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Preliminary paper

## **FLEXIBILITY OF REAL AND NOMINAL WAGES: CASE OF SELECTED WESTERN BALKAN COUNTRIES<sup>1</sup>**

*Wage flexibility is considered to be a key determinant of labour market flexibility. In this paper flexibility of real and nominal wages in the group of Western Balkan countries as well as in selected New Member States (NMS) is explored by means of unrestricted vector autoregressive model. The main goal of this study was to identify whether selected Western Balkan countries show different behaviour with the respect to NMS considering the response of nominal and real wages to shocks. An unrestricted vector autoregressive model on the first differences of nominal and real wages was estimated and impulse response functions were derived to see which long run effects these shocks have. The data were taken from the WIIW Monthly Database, providing data on average gross monthly wages. The analysis is performed for the period from January 2004 to June 2015. The results of the conducted empirical analysis have shown that wage responses to shocks in the Western Balkan countries are in line with the magnitudes observed for the group of NMS or even better, nevertheless, there are some exceptions.*

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*Keywords: nominal wages, real wages, vector autoregression model, Western Balkan countries*

## 1. Introduction

When analysing and forecasting macroeconomic developments, wages play an essential role. Namely, nominal wage inflation is considered to be a very important component of price inflation, whereas real wages have a great influence on demand for labour and other factors of production. Furthermore, the flexibility of the real wage rate is considered to be an important element of labour market flexibility. Generally speaking, the traditional approach to examining labour market flexibility is estimating a Phillips curve in a manner of Eric Pentecost and John Sessions (2002), or a wage curve, following David Card (1995). Aforementioned approaches connect the rate of unemployment to the rate of change in money wages or the level of the money wage rate, resulting with different time-changing unemployment-wage elasticities across countries. However, in this paper, we follow different methodological approach.

In fact, we aim to investigate the degree of aggregate real and nominal wage flexibility following real and nominal shocks using the unrestricted vector autoregressive model. The reason for such a methodological approach is based on the fact that potential long-term restrictions (see for instance Tomoe Moore and Eric Pentecost, 2005) cannot be justified from an economic point of view considering the economic performance in the countries under the analysis. Particularly, following European Commission report (2008), in this paper flexibility of real and nominal wages is explored for the following Western Balkan countries: Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, and Serbia and the following New Member States: Bulgaria, Romania and Slovenia. The main goal of this study is to identify whether selected Western Balkan countries show different behaviour in comparison to the selected New Member States with the respect to the response of nominal and real wages to shocks. The research hypothesis is that the Western Balkan countries should be more responsive to the shocks in nominal and real wages when compared to NMS group of countries. In order to accept or reject the research hypothesis, empirical analysis using VAR model on the first differences of nominal and real wages was performed and impulse response functions were derived to see which long run effects these shocks have.

The reminder of this paper is as follows. After brief introduction, section 2 presents relevant economic literature. In section 3, data and methods are presented. Section 4 presents the results of performed empirical analysis of the rela-

tionship of real and nominal wages in selected Western Balkan countries and New Member States. Finally, section 5 gives the concluding remarks and possibilities for further research.

## 2. Brief relevant literature review

Following Ian Babetskii (2006), wage flexibility can be expressed in nominal or real terms. Accordingly, nominal wage flexibility is the accountability of nominal wages to changes in inflation i.e. the price level, whilst, real wage flexibility is the responsiveness of real wages to various shocks. Furthermore, wage flexibility has different characteristics depending on the data used in the analysis i.e. aggregate or micro data. In our study we follow the aggregate approach to modelling wage flexibility, so in this section, we present only the economic literature that relies on macroeconomic (aggregate level) data.

Relevant economic literature, defines wage flexibility as an important aspect of labour market flexibility, see for instance Boeri et al. (1998) or David Blanchflower (2001). Also, it can be noticed that in Central and Eastern European transition countries, wage flexibility has mostly been analysed using time series methods. According to Moore and Pentecost (2002) who employed a two-equation Structural Vector Autoregression (SVAR) framework to study the responsiveness of nominal and real wages to shocks, among the new EU members, only Hungary and the Czech Republic are well-prepared for EMU membership in terms of labour market adjustment. Babetskii (2006) compared eight new EU member states as well as three Eurozone members to explore how far wages can flexibly accommodate macroeconomic shocks. David Blanchflower and Andrew Oswald (1994) popularized the wage curve for investigating the flexibility of wages at the regional level. Another study that explored the regional dimension of wage adjustment was Thiess Buttner (2007) that estimated country-specific wage curves for six new EU member states, Romania, Bulgaria as well as for five EU-15 members. Also, this research provides quantitative evidence that wages are more responsive to local labour market conditions in the CEE countries than in the old EU members. Finally, recent study by Čeh Časni et al. (2015) records that the impacts shown by impulse response functions of two unrestricted VAR models are similar for Croatia and Slovenia, confirming that Croatia and Slovenia, which have similar political legacy, are also similar regarding the flexibility of nominal and real wages.

Previously mentioned studies suggest that the responsiveness of real and nominal wages to shocks in some of the new member countries are ambiguous

with the noticeable heterogeneity across countries. According to the European Commission study (2008), wages in the new member states are more responsive to local labour market conditions than in the old member states. Also, output recovery has been much slower in Western Balkan countries than in the New Member States as a result of which labour markets began to improve with some delay (when compared to the NMS).

When analysing Western Balkan countries, an important issue to deal with are data limitations. Therefore, there are only few studies on wage flexibility conducted for those countries and our study aims to fill this gap. To be exact, in our study we use an unrestricted VAR model as the adequate statistical tool for modelling the responsiveness of real and nominal wages to macroeconomic shocks in Western Balkan countries, since it has useful statistical properties. That is, it avoids the need for structural modelling and treats every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system (for more details see for instance Lütkepohl, (1991), Hamilton, (1994), Hendry, (1995), Greene, (2002), Brueggemann, (2004) or Ooms,(1994)).

### 3. Data and methods

With the aim of exploring the response of nominal and real wages to shocks in the group of NMS and the group of Western Balkan countries, we use data on gross monthly wages for total economy expressed as nominal and real indexes with the previous period used as the base (previous period =100) provided by the Vienna Institute for International Economic Studies (WIIW) Monthly Database. All the series are expressed in logarithms, so they can be interpreted as the rate of change. The last available observation for all analysed countries is June 2015 and the longest time series is available for Bulgaria starting with February 1991, whereas the shortest time series exist for Montenegro, starting with January 2004. The information on data availability is given in table 1.

Table 1.

DATA AVAILABILITY

Country	Begin	End
Bosnia and Hercegovina	2002m01	2015m06
Bulgaria	1992m02	2015m06
Croatia	1994m01	2015m06
Macedonia	2000m01	2015m06
Montenegro	2004m01	2015m07
Romania	1993m01	2015m06
Serbia	2003m01	2015m07
Slovenia	1992m01	2015m06

Source: WIIW Monthly database

Since the data for all countries in the sample are available from January 2004 to June 2015, average monthly growth rates for that period were calculated. Namely, the real growth rates are below 0.5 per cent in all analysed countries but Montenegro, Romania and Serbia, where the real growth rates range from 0.51 per cent in the case of Montenegro to 0.55 per cent for Serbia. The growth rates of nominal wages, in the same period differ much more, ranging from 0.08 per cent in case of Croatia and Slovenia to 0.55 per cent in the case of Serbia as shown in table 2. and figure 1.

Table 2.

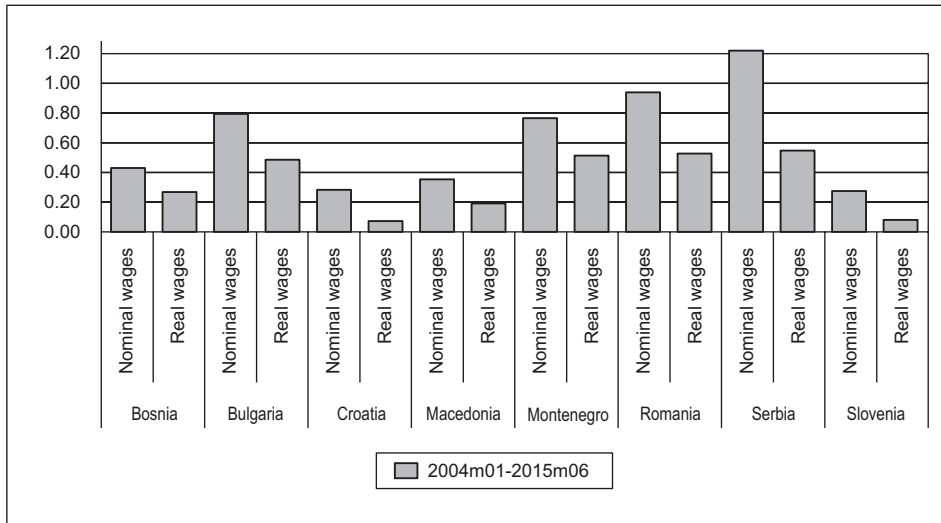
AVERAGE MONTHLY GROWTH RATES OF NOMINAL AND REAL WAGES

Country	Average monthly growth rates	
	Nominal wages	Real wages
Bosnia and Hercegovina	0,43	0,27
Bulgaria	0,79	0,48
Croatia	0,28	0,08
Macedonia	0,35	0,19
Montenegro	0,76	0,51
Romania	0,94	0,53
Serbia	1,21	0,55
Slovenia	0,28	0,08

Source: authors calculations

Figure 1.

AVERAGE MONTHLY GROWTH RATES  
OF NOMINAL AND REAL WAGES



Even though Moore and Pentecost (2005) estimated a structural VAR model in which they imposed a long-run restriction such that nominal shocks do not have a long-run effect on real wages (which is consistent with the hypothesis of natural rate of unemployment), we follow Sims (1980) approach who gave the critique on identifying restrictions in general and we utilize the useful statistical properties that the unrestricted VAR model has. Namely, with the aim of identifying whether selected Western Balkan countries show different behaviour with the respect to NMS considering the response of nominal and real wages to shocks empirically, the unrestricted vector autoregression (VAR) model is applied. Accordingly, the mathematical representation of a VAR is:

$$y_t = \mu + A_1 y_{t-1} + \dots + A_p y_{t-p} + Bx_t + \varepsilon_t \quad (1)$$

where,  $y_t$  is a  $k$  vector of endogenous variables,  $\mu$  is the vector of constant terms for each variable,  $x$  is a  $d$  vector of exogenous variables,  $A_1, \dots, A_p$  and  $B$  are matrices of coefficients to be estimated, and  $\varepsilon_t$  is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables (see for instance Walter Enders, 2010).

Following the VAR procedure, Dickey-Fuller and Phillips-Perron unit root tests using various specifications (in particular regarding lag length) were applied. In almost all cases we cannot reject the null hypothesis of a unit root implying the series to be integrated of order 1. Similarly, we applied the Johansen co-integration test using different lag lengths. Also, in almost all cases, trace and max-eigen value statistics indicated no co-integration at 5% significance level<sup>2</sup>.

Accordingly, all series are first-differenced and seasonally adjusted using tramo-seats method and the stationary time series are obtained. The next step of the empirical analysis was to estimate eight bivariate VAR models (one for each country in the sample). Also, the model diagnostics tests were conducted. In order to check the stability of estimated models the inverse roots of characteristic AR polynomial were calculated (see Lütkepohl, 1991). Explicitly, all estimated VAR models satisfy the stability condition. However, inverse roots are very close to one, and therefore impulse response functions do not die out to zero after one year.

After checking the model stability, residual diagnostic tests were performed. In that sense, serial correlation LM test, White heteroskedasticity with no cross terms test and residual normality tests were applied. For all estimated models, White test has shown that the problem of heteroskedasticity is not present at 1% significance level. Furthermore, according to LM test of autocorrelation, at 1% significance level, for all 8 VAR models, null hypothesis of no autocorrelation of residuals cannot be rejected. However, according to performed residual normality test, using Cholesky orthogonalization, only residuals of VAR models for Croatia, Macedonia and Serbia, seem to be multivariate normal.

#### **4. Results of the empirical analysis of the relationship of real and nominal wages**

Generally, wage and employment flexibility is considered to be much more important in the Western Balkan countries than for NMS, since the first group of countries are aiming at nominal stability where shocks are immediately transmitted to the labour markets. In our research, we are interested in finding out is the behaviour of the nominal and real wages different in selected Western Balkan countries compared to selected New Member states. Consequently, a VAR model on the first differences of nominal and real wages is estimated and impulse response functions are derived to explore which long run effects these shocks might

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<sup>2</sup> In order to save space the results of unit root and co-integration tests are not presented here, but are available from the authors upon the request.

have. Automatic model selection procedures using Akaike and Schwarz information criteria were used in order to specify the proper VAR model for each country. Having in mind that it is not straightforward to use this kind of time series analysis for proper cross-country comparisons without the knowledge of the data generating process, we can still gain some insights on the flexibility of wages and differences across countries in a qualitative manner.

Initially, for each country in the sample a VAR model with 6, 9 and 12 lags was estimated and gave similar results. Anyhow, we present results using 12 lags for each country in the sample, except for Montenegro and Romania, where we used 9 lags due to short time series. Also, from obtained VAR models, impulse response function using orthogonalized shocks based on the Cholesky decomposition were derived. It is important to stress that, with this procedure a commonly known problem is that the decomposition is based on the variable ordering. Having that in mind, as a robustness check, we tried the reversed ordering for these two variables. However, results indicated the same general conclusions showing whether there is a long-run effect on the growth rates of nominal and real wages.

Figures 2a to 3c in Appendix present the set of graphs for the orthogonalized impulse response functions for the Western Balkan countries and for NMS, based on VAR estimations.

It can be seen that the response of nominal wage shocks on nominal wages is initially positive in all countries in the sample. As one can see, in all countries but Bosnia and Herzegovina, Montenegro, Serbia and Romania the effects die out fairly quickly so that the response after 2 periods is rather small. Similarly, the upper right panel presents the effects of a nominal shock on the real wage growth which diminishes rather quickly (after 3 to 4 periods) in all countries. In the case of Croatia, Bulgaria and Slovenia the nominal shock has a negative effect on real wage growth in the first period, however, the opposite is true for all the other countries in the sample. When comparing the group of NMS countries to the group of Western Balkan countries, the response remains slightly below the zero line for the first group, whereas fluctuating around zero for the Western Balkan countries. Furthermore, a shock on real wage growth exhibits a positive effect on nominal wage growth in the first period for all countries in the sample but Romania, where that effect is small and negative. Finally, a shock on real wage growth is initially positive in all countries, but there is some fluctuation around the zero line which is more pronounced in the Western Balkan group of countries and Bulgaria.

From the presented econometric analysis it can be concluded that there is no substantial difference between the group of NMS and the group of Western Balkan countries considering the effects of shocks on nominal or real wage growth. Finally, wage responses to shocks in the Western Balkan countries do



not seem to be a very important issue based on the presented results. They are in line with the magnitudes observed for the group of NMS or even better, with some exception. However, one should be aware that these conclusions are based on a particular statistical methodology and may be affected by certain statistical problems due to the quality of the underlying data series. However, the presented results shed some light on wage setting behaviour in analysed groups of countries.

## 5. Concluding remarks

In this paper flexibility of real and nominal wages in the group of Western Balkan countries as well as in selected New Member States is explored. The main goal of this study was to identify whether selected Western Balkan countries show different behaviour with the respect to NMS considering the response of nominal and real wages to shocks. Therefore, an unrestricted vector autoregressive model on the first differences of nominal and real wages was estimated and impulse response functions were derived to see which long run effects these shocks have.

Initially, for each country in the sample a VAR was estimated and gave similar results. Namely, wage responses to shocks in the Western Balkan countries do not seem to be a very important matter and they are in line with the magnitudes observed for the group of NMS or even better, with some exception.

This paper raised a number of questions that still have to be answered, offering possibilities for further research. In further studies we might focus on similar analysis but using a larger set of variables to explain the macroeconomic concept of wage flexibility. Also, some other methodological approaches and analyses could be undertaken to study this topic.

## REFERENCES

1. Babetkii, I. (2006). *Aggregate Wage Flexibility in Selected New EU Member States*, Working Papers 2006/1, Czech National Bank, Research Department.
2. Blanchflower, D. G. (2001). "Unemployment, Well-being and Wage Curves in Eastern Europe." *Journal of the Japanese and International Economies* 15(4), pp. 364–402.
3. Blanchflower, D., Oswald, A. (1994). *The Wage Curve*, The MIT Press, Cambridge, Mass.

4. Boeri, T., Burda, M., Köllö, J. (1998). *Mediating the Transition: Labour Markets in Central and Eastern Europe*. Centre for Economic Policy Research, London.
5. Brüeggemann, R. (2004). *Model reduction methods for Vector Autoregressive Processes*, Springer.
6. Büttner, T. (2007). "Unemployment Disparities and Regional Wage Flexibility. Comparing EU Members and EU-Accession Countries", *Empirica*, Vol. 34, No. 4, pp. 287-97.
7. Card, D. (1995). "The wage curve: A review". *Journal of Economic Literature* 33, 785-799
8. Čeh Časni, A.; Dumičič, K.; Palič, I. (2015). "Flexibility of Real and Nominal Wages in Slovenia and Croatia: VAR Approach", u: *Proceedings of the 13th International Symposium on Operational Research SOR'15*, Zadnik Stirn, Lidija ; Žerovnik, Janez ; Kljajič Borštnar, Mirjana; Drobne, Samo (ur.). Ljubljana: Slovenian Society Informatika, Section for Operational Research, 395-400
9. Enders, W. (2010). *Applied Econometric Time Series* (3rd ed.). London: John Wiley & Sons Inc.
10. European Commission (2008). *Adjustment capacity of labour markets of the Western Balkan countries*, Final report- Volume I
11. Greene, W. H. (2002). *Econometric Analysis*, 5th Edition, Prentice Hall, Upper Saddle River, New Jersey.
12. Hamilton, J. D. (1994). *Time Series Analysis*, Princeton University Press, Princeton, NJ.
13. Hendry, D. F. (1995). *Dynamic econometrics*, Oxford University Press, Oxford.
14. Lütkepohl, H. (1991). *Introduction to multiple time series*. Springer, New York.
15. Moore, T., Pentecost, E., J. (2005). "An investigation into the sources of fluctuation in real and nominal wage rates in eight EU countries: A structural VAR approach", *Journal of Comparative Economics* 34 (2006) 357-376
16. Ooms, M. (1994). *Empirical Vector Autoregressive Modelling*, Springer.
17. Pentecost, E. J., Sessions, J.G. (2002). "Changing labor market flexibility in the European Union". *Weltwirtschaftliches Archiv/Review of World Economics* 138, 148-160
18. Sims, C.A. (1980). „Macroeconomics and Reality“, *Econometrica*, 48, 1-48.

## APPENDIX

Figure 2a

### ORTHOGONALIZED IMPULSE RESPONSE FUNCTION FOR BOSNIA AND HERCEGOVINA (EVIIEWS 8)

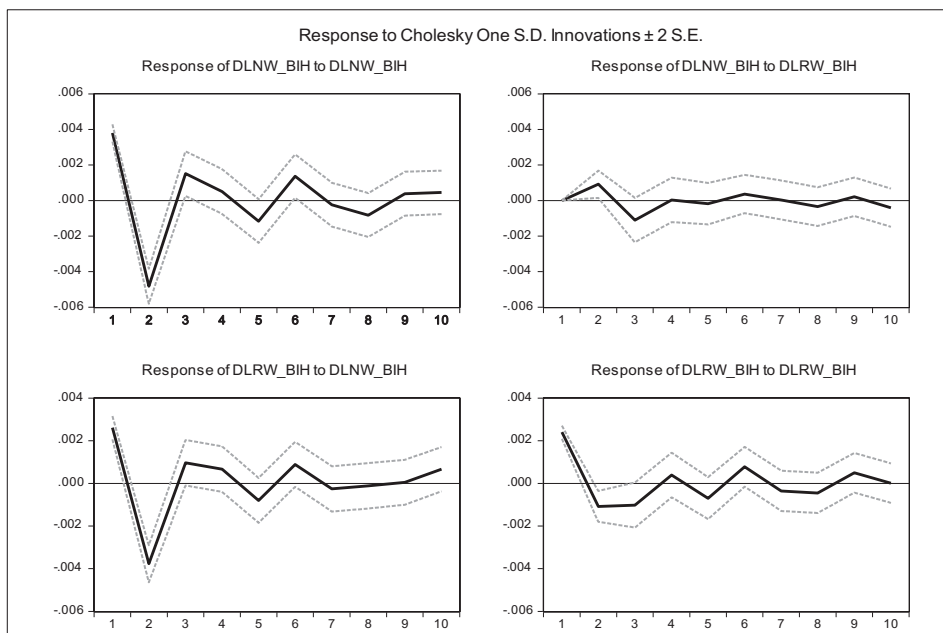


Figure 2b

ORTHOGONALIZED IMPULSE RESPONSE FUNCTION FOR CROATIA  
(EVIIEWS 8)

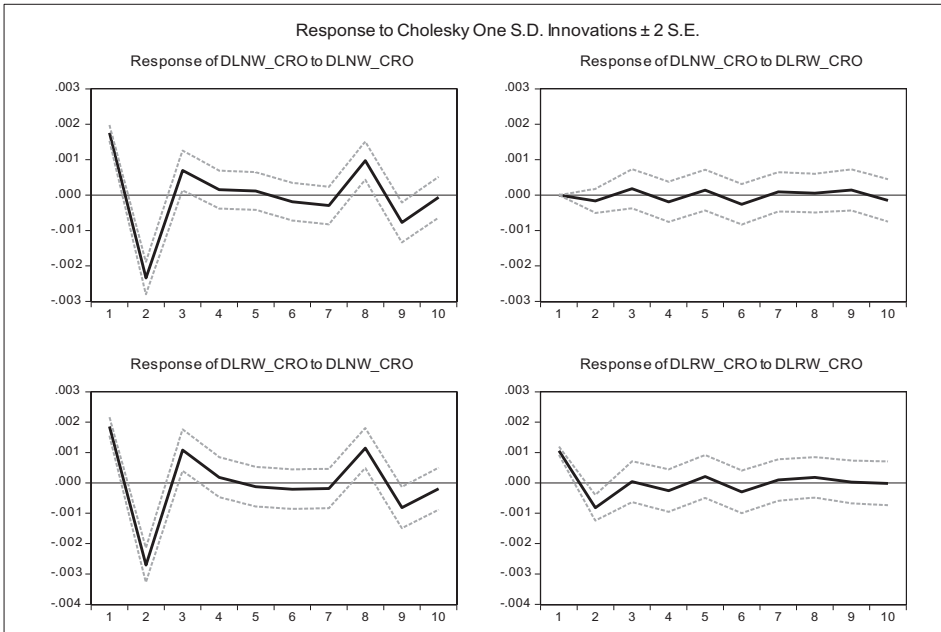


Figure 2c

ORTHOGONALIZED IMPULSE RESPONSE FUNCTION FOR  
MACEDONIA (EVIIEWS 8)

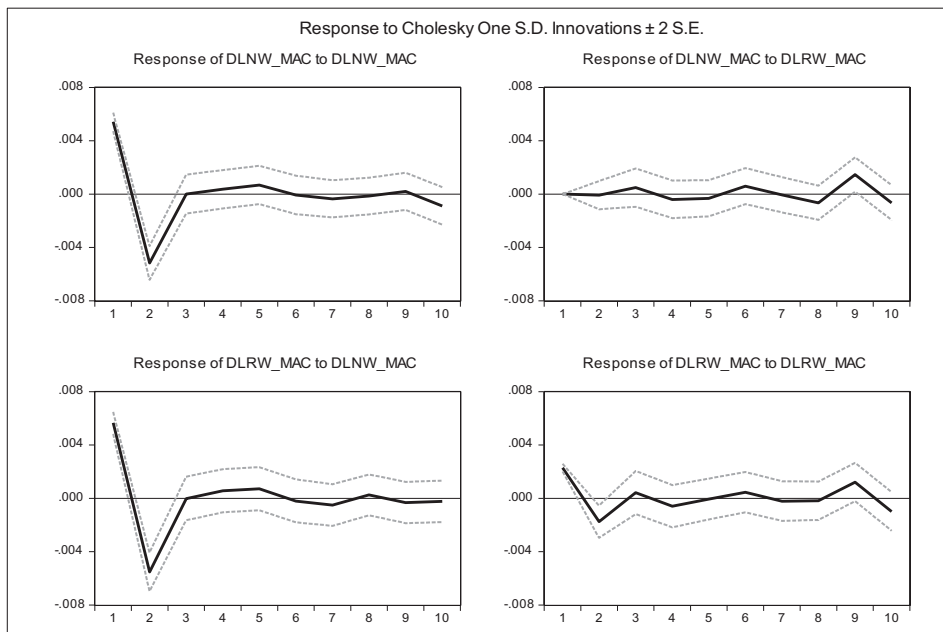


Figure 2d

ORTHOGONALIZED IMPULSE RESPONSE FUNCTION FOR  
 MONTENEGRO (EIEWS 8)

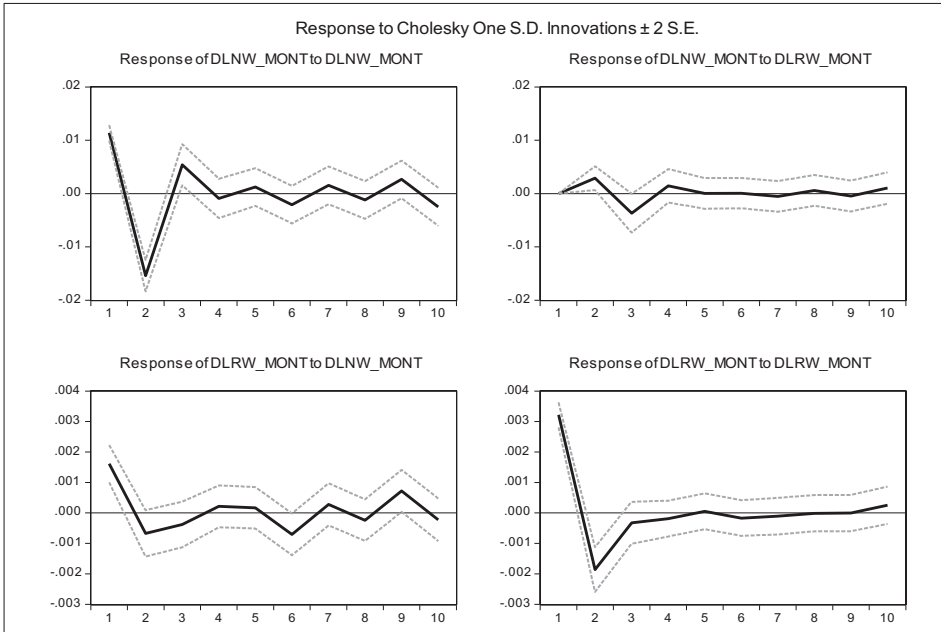


Figure 2e

ORTHOGONALIZED IMPULSE RESPONSE FUNCTION FOR SERBIA  
(EIEWS 8)

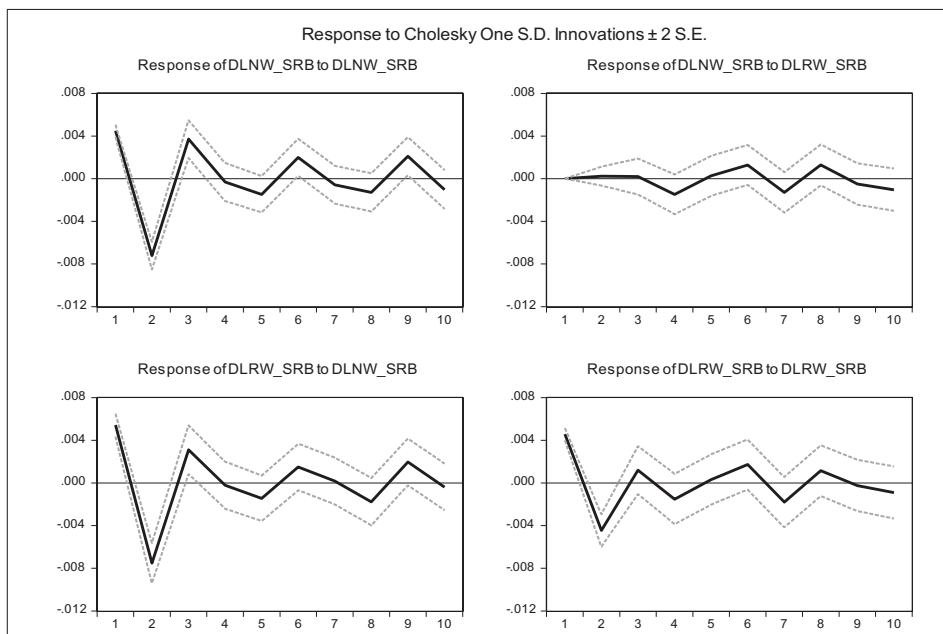


Figure 3a

ORTHOGONALIZED IMPULSE RESPONSE FUNCTION FOR BULGARIA  
(EIEWS 8)

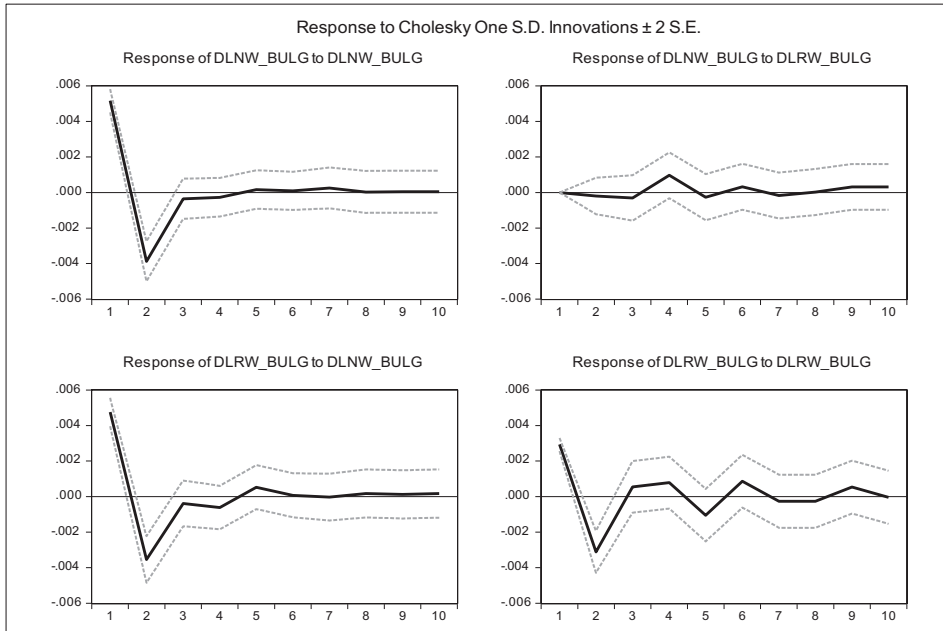




Figure 3b

ORTHOGONALIZED IMPULSE RESPONSE FUNCTION FOR ROMANIA  
(EVIIEWS 8)

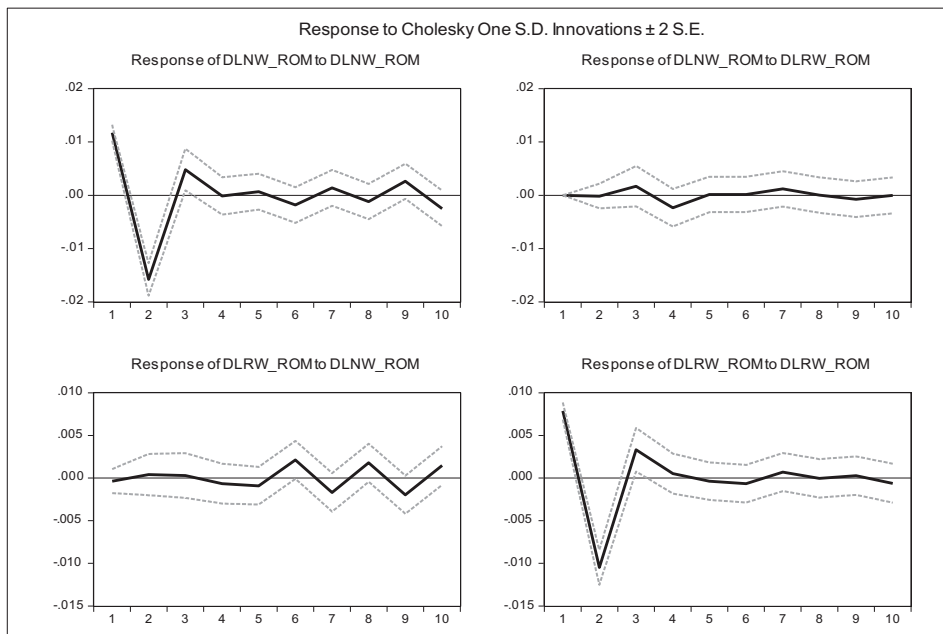
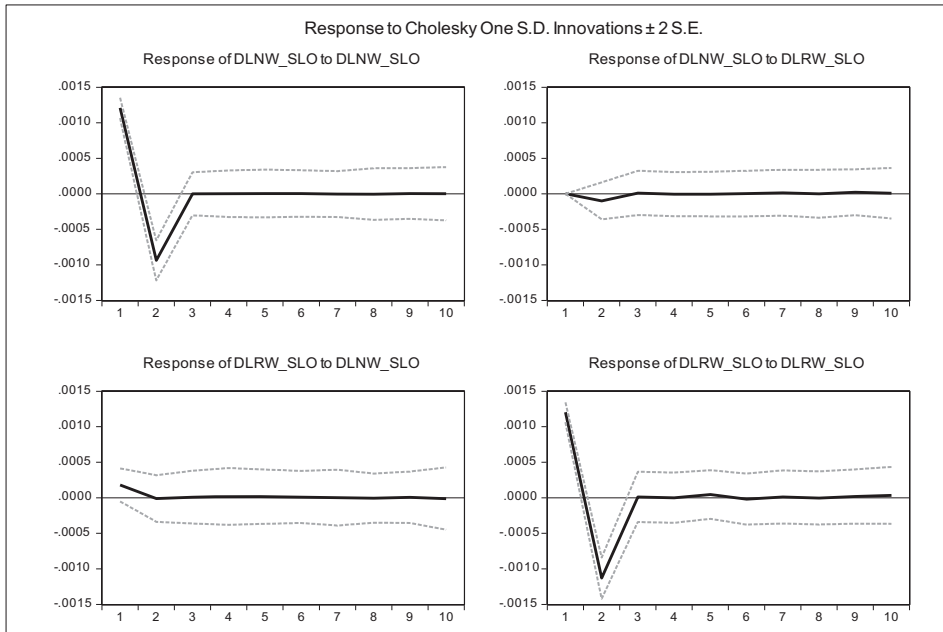


Figure 3c

### ORTHOGONALIZED IMPULSE RESPONSE FUNCTION FOR SLOVENIA (EIEWS 8)



#### FLEKSIBILNOST REALNIH I NOMINALNIH NADNICA: SLUČAJ ODABRANIH ZEMALJA ZAPADNOG BALKANA

##### Sažetak

Fleksibilnost nadnica smatra se jednom od glavnih odrednica fleksibilnosti tržišta rada. U ovome se empirijskom radu analizira fleksibilnost realnih i nominalnih plaća u zemljama Zapadnog Balkana i u odabranim Novim zemljama članicama (NMS) i to pomoću nerestriktivnog vektorskog modela autoregresije. Glavni je cilj ovoga rada bio procijeniti postoji li razlika u reakciji nominalnih i realnih plaća na šokove za skupinu odabranih zemalja Zapadnog Balkana i skupinu Novih zemalja članica. Procijenjen je nerestriktivni autoregresijski model i prikazane su funkcije impulsnih odziva u cilju procjene dugoročnih učinaka šokova na nominalne i realne plaće. U analizi su korišteni podaci o prosječnim bruto plaćama iz WIIW baze. Analiza je provedena za razdoblje od siječnja 2004. do lipnja 2015. godine. Rezultati empirijske analize su pokazali da je reakcija plaća na šokove u zemljama Zapadnog Balkana ista ili jača kao i u skupini Novih zemalja članica.

Ključne riječi: nominalne nadnice, realne nadnice, vektorski model autoregresije, zemlje Zapadnog Balkana