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INDEX OF MONETARY CONDITIONS IN BOSNIA AND HERZEGOVINA

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Review paper

Abstract: The main goal of the research was measuring of the monetary conditions in Bosnia and Herzegovina (BH). By using multiple linear regression, Monetary Conditions Index (MCI) is constructed for the first time for BH. Monetary conditions are measured in relation to the industrial production. Monetary conditions in BH compared to the period before the beginning of the global economic crisis have been improved. Both MCIs show significant improvement in the monetary conditions measured by the movement of interest rates, real effective exchange rate and credit growth. The highest interdependence in the movement with the growth rate of industrial production shows MCI constructed on the basis of the implicit active interest rate (as an approximation for the domestic reference interest rate, i.e. a channel of interest rates) and the rate of credit growth. The interest rate channel in BH is not dominant in relation to the exchange rate channel. The reason is the lack of the central bank loan and therefore the absence of the reference interest rates. MCI ratio (ratio between coefficient with implicit active interest rate and coefficient with REER) is 1.09. By this research the benchmark values of MCI for BH are set. Established MCI is starting point for further measurement of monetary conditions in BH.

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Introduction

The monetary regime of Bosnia and Herzegovina (BH) functions as a currency board with a fixed exchange rate as a nominal anchor. A part of the BH monetary conditions is created through the instrument of monetary policy of the Central Bank of Bosnia and Herzegovina (reserve requirement and remuneration on reserve requirement); the second part is influenced by a combination of external and internal variables (real effective exchange rate/REER). BH's monetary conditions are imported from the euro zone through the channel of interest rates and the nominal exchange rate. Monetary policy produces monetary conditions that affect the commodity, money and financial markets, and ultimately the basic macro variables: industrial production, gross domestic product and prices. Monetary policy influences the position of transition countries in the international division of labour, whereby it is recommended to some transition countries (Croatia) to focus on reducing unit labour costs and the real effective exchange rate (REER) through the process of internal devaluation in order to increase international competitiveness (Ćorić et al, 2013 p. 39). If monetary freedom is defined as currency stability and market-determined prices (Djalilov & Holscher, 2016 p. 16), B&H is, due to the application of the currency board, a country with limited monetary freedom.

The measurement of monetary conditions in Bosnia and Herzegovina is the subject of this research. Our goal is to determine the direction of the monetary conditions in Bosnia and Herzegovina in relation to the period immediately before the bankruptcy of the Lehman Brothers (10/2008). We set the assumption that due to the depreciation of the euro, the reduction in ECB reference interest rates (which came immediately after this bankruptcy), high correlation between domestic and foreign interest rates, and the ECB's generally expansive monetary policy unprecedented in the monetary history of the euro zone,[1] the monetary conditions in Bosnia and Herzegovina have been improved compared to the period before the outbreak of the global economic and financial crisis. We tested the working hypothesis by establishing a link (in form of multiple linear regression models) between the growth rate of BH's industrial production on the one hand and the quasi-reference domestic interest rate, REER and credit growth on the other hand.

Based on the estimated parameters of the regression models/equations, two indexes of monetary movements for Bosnia and Herzegovina (Monetary Condition Index, hereinafter MCI) have been constructed, based on which the hypothesis of the research on improving the monetary conditions after the beginning of the Great Recession has been estimated.

The research and its parts are presented in the following way: An overview of the most important literary references begins with the emergence and development

[1] The policy of extremely expansive monetary policy is labeled as quantitative easing.

of the MCI concept and continues with research on monetary conditions in emerging markets. The methodological framework used for the construction of regression models, MCI and obtaining final conclusions is explained in detail, as well as the characteristics of the BH statistical framework that caused the modification of the calculation method of MCI in relation to world practice. The main findings of the research are presented and discussed in the central part of the research and a short version of all the key findings of the research is presented in the conclusions of the research, followed by a review of the used sources and literature.

The research is the first of its kind that defines monetary conditions in Bosnia and Herzegovina and gives a detailed insight into the stages of the construction of the first MCI in the monetary and economic history of Bosnia and Herzegovina.

1. Index of monetary conditions

At the beginning of the 1990s, the Bank of Canada came up with the idea to construct an instrument whose function would be the determination of monetary conditions based on the targeted inflation for its monetary regime. *MCI* represents the sum of the difference in the value of the regressor and its base value weighted with the estimated value of the coefficients from the regression model. The original Canadian *MCI* was determined as the sum of the weighted difference in the reference interest rate and the reference interest rate in the base period on the one hand and the differences in the logarithms of *REER* and the base foreign exchange rate on the other, which is represented as;

$$MCI = -(\alpha(IR - IR_b) + \beta(l\_REER - l\_REER_b)100) \quad (1)$$

where IR and IR_b are the i reference domestic interest rate and the base reference interest rate, and *l_REER* and l_REER_b the REER logarithms and the *REER* logarithm in the base period respectively. The second part of the index is multiplied by 100 in order to get the rate of change of the REER relative to the base period and the growth/decrease of REER represents the appreciation/depression of the REER[2]. In the short run in B&H, as in the most other countries, REER is predominantly under the influence of changes in the nominal exchange rate (Ćorić et al, 2013 p. 47). Since the rise in the reference interest rate and REER relative to the base period leads to deterioration of monetary conditions and denotes monetary restriction, the MCI has a negative sign in order to avoid ambiguity in the interpretation of the index. After adding the negative sign of the index change, they are interpreted in accordance with the logic; the decline in MCI is deterioration, and MCI growth is improving monetary conditions.

[2] The REER is calculated as the nominal exchange rate of the convertible mark in relation to the currencies of the BH main trading partners weighted with their share in the foreign trade exchange with BH and the ratio of the growth of domestic consumer prices and the value of consumer prices. The source of data on REER is the official statistics of the Central Bank of Bosnia and Herzegovina.

Formula 1 is transformed into

$$MCI = -(\frac{\alpha}{\beta}(IR - IR_b) + (l\_REER - l\_REER_b)100) \quad (2), \text{ or}$$

$$MCI = -((IR - IR_b) + \frac{\beta}{\alpha}(l\_REER - l\_REER_b)100) \quad (3)$$

where α/β and β/α represent ponders or MCI ratios (α/β)[3] i.e. reciprocal value of MCI ratio (β/α).

An individual/point value can be selected for the base, but a better solution is the one in which the average value of the interest rate and the REER for a selected period is set for the base.

The most important stage in the development of the index is the determination of MCI ratio i.e. coefficients α and β. The simplest way of evaluating their value, which was once applied by the Bank of Canada, is to produce a multi-regression model[4] with a specification;

$$\Delta gdp = c - \alpha IR - \beta REER + \varepsilon, \quad (4)$$

where Δgdp, c, ε are the gap of the gross domestic product, the constant and the random error respectively, and the other variables/coefficients are predefined. In order to gain better diagnostics, higher determination coefficients and coefficients at a higher level of significance, the model can be expanded with autoregressive component, credit growth and stock index[5], but the presented specification (Formula 4) is the starting point for the construction and interpretation of MCI.

The weakness of MCI is in its simplicity. The value of MCI and the assessment of monetary conditions depend on the estimation of the regression model coefficient. If the specification and diagnostics of the model are poor, the biased estimate of the coefficients and the wrong assessment of the monetary conditions characteristic of the model based index are obtained[6].

The motive of introducing MCI into the monetary instrument of the Bank of Canada is in its relation to the target variable of Canadian monetary policy - inflation. If GDP is determined by the reference interest rate and the REER, and if GDP determines inflation, then targeted inflation can be realized by changing the reference interest rate and REER, i.e. changing monetary conditions. MCI was used

[3] When constructing an index, MCI ratios are used more often.
[4] There are other ways of determining the value of coefficients, but they are not the subject of the research.
[5] If the index includes a stock exchange index, the Financial Conditions Index can be constructed.
[6] For a wider discussion of MCI disadvantages, see Ericsson, Neil R., Jansen, Eilev S., Kerbeshian, Neva A., and Ragnar Nymoen. *Interpreting a Monetary Conditions Index in Economic Policy*. Retrieved from: http://www.bis.org/publ/confp06i.pdf, Accessed on 16 June 2017.

as an operational indicator of monetary policy. For the target inflation rate, the preferred MCI is determined, so any deviation of the realized MCI from the preferred MCI is treated as a switch/contraction in relation to the targeted inflation which requires correction of the realized MCI, i.e. reference interest rates and REER.

A large number of countries have accepted the concept and economic assumptions of MCI. It is calculated and published by leading central banks (e.g. FED, ECB) as well as banking and non-banking institutions. The key element of the index, MCI ratios, varies considerably not only due to changes in the degree of efficiency of the transmission mechanism, the selected variables, the type of monetary regime and monetary policy, but also because of the choice of type of model for the construction of MCI.

2. Review of literature

As MCI is invented in Canada, the first exploration of monetary conditions refers to this country (Duguay, 1994). Through the regression model (dependent variable GDP gap), the coefficients with reference interest rate and REER in values of -0.4 and -0.15 were determined, resulting in MCI of 2.67 (-0.4/-0.15), while the Bank of Canada used a MCI ratio of 3 (Freedman, 1994). Using the different methodologies for the euro zone, the MCI ratio was determined in a wide interval from 2:1 to 12:1 (ECB, 2002 p. 23). Although abundant with numerous methodological deficiencies, MCI based on the regression model was also designed for Albania (Kodra, 2010). An average MCI ratio of 3.8 was obtained, with the author not testing the diagnostics of the model, and the base value of the interest rate and REER, using the point, and not the average value (Kodra, 2010 p. 19). The result of the research is further contested, because the movement of MCI is not related to the GDP trend (Kodra, 2010 p. 20). Hong Kong Monetary Authorities (HKMA) constructed MCI for Hong Kong. MCI was obtained on the basis of a regression model with a specification in which the GDP gap[7] is dependent value, and independent variables in addition to the autoregressive component, and the long-term real interest rate, the REER deviation from the equilibrium REER and the ratio of Hang Seng Index and nominal GDP (multiplied by 100). The obtained MCI is a good measure of the dynamics of economic activity in Hong Kong. MCI of 5.26 (0.358/0.068) shows the efficiency of the monetary policy transmission mechanism and in particular the efficiency of the interest rate channel. HKMA, although in the monetary board regime, can lend to banks and therefore has a reference interest rate unlike Bosnia and Herzegovina. Regardless of its simplicity, MCI is also designed for one of the world's largest economies (China). The authors

[7] For the method of calculating these variables and detailed specification of the model, see: Hong Kong Monetary Authority. 2010. Monetary Conditions Index for Hong Kong. *Quarterly Bulletin 11/2010*.http://www.hkma.gov.hk/media/eng/publication-and-research/quarterly-bulletin/qb200011/fa02.pdf, Accessed on 27 May 2017.

constructed a narrow MCI (with interest rate and REER) and a broad MCI (with interest rate, REER and credit growth. The reciprocal values of MCI ratio of 0.275[8] (narrow MCI) and 0.249 and 0.4 (broad MCI) well explain the real GDP growth except in two time periods. Research by Chinese authors is a reference research for our research and for this reason we used reciprocal MCI ratios in the research. In the methodology of Counsel of Europe[9], MCI is presented as a weighted average of real interest rates and REER relative to their value in the base period. The ratio between the coefficient of interest rate and REER 6:1 is determined by their impact on GDP over a two-year period (based on the OECD Interlink model).

3. Material and used methods

The research covers the period from 2006 to 2016, with a quarterly data frequency. All series are reduced to real values, although MCI can also be constructed with nominal variables. Because of the short time series for BH GDP (according to the SNA methodology only since 2008), we have decided to use the growth rate of industrial production (for the period 2006-2016) as an approximation (proxy) for aggregate macroeconomic activity.

MCI starts from a very simple assumption that only a few variables determine the economic activity critically and that these variables are involved in determining the value of MCI. In the simplest form, the macroeconomic relationship, i.e. the regression model/equation required for the construction of a narrow MCI can be represented in the form

$$IIP\_gr = c + IIP\_gr(-1) - \alpha IR - \beta REER\_gr + \varepsilon \quad (5)$$

where *IP_gr, c, IP_gr (-1)* $\alpha, \beta, \varepsilon$, *IR, REER_gr* are industrial production growth rate, constant, autoregressive component, model coefficients, error, quasi reference domestic real interest rate and change of *REER* respectively. The model element is an autoregressive component (e.g. *IP_gr*(-1)) which improves the regression equation diagnosis by eliminating a part of autocorrelation, increasing the coefficient of determination, and the significance of the estimated coefficients of the model. To obtain a broad MCI in regression equation credit growth is added;

$$IIP\_gr = c + IIP\_gr(-1) - \alpha IR - \beta REER\_gr + \gamma CREDIT\_gr + \varepsilon_i, \quad (6).$$

In regression equations, the expected sign in front of the *IR* and the *REER* is negative as their growth decreases *IP_gr*, while the sign in front of the credit

[8] The MCI ratios, presented in the usual way, as the ratio of the coefficient with the interest rate and the coefficient with REER/credit growth in this survey is 3.63 (interest rate/REER), 4 (interest rate/REER) and 2.5 (interest rate/credit growth).

[9] Retrieved from: https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/monetary-conditions-index_en, Accessed on 27 May 2017.

growth regressor is usually positive, but depending on the structure of the loan and the degree of industrial production development, it can be negative.

In regression models, the rate of industrial production growth (IIP_gr) is dependent variable while independent variables are: domestic real interest rate (IR_r), change in real effective exchange rate (REER_gr) and credit growth (CREDIT_gr). Since the CBBH (Central bank of Bosnia and Herzegovina) does not have a reference interest rate and the official series of BH interest rates are very short (the new series of banking interest rates starts from 2012), we constructed an implicit lending interest rate (ILIR) as the annualized[10] quotient of quarterly interest income and average interest bearing assets in the banking sector of the Federation of Bosnia and Herzegovina[11] (BSFBH). The constructed domestic interest rate (ILIR) has a very strong correlation (0.92 measured with Pearson's correlation coefficient) with Euribor, which represents the reference interest rate in the vast majority of credit and savings contracts in the banking sector of Bosnia and Herzegovina. If we transform Euribor in real terms in the same way like IR_r, we see again very high correlation. In the period Q1 2016 – Q3 2008 correlation coefficient is 0,63, and in the period Q4 2008 – Q4 2016 it is 0,83. Because of the very high correlation between domestic and foreign interest rate in nominal and also in real terms, we can be sure that ILIR/IR_r is very good approximation for the interest rates channel of the CBBH i.e. ECB. The influence of Euribor on the domestic economy was analyzed through regression models (Jović & Jandrić, 2016). Together with NPL and changes in GDP the value of EURIBOR can also be included in early warning indicators on changes in credit growth (Jović & Jandrić, 2016 p. 246). A Dynamic VAR model also established a link between the reference interest rate of the FED (whose movement has a high degree of interdependence with the movement of EURIBOR) and industrial production in B&H. The shock/growth in the Federal Funds Rate causes stable and long-term decline in production, which after 24 months reaches 0.7% comparing to the trend (Jović, 2017 p. 201).

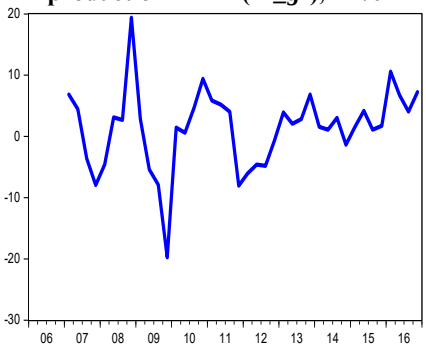
The domestic real interest rate (IR_r) is determined as ex ante ILIR corrected with the inflation rate (CPI) 3 months in advance (Osborne-Kinch et al 2010, 75). The growth rate of industrial production was derived from the monthly industrial production index (2010 = 100), and the growth rate of real loans is calculated after nominal loans are recalculated (base value 2010).

Prior to the design of the model, the stationarity of the time series *IP_gr* (Figure 1), IR_r (Figure 2), *REER_gr* (Figure 3), *CREDIT_gr* (Figure 4) was tested. The Augmented Dickey-Fuller test (ADF) was applied, and the null hypotheses were defined in a way that the variable has a unit root. Given that the variables in the level do not have a trend and significantly oscillate statistics, the ADF is determined without a constant and without trend.

[10] The annualised's coefficients for the first, second, third and fourth quarters are 4, 2, 1.33 and 1 respectively.

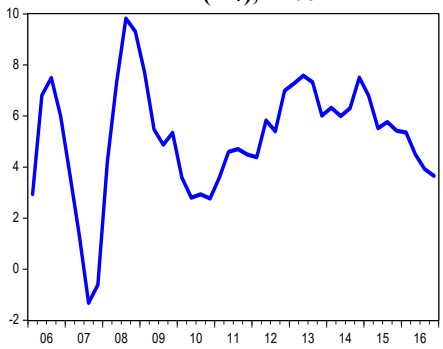
[11] BSFBH includes approx. 75% of the assets of the banking sector of Bosnia and Herzegovina.

Figure 1. Growth rate of industrial production in BH (*IP_gr*), in %



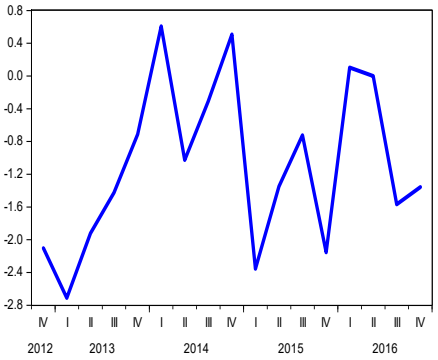
Source: BHAS (Adapted by authors).

Figure 2. Real active interest rate in BH (IR_r), in %



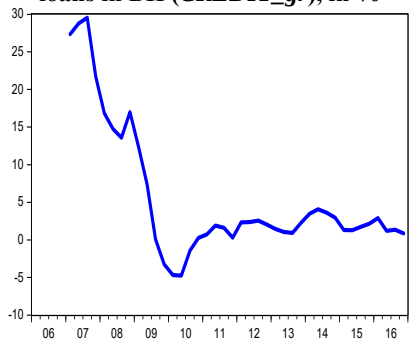
Source: Ibid.

Figure 3. REER, BH (*REER_gr*), in%



Source: Ibid.

Figure 4. Annual growth rate of real loans in BH (*CREDIT_gr*), in %



Source: Ibid.

Two indexes of monetary conditions were constructed on the basis of which the MCI was assessed. In MCI_1 (Formula 7) REER is presented as logarithmic value which represents the growth rate of the REER relative to the base period[12]. In the MCI_2 (Formula 8), the index element is the credit growth in relation to the base period. The bases (IR_b, $REER_b$, $CREDIT\_gr_b$, $CREDIT\_gr_b(-1)$) were determined as average for the period Q4 2007 - Q3 2008 until the definitive change in the ECB's monetary policy stance comes in Q4 2008, after the bankruptcy of US investment bank Lehman Brothers. The research aims to prove that the monetary conditions in Bosnia and Herzegovina have been improved in relation to the period Q4 2007 - Q3 2008.

[12] The second variable in MCI_1 is multiplied by 100 in order to get the rate of change because the exchange rate is log.

$$MCI\_1 = -((IR - IR_b) + \frac{\beta}{\alpha}(l\_REER - l\_REER_b)100), \quad (7)$$

$$MCI\_2 = -((IR - IR_b) + \frac{\beta}{\alpha}(CREDIT\_gr - CREDIT\_gr_b(-1)) + \frac{\gamma}{\alpha}(CREDIT\_gr - CREDIT\_gr_b)) \quad (8)$$

Table 1. List of Abbreviations

Abbrevations	Full name	Calculation	Source
IP	Monthly index of industrial production	base year, 2010	BHAS
IP_gr	Growth rate of industrial production	(logIP-logIP(-4))*100	BHAS
ILIR	Implicit active interest rate	The annualized quotient of quarterly interest income and average interest bearing assets in the banking sector of the Federation of Bosnia and Herzegovina	BSFBH, Authors
IR_r	real *ILIR*	ILIR corrected with the inflation rate (CPI) 3 months in advance	BHAS, Authors
CREDIT	real loans	Ø 2010 = 100	BHAS, Authors
REER	Real effective exchange rate	Product of weighted nominal foreign exchange and quotient of domestic and foreign inflation	CBBH
REER_gr	Change in *REER*	logREER-logREER(-4)*100	BHAS, Authors
CREDIT_gr	credit growth	logCREDIT-logCREDIT(-4)*100	BHAS, Authors
EQ	equation/regression	-	-
MCI	Monetary Condition Index	-	-
l_REER	log *REER*	-	-
l_REER_b	log *REER base value*	Average for period Q4 2007- Q3 2008.	-
CREDIT_gr_b	credit growth, base value	Average for period Q4 2007- Q3 2008.	-

Source: CBBH (Authors).

Abbreviations are presented as English acronyms of full expressions (Table 1). In order to give unbiased evaluation of the coefficients/parameters of the model by the OLS, it is imperative that the regression model meets certain assumptions. We tested four assumptions about the mean value of the residual (zero), the absence of autocorrelation between the residuals (Durbin-Watson test and LM test), the equivalence of residual variance (Breusch-Pagan-Godfrey homoscedasticity test) and the normal distribution of the residuals Jarque-Bera test). The zero hypothesis (no autocorrelation, variance of residuals are equal, residual distribution is normal) is rejected at a level of significance of 5%.

4. Results and discussion

All variables are stationary (Table 2), and the null hypothesis of the existence of a unit root, i.e. on the non-stationary variability is rejected with a very low *p* value of 3.2% and less. The most of the CESEE countries[13] had an impressive credit growth before the outbreak of the financial crisis (Stojanović & Stojanović, 2015 p. 7), that is characteristic of B&H also, but in the observed period credit growth is a stationary variable.

Table 2: Augmented Dickey-Fuller unit root test

Variable	Test values	*P* value	Is variable stationary?
IP_gr	-6,295	0,000	Yes
CREDIT_gr	-3,73	0,0326	Yes
IR_r	-4,983	0,0012	Yes
RERR_gr	-4,5286	0,0054	Yes

Source: Authors. The critical values of the *ADF* test for levels of significance of 1%, 5% and 10% are -3.62, -2.94 and -2.61 respectively.

After the construction of several regression models, we derived the two best models (Table 3).

Table 3: Specifications of regression equations/models

EQ1:	$IIR\_GR = C(1) + C(2)*IP\_gr(-1) + C(3)*IR_r(-4) + C(4)*REER\_gr(-1)$
EQ2:	$IP\_GR = C(1) + C(2)*IP\_gr(-1) + C(3)*IR_r(-4) - C(4)*CREDIT\_gr(-1) + C(5)*CREDIT\_gr$

Source: Authors.

[13] These countries are Serbia, Croatia, Slovenia, Bulgaria, Romania, Poland, Czech Republic, Slovakia, Latvia, Lithuania Estonia and Hungary.

Regression equations have very good diagnostics (Table 4). The value of DW statistics is approx. 2, and LM tests for the first, second and third lag also show the absence of autocorrelation between the residuals. Residuals have a normal distribution (Jarque-Bera test), and the mean value of residuals is zero. The distribution of the residuals do not exhibit differences because, based on the homoscedasticity test, the null hypothesis on the equality of the residual variability cannot be rejected (homoscedasticity test - Breusch-Pagan-Godfrey test).

Table 4. Evaluation and diagnostics of regression models

	EQ1	***EQ2***
C	6,48 (2,75)***	4,868 (2,157)**
IP_gr (-1)	0,343 (2,43)**	0,312 (2,420)**
IR(-4)	**-1,18** (-2,781)***	**-0,609** (-1,645)*
REER_gr (-1)	**-1,08** (-1,744)***	
CREDIT_gr(-1)		**-1,21** (-3,469)***
CREDIT_gr		**1,216** (3,140)***
Diagnostics		
R^2	0,342	0,479
Mean value of residuals	0	0
DW test	1,82	2,027
Jarque Bera test	0,236 (0,88)	2,427 (0,297)
Breusch-Pagan -Godfrey test	1,66 (0,192)	1,65 (0,183)
LM test (first lag)	0,71 (0,4044)	0,0658 (0,799)
LM test (second lag)	2,23 (0,123)	0,62 (0,544)
LM test (third lag)	2,336 (0,092)	1,72 (0,183)
Additional items		
Relation between coefficient with regressor interest rate and with regressor REER (MCI ratio)	1,09	-

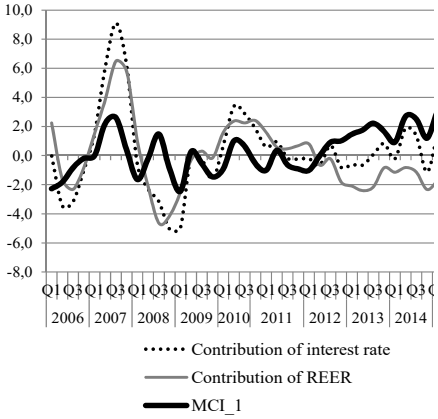
Source: Authors. *Note:* *** significant at the level of 1%, ** significant at the level of 5%, significant at the level of around 10%. In diagnostic tests, the first number denotes the value of the test statistics and the second is the probability. For the parameters of the models t statistics are in the brackets.

The selected variables explain between 34.2% (EQ1) and 47.9% (EQ2) variability in the rate of growth of industrial production which represents the middle level of the coefficient of determination.

Interest rate and REER have an expected, negative sign as their growth indicates an increase in costs, i.e. a worsening of the foreign trade position (appreciation of REER, i.e. faster domestic price growth in relation to foreign prices growth). In the both equations, the coefficient with the regressor IP_gr (-1) is expectedly positive. In EQ1 interest rate growth by 1 pp. deteriorates, compared to the base period, monetary conditions by 1.18 pp, and MCI ratio is 1.09 (1.18/1.08), which in the comparative analysis is very small MCI ratio.

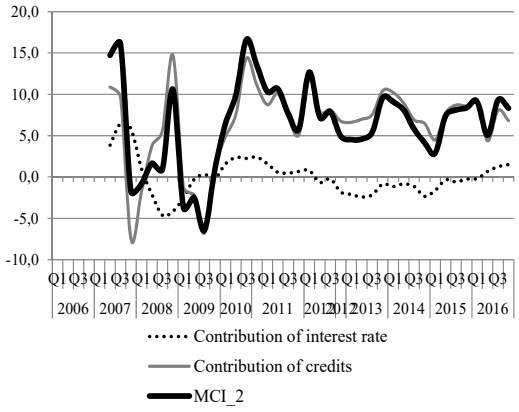
Some regression models[14] (broad MCI) gave a negative sign in front of credit growth. Since we could not accept such an illogical, an unexpected finding and in order to clarify the credit growth role in determining the movement of industrial production in EQ2, we also introduced current credit growth and its first lag and omitted the REER[15]. After this, the value of MCI increases, the net effect of credit growth on MCI is positive and its impact on the improvement of monetary condition is dominant.

Figure 5. ***MCI_1***



Source: Authors.

Figure 6. ***MCI_2***



Source: Ibid.

All two MCIs show that the monetary conditions in relation to the base period have been improved. MCI_1 improvement is ascending (Figure 5) and MCI_2 illustrates a significant improvement in monetary conditions (Figure 6). In MCI_1,

[14] We did not show these models in the research.

[15] The coefficients in models with REER and credit growth have had problems not only with significance (e.g. autoregressive component), but also with diagnostics and therefore we could not construct a broad MCI. Like models with negative credit growth contribution to the growth of industrial production, these models are not shown in the survey.

monetary conditions are improving due to falling interest rates and in MCI_2, the net contribution of the credit growth is positive.

The growth of MCI in relation to the base period is not a final proof that monetary conditions have really improved. That is why we have additionally tested MCI by putting it in relation to industrial production itself, because MCI *per se* does not mean anything if it is not related to changes in industrial production.

Industrial production exhibits interdependence with movements MCI_1 in the period Q42012 - Q42016 (Figure 7). Outside of this period, there is no strong interdependence between industrial production and the MCI.

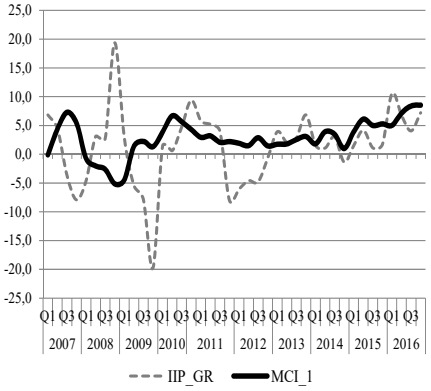
The MCI_2 (which includes current and previous values of credit growth) exhibits strong interdependence with the movement of industrial production and almost moves in the same rhythm (Figure 8). In the period from Q1 2011 to Q1 2013, for a total period of 6 quarters, there was a difference in the movement of industrial production and monetary conditions due to the effects of factors that are not included in EQ2.

If industrial production is taken as a proxy for GDP, then the BH economy, depending on the way of creating monetary conditions, differs significantly from other reference economies in which the interest rate channel is much stronger. According to the impact on industrial production and creation of monetary conditions, REER is almost equal with interest rates (MCI_1). This finding is a logical consequence of the absence of a loan from the central bank, the reference interest rates of the central bank as well as the lack of a public debt market of the Bosnia and Herzegovina.

The role of credit growth in creating monetary conditions and the impact on industrial production is twofold. Due to the underdevelopment of the industrial production, the relative domination of no purpose consumer loans (approximately 33% of total bank loans) and dependence on imports, the causal link is not entirely positive which could be expected on the basis of economic logic. However, a model with this ambiguous link between credit growth and industrial production, through the index of monetary conditions (MCI_2), establishes a firm connection with the rhythm of changes in industrial production.

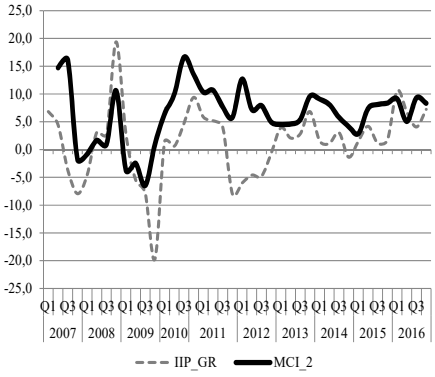
Both developed MCIs, regardless of the ultimate quality of their relationship with the growth rate of industrial production, show that monetary conditions in relation to the base period (Q4 2007- Q3 2008) are improved. The REER and domestic real interest rates are directly influenced by the nominal exchange rate of euro and nominal interest rates in the euro zone. Also, inflation in BH is dependent on inflation in the euro area. Because of that the improvement of monetary conditions in Bosnia and Herzegovina is tied to the ECB's monetary policy, to the reduction of its reference interest rates and to the depreciation of the nominal exchange rate of the euro against the major world currencies.

Figure 7. Growth in industrial production and MCI_1



Source: Authors.

Figure 8. Growth in industrial production and MCI_2



Source: Ibid.

Conclusion

The regime of a fixed exchange rate and a currency board which is very close to the orthodox one[16], regardless of the absolute absence of the credit function of the central bank and the reference interest rate, creates certain monetary conditions in which the economic activity takes place. Monetary conditions are created under the influence of domestic and foreign variables, and the foreign variables through the channel of interest rates and the exchange rate channel influence domestic variables.

In order to make the monetary conditions index (MCI) in accordance with the previous research, we used the domestic quasi-reference interest rate (IR_r), the real effective exchange rate (REER) and credit growth.

All two indexes of MCI (which elements are determined on the basis of the parameters/coefficients of the two multiple regression models) show that on average there was an improvement in the monetary conditions in Bosnia and Herzegovina compared to the period before the bankruptcy of the American investment bank (Lehman Brothers) i.e. in relation to the period immediately before the outbreak of the global economic and financial crisis.

A significant improvement in the monetary conditions is shown by MCI_1, while MCI_2 gives even more favourable monetary environment.

The highest degree of interdependence in the movement with the growth rate of industrial production is demonstrated by MCI_2 from which it can be concluded that the movement of industrial production on a large extent depends on the

[16] It is not orthodox because it has a reserve requirement as an instrument of monetary policy.

monetary conditions created by the domestic lending interest rate and credit growth. Thus, a working hypothesis about the improvement of monetary conditions in relation to industrial production has been proven.

The research also pointed out the significant specificity in determining domestic economic activity, since the effect of interest rates on industrial production (which we used as a proxy for GDP) is not significantly higher than in the REER as is the case in most other countries. The coefficient of -1,183 (interest rate) and -1,084 (REER) gives MCI a ratio of 1.09, which is extremely low compared to the reference group of countries. The absence of a stronger interest rate impact could be explained by the lack of a reference interest rate in the BH monetary regime. On the other hand, the relatively high impact of REER on industrial production is a consequence of the fixed exchange rate, import's inflation, but also the absence of domestic anti-inflationary or anti-deflator policies, not only as part of monetary policy, but also as part of fiscal policy. Since coefficients with interest rate and REER are determined only on the basis of regression models, these findings should be further tested using advanced methodologies.

Some findings could be an incentive for new researches. One of them is our failure to isolate (in a multiple regression model) a clear positive link between the growth rate of industrial production and the growth rate of the bank loans. The causes could be the structure of the bank loan, the chronic current account deficit, the low share of industrial production in GDP, but also the absence of other explanatory variables (omitted-variable bias).

A new research could try to establish a link between monetary conditions and GDP, regardless of the longer available series for BH industrial production, then for BH's GDP. GDP is a wider and more comprehensive indicator of the movement of economic activity than the industrial production. In order to increase the usable value of the index of monetary conditions and for the purpose of its efficient and intensive use in the BH monetary policy, concrete connection with the goals of the BH monetary policy is also needed.

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INDEKS MONETARNIH USLOVA U BOSNI I HERCEGOVINI

Apstrakt: Glavni cilj istraživanja je bio mjerenje monetarnih uslova u Bosni i Hercegovini (BiH). Korištenjem višestruke linearne regresije konstruisan je indeks monetarnih uslova (MCI) prvi put za BiH. Monetarni uslovi su mjereni u odnosu na industrijsku proizvodnju. Monetarni uslovi u BiH su poboljšani u poređenju sa periodom prije početka globalne ekonomske krize. Oba MCI pokazuju značajno poboljšanje monetarnih uslova mjerenih kretanjem kamatnih stopa, realnim efektivnim deviznim kursem i kreditnim rastom. Najveću međuzavisnost u kretanju sa stopom rasta industrijske proizvodnje ispoljava MCI konstruisan na osnovu implicitne aktivne kamatne stope (kao aproksimacije za domaću referentnu kamatnu stopu, tj. kanal kamatnih stopa) i stope rasta kredita. Kanal kamatne stope u BiH nije dominantan u odnosu na kanal deviznog kursa. Razlog je odsustvo kredita centralne banke, a samim tim i nepostojanje referentnih kamatnih stopa. MCI omjer (odnos između koeficijenta uz implicitnu aktivnu kamatnu stopu i koeficijenta uz REER) je 1.09. Ovim istraživanjem postavljene su referentne vrijednosti MCI za BiH. Uspostavljeni MCI je polazna tačka za dalje mjerenje monetarnih uslova u BiH.

Ključne riječi: indeks monetarnih uslova, industrijska proizvodnja, realni efektivni devizni kurs, kanal kamatnih stopa, monetarna politika, novčani odbor, MCI racio.

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