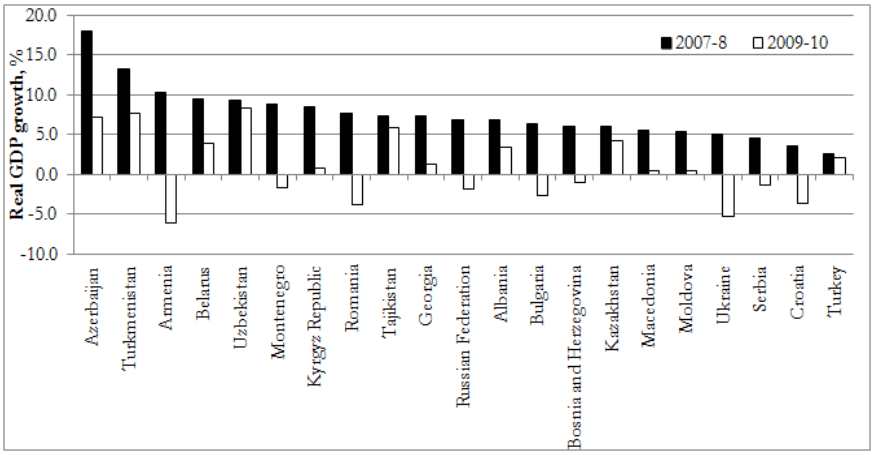
may have more power over inflation dynamics in SEE and CIS than monetary authorities. Third, wages depend on the wage gap, which incorporates the influence of the trade unions, but not on the output gap; the lack of sensitivity of wages to economic activity can be explained by the high level of unemployment in SEE and CIS as the labor supply is high irrespective of the cycle, or by the potentially noisy measure of the output gap. Fourth, monetary policy in countries with weak unions, on average, has supported the economy during the crisis differently than in countries with strong unions. Finally, monetary policy in countries with fixed exchange rates, on average, is found not to react to domestic economic developments during the crisis in contrast to countries with flexible rates.

The rest of the paper is organized as follows. Section 2 presents certain stylized facts about economic activity, monetary policy and wages in SEE and CIS countries. Section 3 reviews the associated literature, suggesting that the issues the present paper addresses have remained largely unexplored, especially in the literature on developing countries. Section 4 briefly portrays the theoretical model used in the econometric analysis. Section 5 explains the data and the empirical methodology. Section 6 presents the econometric results and offers some explanations. Section 7 summarizes the analysis and discusses the policy implications.

II. Stylized facts

Different countries in SEE and the CIS were growing at different rates before the global economic crisis hit in late 2008. Afterwards, different countries were affected in different ways. GDP growth in the 21 SEE and CIS countries before the crisis (2007-2008) and during it (2009-2010) is shown in Figure 1.

FIGURE 1: GDP GROWTH IN SEE AND CIS COUNTRIES BEFORE AND DURING THE CRISIS



Source: IMF's International Financial Statistics. Countries are ordered according to the average GDP growth for 2007 and 2008, from highest to lowest. Turkmenistan and Uzbekistan are excluded due to data unavailability.

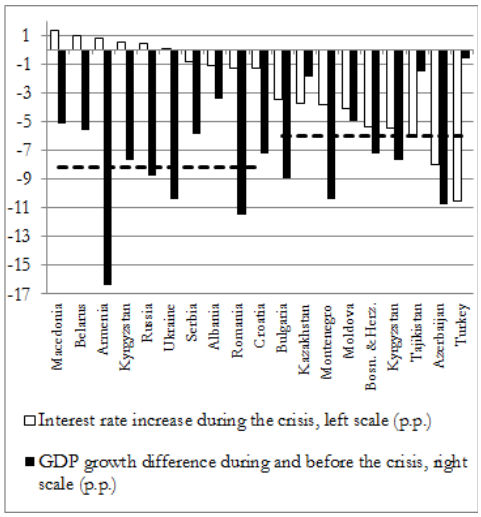
The crisis came to these regions with some lag (end of 2008 and beginning of 2009), but the SEE and CIS countries still suffered heavily. The crisis spread through three main channels - foreign demand, terms of trade and finance, in different proportions for different countries. Many factors help explain why different countries performed differently during the crisis. The main findings are that countries that were more vulnerable before the crisis (had higher financial openness, higher current account deficits, higher external debt and higher credit growth) and had less scope for policy support, suffered more (for more, see Berglof et al, 2009; Blanchard et al, 2010; Crespo Cuaresma and Feldkircher, 2012; IMF, 2010).

The motivation for the present paper emerges from the finding in these studies that the scope for policy support was a crucial determinant of how the countries fared during the crisis. We will focus our attention on the monetary policy. It may be noticed that countries where monetary policy was more expansionary suffered less during the crisis (recorded a lower decline in GDP growth); the average slowdown in GDP growth for the right-hand-side sub-sample in Figure 2, which had a more expansionary monetary policy, was six percentage points, whereas for the left-hand-side sub-sample in the same figure, which had a less supportive monetary policy, it was eight percentage points.

While this observation may be expected, it may be worthwhile to analyze which factors prevented monetary policy from being more expansionary. This study aimed to do so. It focused on two important factors: the regime of the exchange rate and the level of unionization. Other factors of macroeconomic and institutional nature, like the budget deficit, the indebtedness, the exchange-rate pass-through, or the level of euroization, may have constrained authorities, too, and may be worthwhile to investigate[3]. However, we leave this for future research.

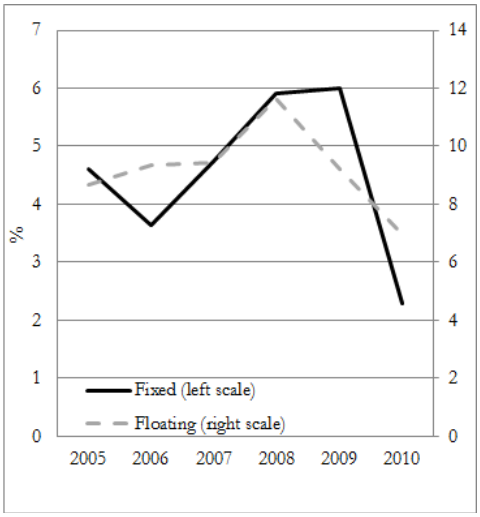
3. For more on how the fiscal policy can constrain the monetary policy response in these countries, see Lewis (2004), Lipinska (2008) or Mikek (2008). Some evidence on the interactions between fiscal and monetary policy during the crisis in these countries is provided by Mitreska et al. (2010). For more on the exchange-rate pass through, see Velickovski and Pugh (2011). For more on the effect of the euroization, see Chitu (2012).

FIGURE 2: GDP GROWTH SLOWDOWN AND INTEREST RATE INCREASE DURING THE CRISIS



The average in 2009-2010 vs. average in 2007-2008. The black dashed lines on the left figure are the averages of the GDP growth decline for the first and second half of the countries (Macedonia-Croatia and Bulgaria-Turkey). Source: IMF's International Financial Statistics.

FIGURE 3: INTEREST RATES IN SEE AND CIS COUNTRIES WITH FIXED AND FLOATING EXCHANGE RATES DURING THE CRISIS



Countries with fixed exchange rate are Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia and Montenegro. All remaining SEE and CIS countries are classified as countries with floating exchange rate (see Section V.A for more details on this). The reported figures are simple averages for the countries that belong to the respective groups. Source: IMF's International Financial Statistics.

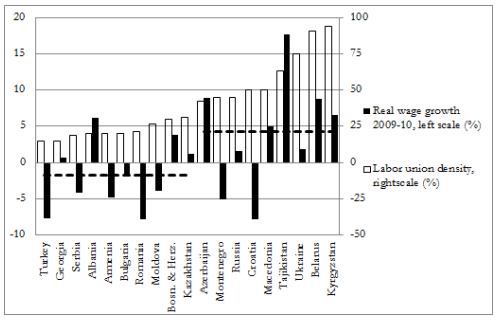
Figure 3 shows the central bank interest rates in SEE and CIS countries with fixed and flexible exchange rates. The constraining role of the peg can be sensed by the notion that countries with flexible exchange rates saw their interest rates declining when the crisis unfolded in 2009, while interest rates in countries with fixed exchange rates rose during the same period, as a consequence of the efforts to defend the currency from devaluation pressures[4]. Admittedly, the difference is statistically insignificant at the 5% level, and a larger relative decline is observed subsequently in

4. See, for instance, National Bank of the Republic of Macedonia (2009, p. 3 and 4), Croatian National Bank (2009, p. 7 and 8).

the countries with fixed exchange rates, when these devaluation pressures subsided.

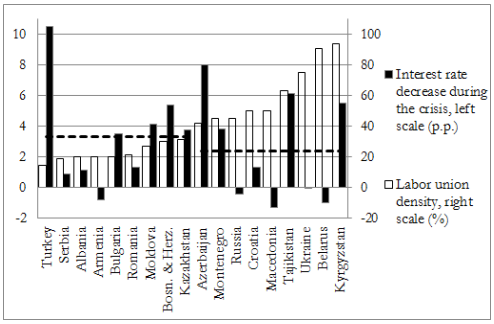
As for the unionization, it is interesting to observe the correlation between the real growth in wages during the crisis and the level of unionization (Figure 4). Wages in countries with higher unionization (right-hand-side sub-sample in Figure 4) rose in 2009 and 2010, by 4% on average, differently from wages in countries with lower unionization (left-hand-side sub-sample in Figure 4), which fell by 2% on average (again, the difference is not statistically significant, due to the small sample). This suggests that strong unions might act to prevent wages from falling during a crisis, which then has implications for how the crisis unfolds. Wage rigidity has implications for monetary policy too, as higher wages lead to higher inflation and higher inflation requires higher interest rates. In times of crisis, higher wages might push interest rates up, in order to fight inflation, preventing monetary policy from being expansionary and supporting the real economy. That this might indeed have been the case can be seen from Figure 5, which shows the central banks' interest-rates decline during the crisis for countries with high and low levels of unionization. It can be observed that countries with lower level of unionization (left-hand-side sub-sample) had more supportive monetary policy during the crisis - the average interest-rate decline in these countries was 3.3 percentage points, compared to 2.4 percentage points in the countries with high unionization (although the difference is not statistically significant). Therefore, wages may have generated inflationary shocks in countries with strong labor unions during the crisis, in addition to the demand shock, experienced due to the global crisis.

Figure 4: Real wage growth during the crisis and the level of unionization



The black dashed lines are the averages of the real wage growth for the first and second half of the countries (Turkey-Kazakhstan and Azerbaijan-Kyrgyzstan). Source: New Unionism Network Global Union Database and authors' calculations based on IMF's International Financial Statistics.

Figure 5: Interest rate increase during the crisis and the level of unionization



The black dashed lines are the averages of the interest rate incease during the crisis for the first and second half of the countries (Turkey-Kazakhstan and Azerbaijan-Kyrgyzstan). Source: New Unionism Network Global Union Database and authors' calculations based on IMF's International Financial Statistics.

III. Literature overview

Monetary policy and wage bargaining in SEE and the CIS have not been researched to any great degree. The reason with regard to monetary policy may be the strict exchange rate regimes in these countries; the average value of the exchange rate rigidity for SEE and the CIS is 2.1, which corresponds to a conventional peg in the Ilzetzki, Reinhart and Rogoff (2008) classification (see Table 1). This may imply that monetary policy could not have been used actively for pursuing domestic objectives. The reason in relation to wage bargaining may lie in the focus that these countries put on their relatively high unemployment levels despite the high labor unionization; the average unionization rate for SEE and the CIS is 41% (see Table 1), in contrast to a rate of 26% in the EU.[5]

5. The number for the EU is from the Federation of European Employers.

Table 1: De-facto exchange rate regimes and unionization in SEE and CIS

Country	Average rigidity of the exchange rate (2000-2010)*	Degree of unionization (in percent)**
	SEE	
Albania	2.5	20
Bosnia and Herzegovina	1	30
Bulgaria	1	20
Croatia	2	50
Macedonia	1.1	50
Montenegro	1	45
Romania	3	21
Serbia	3	19
Turkey	3.9	15
	CIS	
Armenia	2.4	20
Azerbaijan	2	42
Belarus	2	91
Kyrgyz Republic	2	94
Georgia	2.5	15
Kazakhstan	2	31
Moldova	2	27
Russia	2	45
Tajikistan	2.8	63
Ukraine	1	75
Average for all countries	**2.1**	**41**

Notes: *Measure of de-facto exchange rate rigidity from Ilzetzki, Reinhart and Rogoff (2008): 1=complete euroisation/currency board; 2=conventional peg; 3=managed float; 4=free float. Some numbers in the table are not integers, because they are averages for 2000-2010. **Labor union density (percent of total salaried people)

Source: Exchange rate rigidity - Ilzetzki, Reinhart and Rogoff (2008). Union density - New Unionism Network Global Union Database and other sources (see Appendix for more details).

Starr (2005) investigated whether monetary policy has real effects in the four largest CIS countries - Russia, the Ukraine, Belarus and Kazakhstan - and found little evidence for such effects.

The reasons for the non-existence of this channel are likely to be the relative flexibility of prices and wages, thin credit markets, and the fact that domestic interest rates cannot be determined independently of world capital markets. De Grauwe and Schnabl (2008) analyzed the relationship between exchange rates, inflation and growth in South-East and Central Europe and concluded that monetary policy with pegged currency is not an obstacle for growth. Quite the contrary, the study found that this setup leads to increased trade and lower interest rates in the SEE region. Keller and Richardson (2003) argue that these countries manage their currencies heavily; they frequently peg their currency in practice to prevent high exchange rate volatility from negatively affecting the economy. In addition, Korhonen and Wachtel (2006) and Velickovski and Pugh (2011) document the high exchange rate pass-through to prices in these countries, lending additional support to the observation that the smoothing of exchange rate fluctuations might be optimal. Arandarenko (2004) and Pavlova and Rohozynsky (2005), on the other hand, give an elaborative overview of the evolving labor market institutions and trade unions in SEE and the CIS, respectively. The first review concludes that labor unions in SEE progressed from being institutions of Communist party control ('transmission mechanisms') and distributors of fringe benefits to being representatives of workers' economic interests. However, their bargaining power declined both at the national and at the company level, especially in the private sector. The second review argues that the transformation of labor markets in the CIS is incomplete and many problems remain, such as centralized wage-setting, underemployment and ineffective systems of labor relations and social protection. Aside from these two studies, to our knowledge, no study analyses the economic outcomes of the wage-setting process and unionization level, let alone integrates the impact of monetary policy and wage bargaining on economic outcomes in a single quantitative framework.

In the world literature, the integration of monetary policy responses and wage bargaining in a single quantitative framework is also relatively new. An early paper which examined the implications of wage rigidities for monetary policy is that of Erceg, Henderson and Levin (2000) who found that targeting inflation only is suboptimal in the presence of wage rigidities. Giannoni and Woodford (2003) further extended their work, arguing that in some cases optimal monetary policy implies targeting a weighted average of price and wage inflation. Christiano, Eichenbaum and Evans (2005) conclude that wage rigidities are more important than price rigidities in explaining monetary effects on the real economy. Smets and Wouters (2003, 2007) conclude that wage rigidities

are very important drivers of the business cycle. Champagne and Kurmann (2010) find that the increase in wage volatility in the US is likely to be due to a decline in unionization and a shift towards performance-based pay contracts.

IV. Theoretical and empirical model

The model that we use was developed by Erceg, Henderson and Levin (2000). This is a small New Keynesian model with price and wage rigidities, with infinite time periods, two types of agent in the economy, i.e. households and firms (and the central bank), and two markets, i.e. for labor and for goods. There is a continuum of households which make use of consumption goods and offer differentiated labor to firms. They maximize expected utility, which depends positively on consumption and negatively on hours worked. There is a continuum of firms which produce differentiated consumption goods, using identical production technology and one factor of production - labor - and maximize expected profits. Both labor and goods markets are monopolistically competitive (that is, different labor types can substitute themselves, but only imperfectly; same for the goods), as a result of which households/firms can set the prices of their labor/goods types. However, they cannot change their prices at every turn as there is some stickiness in the price of labor/goods. The central bank sets the interest rate.

Maximization of the agents' objective functions, log-linearizing the first-order conditions around the steady state, and some additional algebraic manipulations, yield the following equations:

$$y_t = Ey_{t+1} - \frac{1}{\gamma}(i_t - E\pi^p_{t+1} - r^n_t) \tag{1}$$

$$\pi^p_t = \beta E\pi^p_{t+1} + \kappa_p y_t + \lambda_p w_t \tag{2}$$

$$\pi^w_t = \beta E\pi^w_{t+1} + \kappa_p y_t + \lambda_p w_t \tag{3}$$

$$\Delta w_t = \pi^w_t - \pi^p_t - \Delta w^n_t \tag{4}$$

The first equation is the IS curve, which defines the output gap (y_t) as a positive function of the expected output gap (Ey_{t+1}) and a negative function of the real interest-rate gap ($i_t - E\pi^p_{t+1} - r^n_t$). The intuitive explanation for this equation is that output will grow when agents expect output growth in the future and when the real interest rate is falling (because they will find it easier

to borrow). The second equation is the price Phillips curve, which defines price inflation (π_t^p) as a positive function of the expected price inflation ($E\pi_{t+1}^p$), the output gap (y_t) and the real wage gap (w_t). Therefore, price inflation today will be higher when expected future price inflation is higher and when output and wages are growing. The third equation, similarly, defines wage inflation (π_t^w) as a positive function of the expected wage inflation ($E\pi_{t+1}^w$) and the output gap (y_t), and a negative function of the real wage gap (w_t). Intuitively, wage inflation will rise when future wage inflation is expected to increase, when the output is above the potential (because of the higher demand for labor), and when real wages are below the equilibrium (because wages will tend to return to the equilibrium level). The last equation is simply an identity which expresses the change in the real-wage gap (Δw_t) as a difference in the wage and price inflation ($\pi_t^w - \pi_t^p$) and the increase in the natural wage (Δw_t^n).

The parameter γ denotes the coefficient of relative risk aversion, β is the discount factor, κ_p and κ_w are parameters showing how the output gap affects price and wage inflation, and λ_p and λ_w show how price and wage inflation depend on the real wage gap.

This model was the first New Keynesian model that incorporated wage rigidities. Huge literature emerged subsequently on the issue. One strand of literature included unemployment in the model following the approach of Gali (1996), i.e. treating unemployment as a consequence of the excess of labor supply in a situation when wages cannot be reset. As Casares (2010) illustrates, the only change this brings, with respect to the Erceg, Henderson and Levin (2000) model, is that wage inflation equation now includes unemployment, instead of the output gap. Including indexation in the price and wage setting behavior, as in Gali (2011) and Gali, Smets and Wouters (2011), results with inertia in the price and wage dynamics. Another strand of literature has focused on including labor markets in the New Keynesian model through search and matching frictions a-la Diamond-Mortensen-Pissarides.[6] These papers include Cheron and Langot (2000), Walsh (2003) and Trigari (2006). Most recently, authors have incorporated both search and matching frictions and wage rigidities in New Keynesian models (see Christoffel, Kuester and Linzert, 2009, Gertler, Sala and Trigari, 2008, Walsh, 2005, Trigari, 2009, de Walque et al., 2009, Thomas 2008, Blanchard and Gali, 2010). Alternative approaches for modeling labor markets have been proposed by Christiano, Trabandt and Walentin (2010) and Zanetti (2007).

6. See Diamond (1982a, b), Mortensen (1982a, b), and Pissarides (1984, 1985), for early contributions, or Pissarides, 2000, for detailed elaboration on the Diamond-Mortensen-Pissarides model.

While it may seem that the Erceg, Henderson and Levin (2000) model that we used is outdated today, given all these new developments in the literature, it is still suitable for our purposes, because it incorporates the elements we are interested in, which allows us to investigate the relationship between trade unions, real economy and monetary policy. In addition, it is simple and small, which cannot be said for the later models.

Another question regarding the appropriateness of our model refers to its absence of external sector. Open-economy models, similar to Gali and Monacelli (2005) may seem more appropriate for these countries. However, as can be seen in Gali and Monacelli (2005), the differences between the closed and the open economy models are small and almost irrelevant for our analysis. The first difference refers to the price Phillips curve, where the open-economy version features an additional term as explanatory variable for the inflation - the change in terms of trade (foreign prices/domestic prices). But, if the inflation differential between a country and its major trading partners has a constant mean and variance and no serial correlation, which is likely to be the case, this term will not change anything in the regression. The second difference refers to the IS curve, where the only difference is that now the growth of foreign GDP appears in the natural interest rate. But, since we calculate the natural interest rate by the Hodrick-Prescott filter, the IS curves from the two models will be identical in our case.

The model is closed with a monetary policy rule. Although the exact optimal monetary policy rule in this model depends on the value of the model parameters, as Giannoni and Woodford (2003), Woodford (2003) and Gali (2008) argue, optimal monetary policy in this model reacts to a weighted average of wage and price inflation. On the other hand, as Erceg, Henderson and Levin (2000) argue, the Taylor rule performs almost equally well (in terms of welfare losses) as the optimal monetary policy rule in this model. Therefore, we used a Taylor-type rule, in which monetary policy responds to price inflation, wage inflation and output gap. However, the sample of countries analyzed consisted mostly of small and open economies for which the external sector plays a vital role for the performance of the aggregate economy.[7] Because of this and the related macro-context in those economies (including the degree of euroization and the high exchange rate pass-through), the interest rate rule also includes the nominal exchange rate, to capture the tendency to smooth fluctuations in the exchange rate. In addition, some of the countries in the

7. Even in the countries that might not qualify as small economies, such as Russia, the Ukraine or Turkey, the external sector plays a prominent role in the economy.

sample have a pegged currency, which represents a constraint on monetary policy. To capture this constraint, the monetary policy rule also includes the official reserves, since insufficient reserves might preclude the central bank from targeting inflation or output in a situation when there are pressures on the exchange rate (see Jovanovic and Petreski, 2012, on this).[8] Hence, the monetary-policy rule is of the form:

$$i_t = \rho + \phi_p \pi_t^p + \phi_w \pi_t^w + \phi_y y_t + \phi_q ER_t - \phi_x res_t \tag{5}$$

where i_t stands for the nominal interest rate, ER_t for the nominal exchange rate, res_t for the international reserves, π_t^p, π_t^w, and y_t are as previously defined (price inflation, wage inflation and output gap) and the ϕ denotes parameters that represent central bank preferences.

V. Data and methodology

V.A. Data and variables

Monthly data were used since monetary decisions are usually made on a fortnightly frequency (see Clarida et al, 2000) and since monthly data give more observations, though, admittedly, with potentially more noise. The sample used in the analysis comprised 19 countries from SEE and the CIS: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Georgia, Kazakhstan, Kyrgyzstan, Macedonia, Moldova, Montenegro, Romania, Russia, Serbia, Tajikistan, Turkey[9] and the Ukraine. Turkmenistan and Uzbekistan are not included, mainly due to the unavailability of data. The time period analyzed was January 2002 to March 2011. The chosen nine-year period roughly coincides with one business cycle and would enable comparison of policy responses before the crisis and during the crisis.

The database included data on the reference interest rate of the monetary authority, the consumer price index, industrial production (economic activity), average nominal wages in the economy, international reserves and the nominal exchange rate (against the dollar or the euro, de-

8. Furthermore, the movements in reserves contain important information relating to external sector developments, as well as the whole economy, and monetary authorities observe data on foreign reserves in real time.

9. It is true that Turkey is slightly different from the other included countries, in the sense that it did not have a socialist system in the past. However, it belongs to this region, geographically, and is included in Eastern Europe by the major institutions (see, e.g. IMF, 2011, p. 174).

pending on which currency is more important for exports, see the Appendix; the exchange rate is defined so that increase stands for depreciation). The main data source was the International Financial Statistics (IFS) of the IMF. Industrial production data for many of the countries were from the United Nations Economic Commission for Europe (UNECE), while data on wages were mainly from the International labor Organization (ILO). Data that were not available from these sources were obtained from the corresponding statistical offices or central banks (a detailed list of sources is given in the Appendix).

All the series were rebased so that the average for 2007 was made equal to one. All data that exhibited seasonal patterns were seasonally adjusted (industrial production, wages, prices) using the Census X-12 method. Real wages were calculated by dividing nominal wages with the CPI index, while real interest rates were calculated by subtracting the annual inflation rate from the nominal interest rates. Industrial production, real interest rate, real wages, nominal exchange rate and reserves were non-stationary, and were detrended, using the Hodrick-Prescott filter, with a smoothing factor of 14400, following the suggestions of Backus and Kehoe (1992).[10] Detrending these data using the HP filter, instead of first-differencing, implies that the trends in the variables are deterministic, not stochastic (see, for instance, Enders, 1994). We believe that this is a reasonable assumption, since it is hard to imagine that any of these variables is a random walk process[11]. Therefore, all the variables in the regressions were stationary in accordance with the requirements of the GMM technique (unit root tests are not reported, but are available on request).

The leads of the variables were used as proxies for expectations about the future values of the variables. The error terms in the estimated regressions justify this since they capture (amongst other things) the differences between the leads of the variables and the true expectations of the agents, which, according to the rational expectation hypothesis, are white noise processes as agents do not make systematic errors.[12] In addition, some papers, such as that of Brissimis and Magginas (2008), have found no significant difference between using lead values versus responses from surveys or other types of forecast in the context of inflation.

10. They suggest the following rule for choosing the smoothing factor: factor = 1600*(number of periods in the year/4)^2. For monthly data, this yields 14400.

11. Only the nominal exchange rate can be considered as a random walk, but on a higher frequency (e.g. daily).

12. Note that there are no error terms in the theoretical model (equations 1-4). The error terms appear only in the model that is estimated, due to measurement errors or omitted variables.

Several dummies appear in the analysis: for a fixed/flexible exchange rate, for low/high labor unionization and for SEE countries versus those in the CIS. The classification of Ilzetzki, Reinhart and Rogoff (2008) was loosely followed in order to decide which countries had fixed exchange rates during the crisis, where countries with a value of exchange rate rigidity of 2 and below 2 (hard pegs and conventional pegs), that did not devalue their currencies during the crisis, were classified as countries with fixed exchange rates. Hence, five countries in the dataset have fixed exchange rates: Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia and Montenegro. The data on labor union membership density from the New Unionism Network was used to classify countries as having low versus high levels of unionization, where countries with a density below the average for all the analyzed countries (41%) were treated as having a low level of unionization (Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Georgia, Kazakhstan, Moldova, Romania, Serbia, and Turkey) and the rest as having a high level of unionization. The degree of unionization is, admittedly, not a perfect measure of the power of the trade unions. It is possible that some of the SEE and CIS countries have still very high levels of union membership, a residue of the socialist past, without real power of the unions. However, the authors are not aware of an alternative measure of the trade-unions power, available for all these countries. The widely-used index of labor market freedom from the Heritage Foundation, or the index of labor market flexibility of the World Economic Forum, refer mainly to labor market regulation, not bargaining power of unions, which is something different. Finally, the dummy for SEE took the value of one for Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Montenegro, Romania, Serbia and Turkey and zero for Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan and the Ukraine.

In order to assess differences in the policy response before the crisis versus during the crisis, two sub-samples were used: January 2002 to December 2008 and January 2009 to March 2011. The breakpoint was determined on the grounds of two tests for a structural break in the economic activity (industrial production) series. In the first, the log of the economic activity was regressed on a constant, trend and three dummies for the structural break - one for the shock (taking a value of one in one month only), one for a level shift (taking a value of one for all the months after the shock), and one for a change in the intercept (the level shift, multiplied by the trend). The structural break was first set to January 2008, and then if all the three dummies were not

negative, the structural break was set to the next month and so on. The first period in which all three dummies appeared negative and jointly significant was chosen as the breakpoint. In the second test, the same scheme was used, only the regression included the output gap (gap in industrial production) as a dependent variable and a constant, a shock and a level shift dummy. Both approaches suggested January 2009 as the most likely breakpoint - the time period after which the crisis took place.

V.B. Econometric methodology

One feature of the model described in Section 4 is the endogeneity of the variables, emerging from the notion that the dependent variables affect some of the independent variables (simultaneity). Because of this, the four equations were estimated using the Generalized Method of Moments (GMM) panel. This is a fixed-effects estimator which accounts for the endogeneity present in the model. Here, fixed effects are preferred to random effects a priori, as in all cross-country analyses, since differences between the countries cannot be claimed to be stochastic, that is, the sample of countries cannot be considered to be random. Although the policy rule equation features a lag of the dependent variable as one of the regressors, it was still estimated by standard GMM and not by dynamic panel methods (Arellano-Bond, Arellano-Bover or Blundell-Bond), since dynamic panel methods are appropriate for typical micro panels, with a small time series dimension. When the time dimension is large, as in our case (around 100 monthly points), the dynamic panel bias that emerges from the lagged dependent variables vanishes (see Roodman, 2009), so there is no need for a dynamic panel technique. Heterogeneous panel techniques (Pesaran, Shin and Smith, 1999; Pesaran and Smith, 1995), which allow for differences in coefficients between the cross sections, were not considered since they do not account for endogeneity.

As usual when working with GMM, lags of the independent variables were used as instruments for their current values. The validity of instruments was assessed using four tests: the Hansen J test, where the null hypothesis is that the over-identifying restrictions are valid; the Kleibergen-Paap rank test, where the null is that the model is under-identified; the Cragg-Donald and the Kleibergen-Paap rank tests, where the null is that the model is weakly identified (see Baum et al, 2007; Cragg and Donald, 1993; Kleibergen and Paap, 2006; Kleibergen and Schaffer, 2007). Usually, three lags of the explanatory variables are used as instruments. In the specifications in

which some of the tests are violated, the instrument list is adjusted (either decreasing or increasing the number of lags) until the tests are satisfied.

In addition to the estimations for the whole sample of countries, the analysis was done using subsamples constructed on three criteria: the exchange rate regime, the geographical location and the level of unionization, as explained in section V.A. Our main interest lies in how these country characteristics affect monetary policy. The differences in certain regression coefficients between the estimations for the different groups of countries will inform us about this. It should be noted that the obtained results would represent averages for the included countries, and do not have to hold for every single country, just like the results from cross-sectional regressions do not have to hold for every individual observation.

VI. Results, discussion and policy implications

VI.A. Results and discussion

In this section, we present estimates of the four equations in the model (equations 1-3 and equation 5).[13] The estimates are presented in Tables 2-5. The top parts of the tables report the regression coefficients, while the bottom parts report the tests of the validity of the instruments. The coefficients that are reported are the **long-run coefficients**[14].

The New Keynesian IS curve is presented in Table 2. Two things should be noted. First, the coefficient on the expected output gap is not statistically different from the theoretical value of unity in most of the regressions, albeit the point estimate of the coefficient is higher than one. Second, the coefficient on the real interest rate gap is never statistically significant, which suggests that monetary policy decisions are not transmitted to the business cycles, at least not through the interest rate[15]. The latter finding can be explained by the underdeveloped financial markets in those countries and, in particular, as Gigineishvili (2011) suggests, by the excess of banking liquidity that is a prominent characteristic of transition countries. The finding is consistent with Starr (2005) and Velickovski (2012), who found the same result for the four largest CIS countries

13. Equation 4 is an identity and should not be estimated. It relates the real wage gap to wage and price inflation and is needed for simulations.

14. Standard errors are not reported, for clarity, and because the coefficients that are presented are the long-run coefficients, not the original regression coefficients. The original regression estimates are available upon request.

15. The other channels of monetary transmission are out of the scope of this paper.

and the six Western Balkan countries, respectively.

With respect to estimates of the New Keynesian price Phillips curve (Table 3), the first thing to note is that the coefficient on expected price inflation is statistically different from the conventional values of the discount factor (around 0.99). There are two plausible explanations for this. First, as realized future inflation acted as proxy for expected inflation, a discount factor higher than one might imply that the inflation expected by the economic agents is consistently above the realized inflation. This seems sensible for the investigated countries, which have experienced episodes of high inflation. Second, the estimated coefficient may also include some other factors, besides the discount factor, which can affect inflation but are not included in the model, such as various supply-side shocks. For these reasons, we do not consider the estimated coefficient on expected inflation to be a sign of regression misspecification.

The coefficient on the output gap, which represents the marginal cost, is almost always statistically insignificant, which points to the fact that monetary authorities in SEE and the CIS might have rather limited control over inflation; they affect inflation through the output gap, and both the link between monetary policy and the output gap and that between the output gap and inflation are virtually non-existent in SEE and the CIS. On the other hand, the coefficient on the real wage gap is significant and suggests that prices increase by approximately 0.5% when wages exceed their equilibrium level by 1% (note that this is the long-run coefficient and as such it is in line with the findings of other studies, such as those of Brissimis and Magginas, 2008); this points to the fact that labor unions might have a relatively strong role in the inflation-determination process in SEE and the CIS through wage controls.[16]

When the results were analyzed through different sub-groupings, we observed that the effect of the wage increase on prices disappeared in the fixed exchange rate group. This can be explained by the much lower wage inflation in this group of countries,[17] which may be, at least to some extent, due to the curbing effect that the peg entails on inflation (see Rogoff et al, 2004). The coefficient on the output gap becomes significant in the weak unions group, which points out to higher flexibility of prices in those countries (see Starr, 2005).

16. When the equation is estimated without the real wage gap (so as to reduce to the basic Phillips curve), the output gap becomes significant (although frequently at the 10% level only); this points to the fact that, in this case, the output gap picks up the influence of the labor unions on prices and not the effect of the marginal cost.

17. The average annual increase in the nominal wages in the countries with fixed exchange rates in the observed period is 6.6%, compared to 21% in those countries with flexible exchange rates.

TABLE 2: IS CURVE

Dependent variable:	**Base spec.**	**ER rigidity**		**Geography**		**Level of unionization**	
Output gap		Fixed ER	Flexible ER	SEE	CIS	Weak unions	Strong unions
Expected output gap	1.30***	1.11***	1.29***	1.07***	1.24***	1.07***	1.26***
Real interest rate gap	-0.31	-1.08	-0.33	-0.81	-0.56	-0.39	-0.55
Observations	1778	413	1365	829	959	942	865
Number of cross sections	19	5	14	9	10	10	9
R-squared	0.025	0.209	0.046	0.243	0.12	0.247	0.083
Expected output gap=1 (p value)	0.05	0.37	0.1	0.49	0.07	0.62	0.04
Overidentification test (p value)	0.171	0.461	0.319	0.432	0.107	0.184	0.204
Underidentification test (p value)	0	0.002	0	0	0	0	0
CD weak identification test (F value)	39.89	18.33	29.88	38.29	47.84	74.8	45.16
KP weak identification test (F value)	8.18	9.029	6.385	8.718	11.84	10.02	10.52

Source: Authors' calculations
The coefficient on the real interest rate gap is the long-run coefficient.
Heteroskedasticity and autocorrelation robust standard errors reported (*** p<0.01, ** p<0.05, * p<0.1)
The overidentification test is the Hansen J test. The null hypothesis is that the instruments are not overidentified.
The underidentification test is the Kleibergen-Paap test. The null hypothesis is that the instruments are underidentified.
The CD and KP weak identification tests are the Cragg-Donald and Kleibergen-Paap tests for weak identification. The null hypothesis is that the model is weakly identified. In cases where critical values were not available, as a rule of thumb, F values above 10 indicate that the null can be rejected (Staiger and Stock, 1997). Whenever the associated F-value falls below 10, the continuously updating GMM estimator is used, arguably providing standard errors robust to weak identification (Baum et al. 2007).

Table 3: Price Phillips curve

Dependent variable:	**Base spec.**	**ER rigidity**		**Geography**		**Level of unionization**	
Annual (y-o-y) CPI growth		Fixed ER	Flexible ER	SEE	CIS	Weak unions	Strong unions
Expected future inflation	1.10***	1.08***	1.10***	1.14***	1.06***	1.14***	1.06***
Output gap	0.12	0.13	0.11	0.13	0.19	0.24**	0.13
Real wage gap	0.55***	0.23	0.60***	0.29*	0.88**	0.33**	0.88**
Observations	1734	442	1292	862	863	846	878
Number of cross sections	19	5	14	9	10	10	9
R-squared	0.942	0.902	0.945	0.949	0.929	0.943	0.93
Expected future inflation=0.99 (p val.)	0	0	0	0	0	0	0
Overidentification test (p value)	0.504	0.959	0.494	0.197	0.77	0.073	0.677
Underidentification test (p value)	0	0	0	0	0	0	0
CD weak identification test (F value)	246.3	30.89	195.8	57.83	129.2	72.63	102.1
KP weak identification test (F value)	38.19	17.58	29.65	9.997	35.23	11.86	28.15

Source: Authors' calculations
The coefficients on the output gap and the real wage gap are the long-run coefficients.
Heteroskedasticity and autocorrelation robust standard errors reported (*** p<0.01, ** p<0.05, * p<0.1)
The overidentification test is the Hansen J test. The null hypothesis is that the instruments are not overidentified.
The underidentification test is the Kleibergen-Paap test. The null hypothesis is that the instruments are underidentified.
The CD and KP weak identification tests are the Cragg-Donald and Kleibergen-Paap tests for weak identification. The null hypothesis is that the model is weakly identified. In cases where critical values were not available, as a rule of thumb, F values above 10 indicate that the null can be rejected (Staiger and Stock, 1997). Whenever the associated F-value falls below 10, the continuously updating GMM estimator is used, arguably providing standard errors robust to weak identification (Baum et al. 2007).

To summarize, the main finding from the price Phillips curve is that the inflation does not depend on the output gap, but does depend on the wage gap. Since monetary authorities affect the inflation through the former, and the trade unions through the latter, this finding points out that the trade unions in SEE and CIS may have more power over the inflation than the central banks.

The next two estimated equations are the primary focus of this paper. Table 4 gives the estimates of the wage inflation equation. Again, in all specifications, the coefficient on future wage inflation is higher than the plausible theoretical values for the discount factor, for the same reasons as in equation 2. The output gap is insignificant, which suggests that wages do not depend on economic activity in SEE and the CIS; this might not be strange, given the high unemployment in these countries, i.e. the high supply of labor. In contrast, the real wage gap has explanatory power over wage growth in the majority of cases, suggesting that the labor wedge arising from monopolistic competition in the labor market works mainly through the wage gap, not the output gap; if actual wages are below equilibrium, then there is pressure to close the gap, that is, to increase wages, and vice versa. Not surprisingly, the coefficient is not significant in the strong unions group, suggesting that strong unions prevent wages from falling when above equilibrium. Moreover, the coefficient is insignificant in the pegging group, which, similarly to the price inflation equation, might be a consequence of the lower wage inflation in SEE and CIS, but may also be due to the fact that most of those in the pegging group also have strong unions (the average unionization in the pegging group is 47%, while in the floating group it is 41%).

When the level of unionization and the crisis period were cross-analysed, some interesting findings arose. Crisis drags wages down in the countries with weak unions, as observed by the significant and positive coefficient on the output gap during the crisis (the output gap becomes negative during the crisis, so it leads to a fall in wages because its coefficient in the regression is positive). A 1% drop in output below the trend pulls wages down by a cumulative magnitude of about 2.5%, which is not surprising: the average wage growth in the sub-sample with low levels of unionization before the crisis was 19%, then falling to 7% after the crisis spread. In such circumstances, weak unions cannot press for wages reverting to equilibrium. The coefficient on the real wage gap becomes insignificant during the crisis, suggesting that the mechanism that drives wages to their equilibrium level was not operational during the crisis, i.e. that the fall in wages below the equilibrium could not be offset by the weak unions. The picture is different in the group

Table 4: Wage Phillips Curve

Dependent variable:	**Base spec.**	**ER rigidity**		**Geography**		**Level of unionization**	
Annual (y-o-y) wage growth		Fixed ER	Flexible ER	SEE	CIS	Weak unions before/during crisis	Strong unions before/during crisis
Expected wage growth	1.05***	1.11***	1.05***	1.06***	1.02***	1.16***	0.80***
Output gap	0.46	1.1	0.17	0.8	-1.37	-0.58	3.3***
Real wage gap	-4.07***	-2.04	-4.23***	-5.47***	-9.84*	-3.75***	-6.1*
Output gap during the crisis						2.94***	-6.2**
Real wage gap during crisis						2.4	16***
Observations	1730	439	1290	870	852	855	867
Number of cross sections	19	5	14	9	10	10	9
R-squared	0.767	0.677	0.774	0.841	0.697	0.853	0.649
Expected wage growth=1 (p value)	0	0.11	0.01	0.04	0.3	0	0.03
Overidentification test (p value)	0.749	0.992	0.776	0.112	0.222	0.805	0.04
Underidentification test (p value)	0	0	0	0	0	0.009	0.02
CD weak identif. test (F value)	247.1	36.98	190	75.7	81.46	55.81	1.9
KP weak identif. test (F value)	52.75	26.26	37.61	7.573	32.61	3.593	1.7

Source: Authors' calculations
The coefficients on the output gap and the real wage gap are the long-run coefficients.
Heteroskedasticity and autocorrelation robust standard errors reported (*** p<0.01, ** p<0.05, * p<0.1)
The overidentification test is the Hansen J test. The null hypothesis is that the instruments are not overidentified.
The underidentification test is the Kleibergen-Paap test. The null hypothesis is that the instruments are underidentified.
The CD and KP weak identification tests are the Cragg-Donald and Kleibergen-Paap tests for weak identification. The null hypothesis is that the model is weakly identified. In cases where critical values were not available, as a rule of thumb, F values above 10 indicate that the null can be rejected (Staiger and Stock, 1997). Whenever the associated F-value falls below 10, the continuously updating GMM estimator is used, arguably providing standard errors robust to weak identification (Baum et al. 2007).

with strong unions. The output gap and the real wage gap are significant in these countries both before and during the crisis, but with opposing signs. The output gap has a positive sign before the crisis, implying that wages grow when the economy grows, but become negative during the crisis when the output gap becomes negative, pointing to the fact that wages continue to grow even in such times due to the strong unions. Similarly, the real wage gap is negative before the crisis, indicating that wages start to fall when they are too high, but becomes positive during the crisis, pointing to the fact that then wages continue to grow, even if they are above their equilibrium levels, due to the strong unions. This is evident from the figures on wage growth in countries with high levels of unionization before and during the crisis: the average growth in wages fell from 19% before the crisis to about 12% during the crisis, which is a considerably smaller drop than in the group with low levels of unionization.

To summarize, the main findings from the wage Phillips curve are that the trade unions in SEE and CIS countries have more power over the wages than the monetary authorities, and that the stabilizing role of the trade unions over the wages has become destabilizing during the crisis in the countries with strong unions.

The equation that closes the New Keynesian model is the monetary rule, the estimates of which are given in Table 5. We estimated the rule with the current values of the independent variables only. Note that, in contrast to our theoretical model (4) in section 3, the estimated coefficients herein are central bank responses to the different variables included in the model. These represent both central bank preferences in policymaking and other factors that might have affected their decisions; the distinction between the two is beyond the scope of this study. The results of the baseline specification suggest that the central banks investigated here conducted monetary policy by observing only past interest rates, as suggested by the high and significant smoothing parameter (column 1). Other coefficients did not even approach conventional significance levels. Similar conclusions can be reached by sub-grouping the countries using the geographic criterion (columns 6 and 7).

However, the sample included countries with different levels of exchange rate rigidity, which might be crucial for how central banks respond to developments in the economy. In the group of **fixers**, including when they were observed before versus during the crisis (columns 2 and 3), the conclusion remains the same as for the baseline case. This is not surprising, though, given that a

fixed regime puts domestic policy on complete autopilot if capital mobility is high; in such cases, due to the impossible trinity (Obstfeld et al, 2005), central banks cannot focus on domestic objectives with a simultaneous commitment to sustain the peg[18]. Contrary to expectations, though, given their role in these economies for defending the peg, the pegging central banks did not respond to movements in reserves either. However, their insignificance in the pegging group might also suggest that any pressures in those countries on the foreign exchange market (say, due to the cessation of capital flow during the crisis) were successfully resisted by managing the interest rate.

On the other hand, reserves appear important within the sub-sample of countries with **flexible** exchange rates (column 4). Column 5 suggests that their significance is entirely derived from the crisis period, when a percentage decrease in reserves led to an increase in interest rates of about 1.6% on average to prevent excess exchange rate volatility. More importantly, these countries seem to have supported the real economy during the crisis; the output gap coefficient during the crisis is positive and significant at 10%. This is a notable difference with respect to the findings obtained from the pegging sample.

Interesting findings were obtained when the unionization sub-grouping was observed. In the sub-group with low levels of unionization, inflation and the output gap significantly affected the conducting of monetary policy, with important differences before and during the crisis (column 9). Before the crisis, inflation and wage growth appear significant at the 10% level, with the sign in front of wage unexpectedly negative. While this may simply be due to an imprecise estimation because of the high correlation between wages and price inflation, it could also be because of the high negative coefficient of the wage gap in the wage inflation equation. Namely, when unions are weak, a positive wage gap is rapidly closed. This knowledge is then taken into consideration by the central bank, so that rising wages in good times are not considered a threat to the conducting of monetary policy and the policy can relax even if wages show some growth. However, this completely changes during the crisis. Inflation loses significance, while the cumulative response to wage growth turns positive (though insignificant). Since weak unions are not capable of preventing wage decline during a crisis (see Table 4), the positive coefficient implies the relaxation of monetary policy as

18. Alternative explanation for this could be that countries with fixed exchange rates have less need for policy intervention. Some studies find that fixed exchange rate improves welfare - Belke (2005) finds that it reduces unemployment (see also Schnabl and Ziegler, 2011). However, these effects are more likely to affect the potential level of output instead of the output gap, and monetary authorities are usually concerned with developments in the latter. Hence, these effects are unlikely to be the main drivers behind our results.

TABLE 5: MONETARY POLICY RULE

Dependent variable: Interest rate gap	**Base spec.**	**Exchange Rate rigidity**				**Geography**		**Level of unionization**			
	-1-	**-2-**	**-3-**	**-4-**	**-5-**	**-6-**	**-7-**	**-8-**	**-9-**	**-10-**	**-11-**
		Fixed	Fixed before/during crisis	Flexible	Flexible before/during crisis	SEE	CIS	Low union	Low union before/during crisis	High union	High union before/during crisis
Lagged interest rate gap	0.92***	0.92***	0.97***	0.89***	0.97***	0.92***	0.94***	0.89***	0.90***	0.93***	0.93***
Price inflation	0.08	-4.41	-7.26	0.27	0.46	-0.47	0.77	0.12*	0.17*	0.06	-0.42
Wage inflation	0.04	4.07	6.03	-0.04	-0.5	0.22	-0.17	-0.01	-0.08*	0.24	1.09
Output gap	-0.41	-1.91	-3.94	-0.27	0.39	0	-0.53	0.21**	0.09	-0.88	-1.86
Nominal ER gap	-0.25			-0.3	-0.96	0.72	-0.52	0.08	0.23**	-0.58	-1.38
Reserves gap	-0.04	0.59	1.03	-0.05**	-0.15	0.1	-0.06	-0.03	0.01	-0.03	-0.06
Price inflation during crisis			8.94		-1.85				-0.35		2.53
Wage inflation during crisis			-3.43		-1.08				0.20*		-0.55
Output gap during crisis			3.14		7.81*				0.45**		2.86
Nom. ER gap during crisis					3.85				-0.32		1.21
Reserves gap during crisis			-0.71		-1.62*				-0.07		0.12
Observations	1524	401	401	1124	1116	827	703	743	743	781	784
Number of cross sections	18	5	5	13	13	9	9	9	9	9	9
R-squared	0.721	0.721	0.726	0.704	0.673	0.741	0.702	0.826	0.828	0.718	0.715
Overidentif. test (p val.)	0.403	0.778	0.511	0.529	0.666	0.734	0.429	0.391	0.361	0.593	0.399
Underident. test (p val)	0	0	0	0	0.029	0	0	0	0.018	0	0
CD weak ident. test (F val)	111.6	21.36	6.033	93.26	10.31	64.32	59.96	51.76	25.83	51.51	32.02
KP weak ident. test (F val)	15.85	15.41	3.329	11.99	2.402	9.029	10.86	8.466	3.777	12.39	12.29

Source: Authors' calculations
The coefficients on the price inflation, wage inflation, output gap, nominal exchange rate and the reserves gap are the long-run coefficients.
Heteroskedasticity and autocorrelation robust standard errors reported (*** p<0.01, ** p<0.05, * p<0.1)
The overidentification test is the Hansen J test. The null hypothesis is that the instruments are not overidentified.
The underidentification test is the Kleibergen-Paap test. The null hypothesis is that the instruments are underidentified.
The CD and KP weak identification tests are the Cragg-Donald and Kleibergen-Paap tests for weak identification. The null hypothesis is that the model is weakly identified. In cases where critical values were not available, as a rule of thumb, F values above 10 indicate that the null can be rejected (Staiger and Stock, 1997). Whenever the associated F-value falls below 10, the continuously updating GMM estimator is used, arguably providing standard errors robust to weak identification (Baum et al. 2007).

a fight against the potential recession. This is further supported by the significance appearing in the output gap in column 9.

Turning to the discussion concerning monetary policy responses when unions are strong (columns 10 and 11), we note the insignificance of all variables at conventional levels. Recall that we found that strong unions do not prevent wages from falling and reaching equilibrium in good times, but they do not allow a weak economy to drag wages down. However, central banks do not react to price or wage movements in either case, which points to the absence of the wages interest rate channel in times of crisis under strong labor unions as compared to weak unions (recall that the interest rate falls in times of crisis due to the fall in wages in countries with weak unions).

To summarize, the results from the monetary policy rules indicate that monetary policy in countries with fixed exchange rates and strong unions did not respond counter-cyclically during the recent crisis, in contrast to countries with flexible exchange rates and weak trade unions.

VI.B. Robustness checks

We conduct several robustness checks. First, following Mihailov et al. (2011), we add the foreign inflation[19] and the lag of the inflation itself in the price Phillips curve equation. These results are presented in Table 6. The foreign inflation is insignificant in all the specifications. The lag of the domestic inflation is always significant, just as the expected inflation. Regarding the other variables, the main picture from above remains unchanged - the output gap is insignificant in most of the regressions, while the real wage gap is significant most of the time. Next, following Clarida et al. (1998), we add the foreign interest rate to the monetary policy rule, as an additional constraint on the domestic monetary policy. Again, the results, shown in Table 7, remain similar as before - in the group of peggers, nothing is significant, while in the group of floaters, the output gap becomes significant during the crisis (the sum of the two coefficients); also, several variables are significant for the lowly unionized countries, but none for the countries with strong unions. Finally, we exclude the two countries with the highest labor union membership (Belarus and Kyrgyz), to check if maybe the findings for the strong unions are driven by them. These results are shown in Table 8. The biggest change is that the real wage gap becomes insignificant in the price Phillips curve. However, the results of the two main equation, the wage Phillips curve and the monetary

19. The foreign inflation is either the inflation in EU or the inflation in the US, same as in the case for the nominal exchange rate.

policy rule, remain mainly unchanged.

VII. Conclusion

The objective of this paper was to analyze the relationship between monetary policy conduct, the exchange rate regime, labor unions and the real economy in SEE and the CIS, and to assess whether the level of unionization and the rigidity of the exchange rate constrained policy response in these countries during the on-going economic crisis. To achieve the objective, the paper employed a New Keynesian model with embedded price and wage rigidities. The model was estimated with a panel GMM over the period January 2002 to March 2011.

The first group of results indicates that *output gap* is not affected by interest rates. Similarly, *price inflation* depends on wages, but not on the output gap. The finding that changes in the real interest rate do not channel to prices through domestic demand points out that monetary policy has a rather limited effectiveness in SEE and CIS countries. This may be justified by the still underdeveloped financial markets or the excess banking liquidity in these countries, which do not allow for full transmission of monetary policy, but also the high degree of economic openness (see Gigineishvili, 2011, Starr, 2005, and Velickovski, 2012). On the other hand, the finding that price inflation is driven mainly by wages sheds important light in terms of how to fight episodes of rising prices - by negotiations with the labor unions or by controlling public sector wages.

The second group of results suggests that the real wage gap has explanatory power over *wage growth* in the majority of cases, differently from the output gap. The insignificance of the output gap might be explained by the relatively high unemployment in these countries, or by the noisiness of the output gap as a measure of the business cycle. The significance of the real wage gap points out that trade unions have influence on the dynamics of wages. In addition, important differences in the wages dynamics during the crisis can be observed between countries with low and high levels of unionization. Crisis drags wages down in countries with low levels of unionization, and weak unions cannot press for wages reverting to equilibrium. On the other hand, strong unions prevent a weak economy from dragging wages down, and wages continue to grow during the crisis despite the negative output gap.

The third group of results suggests that central banks have supported the domestic economies

Table 6: Adding foreign inflation and lagged inflation to the price Phillips curve

Dependent variable:	**Base specification**	**ER rigidity**		**Geography**		**Level of unionization**	
Annual (y-o-y) CPI growth		Fixed ER	Floating ER	SEE	CIS	Weak unions	Strong unions
Expected future inflation	0.679***	0.617***	0.692***	0.689***	0.672***	0.736***	0.628***
Lagged inflation	0.354***	0.415***	0.343***	0.348***	0.358***	0.313***	0.394***
Output gap	0.03	1.1875*	0.086	0.027	0.067	0.061	-0.045
Real wage gap	0.606**	-1.1875	0.657**	0.27	0.9**	0.408	1.182**
Foreign inflation	0.758	-3.125	0.771	0.892	0.833	1.02	0.909
Observations	1,715	433	1,278	862	853	846	869
R-squared	0.979	0.961	0.98	0.981	0.977	0.98	0.978
Number of cross sections	19	5	14	9	10	10	9
Hansen test p value	0.985	0.137	0.891	0.625	0.884	0.141	0.574
Underidentification test p value	1.61E-10	0.0173	8.25E-09	0.0535	2.37E-09	0.00165	5.34E-07
KP weak identification test	9.903	2.37	8.432	2.447	5.984	4.676	4.726
CD weak identification test	32.34	3.606	25.44	6.741	20.86	10.75	19.51

Source: Authors' calculations
The coefficients on the output gap, the real wage gap and the foreign inflation are the long-run coefficients.
Heteroskedasticity and autocorrelation robust standard errors reported (*** p<0.01, ** p<0.05, * p<0.1)
The overidentification test is the Hansen J test. The null hypothesis is that the instruments are not overidentified.
The underidentification test is the Kleibergen-Paap test. The null hypothesis is that the instruments are underidentified.
The CD and KP weak identification tests are the Cragg-Donald and Kleibergen-Paap tests for weak identification. The null hypothesis is that the model is weakly identified. In cases where critical values were not available, as a rule of thumb, F values above 10 indicate that the null can be rejected (Staiger and Stock, 1997). Whenever the associated F-value falls below 10, the continuously updating GMM estimator is used, arguably providing standard errors robust to weak identification (Baum et al. 2007).

Table 7: Including foreign interest rate in the monetary policy rule

Dependent variable: interest rate gap	**Base specification**	**Exchange rate rigidity**				**Geography**		**Level of unionization**			
		Fixed IR	Fixed IR before/during crisis	Floating IR	Floating IR before/during crisis	SEE	CIS	Weak unions	Weak unions before/after crisis	Strong unions	Strong unions before/after
Lagged interest rate gap	0.927***	0.919***	0.965***	0.886***	0.980***	0.915***	0.927***	0.885***	0.898***	0.938***	0.936***
Foreign interest rate gap	0.795	1.383	2.514	1.456***	-7.95	0.824*	1.959	0.87***	0.882***	-0.274	-0.266
Inflation	0.082	-4.704	-7.914	0.254	0.8	-0.494	0.658	0.078	0.118	0.145	-0.375
Wage growth	0.027	4.111	6.086	-0.061	-0.7	0.212	-0.192	-0.026	-0.078*	0.242	1.109
Output gap	-0.479	-2.025	-4.057	-0.36	0.55	-0.059	-0.671	0.13*	0.059	-0.935	-1.906
Nominal ER gap	-0.205			-0.228	-1.45	0.776	-0.438	0.139*	0.275**	-0.581	-1.375
Reserves gap	-0.041	0.593	1.086	-0.07***	0	0.094	-0.082*	-0.035	0.01	-0.032	-0.063
Inflation after crisis			1.257		-2.25				-0.157		2.234
Wage growth after crisis			2.515		-2.25				0.108		0.562
Output gap after crisis			-0.971		11.85*				0.294*		1.047
Nom. ER gap after crisis					3.65				-0.088		-0.203
Reserves gap after crisis			1.059		-2.4				-0.068		0.078
Observations	1,524	401	401	1,124	1,116	827	703	743	743	781	784
R-squared	0.721	0.72	0.725	0.704	0.669	0.741	0.702	0.831	0.832	0.718	0.715
Number of cross sections	18	5	5	13	13	9	9	9	9	9	9
Hansen test p value	0.43	0.778	0.509	0.624	0.642	0.728	0.567	0.662	0.453	0.587	0.396
Underidentif. test p val.	0	1.64E-10	2.14E-06	3.58E-09	0.079	1.55E-05	9.96E-09	0.0153	0.0215	1.84E-10	0.00291
KP weak identification test	13.58	14.76	3.265	10.6	1.693	7.667	9.764	5.084	3.438	11.55	1.846
CD weak identification test	101.1	20.12	5.883	87.08	7.719	57.36	54.66	45.1	25.83	48.08	31.67

Source: Authors' calculations
All the coefficients are the long-run coefficients, except the lagged interest rate.
Heteroskedasticity and autocorrelation robust standard errors reported (*** p<0.01, ** p<0.05, * p<0.1)
The overidentification test is the Hansen J test. The null hypothesis is that the instruments are not overidentified.
The underidentification test is the Kleibergen-Paap test. The null hypothesis is that the instruments are underidentified.
The CD and KP weak identification tests are the Cragg-Donald and Kleibergen-Paap tests for weak identification. The null hypothesis is that the model is weakly identified. In cases where critical values were not available, as a rule of thumb, F values above 10 indicate that the null can be rejected (Staiger and Stock, 1997). Whenever the associated F-value falls below 10, the continuously updating GMM estimator is used, arguably providing standard errors robust to weak identification (Baum et al. 2007).

Table 8: Results without Belarus and Kyrgyz Republic

IS curve Dependent variable - output gap		**Price Phillips curve Dependent variable - price inflation**		**Wage Phillips curve Dependent variable - wage inflation**		**Monetary policy rule Dependent variable - interest rate gap**	
Explanatory variables	*Coeff.*	*Explanatory variables*	*Coeff.*	*Explanatory variables*	*Coeff.*	*Explanatory variables*	*Coeff.*
Expected output gap	1.203***	Expected price inflation	1.047***	Expected wage inflation	1.183***	Lagged interest rate gap	0.965***
Real interest rate gap	-0.389	Output gap	0.191	Output gap	5.8*	Output gap	0.514
		Real wage gap	0.183	Real wage gap	-11.4**	Price inflation	0.285
				Output gap during crisis	-16.4**	Wage inflation	-0.828
				Real wage gap during crisis	15.7**	Nominal ER gap	1.742
						Reserves gap	0.571
						Output gap during crisis	-0.229
						Price inflation during crisis	-1.429
						Wage inflation during crisis	-1.2
						Nom. ER gap during crisis	-0.343
						Reserves gap during crisis	-0.8
Observations	677		680		656		616
R-squared	0.182		0.933		-1.281		0.731
Number of cross sections	7		7		7		7
Hansen test p value	0.374		4.26E-05		0.335		0.279
Underidentification test p value	1.67E-10		0		0.25		1.04E-09
KP weak identification test	16.3		11.48		0.841		4.059
CD weak identification test	49.01		35.36		1.109		16.92

Source: Authors' calculations
All the coefficients are the long-run coefficients.
Heteroskedasticity and autocorrelation robust standard errors reported (*** p<0.01, ** p<0.05, * p<0.1)
The overidentification test is the Hansen J test. The null hypothesis is that the instruments are not overidentified.
The underidentification test is the Kleibergen-Paap test. The null hypothesis is that the instruments are underidentified.
The CD and KP weak identification tests are the Cragg-Donald and Kleibergen-Paap tests for weak identification. The null hypothesis is that the model is weakly identified. In cases where critical values were not available, as a rule of thumb, F values above 10 indicate that the null can be rejected (Staiger and Stock, 1997). Whenever the associated F-value falls below 10, the continuously updating GMM estimator is used, arguably providing standard errors robust to weak identification (Baum et al. 2007).

during the crisis only in countries with flexible exchange rates or weak trade unions, which can be interpreted as a constraint that strong unions and fixed exchange rates put on the monetary policy (since the monetary policy cannot support the domestic economy). The finding that strong unions constrain central banks from supporting the economy in times of crisis stresses the need for good cooperation with the labor unions, so that future shocks (either to the GDP or to inflation) are managed better. This recommendation is in line with Freeman (2013) and Rinne and Zimmermann (2013), who attribute the superior post-crisis performance of the German labor market to the existence of active dialogue between policymakers and labor unions. The finding that fixed exchange rates serve as constraints to the monetary policy in times of crisis points out that increasing the flexibility of the exchange rate is likely to give more space to the monetary authorities in times of negative demand shocks.

Certainly, these recommendations for the unionization and the exchange rate regime are only one piece of the puzzle concerning the appropriate exchange rate regime and the optimal degree of unionization in these countries. This is particularly so for exchange rate flexibility as these countries have fairly high exchange rate pass-through due to the high openness (see Velickovski and Pugh, 2011), which shows that increased flexibility in the exchange rate might have adverse effects on inflation in these countries. Also, the euroization of household liabilities is very high in many SEE and CIS countries (see Beckmann et al, 2011), which implies that a more flexible exchange rate regime might have negative balance sheet effects, i.e. exchange rate depreciation will increase households' debt-servicing burden, which might then hurt the real economy.

Some limitations of the research are to follow. To begin with, the paper investigated the constraining role of only two factors for the monetary policy, the level of unionization and the regime of the exchange rate. There may be many other factors that constrain monetary policy in certain ways, like the level of euroization, the exchange rate pass-through, the fiscal policy, the indebtedness etc., which may be worthwhile to investigate. In addition, if these factors are correlated with the unionization, or the exchange rate regime, their omission may imply that our findings should be treated with care. Second, the paper focused only on one monetary policy instrument, i.e. only on the interest rate channel of the monetary transmission. But, these countries have underdeveloped financial markets, where other instruments may be also very important. Finally, the data on unionization measure the official union membership. However, the actual power of the unions may

be different from the official membership. All these aspects point out to areas for future research.

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VIII. Appendix

Table A1: Data sources

Data series	*Source*
Economic activity	Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Kazakhstan, Kyrgyzstan, Macedonia, Moldova, Montenegro, Romania, Russia, Serbia, Tajikistan, Turkey, Ukraine - monthly industrial production index from UNECE. Albania - until 2008, quarterly* sales index (the main index of economic activity in that time), after that, quarterly GDP, from the statistical office. Moldova - quarterly GDP from the statistical office.
Wages	Croatia, Macedonia, Kyrgyzstan, Kazakhstan - monthly wages for the whole economy, from IFS. Moldova, Romania - monthly wages in non-agriculture, from ILO. Armenia, Bulgaria, Montenegro, Ukraine - monthly wages in the manufacturing sector, ILO. Bosnia and Herzegovina - wages in non-agriculture until 2008-M10, manufacturing after that, from ILO. Belarus - monthly wages for the whole economy, from the central bank. Albania – quarterly* wages in the state sector, from the statistical office. Azerbaijan - monthly wages for the whole economy, from the central bank. Georgia - quarterly for the whole economy, from the statistical office. Russia - from the statistical office, until 2009 quarterly, after that - monthly. Serbia - monthly, whole economy, statistical office. Tajikistan - monthly, whole economy, statistical office. Turkey - total wage payments in manufacturing sector, quarterly, statistical office.
Interest rate	Bosnia and Herzegovina and Montenegro - reserve requirement rate, from the central bank. Kyrgyzstan - lombard rate, from IFS. All other countries - the reference interest rate of the central bank, from IFS. The interest rate for Bulgaria is the base interest rate, reported from the central bank, which is actually the interest rate on short-term government securities on the primary market until 2005, and the interbank money market rate later on.
Prices	All countries, except Montenegro - consumer price index from the IFS. Montenegro - constructed by the authors, from the monthly rates of inflation from the central bank.

Nominal exchange rate	Nominal exchange rate, national currency per euro or dollar (i.e. increase = depreciation), from the IFS. For Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Russia and Tajikistan - against the dollar, since commodities represent major part of their exports, or the US are the most important trading partner. For Belarus - against the Russian ruble, since more than 50 percent of their exports goes to Russia. For all other countries - against the euro.
International reserves	Foreign exchange reserves of the country, from the IFS. The currency in which they are expressed is the same as the currency against which the nominal exchange rate is quoted.
Trade Union Membership	In order to have as consistent data as possible, data on union membership were taken from the New Unionism Network Global Union Database, which provides data on all but two countries from the analysis (all other sources provided data on fewer countries). Ukrainian data are from the Federation of European Employers (available on: http://www.fedee.com/labour-relations/trade-unions-in-europe/Ukraine, last accessed on 23 April 2012), while data on Bosnia and Herzegovina are from Eurofound (2012).

*in the cases where quarterly data are used, the same quarterly value is assumed for all the months in the quarter, without using any interpolation methods. While this may have some downsides, we believe this is closer to the way policymakers analyze data, since they rarely look at interpolated data.