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Monetary policy and unemployment in Croatia

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ABSTRACT
Achieving full employment is one of the most important economic policy tasks. Economic policy affects employment primarily through monetary and fiscal policies, which with their instruments affect aggregate supply and demand for goods and services. The aim of this article is to determine the impact of monetary policy on unemployment in Croatia. For this purpose, the bounds testing (ARDL) approach for cointegration is applied. The results indicate the existence of stable cointegration relationship between the variables and show that Croatian monetary policy is quite limited in reducing unemployment.

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Introduction

It is well known that the four major economic policy objectives are: full employment, price stability, high and sustainable rate of economic growth, and keeping the balance of payments in equilibrium. Economic policy affects employment primarily through monetary and fiscal policies, which with their instruments affect aggregate supply and demand for goods and services (Blanchard, 2005). This article will mainly emphasise the influence of monetary policy. In the short run, monetary policy influences inflation and the economy i.e., the demand for goods and services and, therefore, the demand for the employees who produce those goods and services. This primarily occurs through the influence on the financial conditions of households and firms. On this behalf, monetary policy operates through different monetary policy channels such as interest rate channel, credit channel, exchange rate channel, etc. (Board of Governors of the Federal Reserve System, 2015; The European Central Bank, 2015).

Generally, in large economies the monetary policy authorities with their instruments try to influence overall financial conditions by adjusting the official rate, i.e., the rate that banks charge each other for short-term loans. Movements in this rate are passed onto other short-term interest rates that influence borrowing costs for firms and households. These movements also influence long-term interest rates, such as corporate bond rates and residential mortgage rates. Shifts in long-term interest rates then affect asset prices such

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as equity prices (e.g., stock market prices) and the foreign exchange rate. In turn, these changes affect economic activity. For example, when short-term and long-term interest rates are falling, borrowing becomes cheaper, so households and firms will more likely buy goods, services and items to expand their businesses (such as property and equipment). In turn, firms are hiring more workers and boosting production while household wealth increases, which encourages even more spending. A relationship that goes from monetary policy to production and employment mostly depends on time element but also on many other factors that affect the effectiveness of monetary policy.

In small and open economies, such as Croatia, monetary policy abilities are limited by many constraints. Croatia is a highly euro-ised economy with relative freedom of international capital flows. Therefore, large changes in capital flows significantly affect the stability of the exchange rate and the rest of the highly euro-ised economy. In such circumstances, independent setting of domestic interest rates and money supply is rather limited. The main objective of the Croatian National Bank (CNB) is maintaining the price stability without prejudice to the achievement of its objective, the CNB shall support the economic policy of the Republic of Croatia. The Act on the Croatian National Bank (2008) stays that the CNB may, for the purpose of implementing the defined monetary and foreign exchange policies, lay down measures and instruments necessary to regulate credit institutions' credit activities and liquidity, as well as money supply, and take measures regarding interest rates and the domestic currency exchange rate. However, according to CNB (2008), an increase in interest rates under direct CNB control aimed at slowing down monetary and credit expansion would be offset by capital inflows attracted by higher interest rates. Likewise, market interest rates and the amount of money in circulation react more to changes in foreign interest rates and liquidity than to changes in interest rates that are under direct CNB control. As so, the creation of additional kuna liquidity in conditions of high euro-isation would rather lead to depreciation of the domestic currency since the foreign currency liquidity is limited by the level of international reserves. Depreciation of the domestic currency will in turn decrease international reserves and rise the investors' risk perception. Constraints lead to the underdevelopment of the money market and its illiquidity, money market interest rate volatility, under-representation of the money market compared to other sources of funds, etc. (Croatian Banking Association, 2008). Partly, the limitation of setting the domestic interest rates and money supply arises from banking contracts. For example, contracts on real estate loans contain clauses on variable interest rates that are changing according to the decisions of bank management (Croatian Banking Association, 2007). Therefore, in small and open economies such as Croatia's, the most dominant monetary policy channel is the exchange rate channel since the exchange rate can affect inflation directly, insofar as imported goods are directly used in consumption.

Literature review

This section provides a brief literature review related to the theoretical and empirical relationship between monetary policy and unemployment. The literature review begins with papers that analyse the relationship between monetary policy and unemployment in the US, followed by papers that analyse the same issue in European countries.

Christiano, Eichenbaum, and Evans (1996) investigated the effects of monetary policy shocks on the US economy using a vector autoregressive (VAR) model and various quarterly macroeconomic variables in the period from March 1960 to December 1992. Results indicate that a contractionary monetary policy shock causes a rise in unemployment and a fall in employment.

Leeper, Sims, and Zha (1996) investigated the role of monetary policy in the US using a VAR model and a range of monthly macroeconomic variables in the period from January 1960 to March 1996. The results suggest that a contractionary monetary policy shock causes a rise in unemployment.

Christiano, Eichenbaum, and Evans (1999) investigated the effects of monetary policy shocks in the US using a large subset of the VAR model identification schemes and a range of macroeconomic variables. The results indicate that a contractionary monetary policy shock causes a fall in employment.

Korenok and Radchenko (2004) analysed the monetary policy effects on the business cycle fluctuations in the US using a plucking factor augmented vector autoregressive (PFAVAR) model and a range of quarterly aggregate economic variables in the period from June 1959 to September 2002. They found that contractionary monetary policy shock leads to a decline in the level of employment.

Ravn and Simonelli (2007) examined the dynamic effects on the labour market of four structural technology and policy shocks in the US using a 12-dimensional SVAR (structural vector autoregressive) model and quarterly data of real government spending, relative investment price, labour productivity, real wages, inflation rate, capacity utilisation, average hours worked, consumption share, the investment share, unemployment, vacancies, vacancies–unemployment-ratio and the Federal funds rate in the period from September 1959 to March 2003. They found that contractionary monetary policy shock increases unemployment.

Erjavec, Cota, and Bahovec (1999) analysed the relationship between monetary-credit and real economic activity in Croatia using a VAR model and monthly data of industrial production, money supply, prices, credit supply and unemployment in the period from January 1992 to December 1998. Conducted Granger causality tests showed that money supply does not cause unemployment. Furthermore, with additional tests they concluded that unemployment might be excluded from the model as insignificant.

Lo Cascio (2001) examined possible asymmetric effects of common monetary policy shock to output and prices across 11 European countries (Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Spain, Sweden and the UK) using a VAR model and quarterly data of real GDP, the consumer price index and a short-term interest rate in the period from March 1979 to December 1998. The results indicate that monetary shocks influence unemployment but they differ from country to country.

Peersman and Smets (2001) investigated the monetary transmission mechanisms in the euro area and the US using alternative identification schemes of a VAR model and quarterly data of several macroeconomic variables in the period from 1980 to 1998. They found that monetary policy shocks represented as an unexpected change in policy-controlled interest rates have very similar effects on the two economies whereby an interest rate tightening causes a fall in employment in the euro area.

Alexius and Holmlund (2007) analysed the relationship between monetary policy and unemployment fluctuations in Sweden using a SVAR model and quarterly data of domestic output gap, unemployment, monetary conditions index (MCI), foreign output gap, technology and government deficit in the period from March 1980 to March 2005. Obtained results suggests that expansionary monetary policy increases the output gap and decreases unemployment.

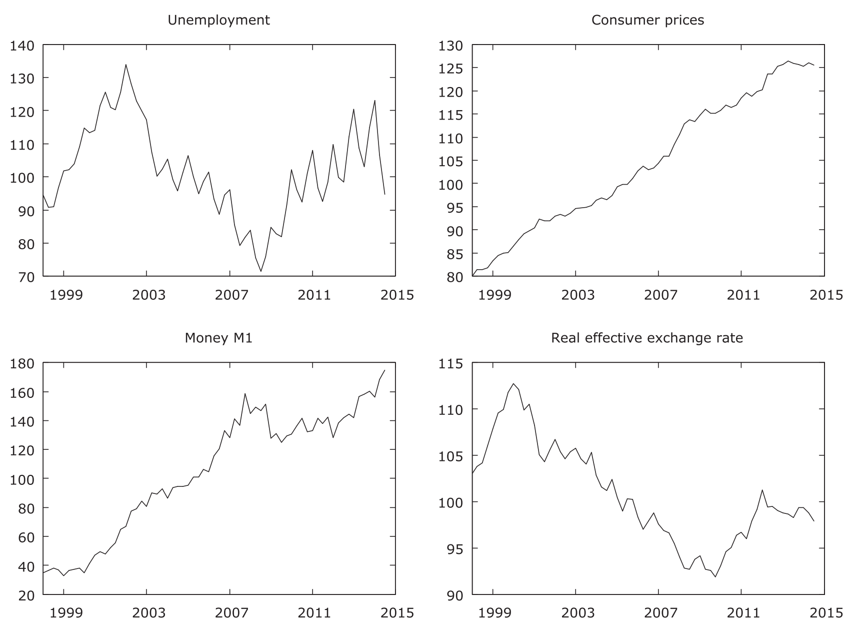
Altavilla and Ciccarelli (2009) investigated the effects of monetary policy on unemployment dynamics under uncertainty in the US and the euro area using a Bayesian model averaging procedure and quarterly data of inflation, interest rate, unemployment rate, exchange rate, labour force participation rate, and a commodity price index in the period from March 1970 to December 2007. They found that monetary policy shocks have very similar recessionary effects on the two economies, with a different role played by the participation rate in the transmission mechanism.

This brief literature overview points to a few facts. Firstly, to analyse the relationship between monetary policy and unemployment, the majority of the authors used VAR or SVAR methodology, thus leaving the possibility of using other methodologies. Secondly, all conducted analyses for the US suggest that monetary policy affects unemployment while the results for European countries show some differences.

In addition, much research available on the CNB's website showed that unemployment is one of the most significant sources of risk in the Croatian financial system and therefore it should be given great attention.

Methodology and results

The main goal of this article was to determine the impact of monetary policy on unemployment in Croatia by using the bounds testing (ARDL) approach for cointegration of time series. Data for four selected variables are observed on a quarterly basis as indices (2005=100) in the period from March 1998 to September 2014 and Graph 1 shows their movement, i.e., the movement of unemployment (UNEMP)[1], consumer prices (CPI), money



Graph 1. Unemployment, consumer prices, money M1 and the real effective exchange rate of Croatian kuna. Source: Authors' calculation.

M1 (M1) and the real effective exchange rate of Croatian kuna (REER)[23]. Data are taken from the CNB (2014) and the Institute of Economics, Zagreb (2014) databases.

Both consumer prices and money M1 showed an upward trend throughout the whole period, although this trend slowed down during 2008. Unemployment and the real effective exchange rate showed very similar movements with two break points. First, at the end of the 1990s, mainly due to the introduction of value added tax (VAT), a second banking crisis, democratic elections and second, during 2008 due to the spill over effect of global crisis on the Croatian economy. It is noticeable that the increase in unemployment is accompanied by a depreciation of the exchange rate, and vice versa. This is particularly visible in periods of crisis when reduced capital inflows and increased capital outflows cause exchange rate depreciation.

The unemployment equation is estimated using the ARDL modelling approach (Pesaran, Shin, and Smith (1996), Pesaran and Shin (1999)). The main advantage of this approach is that it can be applied irrespective of whether the regressors are I(0) or I(1) and can avoid the pre-testing problems associated with the standard cointegration analysis which requires identification of the order of integration. Another advantage is that the ARDL approach does not require symmetry of lag lengths, i.e., each variable can have a different number of lag terms. The ARDL model is performed in two steps. The first step starts with conducting the bounds test for cointegration. In the second step, when cointegration is found, the long-term relationship and the associated error correction model are estimated.

Before proceeding with the bounds test, it is necessary to examine the properties of the time series, i.e., the degree of integration because it is very important to determine whether the variables are integrated of order n = 0, 1, 2 as to avoid spurious results. In the presence of I(2) variables the computed *F*-statistic and *W*-statistic are not valid because the bounds test is based on the assumption that the variables are I(0) or I(1). To do so, Augmented Dickey-Fuller (ADF)[4] (Dickey & Fuller, 1979), Phillips-Perron (PP) (1988) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) (1992) unit root tests are considered and presented in Table 1. To eliminate the influence of seasonal factors, all series were seasonally adjusted[5] and to stabilise the variance, are expressed in logarithms.

The results of the ADF and PP tests indicate a possible non-stationarity of unemployment in first differences, i.e., the possibility that unemployment is integrated of order I(2). However, KPSS test clearly rejects this possibility. Therefore, for the purposes of the analysis it can be concluded that all the series are integrated of order I(1), i.e., they are stationary in their first differences.

As stated before, the first step of ARDL approach starts with conducting the bounds test for cointegration. The long-term relationship between the variables is tested by computing the *F*-statistic and *W*-statistic for testing the significance of the lagged levels of the variables in the error correction form of the underlying ARDL model. Since the observations are given quarterly, the maximum order of lags in the ARDL model is 4 and furthermore, the trend is included.[6] The error correction version of the ARDL (5, 5, 5, 5) model is defined as follows:

$$\begin{aligned} DLUNEMP_t = a_0 + a_1 t + \sum_{i=1}^{4} b_i DLUNEMP_{t-i} + \sum_{i=1}^{4} d_i DLCPI_{t-i} + \sum_{i=1}^{4} e_i DLM1_{t-i} \\ + \sum_{i=1}^{4} f_i DLREER_{t-i} + \delta_1 LUNEMP_{t-1} + \delta_2 LCPI_{t-1} + \delta_3 LM1_{t-1} + \delta_4 LREER_{t-1} + u_t \end{aligned} \quad (1)$$

Table 1. Unit root tests.

Variable and test	Level		First difference	
	Constant	Constant and trend	Constant	Constant and trend
ADF test		t-stat.		
LUNEMP	-2.899280	-3.300217	-2.172292	-2.180518
LCPI	-1.589609	-2.469990	-3.147214	-3.430400
LM1	-1.671564	-0.670032	-5.859515	-6.111687
LREER	-1.399625	-1.926888	-4.227311	-4.195562
PP test		Adj. t-stat.		
LUNEMP	-1.679008	-1.805247	-2.348963	-2.354420
LCPI	-1.926064	-1.723374	-6.160648	-6.429134
LM1	-1.435638	-1.050568	-5.887578	-6.057253
LREER	-1.077275	-1.707173	-4.225847	-4.192105
KPSS test		LM-stat.		
LUNEMP	0.235018	0.147416	0.123902	0.126338
LCPI	1.058710	0.097381	0.266383	0.073131
LM1	0.935932	0.239876	0.252457	0.092824
LREER	0.719631	0.176629	0.149812	0.151273

Source: Authors' calculation.

Note: In the analysis, EViews (IHS Global Inc., 2015), Gretl (Cottrell & Lucchetti, 2015) and Microfit (Pesaran & Pesaran, 2009) econometric software were used. '*L*' indicates logarithm of the variable. For the implementation of ADF test the Schwarz information criterion has been implemented. ADF test critical values (MacKinnon, 1996); constant: 1% level (-3.53), 5% level (-2.91), 10% level (-2.59); constant and trend: 1% level (-4.10), 5% level (-3.48), 10% level (-3.17). PP test critical values (MacKinnon, 1996); constant: 1% level (-3.53), 5% level (-2.91), 10% level (-2.59); constant and trend: 1% level (-4.10), 5% level (-3.48), 10% level (-3.17). KPSS asymptotic critical values (Kwiatkowski et.al., 1992); constant: 1% level (0.739), 5% level (0.463), 10% level (0.347); constant and trend: 1% level (0.216), 5% level (0.146), 10% level (0.119).

where δ_1, δ_2, δ_3 and δ_4 are the long-run multipliers, b_i, d_i, e_i and f_i are the short-run dynamic coefficients, a_0 is the intercept term, t is a deterministic time trend while u_t are serially uncorrelated residuals with zero mean. The current values of dLCPI, dLM1 and dLREER are excluded since it is not possible to know a priori whether LCPI, LM1 and LREER are the 'long-run forcing' variables for the unemployment (LUNEMP).

Next, F-test and W-test are conducted for the joint hypothesis that the lagged levels of the variables in Equation (1) are zero:

$$H_0{:}\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0 \tag{2}$$

against the alternative hypothesis that at least one lagged level variable is non-zero:

$$H_1{:}\delta_1 \neq 0,\ \delta_2 \neq 0,\ \delta_3 \neq 0,\ \delta_4 \neq\ 0 \tag{3}$$

Computed F-statistic and W-statistic should be compared with the critical values in Pesaran et al. (1996). The distributions of F-statistic and W-statistic for testing the existence of the level relationship in the ARDL model are non-standard and must be computed by stochastic simulations. Two sets of asymptotic critical values are provided; one set assuming that all the variables in the model are I(1) and another set assuming that they are all I(0). If the computed F-statistic and W-statistic exceed the upper bound, the null hypothesis of no long-term relationship can be rejected without needing to know whether the variables are I(0) or I(1), or fractionally integrated. If they fall below the lower bound, the null hypothesis of no long-term relationships can be accepted without needing to know whether the variables are I(0) or I(1), or fractionally integrated. Finally, if they fall between these two bounds, the result is inconclusive and depends on whether the variables are I(0) or I(1), and so the unit root tests on the variables may be carried out. For the sake of the analysis, F-statistic and

Table 2. Testing for existence of a level relationship among the variables in the ARDL model.

F-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
6.9387	4.2937	5.3474	3.6399	4.6332
W-statistic	95% Lower Bound	95% Upper Bound	90% Lower Bound	90% Upper Bound
27.7547	17.1750	21.3896	14.5596	18.5327

Source: Research results.
Note: The critical value bounds are computed by stochastic simulations using 20.000 replications.

Table 3. Diagnostic tests of the ARDL (2, 1, 0, 0) unemployment equation.

Test Statistics	LM Version	F Version
Serial Correlation: Lagrange multiplier test of residual serial correlation	CHSQ(4) = 2.2020, Prob. = 0.699	F(4,32) = 0.46177, Prob. = 0.763
Functional Form: Ramsey's RESET test using the square of the fitted values	CHSQ(1) = 4.2336, Prob. = 0.040	F(1,35) = 3.8902, Prob. = 0.054
Normality: Based on a test of skewness and kurtosis of residuals	CHSQ(2) = 0.37409, Prob. = 0.829	-
Heteroscedasticity: Based on the regression of squared residuals on squared fitted values	CHSQ(1) = 0.49587, Prob. = 0.481	F(1,61) = 0.48394, Prob. = 0.489

Source: Research results.

W-statistic together with their critical value bounds at 90% and 95% levels are computed automatically through the programme procedure and are summarised in the Table 2.

Since the computed *F*-statistic and *W*-statistic exceed the upper bounds, the null hypothesis of no long-term relationship between LUNEMP, LCPI, LM1 and LREER can be rejected irrespective of the order of their integration. The results also suggest that LCPI, LM1 and LREER can be treated as the 'long-run forcing' variables for the explanation of the unemployment (LUNEMP).

In the second step, the ARDL long-run model is estimated. The appropriate number of lags for each variable in the model is detected automatically by the programme procedure using the SBIC[7]. Namely, the automated programme procedure leaves only significant lags while the insignificant are removed. Accordingly, Table 3 summarises the diagnostic tests of the selected ARDL (2, 1, 0, 0) unemployment equation – 2 lags of the dependent variable, LUNEMP, 1 lag of LCPI and 0 lags of LM1 and LREER.

Diagnostic tests suggest that the model is adequately estimated and that the conclusions of the model are acceptable.

The level relationship, i.e., the long-run ARDL (2, 1, 0, 0) unemployment equation is presented in Table 4.

It is evident that an increase in prices and the exchange rate depreciation cause a rise in unemployment in the long-run wherein an increase in money M1 causes a reduction. Calculated *t*-ratios suggest that prices and the exchange rate are the most significant factors in determining the unemployment equation while money M1 is statistically insignificant.

The error correction representation of the ARDL (2, 1, 0, 0) model together with the model statistics is presented in Table 5.

It is evident that positive change in the current lag of prices (dLCPI) has negative but statistically insignificant effects on the change in unemployment (dLUNEMP). The same goes for the money M1 (dLM1). As well as in the long-run, money M1 is insignificant in the short-run too. Finally, positive change in the current lag of the exchange rate (dLREER) has

Table 4. Estimated long-run coefficients of the ARDL (2, 1, 0, 0) unemployment equation.

Dependent variable: LUNEMP

	Coefficient	Std. Error	T-Ratio	Prob.
LCPI	4.7702	1.8629	2.5607	0.013
LM1	-0.18340	0.23650	-0.77545	0.441
LREER	2.4514	0.99624	2.4607	0.017
INPT	-27.0082	9.8698	-2.7365	0.008
TREND	-0.026995	0.012028	-2.2443	0.029

Source: Research results.
Note: '*L*' indicates logarithm of the variable.

Table 5. Error correction representation of the ARDL (2, 1, 0, 0) unemployment equation.

Dependent variable: dLUNEMP

	Coefficient	Std. Error	T-Ratio	Prob.
dLUNEMP_1	0.68620	0.10266	6.6841	0.000
dLCPI	-0.37643	0.35058	-1.0737	0.288
dLM1	-0.018313	0.020938	-0.87465	0.386
dLREER	0.24479	0.14157	1.7291	0.089
dTREND	-0.0026956	0.0011473	-2.3496	0.022
ecm(-1)	-0.099857	0.026568	-3.7586	0.000

R-Squared = 0.78282
S.E. of Regression = 0.013850
Mean of Dependent Variable = 0.0011893
Residual Sum of Squares = 0.010550
Akaike Info. Criterion = 176.4922
DW-statistic = 1.9293
R-Bar-Squared = 0.75518
F-Stat. F(6,56) = 33.0407, Prob. = 0.000
S.D. of Dependent Variable = 0.027991
Equation Log-likelihood = 184.4922
Schwarz Bayesian Criterion = 167.9197

Source: Research results.
Note: '*d*' indicates first difference, while '*L*' indicates logarithm of the variable.

statistically significant and positive effects on the change in unemployment (dLUNEMP) indicating that exchange rate depreciation causes a rise in unemployment in the short-run. The error correction coefficient (ecm(-1)) is statistically highly significant, has the correct sign and suggests a moderate speed of convergence to the long-run equilibrium. Nearly 10% of the disequilibria of the previous quarter's shock adjust back to the long-run equilibrium in the current quarter.

Discussion and conclusion

Conducted analysis showed that it is very doubtful whether Croatian monetary authorities may affect unemployment in Croatia using standard monetary policy instruments as shown in Erjavec et.al. (1999). The main finding is that money M1 is found to be insignificant in the short- and long-run indicating that changes in the quantity of money have no effect on unemployment. This is along the lines of 'the long-run neutrality of money' concept, meaning that a change in the quantity of money in the economy in the long-run will be reflected only in a change in the general level of prices and not in real variables such as real output or unemployment. In this case, real output or unemployment are determined by real factors, such as technology, population growth, preferences, etc. Although in the short-term it is considered that monetary policy is effective, i.e., that changes in the quantity of money affect real variables, this is not proven by this analysis. On the other side, depreciation of the real effective exchange rate would rather lead to even greater unemployment, although real depreciation should improve exports that ultimately increase the GDP and employment. An increase in prices in the long-run increase unemployment, mainly because rising prices will decrease aggregate demand for products and services while in the short-run an increase in prices lead to a decrease in unemployment. However, in the short-term prices are found to be statistically insignificant. Bearing in mind that the relationship between unemployment and the real effective exchange rate is significant and positive, the conclusion that emerges from the data is that Croatia actually needs real exchange rate appreciation. A period of real exchange rate appreciation was achieved during Croatian economic expansion from 2002 to 2008 and was mainly caused by large foreign capital inflows wherein production resources spilled over to then propulsive economic sectors such as financial intermediation, trade and construction (Brkić & Šabić, 2014). The development of these sectors was facilitated by a strong growth in domestic demand that in turn stimulated employment. Although during this period the real effective exchange rate appreciated strongly, CNB sought to alleviate appreciations pressures by increasing the amount of kuna in circulation in order to keep the exchange rate stable, which is clearly noticeable from the CNB's foreign exchange interventions. On the other side, in times of recession and reduced foreign capital inflows, CNB was withdrawing kuna from circulation. Additional difficulty of maintaining the exchange rate stability stems from the large foreign currency debt and euro-isation, which further limit the effectiveness of monetary policy (Croatian National Bank, 2012). However, in such circumstances it is very difficult to implement countercyclical monetary policy and at the same time protect exchange rate stability (Bokan, Grgurić, Krznar, & Lang, 2009). Despite many measures during the last crisis, CNB's attempts to encourage bank lending by releasing liquidity through reserve requirement cuts have failed to produce credit growth because of low demand by export-oriented enterprises and the increased risk associated with loans to domestic-oriented enterprises (Croatian National Bank, 2012). It is obvious that the abilities to influence unemployment should be found in fields other than monetary, for example in the economy restructuring, in a more effective fiscal policy, in better export strategies, in attracting foreign investments, etc.

In the end, it is necessary to mention that this analysis has some limitations. Firstly, it does not take into account all (or other) variables that affect unemployment. Secondly, it assumed the existence of only one cointegrating vector, which may not be the case since the model includes four variables of interest. Thirdly, used methodology does not allow the identification of structural shocks which may be important in analysing the effects of monetary policy in an economy. Taking into account foregoing limitations, future research may be extended by using the structural vector error correction methodology (SVEC) or some other methodology that allows us to overcome these constraints.

Notes

1. Represents the number of unemployed persons.
2. According to the CNB methodology, an increase in the index of the real effective exchange rate of the kuna in a certain period indicates that the kuna has depreciated against the basket of currencies and *vice versa*.
3. The interest rate under direct CNB control is not included for the reasons already stated in the introduction.
4. For the implementation of ADF test the Schwarz information criterion has been implemented.

5. Using the Arima X-13 method.
6. The comparison of the information criterions (R-BAR Squared Criterion, AIC – Akaike Information Criterion, SBIC – Schwarz Bayesian Criterion and HQ – Hannan-Quinn Criterion) showed that higher values of the information criterion achieve models that include a trend.
7. The model using the SBIC is estimated since it provides smaller estimated standard errors in comparison with the R-BAR Squared and AIC criterion. Additionally, the SBIC selects the same model as the HQ criterion as well as the R-BAR Squared criterion selects the same model as the AIC.

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