

UNEMPLOYMENT AND BUSINESS CYCLES IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

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Abstract:

The economies of the capitalist countries are continuously facing fluctuations known as business cycles. The estimation of global business cycles as well as of business cycles of different macroeconomic variables expressing the state of the economy are of utter importance for the decision making process having as a final goal the reduction of recession periods. The unemployment rate is known as a lagging indicator for the business cycles and it can offer important information regarding the business cycles forecasting. Therefore, the purpose of this study is to analyze in a comparative manner the general business cycles and the business cycles of unemployment rate in the CEE countries. The results confirm the persistence of the business cycles under analysis and the existence of great differences by countries of the reaction of unemployment business cycles to general business cycles.

Key words: Hodrick-Prescott filter, unemployment, lagging indicators

JEL classification: E 32, C 18, C 22

1. Introduction

The last years, starting with the financial global crisis in the end of the year 2007, have showed once again that an economy faces both economic growth periods and economic recession times, being thus subjected to business cycles. Generally speaking, business cycles are considered to have two phases: an expansion phase when the macroeconomic variables characterising the economic situation of an economy register an increasing trend and the depression phase when a drop in the level of the macroeconomic variables is registered. During the expansion stage the input increase of a country starts from the macroeconomic level, from the level of companies, then determining the global growth of the economy. During the depression phase the output decrease is generated by the global decrease in demand at macroeconomic level. As a consequence, in order to diminish the general output decrease and to limit the depression phase decisions should be taken at macroeconomic level. The insurance of the labour market stability is a priority for any country, therefore knowing exactly its situation especially during the economic recession periods represents a main objective for the national policy makers.

The business cycles can be forecasted based on some macroeconomic variables that will represent in the sphere of economic cycles the economic indicators. The procyclical macroeconomic indicators measure the economic activity and have an ascending trend when the economy is in its growth stage and a descending trend when the economy is in its recession phase. Within these indicators we may include the gross domestic product, the inflation rate and the interest rate. The countercyclical macroeconomic indicators have a descending trend when the economy is in the growth stage and an ascending one when the economy is its recession phase. Within these indicators we may include the unemployment rate. The unemployment rate is also an indicator starting to face changes in its evolution once in several months after the beginning of the recession period in the economy, being integrated within the lagging indicators. Even if there are macroeconomic indicators anticipating the business cycles

known as leading indicators (such as the new orders for capital goods, the price of stock), the lagging indicators are more useful in forecasting the business cycles since they add confidence. When the lagging indicators transmit positive signals they certainly forecast the economic revival. Therefore, due to the importance of labour market in a country's economy we aimed at studying it in relation to the business cycles of the Central and East European countries (CEE in what follows).

Studies about the stylised facts of the business cycle indicators have been performed especially for the developed countries. In the last years the research on the business cycle indicators has been extended to the Central and East European countries which passed almost at the same time to a market economy. The databases with macroeconomic indicators enable empirical research in the field of business cycles. Caraiani (Caraiani P., 2004) studies the empirical features of the business cycles in Romania. In this study the cycle of the number of unemployed people has a strong countercyclical feature, a 5 month lag and a correlation coefficient of -0.54 with the business cycle of the industrial production index.

Benczur P., Ratfai A. (2010) studies the empirical characteristics of the business cycles in the CEE countries but he does not focus on the unemployment rate. The results obtained for the employment confirm that it is a procyclical indicator and that the volatility of business cycles in the CEE is higher than that of the developed countries.

The identification of the stylised facts for the business cycles is needed for the performance of an information database in the creation of the theoretical models of business cycles or for the choice of a model out of several possible models. Agenor and Montiel (1996) also support that the identification of stylised facts for business cycles can be essential for the policies and programs of macroeconomic stability.

Before starting his study, Male R. (2010) performs a synthesis of the empirical characteristics of the business cycles in the developed and developing countries. In the developing countries the output is more volatile than in the developed countries, the consumption more volatile than the output and the real interest rates are more volatile than those in the developed countries. As in the developed countries, the developing countries have procyclical consumption, investments, real wage and money aggregate while the real interest rates are countercyclical.

2. Methods

For the analysis of business cycles of the macroeconomic variables we take into account the growth rates of the variables expressed in real data (Male, 2010). For the estimation of growth rates the variables are logarithmated and the reason will be explained below.

If we have a macroeconomic variable, supposing the real GDP, that is noted with Y and it has a constant growth rate, we may write that:

$$Y_t = (1 + g)^t Y_0$$

where: Y_t, Y_0 - the analysed macroeconomic variable registered at the moment t , respectively at the initial moment

g - the constant growth rate of the variable Y

$t=1,2,\dots,T$, the moments when the variable was registered

If we logarithmate the previous expression we will obtain:

$$\ln(Y_t) = \ln[(1 + g)^t Y_0]$$

$$\ln(Y_t) = \ln(Y_0) + \ln[(1 + g)^t]$$

$$\ln(Y_t) = \ln(Y_0) + t \cdot \ln(1 + g)$$

but $\ln(1 + g) \approx g$ since

$$\ln(1+g) = \ln(1) + \frac{g-0}{1} - \frac{1}{2}(g-0)^2 + \frac{1}{6}(g-0)^3 + \dots$$

$$\ln(1+g) = g - \frac{1}{2}g^2 + \frac{1}{6}g^3 + \dots$$

The growth rate g has a low value, therefore when raised to any power it will be even lower, therefore:

$$\ln(1+g) \approx g.$$

For the estimation of business cycles we need stationary time series of the macroeconomic variables. Therefore, if we have monthly or quarterly data to get the cyclical component of the time series we need to go through the following stages:

- testing the stationarity of variables and, if the variables have a seasonal component, its exclusion;
- using one method or model to exclude the trend from the analysed variable and estimating the cyclical component;
- testing the stationarity of the estimated cyclical component.

The cyclical component of the analysed series which is obtained after performing these stages should meet the stationarity condition.

The Hodrick-Prescott filter (Hodrick, Prescott, 1997) is one of the most used procedures in the estimation of the business cycles. Its use in the macroeconomic field is justified because it succeeds in estimating the long-term component of the time series, the trend, showing flexibility and adjustment to the recorded values so that the resulted trend corresponds to the line someone would have drawn for the graphical representation of data. The trend component is obtained by minimizing the expression:

$$\sum_{t=1}^t c_t^2 + \lambda \sum_{t=2}^t [(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})]^2$$

where: $c_t = \ln y(t) - \ln y^*(t)$, $g_t = \ln y^*(t+1)$, $g_{t-1} = \ln y^*(t)$, $g_{t-2} = \ln y^*(t-1)$

y^* - the long-term trend of the variable y .

t - the size of the sample

λ - a parameter penalizing the trend variability.

The most used values of the parameter λ are of 1600 for the quarterly data and 14400 for the monthly data.

By applying the Hodrick-Prescott filter the stochastic trend and the cyclical component are not correlated.

The variable that represents the cyclical component is stationary and autocorrelated. To test the stationarity we use the Philips Perron (PP) test because it also takes into consideration the potential autocorrelation of the variable. Since the variables representing the cyclical component are autocorrelated, the PP test is better than the Augmented Dickey-Fuller (ADF) test. The null hypothesis H_0 implies that the time series has a unit root (it is not stationary) while the alternative hypothesis H_1 supposes that the time series does not have a unit root (it is stationary). The test consists in estimating three regression models based on the general model:

$$\Delta Y_t = \mu + \gamma t + \alpha Y_{t-1} + \sum_{i=1}^n \beta_i \Delta Y_{t-i} + \varepsilon_t$$

where: Δ - the difference operator, t - the time, $t=1, \dots, T$ and ε_t - the error term.

The three regression models tested are: 1. $\Delta LR_t = c + \gamma t + \alpha LR_{t-1} + \varepsilon_t$, 2.

$\Delta LR_t = c + \alpha LR_{t-1} + \varepsilon_t$, 3. $\Delta LR_t = \alpha LR_{t-1} + \varepsilon_t$

If the values of the PP tests are higher than the critical values then the null hypothesis is rejected and the alternative hypothesis implying the existence of stationarity of the time series is accepted.

To test the autocorrelation of the values of the cyclical component we use the Ljung-Box test. The tested hypotheses are the following: the null hypothesis H_0 supposes that the variable is white noise while the alternative hypothesis H_1 implies the variable is auto-correlated. The test statistics is calculated by means of the relation:

$$Q_k = T(T+2) \sum_{i=1}^k \frac{\hat{\rho}_i^2}{T-i}$$

If the null hypothesis is rejected the time series is not white noise and it has a cyclical component.

To analyze the type of the macroeconomic indicators, we estimate the bivariate correlation coefficients $\rho(j)$ for different values of j , $j \in \{0, \pm 1, \pm 2, \pm 3, \dots\}$ between the business cycles of the national product and the business cycles of the analysed variable. A series of a macroeconomic variable is called procyclical if the bivariate correlation coefficient $\rho(0)$ is positive, it is acyclical if the bivariate correlation coefficient $\rho(0)$ is zero and it is countercyclical if the bivariate correlation coefficient $\rho(0)$ is negative. The correlation coefficients may also indicate whether the cycles of the macroeconomic variables under analysis anticipate the general cycle by j periods if $|\rho(j)|$ has the highest value for a positive j , it is lagged from the general cycle by j periods if $|\rho(j)|$ has the highest value for a negative j or it is synchronous if $|\rho(j)|$ has the highest value for $j = 0$ (Agenor et alii, 1999).

3. Data and Empirical Results

For the estimation of business cycles of a country's output the gross domestic product is used. Since the CEE countries register the gross domestic product on a quarterly basis and given the short period of time of data availability, we will take into consideration the industrial production index as Male R. (2010) also uses. The deseasonalised values of the industrial production index and unemployment rate were provided by the Eurostat database for the period January 1997 – September 2012. We do not have at our disposal information for all the countries for the entire period so that the number of monthly records for the industrial production index varies from 151 values for Hungary to 177 values for Lithuania while the unemployment rate registers values from 151 for Estonia to 184 for Poland and Slovenia. For each country we took into consideration the maximum period in relation to the available data.

3.1. The general business cycles in the CEE countries

The general business cycles of the CEE countries estimated by means of the Hodrick-Prescott filter are presented in figure 1. The cycle phases for the Czech Republic, Bulgaria, Poland, Romania and Slovakia can be identified easily on the graph while for Lithuania and Slovenia the estimated cycles are represented mostly as repeated fluctuations. The PP tests confirm the stationarity of the estimated cycles for all the countries analysed while the Ljung-Box test confirm the autocorrelation of the values of the cyclical components.

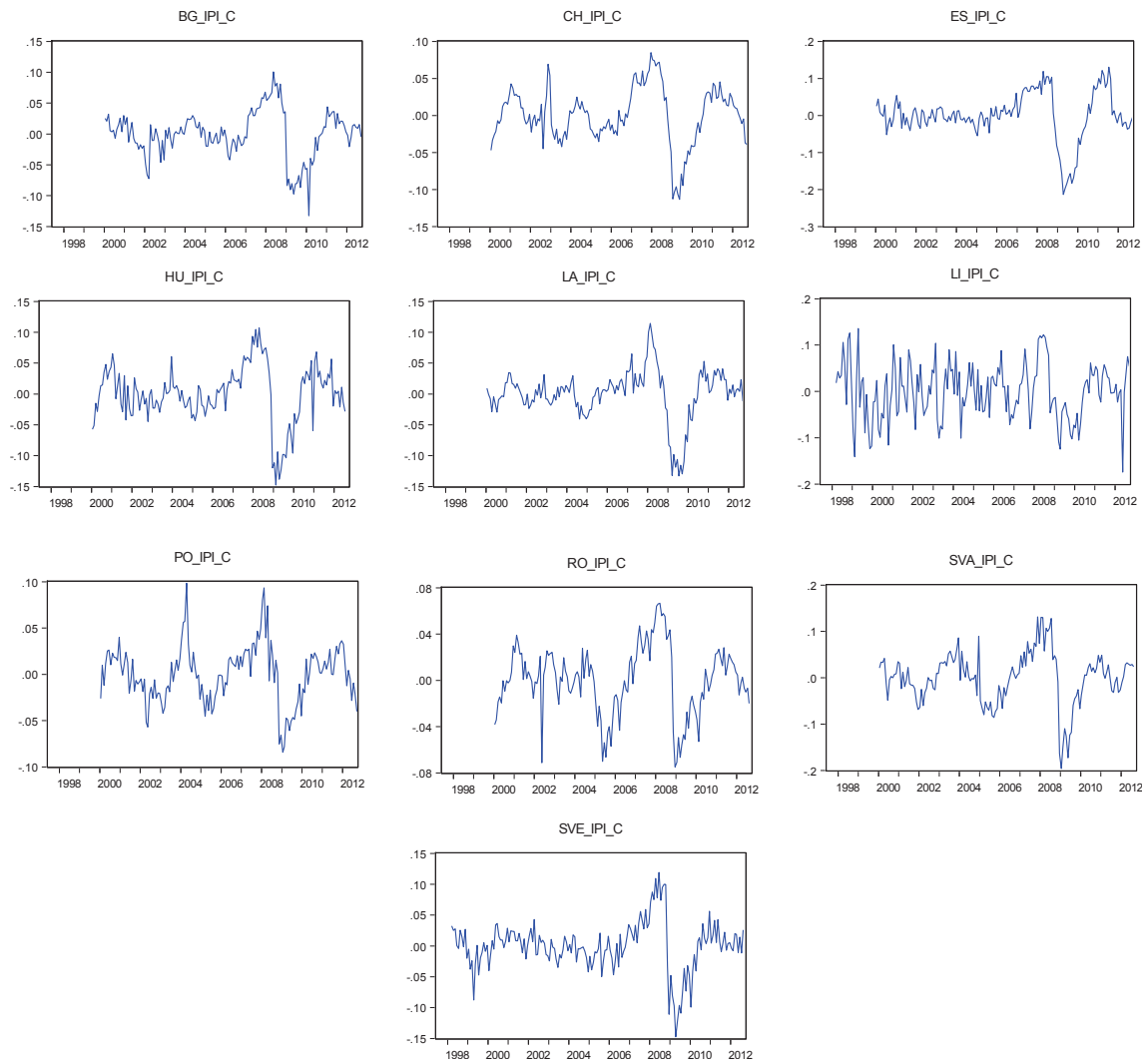


Figure 1. The general business cycles of the Central and East European countries

For the characterisation of the general business cycles in the CEE countries we determined their volatility by means of the standard deviation and the correlation coefficients $\rho(1)$, $\rho(2)$ and $\rho(3)$ in order to analyze their persistence.

Table 1. Descriptive statistics for general business cycles in the CEE countries

	bg ipi c	ch ipi c	es ipi c	hu ipi c	la ipi c	li ipi c	po ipi c	ro ipi c	sva ipi c	sve ipi c
Stand. Dev.	0.038	0.038	0.064	0.046	0.040	0.060	0.0309	0.029	0.056	0.040
$\rho(1)$	0.827	0.900	0.902	0.786	0.885	0.475	0.763	0.818	0.816	0.747
$\rho(2)$	0.775	0.819	0.837	0.722	0.842	0.237	0.698	0.727	0.733	0.662
$\rho(3)$	0.680	0.725	0.769	0.650	0.745	0.101	0.618	0.638	0.640	0.611
Obs.	153	153	153	151	153	177	153	152	152	174

The highest volatility of the general business cycles of the CEE economies belongs to Estonia, closely followed by Lithuania and Slovakia, while the lowest volatility is registered for the business cycles in Romania and Poland.

As regards the persistence, most of the business cycles in the CEE countries present a significant persistence implying that fluctuations have the tendency to last. As we anticipated in the graphical representation, the fluctuations in Lithuania last less, result also indicated by the autocorrelation coefficients which are the lowest ones in comparison with all the countries under analysis.

3.2. The business cycles of unemployment rate in the CEE countries

The business cycles of unemployment rate for the CEE countries are graphically represented in figure 2. The PP tests confirm the stationarity of the estimated cycles of the unemployment rate for all the countries analysed while the Ljung-Box test confirm the autocorrelation of the cyclical component values.

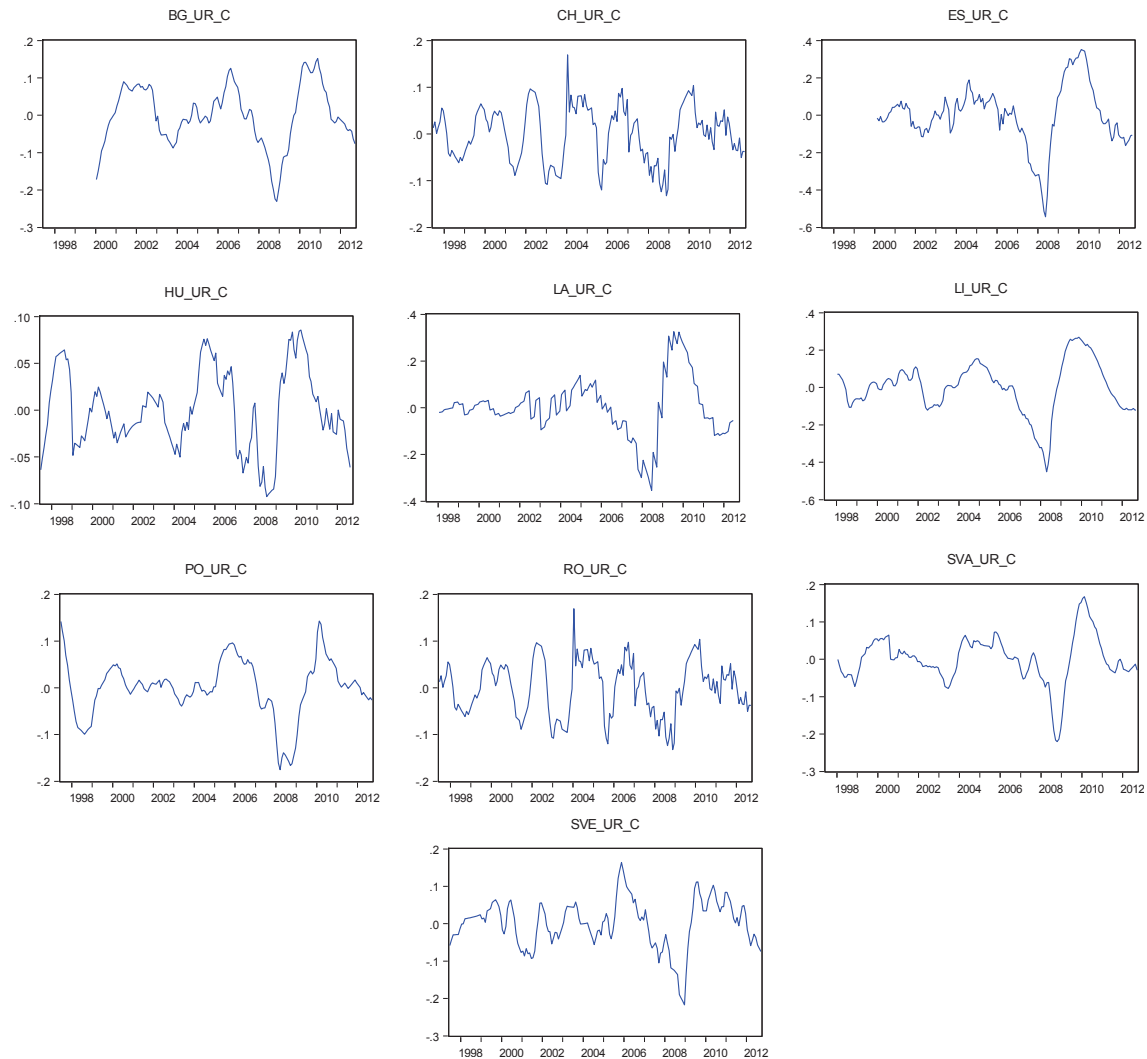


Figure 2. The business cycles of unemployment rate in the Central and East European countries

The business cycles of unemployment rate are also characterised by a low volatility. The highest volatility belongs to the cycles of unemployment rate in Estonia and Lithuania while the lowest volatility is registered by the unemployment rate cycles in Hungary.

Table 2. Descriptive statistics for unemployment business cycles in the CEE countries

	BG_U R_C	CH_UR_ C	ES_UR_ C	HU_UR_ C	LA_UR_ C	LI_UR_ C	PO_UR_ C	RO_UR_ C	SVA_UR_ C	SVE_UR_ C
Std. Dev.	0.080	0.058	0.161	0.042	0.123	0.137	0.061	0.058	0.063	0.065
$\rho(1)$	0.959	0.853	0.962	0.934	0.928	0.980	0.960	0.853	0.971	0.937
$\rho(2)$	0.894	0.747	0.904	0.839	0.877	0.935	0.892	0.747	0.905	0.819
$\rho(3)$	0.817	0.604	0.830	0.734	0.848	0.875	0.807	0.604	0.815	0.676
Obs.	153	184	151	183	174	177	184	184	177	184

The business cycles of unemployment rate can be more easily distinguished from the graphical representations in comparison with the general business cycles because they seem to be characterised by a greater persistence. Indeed, table 2 shows that for all the analysed countries the business cycles of unemployment rate are characterised by a significant persistence.

3.3. The analysis of the correlation between the business cycles and business cycles of the unemployment rate in the CEE countries

We previously stated that the unemployment rate is a lagging indicator because the changes in its evolution occur according to the general changes in economy. In order to identify after how many periods the unemployment rate reacts to the changes of general business cycles, we calculated the bivariate correlation coefficients between the general business cycles and the business cycles of unemployment rate for each country. The results obtained are presented in the table below.

Table 3 The estimation of bivariate correlation coefficients between the general business cycle and the unemployment rate cycle with different lags and leads for the CEE countries

	BG IPI_C	CH IPI_C	ES IPI_C	HU	LA	LI	PO	RO	SVA	SVE
UR_C(-4)	0.093	0.166**	-0.467*	-0.042	-0.500*	-0.280*	0.189**	0.058	0.197**	-0.002
UR_C(-3)	0.009	0.094	-0.548*	0.141***	-0.597*	-0.332*	0.118	-0.004	0.134	-0.065
UR_C(-2)	-0.085	0.004	-0.605*	-0.256*	-0.668*	-0.358*	0.037	-0.061	0.052	0.148***
UR_C(-1)	-0.183**	-0.088	-0.656*	-0.363*	-0.731*	-0.362*	-0.063	-0.107	-0.045	-0.248*
UR_C	-0.274*	-0.18**	-0.698*	-0.477*	-0.772*	-0.356*	-0.16**	-0.17**	-0.14***	-0.35**
UR_C(1)	-0.362*	-0.261*	-0.730*	-0.586*	-0.808*	-0.339*	-0.263*	-0.243*	-0.256*	-0.469*
UR_C(2)	-0.431*	-0.311*	-0.733*	-0.661*	-0.832*	-0.304*	-0.345*	-0.284*	-0.349*	-0.581*
UR_C(3)	-0.490*	-0.357*	-0.727*	-0.698*	-0.839*	-0.263*	-0.410*	-0.329*	-0.421*	-0.642*
UR_C(4)	-0.547*	-0.390*	-0.723*	-0.690*	-0.804*	-0.219*	-0.467*	-0.349*	-0.490*	-0.643*
UR_C(5)	-0.598*	-0.445*	-0.707*	-0.695*	-0.761*	-0.191**	-0.517*	-0.369*	-0.548*	-0.620*
UR_C(6)	-0.645*	-0.485*	-0.675*	-0.708*	-0.705*	-0.174**	-0.555*	-0.391*	-0.599*	-0.585*
UR_C(7)	-0.674*	-0.491*	-0.643*	-0.693*	-0.638*	-0.168**	-0.579*	-0.396*	-0.636*	-0.545*
UR_C(8)	-0.693*	-0.507*	-0.598*	-0.658*	-0.551*	-0.163**	-0.586*	-0.430*	-0.646*	-0.502*
UR_C(9)	-0.685*	-0.481*	-0.562*	-0.610*	-0.482*	-0.14***	-0.578*	-0.436*	-0.626*	-0.442*
UR_C(10)	-0.667*	-0.454*	-0.507*	-0.532*	-0.390*	-0.116	-0.552*	-0.407*	-0.588*	-0.383*

*, **, *** significant at 1%, 5%, 10%

As we expected, based on the results of previous research, the unemployment rate is a countercyclical indicator because the correlation coefficients between the general business cycles of economies and the unemployment rate cycles are negative. As regards the number of periods passed since the changes of general cycles of the economies reflected in the business cycles of the unemployment rate, there are some major differences. The maximal values of the bivariate correlation coefficients indicate this situation. For Romania, the unemployment rate cycles react after 9 months, for Bulgaria, Czech Republic and Poland after 8 months, for Hungary after 6 months, for Latvia and Slovenia after 3 months and for Lithuania after only 1 month.

4. Conclusions

The analysis of the general business cycles and the unemployment rate cycles in the Central and East European countries shows that these are characterized by persistence, meaning they last much more time. The unemployment rate is a lagging indicator in all the countries but it reacts after significantly different periods of time to the changes in the general business cycles.

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