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Inflation, Employment and FDI in Bosnia and Herzegovina

Инфлација, запосленост и СДИ у Босни и Херцеговини

Summary

The monetary policy of Bosnia and Herzegovina (hereinafter referred to as BIH) operates under the currency board system, responsible for strengthening the market economy and price stability. On the other hand, the economy of BIH is facing long-term unemployment, unfavorable business environment and feeble competitive position. This discourages economic development. Further retaining the currency board system in BIH attracts great interest. The paper analyzes the relation among inflation, unemployment and foreign direct investment (FDI). Statistical analysis (coefficient of correlation and simple linear regression (period 2004/2014)) indicates that there is no inversion similar to the Phillips curve between inflation and unemployment. Thus, it is implied that BIH renounces employment, aggregate demand and economic growth for the sake of stable prices. Moreover, the ratio of inflation and participation of FDI in GDP is inverse with a negligible correlation. Analyses demonstrate that there is no optimal combination of inflation and unemployment in BIH that would improve business environment and stimulate FDI and aggregate demand. Correlation and regression analyses fail to provide the arguments to statistically challenge the currency board as the monetary system model of BIH.

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Keywords: *currency board, BIH, inflation, unemployment, FDI, monetary policy, Phillips curve.*

Резиме

Монетарна политика Босне и Херцеговине функционише у систему валутног одбора који је заслужан за јачање тржишне привреде и стабилност цијена. С друге стране, економија БиХ се суочава са дугорочном незапосленошћу, неповољним пословним амбијентом и слабом конкурентском позицијом. То дестимулише економски развој. Даље задржавање система валутног одбора у БиХ изазива велики интерес. У раду се анализирају односи инфлације, незапослености и страних директних инвестиција (СДИ). Статистичка анализа (коефицијент корелације и једноставна линеарна регресија (2004–2014)) показује да између инфлације и незапослености не постоји инверзија слична Филипсовој кривој. Ово имплицира да се БиХ због стабилних цијена одриче запошљавања, агрегатне тражње и економског раста. Даље, однос инфлације и учешћа СДИ у БДП је инверзан уз занемарљиву корелацију. Анализе показују да у БиХ не постоји оптимална комбинација инфлације и незапослености која би побољшала услове привређивања и стимулисала СДИ и агрегатну тражњу. Корелациона и регресиона анализа не дају аргументе за статистичко оспоравање валутног одбора као модела монетарног система БиХ.

Кључне ријечи: *валутни одбор, БиХ, инфлација, незапосленост, СДИ, монетарна политика, Филипсова крива.*

1. Introductory remarks

Bosnia and Herzegovina is a country that is currently undergoing transition. The country formed by the disintegration of the former Yugoslavia. It is one of the countries that govern its monetary policy via currency board model (Coats, 2007). However, such system has been criticized for a lack of development component. The unemployment rate in BIH is extremely high (30-35%, in the last ten years)[3], whereas the growth rates are insufficient to provide employment for the coming generations. The high foreign trade balance represents a permanent source of crisis, and one of the causes is the overvalued local currency, i.e. the currency board system (Tomas, 2012).

Economic conflicts in BIH speak in favour of the "impossible trinity" theory according to which it is impossible to synchronize complete capital mobility, lib-

[3] The data on the unemployment rate according to ILO methodology.

eralisation of capital flow, fixed exchange rates and independent monetary policy (Mundell-Fleming IS-LM model (Mundell, 1962)). According to Mundell-Fleming, fixed exchange rate and fixed prices in the IS-LM model affect the loss of independence of monetary policy. The monetary system of BIH obtained stable currency through the currency board, but also gained unemployment and unstable development. This research shall from an analytical perspective either confirm or disprove justification for retaining the currency board. The ratio of inflation, unemployment and foreign direct investment is assessed by correlation and regression analysis. In particular, the direction and intensity of the linear association of variables is expressed by correlation, while regression analysis provides an analytical form of mutual relations. The analysis uses a linear correlation and simple linear regression model. Value of dependent, regressand or endogenous variable (y) is predicted in the regression model using independent or exogenous variables (x). This analysis evaluates several aspects of the relationships among the variables: correlation and regression of inflation and unemployment, as well as correlation and regression of inflation and FDI expressed in % of GDP. Correlation and regression of inflation and unemployment is based on the theoretical meaning of Phillips curve (Phillips, 1958) where unemployment is represented as an independent variable, while inflation is denoted as dependent one. In the analysis of FDI and inflation, FDI is defined as a dependent variable in relation to inflation which is an independent variable. The following two questions shall be answered: (1) Can growth and employment be affected by "stirring up" aggregate and by the monetary policy? (2) Is the inflation in the currency board system stable and does it affect the business environment and attracting FDI? The relationship between the variables is analyzed for BIH for the period of 2004-2014.

2. Model

A dispersion diagram or scatter diagram should be comprised in order to better monitor the relationship between the variables. The abscissa contains an independent variable *x*, with the dependent variable *y* being placed on the ordinate. Scatter diagram represents a graphical representation of points in the coordinate system of a set of ordered pairs (x_1,y_1), (x_2,y_2), … , (x_n,y_n). Pearson coefficient is used to calculate the correlation (r). The method of least squares is used for credible representation of the regression line to calculate the inclination (*a*) and fragment (*b*) according to the linear regression equation: $y = bx + a + u_i$, where *y* is the dependent and *x* is the independent variable, with *a* being a regression constant which graphically corresponds to a fragment on the y-axis ($a = \overline{y} - b\overline{x}$) while *b* is the regression line inclinaction coefficient ($b = \frac{\sum xy - n\,\overline{x}\,\overline{y}}{\sum x^2 - n\left(\overline{x}\right)^2}$). In the for-

mula the u_i is a residual deviation or random error ((the difference between the real (empirical) and the estimated value *y*)). Residual deviation is broken down onto the interpreted deviation and uninterpreted (residual) deviation.

Further, the variance analyses are used, expressed by the equation: ST = SP + SR, whereby: ST is the sum of squared deviations of variable value from its arithmetic mean, SP is the sum of squared deviations of regression variable value from its arithmetic mean (deviation interpreted by a model), and SR is the sum of squared deviations of empirical values of the variable from the regression values (deviation uninterpreted by the model).

The results of variance analysis equation are consolidated by the ANOVA table.

3. Analysis of inflation, unemployment and FDI

The values of variables have been taken from primary and secondary sources of representative statistical bases: BIH Statistics Agency, the Central Bank of BIH and the Foreign Investment Promotion Agency in BIH - FIPA (Table 1). Unemployment is expressed by administrative unemployment rates, inflation - by average annual rates of consumer price index - CPI, while FDI is expressed by a percentage of the share of FDI in GDP.

Table 1.
Unemployment, inflation and FDI in BIH (2004 – 2014, %)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Unemployment	43.2	44.0	45.5	43.9	41.5	42.0	42.6	43.4	44.2	44.6	43.9
Inflation	2.1	2.2	7.7	1.5	7.5	-0.4	2.1	3.7	2.1	0.2	-0.2
FDI (% GDP)	6.2	4.5	5.2	11.6	5.4	1.4	2.4	2.7	2.3	1.7	2.7

Sources: BHAS, CBBIH, FIPA

Explanation of the inflation - unemployment ratio from the theoretical context is provided by the Phillips curve, based on which a rise in inflation leads to a decrease in unemployment and vice versa. The ratio of inflation and unemployment shall verify or refute such Phillips claim upon calculating the correlation and linear regression equation (data from Table 1). For the period 2004 - 2014 Pearson correlation coefficient is r= 0.020131. Relation between inflation and unemployment in BIH has been positive and insignificant.

Table 2.
Regression model of unemployment and inflation (2004 – 2014)

I	year	x_i	y_i	$x_i y_i$	x^2_i
1	2004	43.2	2.1	90.72	1866.24
2	2005	44	2.2	96.8	1936
3	2006	45.5	7.7	350.35	2070.25
4	2007	43.9	1.5	65.85	1927.21
5	2008	41.5	7.5	311.25	1722.25
6	2009	42	-0.4	-16.8	1764
7	2010	42.6	2.1	89.46	1814.76
8	2011	43.4	3.7	160.58	1883.56
9	2012	44.2	2.1	92.82	1953.64
10	2013	44.6	0.2	8.92	1989.16
11	2014	43.9	-0.2	-8.78	1927.21
	Σ	478.8	28.5	1241.17	20854.28

The results from the Table above serve as a basis for the following Chart No.1

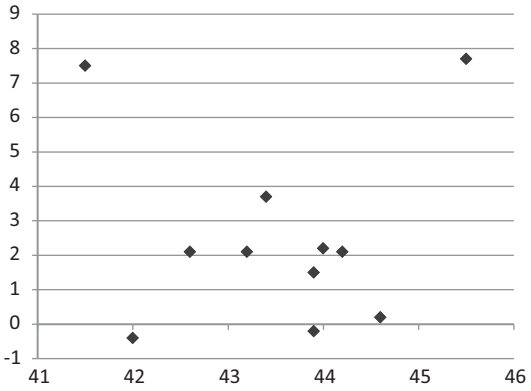


Chart 1. Scatter diagram of inflation and unemployment

Distribution of points in the scatter diagram indicates the linear growth of unemployment as an independent variable which generally benefits from a linear increase in inflation as a dependent variable. The linear correlation coefficient (0.020131) is relatively low. Chart clearly demonstrates that the most likely outcome of the analysis shall demonstrate that inflation and unemployment generally tend not to move along the Phillips line.

Table 3.
Random error for the estimated regression model

x_i	y_i	$\hat{y}$	u_i	adjusted $\hat{y}$
43.2	2.1	2.575216	-0.475216	2.575216
44	2.2	2.61352	-0.41352	2.61352
45.5	7.7	2.68534	5.01466	2.68534
43.9	1.5	2.608732	-1.108732	2.608732
41.5	7.5	2.49382	5.00618	2.49382
42	-0.4	2.51776	-2.91776	2.51776
42.6	2.1	2.546488	-0.446488	2.546488
43.4	3.7	2.584792	1.115208	2.584792
44.2	2.1	2.623096	41.576904	2.623096
44.6	0.2	2.642248	-2.442248	2.642248
43.9	-0.2	2.608732	-2.808732	2.608732

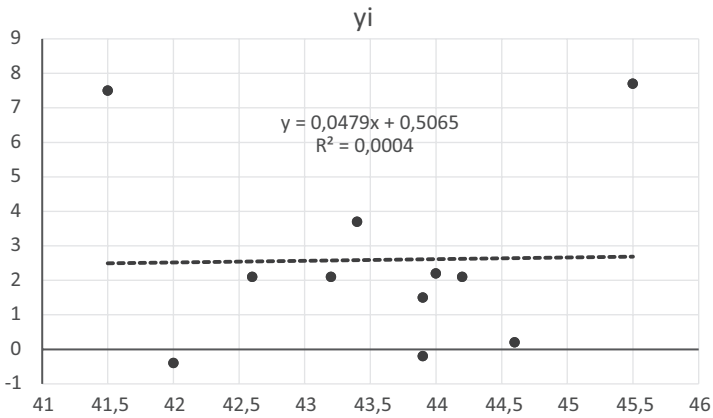


Chart 2. Scatter diagram and linear regression curve of unemployment and inflation

Data show the residual deviation (the difference between the empirical and the estimated value), because $u_i = 0.000256$, thus the linear regression model equation should be adjusted.

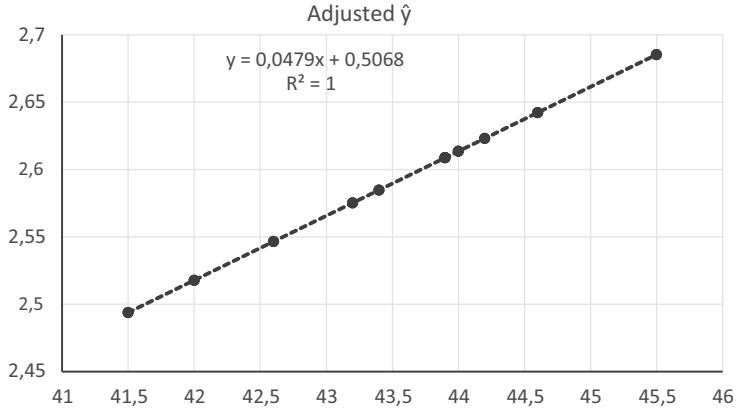


Chart 3. Regression curve adjusted for random error in the regression model

Adjusted regression curve is defined by the equation $y = 0.0479x + 0.5068$ which illustrates that the inflation rate shall rise by 0.0479 index points if the unemployment rate changes by one percentage point. The following step is to evaluate the variance analysis equation.

Table 4.
Recap of regression results in ANOVA Table

VARIATION SOURCE	SS	Sum squared	Variance
Interpreted by model	2-1=1	0.03076	0.03076
Uninterpreted by model	11-1=10	75.74732	7.574732
TOTAL	11-1=10	75.9490909	

The analysis shows that the sum of the squares interpreted by the model, or the sum of squares of deviations of the regression values from the dependent variable average amounts to 75.74732, i.e. the residual sum of squared deviations from the regression values of the dependent variable is 0.03076.

The results of the analysis and earlier studies (Popovic and Ibrahimbegovic, 2015) show a nearly horizontal regression line that indicates that with minor corrective measures a regression line could be parallel to the abscissa. Coefficient *b* in the given regression model has a value of zero, which means that inflation always has the same value, and does not depend on the characteristics of the independent variable (unemployment). This implies that the correlation between these sizes would also be equal to zero and suggests the absence of the quantitative correlation. The results indicate that, even if BIH abandoned the currency board policy and "transcended" the model of flexible monetary policy, the employment rate would not increase much. Problems of internal and external balance would

still remain. According to Krugman, for example, key issues of internal balance are "full employment and price stability" (Krugman and Obsfeld, 2009).

Economically speaking, the horizontal line of the regression equation suggests that policy makers prefer stable prices and lower employment rate in monetary policy. Regression line horizontal to the x-axis from the perspective of Phillips curve means that it is not the optimum of inflation and unemployment in the function of economic growth. In other words, maintaining stable inflation in BIH has created a cost that reflected onto higher unemployment rate and lower growth rate.

Statistical analysis provide us with two conclusions: (1) there is no long-term (2004-2014) Phillips curve in BIH, and (2) the relationship between variables was almost imperceptibly stronger following the crisis year of 2009 (Popovic and Ibrahimbegovic, 2015). At that time, there was no compromise between inflation and unemployment, thus neither the aggregate demand growth nor acceleration of such growth could be affected by a combination of macroeconomic variables. The absence of the curve is also demonstrated by the inflation and GDP ratio. In theory, Phillips curve is also shown as the ratio of inflation and excess aggregate demand expressed in GDP changes. Statistical analysis suggests a weak positive correlation of inflation and GDP, i.e. the correlation itself can be classified as "medium strong". If we were to assume that aggregate supply, demand and consumer prices in a small open economy such as BIH are dependent on changes in the developed countries, it would be interesting to analyze the correlation between domestic and foreign inflation, as well as between domestic and foreign GDP.

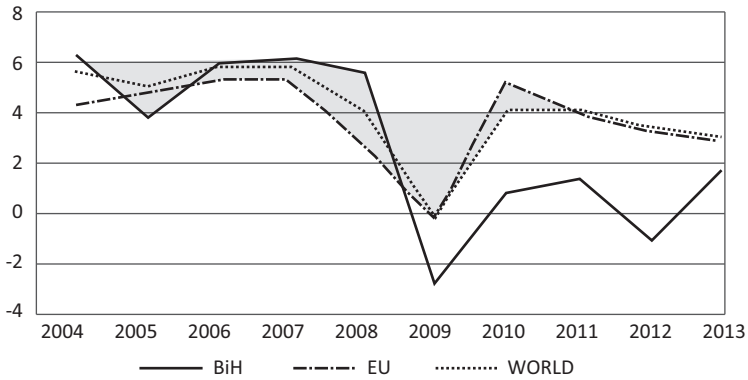
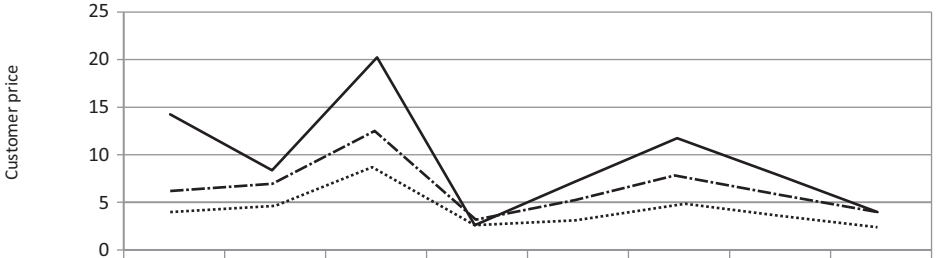


Chart 4. Real GDP (BIH, EU, and world, 2004 - 2013).
Sources: CBBiH, BHAS, Eurostat, World Bank

Pearson coefficient of domestic and foreign prices in BIH (2004-2013) is 0.733851. Domestic prices react to external prices with medium intensity. The correlation between domestic and foreign GDP for the same period amounts to

0.720937 and suggests a medium-strength connection. Domestic prices and GDP are more responsive (oscillatory) to the foreign ones, thus serving as another confirmation that there is no Phillips curve signal.



	2006	2007	2008	2009	2010	2011	2012	2013
BiH	7,7	1,5	7,5	-0,4	2,1	3,7	2,1	0,2
EU	2,2	2,3	3,7	1	2,1	3,1	2,6	1,5
WORLD	4,4	5	9	2,9	3,5	5	3,7	2,7

Chart 5. Movement of consumer prices (BIH, EU, and world, 2006 – 2013).
Sources: World Bank, Eurostat, CBBiH, BHAS

Statistical analysis provides reasoning for the assumption of the existence of the Phillips curve. The graphic segments imply stages of development of BIH, where a mild correction could cause inflation and unemployment to move along the Phillips curve direction.

Chart 6 represents a result of earlier research of the authors (Popovic and Ibrahimbegovic, 2015).

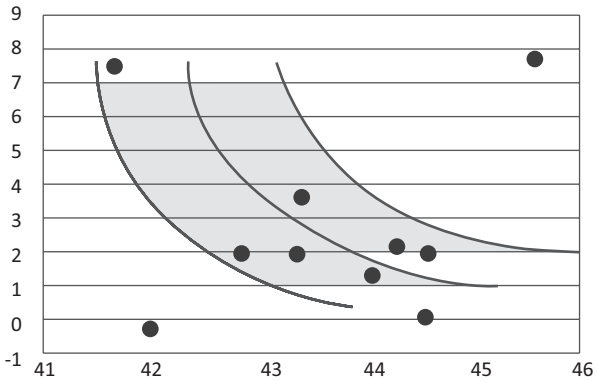


Chart 6. Projection of imaginary Phillips curve zone of action[4]
Source: authors' projection

[4] Reference points in the graph represent a regression value, not the actual statistical values of inflation and unemployment.

From a total of ten observations (the above chart refers to regression for the period 2004-2013), only two points of the highlighted section are located outside the imaginary action zone of Phillips curve. Thus, although the statistical analysis demonstrated that there is no Phillips curve, there are no strong theoretical arguments to contest the existence of marginal zone in which an environment for the regulation of inflation and unemployment could be created according to Phillips theory. By means of corrective macroeconomic measures, certain conditions could have been created in this zone for investment growth, reduction of unemployment and GDP growth, but with the "sacrifice" of growth of inflation.

Inverse relationship of inflation and unemployment in BIH was registered in 2008, 2009, 2010, 2013, which was partly caused by the investments[5] (Chart 7).

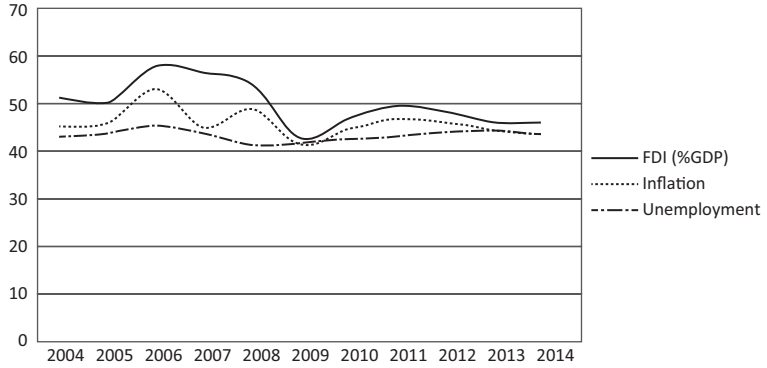


Chart 7. Inflation, unemployment and FDI (BIH, 2004 – 2014)

In order to assess such claim, the relationship between FDI and inflation in BIH is shown for the period 2004-2014. Inflation is an independent variable and FDI is a dependent variable. The correlation coefficient is 0.252822 and shows that inflation and FDI are in a positive but negligible correlation.

[5] Following the year of the highest FDI (2007), the inverse relationship of inflation and unemployment was observed in as early as 2008 (unemployment drop by 2.4%, inflation rise by 6%). In 2011, FDI was increased by 0.3%, whereby an inverse relationship of inflation and unemployment was recorded in the following year: unemployment rose by 0.8%, inflation dropped by 1.6%.

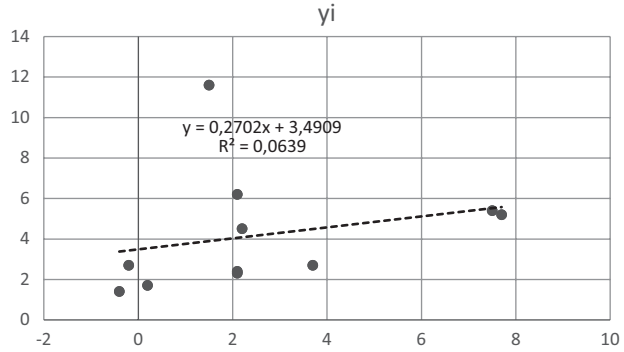


Chart 8. Scatter diagram and linear regression curve of inflation and FDI

Distribution of points shows that inflation and FDI are in an inverse relationship, with a negligible correlation (r = 0.252822). Inflation growth is usually accompanied by negligible linear decline in FDI rates. The analysis shows the difference between the empirical and the estimated value of y, because: $u_i = 0.196$. Thus, corrections in the regression line should be made. The estimated value y is located on the best adjusted regression line (Chart 9).

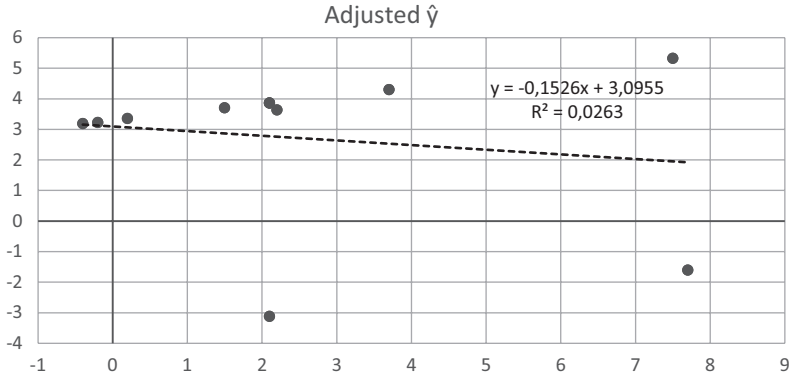


Chart 9. Adjusted regression curve for random error in the regression model

From the regression equation $y = -0.1526x + 3.0955$, it follows that the estimated parameter b or the regression coefficient amounts to – 0.1526 (1% increase in inflation causes the value of the regression rate of FDI expressed in GDP share to decrease by 0.1526 %). Constant a indicates an FDI regression value in case there is no inflation and it is only an assumption without a logical theoretical explanation. It is necessary to assess the variance analysis equation (Table 5).

Table 5.
Results of inflation regression and FDI in ANOVA table (2004 – 2014)

VARIANCE SOURCE	SS	SS	Sum squared	Variance
Interpreted by model	m-1	2-1=1	72.86977	72.86977
Uninterpreted by model	N-m	11-1=10	155.8197	15.58197
TOTAL	N-1	11-1=10	93.454291	

Analysis of variance demonstrates that the residual or uninterpreted sum of squared deviations of the actual values from the regression values of dependant variable amounts to 155.8197, i.e. that the sum of squared deviations of regression values from the average 72.86977 (sum of squares interpreted by the model).

4. Conclusion

The monetary system of Bosnia and Herzegovina has been designed on the basis of the currency board model. BIH is faced with unemployment, high foreign trade deficit, insufficient GDP growth, social problems, inefficient administration, etc. Poor entrepreneurial climate, instability and other problems are slowing down its path towards the European Union. The currency board has affected the price stability and stable exchange rate. The local currency is pegged to the euro with full coverage in convertible foreign currency. However, the currency board model hampers economic growth and discourages the growth of employment. Waiver of flexible monetary policy has given birth to numerous critics. The hypothesis is that the denial of the currency board is justified provided that the statistical analysis confirms that BIH inflation and unemployment are moving along the Phillips line. Thus, the need for changing the currency board would transcend from the abstract to the real evidence. However, statistical analysis has failed to confirm this hypothesis, since for a period of 11 observations (2004-2014) the coefficient of linear correlation was r = 0.020131, whereby the inflation and unemployment ratio in BIH was positive and insignificant. Adjusted regression curve is defined by the equation $y = 0.0479x + 0.5068$ which shows that the inflation would increase by 0.0479% if the unemployment rate changed by 1%. Analysis of variance demonstrated that the sum of the squared actual value of the dependent variable deviates from its regression value by 75.74732, i.e. that the sum of the squared regression values of the dependent variable from the average amounts to 0.03076. Further, the coefficient of correlation of domestic and foreign price is r = 0.733851, which indicates that the domestic prices react to external prices with medium intensity. The correlation of domestic and foreign GDP for the same period is r = 0.720937 and it is considered to be of medium strenth.

Statistical analysis does not provide strong arguments with respect to the existence of the Phillips regularity. However, the graphical display shows some developmental stages of BIH when it was possible to affect inflation and unemployment through corrections, i.e. to direct them along the Phillips path. In these zones, corrective macroeconomic measures and "sacrificing the inflation" could create the conditions to accelerate investments (mainly FDI), the decline in unemployment and GDP growth.

The correlation coefficient of FDI and inflation for the period 2004-2014 amounts to r = 0.252822. Inflation and FDI are in a positive and negligible correlation. The regression equation $y = -0.1526x + 3.0955$ shows that the regression coefficient is $b = -0.1526$, so inflation growth of 1% causes the value of FDI regression rate expressed in GDP share to decrease by 0.1526%. Residual (uninterpreted) sum of squared deviations of actual values from the regression values of dependent variable amounts to 155.8197, while the value of the sum of squares interpreted by the model is 72.86977.

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