MONETARY EFFECTIVENESS IN SMALL TRANSITION ECONOMY – THE CASE OF THE REPUBLIC OF SERBIA

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Abstract

This paper examines the factors which influence the effectiveness of central bank in Serbia. Specifically, we have observed the effect of the various macroeconomic variables, inter alia uncovered interest rate parity (UIRP) premium on the monetary policy. The results showed that risk premium, as the balancing value in UIRP, had a significant impact on the monetary policy. The research examined two sub-samples – before and after the world crisis. Before the crisis, central bank could affect its indirect targets, the nominal exchange rate and money supply, via higher interest rate. However, higher interest rate proved inefficient after the crisis, primary due very huge and abrupt depreciation of RSD SVAR model and its impulse response function (IRF) have been used in the paper.

Keywords: risk premium, structural VAR, referent interest rate, Serbia, monetary policy
JEL Classification: E52, F30, F31, C01

I. Introduction

Development of the transitional financial markets dramatically increased the capital mobility between developed and emerging markets. Many Eastern European planned economies began the process of transition in the early nineties of the twentieth century, so one of the key questions for policymakers was how to achieve the most effective

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monetary policy of inflation stabilization strategy. Some developing economies chose pegged exchange rate arrangements[5], since that transmission channel had an immediate effect on inflation, and technically it was easy to implement. However, Calvo and Mishkin (2003) and Fisher (2001) point out that for open countries conventional pegged exchange rate regimes proved to be crisis-prone and therefore countries should embrace greater exchange rate flexibility. According to Taguchi (2011) most emerging Asian economies have increased monetary autonomy utilizing floating regimes and accumulation of foreign reserves. Additionally, carrying out the strategy of fix exchange rates is much more difficult in economies with unregulated public finances and unstructured real sector (Maliszewski, 2002). In such circumstances, it is highly likely that fixed rate will not be sustainable in the long term due to the limited level of foreign exchange reserves and its unfavorable impact on the export competitiveness. Therefore, many central banks have abandoned their exchange rate targeting rule by adopting inflation targeting (IT), as their main monetary policy principle, in 1990s[6].

However, inflation targeting is quite a sophisticated policy to conduct in practice. Numerous researchers such as (Christoffersen *et al*. 2001) and (Gottschalk and Moore, 2001) concluded that in these circumstances there is a highly precarious relationship between monetary policy instruments and inflation. It requests a *de facto* mandate to pursue an inflation stability objective, independence of the central bank, macroeconomic and financial stability and well-functioning domestic asset market (Pang, 2013). Despite some studies in which inflation targeting strategy has positive effects on the transparency and credibility of monetary policy, Svensson (1995) and Orlowski (2000) asserted that there is no consensus whether this policy is best suited for all transition economies. Apart from the existing hereditary problems, transition and developing countries that have opted for inflation-targeting strategy need to improve their operational instruments. Inflation usually involves control of the money supply as an indirect target whereas different solutions can be found as indicators in various developing and transition countries[7]. Commonly, control of the money supply can be efficiently accomplished via open market operations (usually through REPO and reverse REPO), and it can be implemented in two ways: 1) active – central bank targets a specific level of reserves and the price of banking reserves is changeable, or 2) passive – central bank determines the interest rate and the level of reserves fluctuate in view of its height (Axilrod, 1996.). Daianu and Lungu (2005) suggest that for the success of open market operations at least two preconditions must be met: 1) central bank can and must control the intermediate variables, and 2) a stable relationship between the intermediate target and the inflation must exist.

Serbia officially adopted IT strategy in January 2009. This strategy was implemented years after introduction of the new monetary policy instrument - 2W REPO rate in

[5] *Countries which pegged their currencies via currency board are: Bulgaria, Bosnia and Herzegovina, Lithuania, and Estonia (before membership in EMU). Latvia pegs to the SDR.*

[6] *The developing and transition countries that have adopted an inflation targeting regime are: Brazil, Chile, the Czech Republic, Colombia, Guatemala, Hungary, Indonesia, Israel, Korea, Mexico, Peru, Philippines, Poland, Romania, the Slovak Republic, South Africa, Thailand, Turkey and Serbia.*

[7] *For example, the net domestic asset is used in Poland and Mexico, the M3 aggregate in India and Malaysia and reserve money in Brazil and the Philippines.*

September 2006. Two-week maturity was met to be a reference period for all open market operations. The key goal of its introduction was a reduction (sterilization) of the net domestic assets as a direct aftermath of the growth in net foreign assets in NBS balance-sheet, as well as exchange rate stabilization, which eventually reflects on the inflation level. After transition process commenced, Serbia had, *inter alia*, the constant surplus of capital account, as well as instability and frequent exchange rate overvaluation. The challenge of this paper is to analyze the factors which affected the efficiency of REPO operations in Serbia. To the best of authors' knowledge, this is the first study that examines monetary effectiveness in Serbia, taking into account risk premium existence and utilizing SVAR methodlogy.

The structure of the paper is as follows. Second section introduces well known concept in international finances, i.e. uncovered interest rate parity (UIRP) and existing risk premium in the Serbian economy. Third section presents methodology, Structural Vector Auto-Regression (SVAR) model, and fourth section discloses data. Fifth section reveals results and sixth section concludes.

II. Uncovered interest rate parity and risk premium

One well known cornerstone of international finance is Uncovered Interest Rate Parity (UIRP). It states that high yielding currencies should depreciate in just the exact amount to equalize expected returns on two different currency deposits. However, the majority of empirical studies performed on developed as well as developing countries (Froot and Thaler; 1990; Chinn and Meredith, 2004; Burnside *et al*., 2009; Fisher, 2006; Sarno, 2005) thus far indicate that exchange rates disappoint to move one-for-one with interest rate differentials, leading to the conclusion that UIRP could not explain future exchange rate change. This phenomenon is widely known as the forward premium puzzle. One of the common suggestions in the literature why UIRP does not work includes the existence of time-varying risk-premium (defined as ex-ante expected profit on the carry trade strategy). A carry trade is outlined as a strategy of borrowing in the currency of the low interest and depositing the income in the high interest currency, taking an open position to nominal exchange rate risk, i.e. exchange rate change. In this way investors are facing potentially hazardous situation if sudden depreciation happens. This could negatively influence securities inclined to such kind of risk. Firstly, we create fitted values of risk premium (δ) by regressing the UIRP general expression:

$$i_{t+n} = i^{*}_{t+n} + E_t(s^{PPP}_{t+1} - s_t) + \delta_t \quad (1)$$

where: $E_t(s^{PPP}_{t+1} - s_t)$ is the expected depreciation of the home currency and δ_t is the risk coefficient or risk premium, which equalize the difference between interest rates and the level of currency depreciation. *E* stands for expectation operator; i_{t+n} and i^{*}_{t+n} are nominal interest rates on domestic and foreign securities respectively, issued at time t and maturing after n periods. However, we observed very short maturity securities (two weeks) issued by NBS (National Bank of Serbia) and its counterpart ECB (European Central Bank), thus n=0. We chose these securities since they are regarded as most attractive due to ever present exchange rate risk (fear of sudden depreciation) in the Serbian market. Additionally, in order to express risk premium, we need to know the

forward (future) exchange rate. Majority of the papers, which consider forward exchange rate, used preposition of rational expectations where actual exchange rate movement proxy for expected one. However, that is not always true and could be yet another reason why UIRP does not work – the failure of the rational expectations. In order to circumvent this problem, we followed the work of Berk and Knot (2001) that used the principle of long-run purchasing power parity (PPP) to derive a future exchange rate, instead of common rational expectations approach. The PPP path can be expressed as the long-run average around which the exchange rate moves. Many studies confirmed that hypothesis. For instance, Alba and Park (2003) and Alba and Papell (2007) find that PPP holds well in countries with high openness. Also, PPP is more likely to hold in high inflation rate countries, since prices adjust quickly to ensure parity reversion. Empirical findings in literature typically support that high inflation rates strengthen the evidence of PPP (Frenkel, 1978; McNown and Wallace, 1989; Cheung and Lai, 2000; Bahmani-Oskooeea *et al*., 2008).

Creating risk premium (RRP) series and using it in analysis, we assessed whether and how much monetary policy have been successful in carrying out its objectives – money supply sterilization and exchange rate stabilization as indirect goals of inflation targeting. NBS introduced new 2W REPO rate instrument in September 2006 and this interest rate was quite higher comparing to ECB referent rate. It means that interest rate span could entice investors to purchase REPO securities, but on the other hand risk premium existence could discourage their purchase, because it might imply sudden currency depreciation at some point. Using the SVAR model, we observed the dynamic relationship between following monetary variables: repurchasing liabilities of the NBS (REPO), M1 aggregate (M1), the nominal exchange rate RSD/€ (EXR), referent interest rate (RIR), inflation (INF) and risk premium (RRP). In other words, we strived to see whether referent interest rate was the primary instrument when it comes to the determination of the level of open market operations, or possibly other factors played a role, and why.

III. Methodological issues

The Vector Auto-Regression (VAR) approach is a multivariate time series model where the interaction between several variables is used to forecast each variable (see Sims, 1980). However, sometimes economic interpretations of reduced form VAR can be challenging. Instead, we have used the Structural VAR model and accompanying economic theory to impose some restrictions on the system structure. The main goal of SVAR methodology is to stipulate the dynamics responses of various economic variables to independent innovations combining time series analysis and relevant economic theory. For the traditional a-theoretic VAR method and its Cholesky decomposition accomplice, the SVAR model could represent a valid alternative. Using solely VAR approach, only a recursive structure could be accomplished. Some authors as Sims (1986), Bernanke (1986) and Blanchard and Watson (1986) proposed a more generalized method without recursive structure allowing constraints on contemporaneous structural parameters. The underlying specification of the standard Sims (1980) unrestricted reduced-form VAR model of order m, where each variable has common lag length in every equation can be presented as:

$$Y_t = \sum_{i=1}^{m} \varphi_i Y_{t-i} + \omega C_t + e_t \quad (2)$$

where: Y_t is the (n × 1) vector of endogenous variables Y_t:(RIR, EXR, RRP, REPO, M1 and INF), (n = 6); C is a (q × 1) vector of independent deterministic variables (in our case only constant), and e_t is a (n × 1) vector of reduced form residuals that are not correlated with each other, i.e. white noise process with E(e_t=0). ϕ and ω are (n × n) and (n × q) matrix of coefficients. The lag length was determined by Akaike information criterion (AIC) and this test reported three lags.

However, in equation (2) any explication of the instantaneous relationship (contemporaneous effects) among the variables is not expected. The reason is fact that such contemporaneous effects are dormant in the correlation structure of the covariance matrix coming from ε_t. The necessary consequence is that the shocks in ε_t will be contemporaneously correlated. Therefore, a structural representation of the VAR model can be useful. SVAR specification, without independent term, can be expressed as:

$$\Xi Y_t = \sum_{i=1}^{m} \Lambda_i Y_{t-i} + u_t \quad (3)$$

In equation (3) the errors in u_t are not cross correlated, since variables contemporaneously interact in the matrix Ξ. On the other hand, matrix Λ envelops all the lagged interactions among the same variables. Consequently, a relation between the reduced-form VAR and structural-form VAR could be expressed via relations: $A = \Xi^{-1}\Lambda$, and $e_t = \Xi^{-1}u_t$. It means that reduced VAR model innovations (e_t) are linear combination of the uncorrelated shocks (u_t). Also, it implies that contemporaneous interactions, contained in matrix Ξ, can be regain as long some restrictions differ from the standard structure of triangular Choleski decomposition. A classical procedure with triangular decomposition is intended to compute a matrix of disturbances. Most commonly, with usage of maximum likelihood method those disturbances serve to estimate matrices Ξ and Λ. Matrix Ξ is quite important because it contains the parametric restrictions adopted from relevant economic theory. Last but not least, the momentary reactions of the system to the self-contained shocks can be estimated, as well as impulse response function (IRF). A viable conjecture is that structural shocks are mutually uncorrelated and therefore orthogonal. However, one necessary condition for identification of the system must be met, the number of non-zero elements in matrix Ξ must be equal or less than n(n + 1)/2. The complete structure of the contemporaneous effects is scored by means of two matrices (Ξ and Λ) as in following equation:

$$\Xi e_t = \Lambda u_t \quad (4)$$

Our system included six endogenous variables, namely Y_t = (REPO, EXR, M1, RIR, RRP and INF); $e_t = (e_t^{REPO}, e_t^{EXR}, e_t^{M1}, e_t^{RIR}, e_t^{RRP}, e_t^{INF})$ are errors of reduced form VAR; structural disturbances are $u_t = (u_t^{REPO}, u_t^{EXR}, u_t^{M1}, u_t^{RIR}, u_t^{RRP}, u_t^{INF})$. The structural VAR in full matrix form can be written as:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ \Xi_{21} & 1 & 0 & 0 & 0 & 0 \\ \Xi_{31} & \Xi_{32} & 1 & 0 & 0 & 0 \\ \Xi_{41} & \Xi_{42} & \Xi_{43} & 1 & 0 & 0 \\ \Xi_{51} & \Xi_{52} & 0 & \Xi_{54} & 1 & 0 \\ \Xi_{61} & \Xi_{62} & \Xi_{63} & 0 & \Xi_{65} & 1 \end{bmatrix} \times \begin{bmatrix} e_t^{RIR} \\ e_t^{EXR} \\ e_t^{RRP} \\ e_t^{REPO} \\ e_t^{M1} \\ e_t^{INF} \end{bmatrix} = \begin{bmatrix} \Lambda_{11} & 0 & 0 & 0 & 0 & 0 \\ 0 & \Lambda_{22} & 0 & 0 & 0 & 0 \\ 0 & 0 & \Lambda_{33} & 0 & 0 & 0 \\ 0 & 0 & 0 & \Lambda_{44} & 0 & 0 \\ 0 & 0 & 0 & 0 & \Lambda_{55} & 0 \\ 0 & 0 & 0 & 0 & 0 & \Lambda_{66} \end{bmatrix} \times \begin{bmatrix} u_t^{RIR} \\ u_t^{EXR} \\ u_t^{RRP} \\ u_t^{REPO} \\ u_t^{M1} \\ u_t^{INF} \end{bmatrix} \quad (5)$$

Matrix Ξ has 22 restrictions and according to the above, there has to be at least 21 restrictions, thus the model is over-identified and could be evaluated. However, considering the potential sensitivity of the IRFs results to variable orderings, theoretical consideration is also necessary. Namely, the referent interest rate is the first variable in sequence because it is autonomous monetary policy instrument that influences all other variables directly or indirectly, but do not suffer contemporaneous affect from them. In fact, the first row represents the conventional monetary policy reaction function. Exchange rate is the second row since one of the main indirect monetary policy goals was its stability. NBS tried to accomplish that objective via the greater attractiveness of domestic assets. Exchange rate, similarly to RIR, influences contemporaneously all other variable below, directly or indirectly. Risk premium suffers direct impact from exchange rate movements via UIRP relation. Attractiveness of REPO securities directly depends on exchange rate stability. Due to autonomous flows, money supply was determined by capital inflow and the exchange rate level. Similar to other transition countries, exchange rate is one of the most important factors for the cost push inflation. Further, risk premium has effect on REPO liabilities because it directly affects investor's opportunity to take advantage of carry-trade strategy. RRP does not have proximate effect on money supply so in matrix Ξ we impose our first null restriction on Ξ_{53} parameters. Since RIR and EXR directly affect risk premium, it has an indirect effect on inflation. REPO liabilities have immediate effect on money supply because NBS has used REPO securities for excess money sterilization. Our assumption is that REPO activities did not have as much influence on inflation as exchange rate, referent interest rate and M1, so we impose second restriction on parameter Ξ_{64}. Lastly, M1 aggregate affects inflation according to monetary theory stance.

IV. Data and unit-root tests

The data used for the Structural VAR analysis are monthly time series from January 2005 to June 2014. These data could be found on the official website of the NBS[8], except for RRP which have been created via UIRP tenet. Some of the major preconditions of VAR specification is the absence of a structural break in the time series that are observed. Taking into account the fact that in 2008 global economic crises spilled over to the Serbian market, it is a reasonable assumption that we can expect structural breaks and erratic dynamics in some monetary time series. In order to

[8] *http://www.nbs.rs/internet/english/80/index.html*

investigate the existence of structural breaks in the monetary series we conduct CUSUM test and CUSUM of squares test (Brown, Durbin, and Evans, 1975). The tests have revealed that EXR, RRP and REPO series have variance instability or the presence of structural breaks in roughly the same period. It was when the crisis occurred in Serbian economy around the last quarter 2008. The existence of structural breaks might pose a threat for parameter bias. Therefore, we divide the observed period into two sub periods - before and after the crisis. In this way we were able to compare the two periods and to determine possible differences in the implementation of monetary policy. Also, VAR analysis requires that all series used in the model are stationary. For that purpose we conducted traditional Augmented Dickey–Fuller ADF(3) and Philips-Perron (PP) unit root tests.

Table 1

Unit root tests results

	2005:1-2012:4		2005:1-2008:9		2008:10-2012:4	
	PP	ADF	PP	ADF	PP	ADF
REPO	-2.033	-2.428	-0.026	-0.057	-2.331	-2.062
EXR	-0.268	-0.177	-1.957	-0.937	-1.651	-1.601
M1	-0.700	-0.725	-1.043	-0.919	-1.881	-0.945
INF	-7.403	-7.403	-5.521	-5.522	-5.233	-5.206
RIR	-2.361	-2.137	-1.673	-1.520	-1.580	-1.326
RP	-2.323	-2.226	0.504	0.427	-2.481	-2.128
DLOG(REPO)	-15.492	-5.969	-15.559	-17.663	-6.309	-6.248
DLOG(EXR)	-10.143	-10.189	-9.450	-9.890	-6.756	-6.765
DLOG(M1)	-17.332	-14.154	-13.183	-7.512	-11.215	-10.106
D(RIR)	-7.921	-7.930	-5.710	-5.761	-5.613	-5.753
D(RP)	-9.134	-9.128	-10.681	-10.029	-5.901	-5.901

Asymptotic critical values for unit root tests are: -2.894, -2.584 respectively at the 5% and 10% levels of significance for period 2005:1-2012:4. For period 2005:1-2008:9 critical values are: -2.927, -2.601, and for period 2008:10-2012:4 critical values are -2.930, -2.603 at the 5% and 10% levels of significance. Three lags are used for ADF test.

Unit root tests show that all series in level are non-stationary except inflation. On the contrary, all series observed in the first difference or in log-difference form are stationary. In the next section we evaluated the two SVAR models, before and after the crisis, and all variables were scaled as growth rate. The SVAR analysis used stationary series dlog(REPO), dlog(M1), dlog(EXR), d(RIR), d(RRP) and d(INF). Inflation series is also differentiated, although it is I(0), in order to avoid the presence of its significant innovation impact on the other variables in the IRFs.

V. Empirical Results

In order to be sure about good VAR model specification we conducted several major misspecification tests. It encompasses the Portmanteau test for serial autocorrelation, the Jargue-Bera test using Doornik-Hansen orthogonalization and White heteroskedasticity test (results are not reported due to space parsimony). The tests do not display any major worry about model inadequacy. The structural parameter estimates of Ξ and Λ matrices are exposed in the Figure 1. The over-identifying restrictions for any of the sub-model is not rejected by the formal likelihood ratio test; for model before September 2008 the test statistics are $\chi^2(2) = 5.516$ ($p = 0.063$) and for model after September 2008 $\chi^2(2) = 11.926$ ($p = 0.0026$).

Figure 1

Estimated matrix for contemporaneous structural parameters in two sub-samples

$$-\Xi = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ -0.003 & 1 & 0 & 0 & 0 & 0 \\ 0.985^{*} & 110.6^{*} & 1 & 0 & 0 & 0 \\ -0.035 & -2.920 & 0.025 & 1 & 0 & 0 \\ 0.003 & -0.347 & 0 & -0.003 & 1 & 0 \\ 0.908^{*} & 110.4^{*} & -0.868^{*} & 0 & 0.963^{*} & 1 \end{bmatrix} \quad 2005{:}1\text{-}2008{:}9$$

$$-\Xi = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0.004 & 1 & 0 & 0 & 0 & 0 \\ 0.935^{*} & 109.7^{*} & 1 & 0 & 0 & 0 \\ -0.139^{**} & -7.461^{**} & 0.038 & 1 & 0 & 0 \\ 0.028 & 0.441 & 0 & 0.098 & 1 & 0 \\ 0.684^{*} & 91.84^{*} & -0.683^{*} & 0 & -0.552 & 1 \end{bmatrix} \quad 2008{:}10\text{-}2014{:}6$$

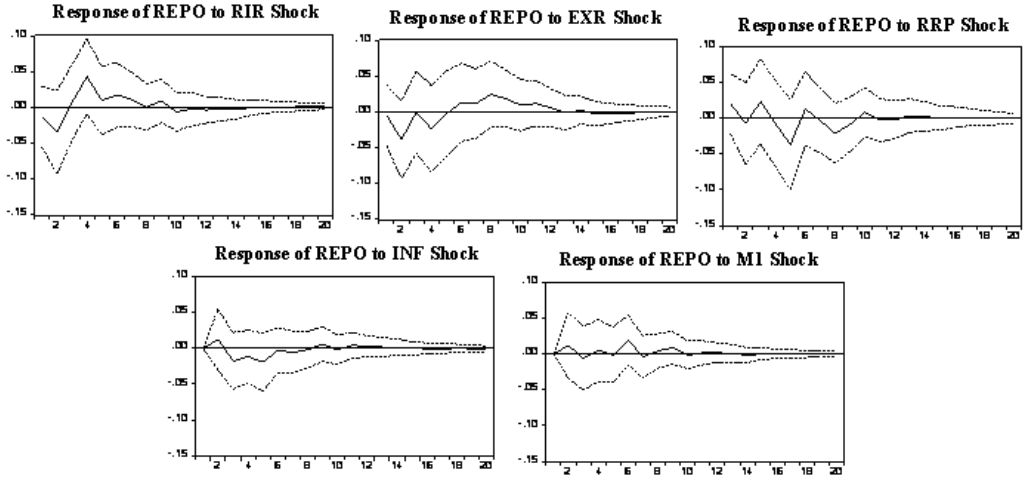
*Note: * denotes significance at 1% level and ** at the 5% level.*

However, it is well known that estimated parameters in the VAR model are very difficult to interpret; accordingly, we skip our parameters explanations. Commonly, the VAR models are employed for obtaining the impulse response function (IRF) results. In the following we present the findings of IRF observed only for REPO liabilities responses, since we perceive REPO operations as proxy for monetary policy effectiveness. Higher REPO liabilities indicate more effective monetary policy and *vice-versa*. The evaluation was carried out for every sub-period. Figure 2 and 3 show point estimates of the IRFs, which are plotted with the solid line, while dotted lines represent two standard deviations

band around the point estimate. The standard errors are calculated employing analytic (asymptotic) integration procedure.

Figure 2

Impulse response of repo liabilities to innovations In other variables (Jan 2005 – Sep 2008)



Source: Authors' calculations.

In Figure 2 we present the responses of REPO liabilities to innovations in all other variables, alluding on attractiveness of REPO securities and efficiency of new monetary policy instrument – 2W referent interest rate. IRFs indicate how attractive repurchasing operations really were, which indirectly shows how much monetary policy was successful in fulfillment of its objectives. In line with the theoretical assumptions, it is expected that the reference interest rate (RIR) has the exact proportional relationship with the repurchase liabilities. IRF also suggests that this effect was relatively significant. Following the introduction of the interest rates in September 2006, the NBS was offering a significantly higher interest rate on 2W repurchasing operations compared to ECB 2W interest rate, which attracted commercial banks to place their funds in REPO securities of NBS. A referent interest rate shock on REPO operations is in line with economic theory and expectations, and we can conclude that the initial introduction of a new instrument contributed to a more efficient monetary policy.

Innovations in the exchange rate have an inconclusive effect prior to the crisis. This is because exchange rate RSD/€ was relatively stable after the introduction of 2W REPO rate and even had appreciation trend. Thus, exchange rate movement before the crisis did not pose a threat for monetary policy efficiency and NBS could conduct the policy of excess money sterilization with great success. The impact of inflation is low and negative in Figure 2 as expected, since Serbia had relatively low inflation in pre-crisis period the inflation shocks could not significantly affect the level of REPO liabilities. Also, additional reason is that National Bank of Serbia primarily issued short-term securities with a maturity of two weeks, and in such short time inflation could not notably invalidate the purchasing power of the domestic currency (RSD). The last picture in Figure 2

suggests that changes in the money supply (M1 aggregate) had almost no effect on the movement of investments in NBS securities, i.e. IRF is near flat.

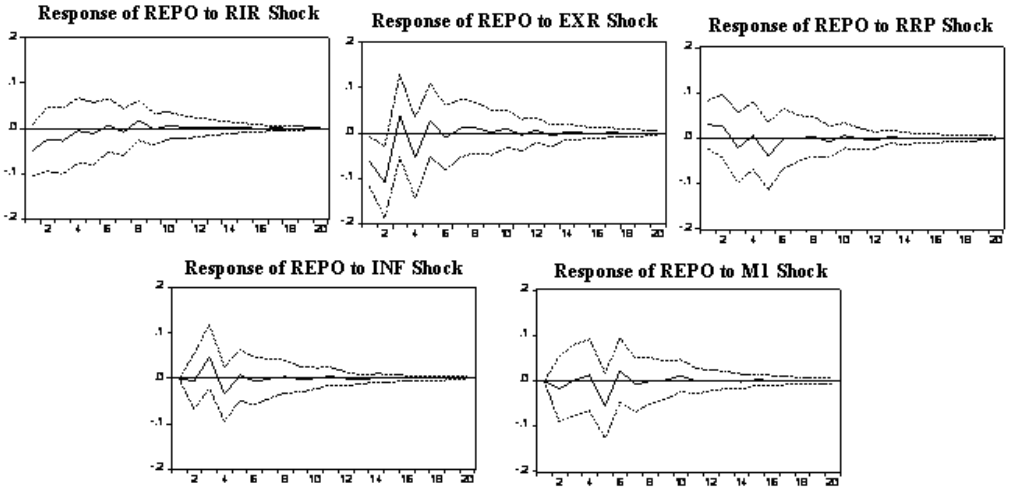
Relationship between risk premium and repurchasing liabilities in most of the time is negative. The initial hypothesis of this study is that the risk premium is a constituent part of the UIRP theory in Serbian economy. Results of the other researchers also indicated that UIRP theory does not hold without risk premium. Findings of MacDonald and Torrance (1989), Taylor (1989), and Cavaglia, *et al*. (1993) implied an important role for the time-varying risk premium in the UIRP. Consequently, it could mean that positive interest yield differential is not compensated by an expected currency loss. Due to the fear that sudden depreciation could happen in any time many investors reluctantly invested in REPO securities. This is reflected in opposite relation between risk premium and REPO securities. As greater risk premium was, the greater danger existed from sudden currency depreciation, therefore lesser investment in REPO securities occurred. According to IRF, reverse proportionality is situated between RRP innovation and REPO response. Nevertheless, at first glimpse, it appeared that the strategy of higher interest rate proved to be successful. In this way, NBS managed to reduce inflation pressures coming from the direction of the exchange rate and increased money supply. However, this "success" could not last long because according to the principle of Purchasing Power Parity the RSD has become a dangerously overvalued currency. Only a bit should happen to everyone become clear that they possess a high-risk currency. That event was the outbreak of a global economic crisis.

Figure 3 presents what happened after the crisis outbreak in Serbia in 2008. First notable finding is that impact from the higher interest rate completely faded. The primary reason for that was very abrupt depreciation of RSD. Serbian currency within period of six months depreciated nominally as much as 19%. It could be noticed that the exchange rate shock is much stronger in the period from October 2008 than up to that point. Risk premium has expected negative effect on the REPO liabilities as in the period before the crisis. In addition, caution investment in RSD securities can also be recognized as negative relationship between monetary aggregates M1 and repurchase obligations. Although the supply of money still had a tendency to raise[9], the short-term investment in RSD securities were reduced. In other words, the NBS strategy of money sterilization was failing. Additionally, the findings of impulse response function also could be corroborated with variance decomposition analysis. It separates the variation in an endogenous variable into the component shocks. Thus, the variance decomposition provides information about the relative importance of each random innovation affecting the REPO variable in the SVAR.

[9] *A slight decrease in the monetary aggregate M1 occurred at the end of 2010, but repeated growth continues in the second half of 2011. The constant raise of money supply from 2002 based on autonomous flows is one of the key features of Serbian economy.*

Figure 3

Impulse response of repo liabilities to innovations In other variables (Oct 2008 – Jun 2014)



Source: Authors' calculations.

It is obvious that the variance decomposition findings match with the IRFs. Specifically, the impact of the interest rates in the period before the crisis was greater than after the crisis. That refers to the effects of the new monetary policy following the introduction of a new instrument, i.e. 2W REPO rate was providing positive results[10]. Similar to the IRF, the risk premium, a value that balances the UIRP, before the crisis had more significant impact on the implementation of monetary policy then after the crisis. However, the most important factor for monetary policy after the crisis is the nominal exchange rate, suggested both by the IRF and variance decomposition. Table 2 provides clear evidence that the impact of exchange rate was significantly smaller before the crisis than afterwards. The reason is that in the pre-crisis period NBS has utilized the opportunities that were artificially created in the market (higher interest rate bid), and the side effect was relative stability and even appreciation of the domestic currency. During this period, investors were able to take advantage of higher interest and NBS was capable to implement a strategy of inflation targeting by controlling indirect goal – the exchange rate.

[10] *For the comparison purpose, the auction sale in December 2006 increased 3.5 times comparing to the ends of August of the same year. This trend continued in 2007 where the repurchase securities sold four times more than in all the transactions carried out in 2006 totaling 3825.2 billion, and in 2008 5217.7 billion. Such a rapid increase of money withdrawal or money sterilization in the system had to be reflected in the foreign exchange market as well, where more demand than supply of RSD suddenly prevailed.*

Table 2

Variance decomposition in two observed periods

	RIR	EXR	RRP	REPO	M1	INF
Jan. 2005 – Sep. 2008						
3 months	6.39	6.74	4.18	79.60	0.77	2.31
6 months	12.68	7.86	8.78	64.87	1.93	3.88
9 months	12.49	10.74	9.95	60.79	2.15	3.89
Oct. 2008 – Jun 2014						
3 months	6.81	32.02	5.18	50.79	0.87	4.32
6 months	5.97	32.53	4.69	42.95	8.19	5.67
9 months	6.44	32.39	4.78	42.56	8.22	5.61

VI. Conclusion

The main result of this paper is that economic fundamentals have the precedence in the long run when it comes to the effective use of monetary policy. Also, it is shown that risk premium could play significant role in the short-run reducing the level of repurchasing operations. The central bank could affect its indirect targets, primarily the nominal exchange rate and money supply, via higher interest rate in order to achieve the targeted inflation rates. However, higher interest rate span creates latent problem of over-valuated currency, which can abruptly lose its value creating losses for investors. Risk premium presence has negatively influenced repurchasing operations of NBS, but impact from the greater interest rate span overshadowed potential risk of sudden depreciation before the crisis. Eventually, it became apparent that RSD securities are a risky asset, which significantly reduced efforts of NBS to regain attractiveness of its repurchasing securities. The conclusion is that NBS possess very powerful instrument – interest rate, but the exchange rate stability has also huge influence on monetary policy in Serbia. Using the SVAR model, we have shown that in relatively stable conditions NBS can use its interest rate pretty effectively but in precarious time its function fades away very rapidly.

Relaying constantly on higher interest rate cannot last indefinitely, since economic fundamentals begin to act sooner or later. According to PPP, currency that has appreciated become dangerously overvalued and therefore carries a high dose of currency risk. At one point, a currency that have higher yield can start to depreciate, reducing the imbalance in UIRP and affecting the risk premium that begins to approach to zero. In Serbia, it happened with the outbreak of the global economic crisis. Although the risk premium was not annulled the efficiency of the NBS primary instrument was drastically reduced, and the main determinant of monetary policy ineffectiveness have become the exchange rate instability.

The extension of this paper could be the analysis of risk premium existence in other Western Balkans and Eastern Europe Countries, which pursue a flexible exchange rate. Therefore, the panel analysis can check for cointegration relationship between the risk premiums in different countries.

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