The business cycle and unemployment: empirical evidence from the Visegrad group countries

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Abstract—The paper deals with a relationship between the economic cycle and unemployment in the Visegrad group countries. The paper examines the causes of the economic crisis and its consequences on the labor market. Quarterly Eurostat and OECD data were used for the analysis of labor market performance. We also used the Beveridge curve which implicitly depicts a negative relationship between the rate of unfilled job vacancies and the unemployment rate and so it can properly link related creation of new job vacancies and the unemployed. Another finding is that shifts of individual Beveridge curves correspond to shifts of the theoretical Beveridge curve. In the last part of the paper, the Johansen test and the Error Correction Model were applied on 2000-2010 data to examine cointegration between the number of the unemployed labor force and output. On the basis of the unit root test, we found that in all countries, both variables are stationary except for their first differences Cointegration was proved only in the case of Slovakia.

Keywords—Labor market, Unemployment, Economic crisis, Visegrad Group, Cointegration, Error correction model

I. INTRODUCTION

DEREGULATION and globalisation of financial markets helped create conditions that led to the global financial crisis. According to [8] the severity of the global financial crisis and the global economic recession that accompanied it demonstrate the utter bankruptcy of the deregulated global neoliberal financial system. As the crisis unfolded in the U.S., a number of countries' real economies suffered from a decreased U.S. consumer demand, and credit problems arising from the U.S. mortgage sector rapidly have permeated across nations, ensnaring financial institutions worldwide [10]. This crisis is seen as a synchronized one and is often compared with the Great Depression. The financial crisis has spread to a wider range of institutions and markets, including emerging economies, which until quite recently seemed to have been relatively unscathed, and there have been huge falls in global financial wealth [16]. Now the global economy is recovering from the deepest recession in the post-World War II era.

In this paper we analyze the transmission of the global financial crisis to business cycle in the Czech Republic and its consequences on a real economy. The Czech economy is characterized as a small open economy strongly dependent on foreign demand, especially German one. It generally displays a high degree of synchronization with other EU Member States. In the pre-crisis period, the Czech economy benefited from flourishing external demand shifting real GDP above its long-term potential. This dependence on foreign markets seems to be the main cause of macroeconomic vulnerability. According to [19] a limited internal market or high taxation burdens are other weaknesses of the Czech economy. On the other hand, high productivity and industrial competitiveness, high investment attractiveness and financial reliability, low government debt and low private debt or EU membership are the main strengths of the Czech economy.

The paper is structured as follows. The next section presents a literature survey on determinants of the global financial crisis. Section 3 describes impacts of the global crisis on the real economy and continues with an analysis of the labor market and the last section concludes.

II. EVOLUTION OF THE FINANCIAL CRISIS

The financial crisis began in August 2007, when subprime-related turmoil in other asset classes finally spilled over into the currency market. This initial phase of the crisis was manifested in a major carry trade sell-off. Then in November 2007, credit restrictions were associated with a major deleveraging in financial markets and many investment funds were forced to liquidate positions [14]. The crisis fully developed after the collapse of Lehman Brothers in September 2008.

The causes of overheating of the U.S. credit market and a consequent global housing bubble, which peaked in the U.S. in 2006, are [21]: (i) excessive risk taking by private entities; (ii) new complicated financial products (securities); (iii) poor regulation and lax supervision of financial markets; (iv) government support for ownership housing for low-income population; (v) excess liquidity and very low FED interest rates. All these factors combined with fall in prices on the real estate market have led to expansion into to other segments of the financial sector and it was followed by nationalisations and takeovers of banks and insurance companies (Northern Rock, Fannie Mae and Freddie Mac, Merrill Lynch, Washington Mutual, Wachovia, and AIG). The financial crisis then spilled over into the real economy.

Consequences of the global economic crisis would be characterized as follows [21]: (i) sharp deterioration in the expectations of firms and households; (ii) increase of problems related to funding of business, production or investment; (iii) fall in production and foreign trade; (iv) firing employees; (v) reduction in consumption and investment.

The global recession was triggered by a severe financial crisis in key advanced economies that coincided with the freezing of global financial markets and the collapse in global trade flows. The intensification of the financial crisis in September 2008 caused an abrupt increase in uncertainty and led to a downward reassessment of wealth and income prospects. The crisis had four features in common with other crises: 1) asset price increases that turned out to be unsustainable; 2) credit booms that led to excessive debt burdens; 3) build-up of marginal loans and systemic risk; and 4) the failure of regulation and supervision to keep up with and get ahead of the crisis when it erupted [7]. Some authors have even compared the contemporary global recession with the Great Depression: Eichengreen – O´Rourke [9] found out that the decline in world industrial production in the first nine months was at least severe as in the nine months following the 1929 peak. Moreover, global stock markets and world trade were falling even faster now than in the Great Depression.

While the crisis quickly resulted in deep recessions in a number of advanced economies, the emerging market and developing economies were also seriously affected (see Figure 2) but the impact varied across regions and countries [6]. Economic development is determined both by domestic (e.g. aggregate demand shocks and budgetary policy) and international factors (external demand and international prices of traded goods). In open economies, the latter are playing an increasingly important role and often determine also domestic policies, which are aimed at insulating the economy from adverse external economic shocks [11]. According to World Bank´s Report [22] governments face the challenges to secure the recovery, bring about fiscal consolidation, raise productivity, and generate jobs.

III. IMPACT OF THE GLOBAL FINANCIAL CRISIS ON EU MEMBER STATES´ LABOR MARKETS

Economic transition in the Czech Republic ran into difficulties in the late 1990s with a banking crisis, currency problems and an economic recession. However, during the years 2004-2008, the Czech economy grew steadily and rapidly, and its growth rate was more than twice higher compared with Eurozone´Member States. Significant growth was based on increasing exports and improving labour productivity. Large foreign direct investment (FDI) inflows fostered trade integration, underpinning an export-led expansion. All these factors created conditions for real convergence of the Czech economy or for so called the catch-up effect. Despite the good macroeconomic performance and the stable banking sector, the Czech economy has been impacted by spillover effects from the global crisis (mainly

through decline in foreign demand). Heavy dependence on industry, which is most affected, caused that industry´ performance drop pulls down the whole economy. Global financial and economic crisis erupted in full force in 2008 and first signs of the coming economic crisis, we could see already later than in other western European countries, in the last quarter of 2008, where GDP growth over the same period last year, reached only 0.5%. Although the Czech Republic is not among the countries most affected by the crisis, it still faced with substantial year on year decline in real GDP in every quarter of 2009 (according to preliminary data released by the Czech Statistical Office, real GDP fell by 3.1 percent year-on-year, 4.9 percent in 4Q 2009 respectively). As it is seen from Figure 2B, the downturn was largely driven by a sharp contraction in investment, as companies scaled down their production capacities in view of low access to financing and uncertainty about future prospects. The contribution of investment to GDP growth declined, and the year-on-year reduction reached -7.0 percent in the last quarter 2009. Private consumption held up better. It was supported by modest inflation, stable wages, and still largely robust labour markets. Large declines in domestic demand led to increasing net exports.
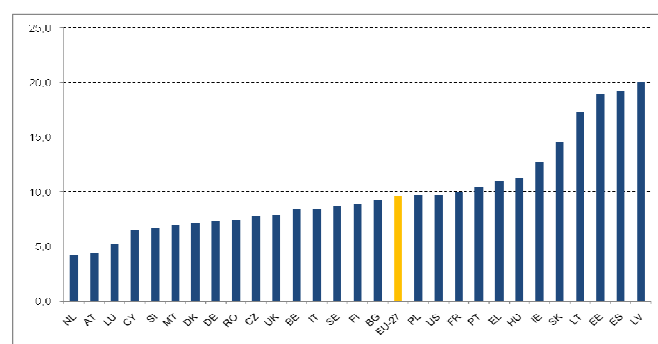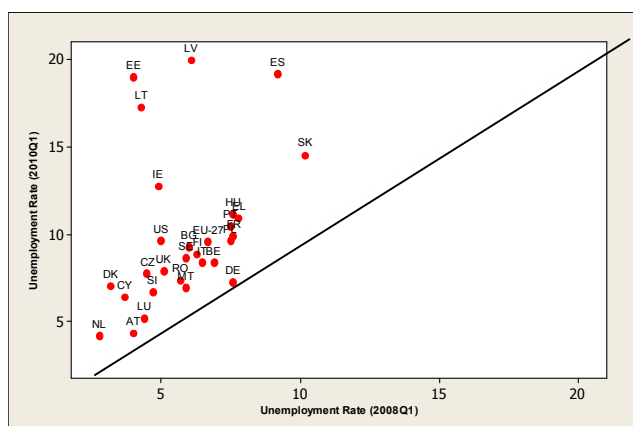

Source: Eurostat
Fig. 1 Unemployment Rates (2010Q1)

Labor markets in the European Union Member States were influenced by the global economic crisis in most cases, which arose as a result of the financial crisis [19][22][24]. Figure 1 shows the unemployment rates in the first quarter of 2010 (at the time of writing the article was the most recent data) in the EU Member States. The figure shows that the contemporary labor market performance reflects depth of the crisis. The average unemployment rate was approaching ten percent, with some countries exceeded by up to ten percentage points. These countries include the Baltic countries (Lithuania, Etonia and Latvia), and Spain or Slovakia. The Czech unemployment rate was situated in the bottom group of countries, and its value was 7.8%. Countries with the lowest unemployment rate were the Netherlands, Austria and Luxembourg, whose values were around five percent. We also added the United States unemployment rate in the figure. The purpose of this step was simple - the US unemployment rate was approximately half in the past in comparison with the EU-27 average. From

development of the unemployment rate (since 2009) it is evident that the impact of the economic crisis on labor market performance was larger in the U.S., which resulted in the rate 9.6% in the first quarter of 2010, which is the highest in the last twenty years.

But the unemployment rate can not express to what extent it was influenced by the economic crisis [4]. As a typical example, we can use a case of a country which was fighting with the high unemployment even before the crisis (e.g. Hungary). There could be a bias in this case. To avoid this bias, we created Figure 2, which shows the change in unemployment rates between the first quarter of 2008 and fourth quarter of 2009. The first quarter of 2008 was selected because the first signals of the economic crisis had appeared in the economies of Western Europe (labor market, however, was still in good shape), while the last quarter of 2009 showed the first signals of future recovery.

Source: Eurostat
Fig. 2 Unemployment rates (2008Q1 and 2010Q1)

For most countries, the evolution of the unemployment rate was similar during the observed period; a slight increase in the order in units of percentage points. The only country, where the unemployment rate increased, was Germany, but it should be mentioned that it had a relatively high base rate. Among the countries that have experienced large increases in the unemployment rate were Estonia, Lithuania and Ireland (with the initial unemployment rate under five per cent). The countries with the highest unemployment rate in the fourth quarter of 2009 also included Spain and Latvia, with the increase 13.9 percentage points in the case of Latvia.

In addition, Abraham and Shimer [1] mention that at the most of proceeded economic cycles it was proved rather strong correlation between the unemployment level and an average length of persistence of unemployment. Besides, there is an interesting fact that the persistence of unemployment did not decrease after the economic recession in such intensity as in the case of the decrease of the unemployment rate. OECD study [17] even declares, that the long-term unemployment tends to grow for a year or two since the beginning of decreasing of the unemployment level and afterwards it starts to decline slowly. The fundamental question than is, which

factors cause the delayed reaction of the long-term unemployment (in the sense of its decreasing) after subsiding of a shock. OECD study explains this through the dynamics of the labor market, which is a function of speed recovery of the market, degree of structural changes taking place in the economy. In addition it could be the setting of various government programs assisting unemployed people and finally it is also the amount of previous short-term unemployed with the job.

The unemployment or its duration can have an influence even on the forming of macroeconomic equilibrium. The mechanism of possible impact of extending the duration of unemployment in the overall functioning of the economy is described by Pissarides [19] – let's presume a negative shock that will have effects on employment in the sense that firms, by reason of wariness caused by uncertainty of the future development of the economy, will hire less labor force which will, among others, lengthen the persistence of unemployment. If the long-term unemployed lose their knowledge and skills and thus they become less attractive for their potential employers, the results of this phenomenon will be that there will be created fewer jobs and the labor market becomes "tight" for the reason of a lower human capital brought by the labor force as the whole. With the number of offered jobs, which is lower than usually, it also increases duration of unemployment of the new group of unemployed above a trend level. This is the reason why the labor market remains tight in the future and even if all the labor force, which had been in the previous period (before the shock) unemployed, would have attained a job. The tight labor market leads to a greater lack of work, which causes maintenance of the tightness of the labor market. Thus the effects of a negative shock persist and if the externality is strong enough, than the economy can "get stuck" on the lower macroeconomic equilibrium level.

Except the above mentioned correlation of the unemployment level and the persistence of the unemployment, according to [5], there also exists even a relationship between unemployment and jobs: "if there grows a share of a long-term unemployment in an aggregate unemployment and if the employees hesitate to hire long-term unemployed people (who are simultaneously less active during job search), than at a given level of unemployment the jobs stay void for a longer period."

If we look at changes in real GDP and the unemployment rate, based on the Eurostat data, we can categorized countries into two basic groups: (i) the countries, whose real GDP fell between one and five percentage points, while there was a remarkable increase in unemployment rates - see the left circle in the figure; and (ii) countries whose real GDP fell by more than ten percentage points on the one hand, and their unemployment rate increased significantly on the other hand - see the right circle in the figure. As figure shows, we can conclude that Ireland, Latvia, Estonia and Lithuania were hit by the global economic crisis most. Apart from these two groups of countries are Poland and Spain. While Poland was

the only country which has experienced an increase in real GDP and a minor increase in the unemployment rate, Spain shared some similarities with the first group of countries within the meaning of GDP development, with the difference of the significantly increased unemployment rate.

Beveridge curve is a graphical representation of the relationship between unemployment and the job vacancy rate (the number of unfilled jobs expressed as a proportion of the labor force). It typically has vacancies on the vertical axis and unemployment on the horizontal; it slopes downwards as a higher rate of unemployment normally occurs with a lower rate of vacancies. If it moves outwards over time, then a given level of vacancies would be associated with higher and higher levels of unemployment, which would imply decreasing efficiency in the labor market. Inefficient labor markets are due to mismatches between available jobs and the unemployed and an immobile labor force (for a more detailed analysis see [4] or [15]).

Development of the Czech labor market most closely matches theoretical construction of the Beveridge curve (Figure 3). The initial quarter (1Q2000) was characterized by the high unemployment rate and low level of unfilled jobs. The figure shows that the Czech labor market has undergone two cycles during the observed period. The first cycle occurred between 2000 and 2004, the second one occurred from 2006 to 2010. Each cycle started by gradual improvement in the labor market. This trend was reflected by reducing unemployment and raising the number of unfilled jobs. In the next phase, after reaching the summit, unemployment started to grow and the number of unfilled jobs started to decline as the consequences of the economic crisis. The fundamental difference between these two cycles consisted of dynamics. While in the first cycle, shifts of the Beveridge curve were minor, there were significant shifts during the second cycle (see figure).
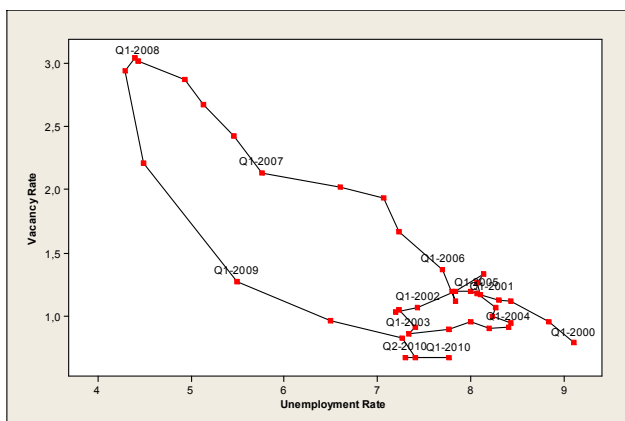
Source: OECD

Fig. 3 Beveridge Curve – Czech Republic
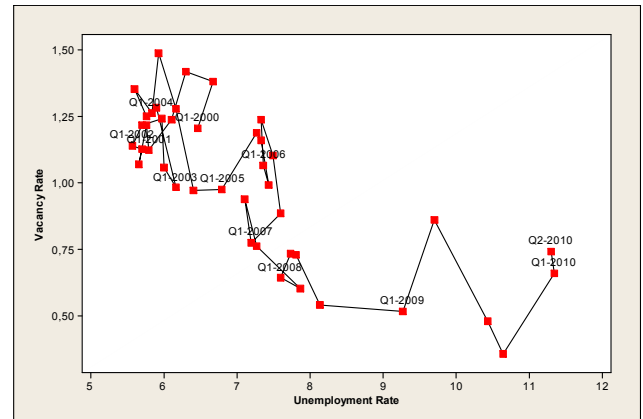
Source: OECD

Fig. 4 Beveridge Curve – Hungary

On the contrary, the Hungarian labor market can be described as rigid, though some shifts occurred during the observed period. In the first half (until 2004), both the unemployment rate and the rate of unfilled jobs stayed stabile. Since 2004, however, the rate of unemployment has increased and the rate of unfilled jobs has decline. Unlike other V-4 countries the subsequent development of the labor market was affected by the problems with which the economy struggled. As shown in Figure 4, the unemployment rate has increased continuously since 2007, even labor market performance significantly improved in the other V-4 countries. This insufficient labor market development was influenced by bad economic situation in the country which was caused by unstable finances, large fiscal imbalances and high government debt. Given the size of fiscal imbalances, government had to raise state budget´s revenues, e.g. hikes in employee social contributions, value-added tax and business taxation. Yet development of recent data shows the first signs of labor market performance (stopping an increase in the unemployment rate and increasing the rate of unfilled jobs).

Polish labor market performance was worsening by increasing the unemployment rate to beyond 20% accompanied by the low rate of unfilled jobs in the first four years. It has started to improve since 2004 - the unemployment rate gradually declined to a historically low rate of 7% before the economic crisis. Like the rest of V-4 countries or other EU countries the unemployment rate started to increase again since the second half of 2008. Compared to such development in the Czech Republic, the overall shift of the Beveridge curve did not reach such a dynamic perspective. Although the Polish market is four time bigger than the Czech labor market it was not reflected by a higher number of unfilled jobs. Therefore, the rate of unfilled vacancies exceeded 0.5% during the observed period, whereas the Czech labor market vacancy rate reached up to 3%.
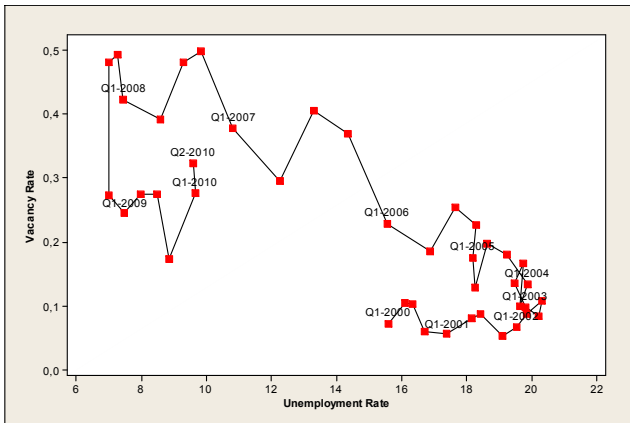
Source: OECD
Fig. 5 Beveridge Curve – Poland

The vacancy rates data from OECD database were inaccessible in the case of Slovakia. So we used Eurostat data but the database starts with first data at the first quarter of 2008. However, Figure 6 shows that the Slovak labor market was influenced by the economic recession. Unlike the Czech Republic the economic recession showed a decline vacancy rate first. Afterward the unemployment rate increased and this increase was among the EU countries with the highest shift.
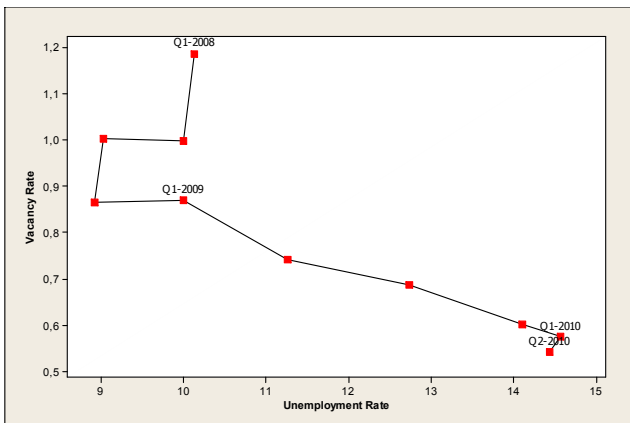
Source: OECD
Fig. 6 Beveridge Curve – Slovakia

IV. COINTEGRATION ANALYSIS

Cointegration is an econometric technique for testing the relationship between non-stationary time series variables. This technique is often used because of many macroeconomic time series are not stationary in their levels. If two or more series each have a unit root, that is I(1), but a linear combination of them is stationary, I(0), then the series are said to be cointegrated. Thus cointegration analysis is an extension of the simple correlation based analysis. The objective of this article is to analyze the effects of economic growth on unemployment in the Visegrád group countries.

The problem then is to find a way to work with two possibly non-stationary series in a fashion that allows us to capture both short run and long run effects. In more technical parlance, cointegration is the link between integrated processes and steady state equilibrium. If the time series are stationary in first differences than it is fulfilled requirements for the implementation of cointegration. Although we have two non-stationary time series, their common cointegration long-term shift in time moves towards some equilibrium.

We used Phillips-Perron (PP) test as the unit root test. We used this approach to test the null hypothesis that a time series in integrated of order 1. The PP method estimates the non-augmented DF test equation, and modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The PP test makes a non-parametric correction to the t-test statistic.

The PP test is based on the statistic [18]:

$$\bar{t}_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0} \right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\hat{\alpha}))}{2 f_0^{1/2} s} \quad (1)$$

where $\hat{\alpha}$ is the estimate, and t_α the t-ratio of α, $se(\hat{\alpha})$ is coefficient standard error, and s is the standard error of the test regression. In addition, γ_0 is a consistent estimate of the error variance. The remaining term, f_0, is an estimator of the residual spectrum at frequency zero.

Cointegration test is based on the determination of r cointegration relations in the VAR model. Cointegration is confirmed, if true, that r > 0. For testing purposes, we used Johansen cointegration test.

It is necessary to obtain an indication of optimal time delay before the implementation of Johansen cointegration test, which was in our case according to the Schwarz information criterion (SC) applied to estimate the VAR model of differentiation two periods. The SC criterion is defined as [13]:

$$SC = n^{k/n} \frac{\sum \hat{u}^2}{n} = n^{k/n} \frac{RSS}{n} \quad (2)$$

where RSS means the residual sum of squares, k/n is the penalty factor.

We used two test for determining the number of cointegration vectors: (i) the Trace test; and (ii) the Maximal Eigenvalue test.

The Trace test for the number of cointegrating vectors determines the number of cointegrating equations r:

$$(r) = -N * \sum_{i=r+1}^{m} \ln(1 - \hat{\lambda}_i) \quad (3)$$

where $\hat{\lambda}_i$ are the eigenvalues, N is

the number of observations, m the number of variables and r is the rank. We tested hypothesis by the Trace test for H0 r=0 (there are no cointegration vectors) and H1 r≤1 (there is

cointegration equation). We did not reject the H0 hypothesis because the Trace statistics was no larger than the 5% critical value).

Another test is the maximal Eigenvalue test:

$$(r, r+1) = -N * \ln(1 - \hat{\lambda}_{r+1}) \quad (4)$$

We tested hypothesis by the maximal Eigenvalue test for the same H0 and H1 like the Trace test. We also did not reject the H0 hypothesis because the maximal Eigen statistists was no larger than the 5 % critical value.

As the following step the Error Correction Term (ECT) should be estimated and test for stationarity. The result of the PP test for the unit root should confirm integration in order I(0). It means that the Y_t and X_t are cointegrated or that the regression of equation in no longer spurious, and we can also find the linear combination that connects Y_t and X_t in the long run [3] or we can say that there is a long-run equilibrium relationship between X and Y:

$$\hat{\mu}_t = Y_t - \hat{\beta}_1 + \hat{\beta}_2 X_t \quad (5)$$

Finally the Error Correction Model (ECM) should be estimated (if Y_t and X_t are cointagrated). Thus, we can express the relation between Y_t and X_t with an ECM specification as [3]:

$$\Delta Y_t = \alpha_0 - \alpha_1 (Y_{t-1} - \beta_1 X_{t-1}) + \beta_0 X_t + \varepsilon_t \quad (6)$$

where current changes in Y are a function of current changes in X (the first difference of X) and the degree to which the two series are outside of their equilibrium in the previous time period. Specifically, β_0 captures any immediate effect that X has on Y, described as a contemporaneous effect or short-term effect. The coefficient, β_1 reflects the equilibrium effect of X on Y. It is the causal effect that occurs over future time periods, often referred to as the long-term effect that X has on Y. Finally, the long-term effect occurs at a rate dictated by the value of α_1.

The data used in this study are Gross Domestic Product (GDP) at market prices expressed in EUR (reference year 2000 – at 2000 exchange rates) and a number of the unemployed labor force (UNLF). We used quarterly OECD and Eurostat data between the first quarter 2000 and third quarter 2010. GDP data were seasonally adjusted. The first step was to transform the these variables into logs (LGDP and LUNLF) and then establish that every variable is integrated of order one or I(1).

The first analyzed country was the Czech Republic. If we look at the GDP and UNLF data we can see that both variables evolved over time, particularly in response to the economic cycle.

Table 1 shows that the statistics for all the variables (GDP, UNLF) in the Czech Republic are greater than the critical

values at 5% levels from Phillip- Perron test (PP test). Thus, the results show that the null unit roots cannot be rejected, suggesting that all the variables are non-stationary in their level forms. The results of the first differenced variables show that the PP test statistics for all the variables are less than the critical values at 5% levels. That results show that all the variables are stationary after differencing once, suggesting that all the variables are integrated of order I(1).
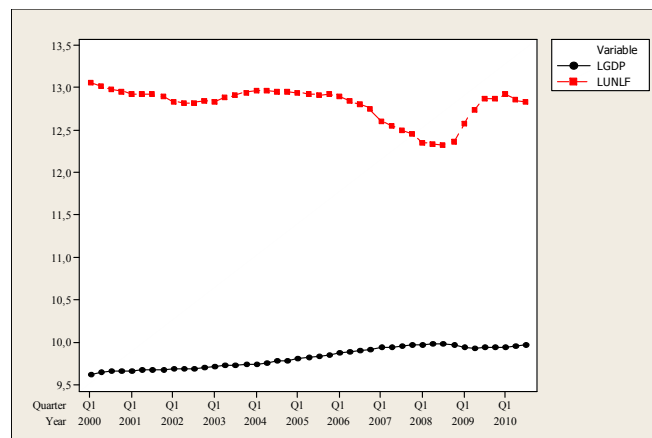
Source: OECD, Eurostat
Fig. 7 Log variables – the Czech Republic data

Table 1 Unit root test (PP) – Czech Republic

	Level form		First diference	
Variable	Test Statistic PP	5 % level	Test Statistic PP	5 % level
GDP	3.241106	-1.948886	-3.496629	-2.935001
UNLF	-0.36542	-1.948886	-2.932971	-1.949097

Note: PP: Phillip-Perron test.
Source: own calculation

Next step was to obtain an indication of optimal time delay before the implementation of Johansen cointegration test, which was in the case of the Czech Republic according to the Schwarz information criterion (SC) applied to estimate the VAR model of differentiation two periods.

Results of the unrestricted cointegration rank test can be seen in Table 2 and Table 3. Both the Trace test and the Maximum Eigenvalue test indicated that there is no cointegration at the 0.05 level in the case of the Czech Republic.
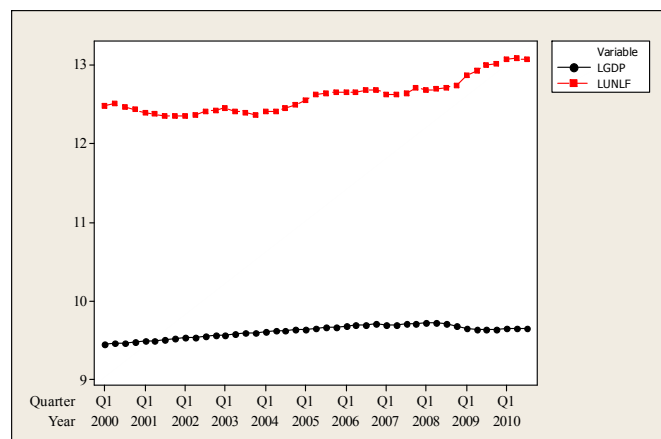
Table 2 Unrestricted Cointegration Rank Test (Trace) – Czech Republic

Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.216907	10.66853	15.49471	0.2327
At most 1	0.021964	0.888362	3.841466	0.3459

Table 3 Unrestricted Cointegration Rank Test (Maximum Eigenvalue) – Czech Republic

Hypothesized No. Of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.216907	9.780164	14.26460	0.2268
At most 1	0.021964	0.888362	3.841466	0.3459

Second analyzed country was Hungary. The results of the cointegration analysis were similar as in the case of the Czech Republic, in other words we failed to prove at least one cointegration relationship between the variables (see Table 5, Table 6).

Source: OECD, Eurostat
Fig. 8 Log variables – Hungary data

Table 4 Unit root test (PP) – Hungary

	Level		First difference	
Variable	Test Statistic PP	5 % level	Test Statistic PP	5 % level
GDP	-0.486641	-3.520787	-2.468996	-1.949097
UNLF	-1.864527	-3.520787	-3.754194	-1.949097

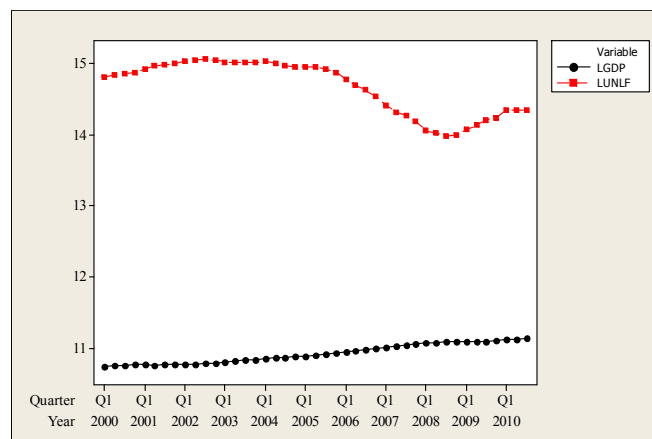Table 5 Unrestricted Cointegration Rank Test (Trace) - Hungary

Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.170095	11.18900	15.49471	0.2002
At most 1	0.089063	3.731264	3.841466	0.0534

Table 6 Unrestricted Cointegration Rank Test (Maximum Eigenvalue) - Hungary

Hypothesized No. Of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.170095	7.457739	14.26460	0.4365
At most 1	0.089063	3.731264	3.841466	0.0534

It was found one cointegration relationship at the 0.05 level

in the case of Poland (see Table 8 and Table 9), but the coefficient of the error correction term (ECT) was not statistically significant suggesting that LUNLF and LGDP are not cointegrated.

Source: OECD, Eurostat
Fig. 9 Log variables – the Poland data

Table 7 Unit root test (PP) – Poland

	Level		First difference	
Variable	Test Statistic PP	5 % level	Test Statistic PP	5 % level
GDP	5.883958	-1.948886	-4.550661	-2.935001
UNLF	-0.677159	-1.948886	-2.150775	-1.949097

Table 8 Unrestricted Cointegration Rank Test (Trace) - Poland

Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.309712	16.34913	12.32090	0.0101
At most 1	0.037366	1.523284	4.129906	0.2546

Table 9 Unrestricted Cointegration Rank Test (Maximum Eigenvalue) - Poland

| Hypothesized No. Of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.309712	14.82585	11.22480	0.0112
At most 1	0.037366	1.523284	4.129906	0.2546

The only country for which cointegration was confirmed, was Slovakia. Both the Trace test and the Max-eigenvalue test indicated one cointegration equation at the 0.05 level. Moreover, the coefficient of the ECT was statistically significant suggesting that LGDP and LUNLF are cointegrated. Cointegration equation has the following form:

$$LGDP = -0,256086*LUNLF + 0,009841*trend \quad (7)$$

Explanation of the trend is following: with each passing quarter, an increase of the product of 0.009841% is recorded, and if the increase in the number of the unemployed labor force by 1% leads to decrease of GDP by one-quarter percent.

$$\Delta LGDP_t = 0.012522 - \Delta LGDP_{t-1}*0.105934 + \Delta LGDP_{t-2}*0.035312 - \Delta LUNLF_{t-1}*0.055158 + \Delta LUNLF_{t-2}*0.061434 + 0.05621*\varepsilon_t \quad (8)$$

It means that about 5.6 % of disequilibrium is corrected each quarter by changes in GDP.
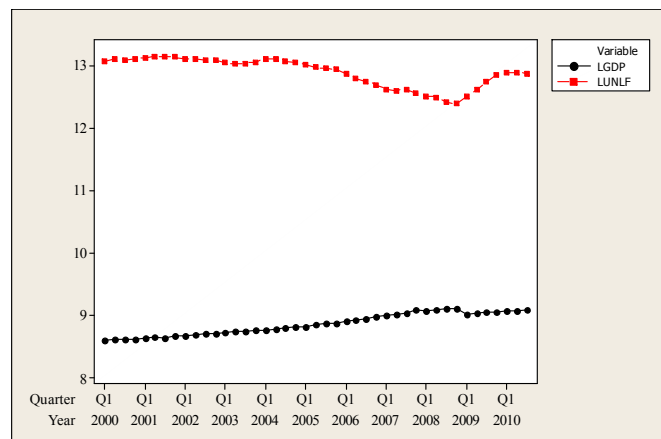
Source: OECD, Eurostat
Fig. 10 Log variables – Slovakia data

Table 10 Unit root test (PP) – Slovakia

Variable	Level		First difference	
	Test Statistic PP	5 % level	Test Statistic PP	5 % level
GDP	3.823359	-1.948886	-6.298179	-2.935001
UNLF	-0.381525	-1.948886	-2.808014	-1.949097

Table 11 Unrestricted Cointegration Rank Test (Trace) - Slovakia

Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.445375	26.04419	25.87211	0.0476
At most 1	0.059779	2.465630	12.51798	0.9330

Table 12 Unrestricted Cointegration Rank Test (Maximum Eigenvalue) - Slovakia

Hypothesized No. Of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.445375	23.57856	19.38704	0.0116
At most 1	0.059779	2.465630	12.51798	0.9330

V. CONCLUSION

We have to keep in mind two important factors in the case

of conclusions regarding the analysis of the Beveridge curve shifts: (i) shift to the right and down is considered negative (rising unemployment and declining number of unfilled jobs); (ii) we must take into account the scale of the axes, respectively, in the range of values of the axes. For most Visegrád group countries, a relationship can be seen between shifts of the Beveridge curve and the business cycle. First, the Beveridge curve shifted toward the left and upward (number of unfilled jobs was increasing while the unemployment rate was decreasing) in the period 2006-2008. Since the second half of 2008, the whole economy of the European Union was hit by the economic crisis. The Beveridge curve shifted toward the right (vacancy rate declined and the unemployment rate rose) during this period. The next period, albeit with less intensity, which also confirms dependence of the Beveridge curve shifts on the business cycle is the period 2000-2004. The exception is Hungary - its Beveridge curve shifted to the right for the most of the observed period. This development was mainly due to internal economic problems of this country.

In the last, empirical, part of the paper, we examined the possible cointegration between GDP and UNLF. On the basis of the unit root test, we found that in all countries, both variables are stationary except for their first differences. This result allowed us to continue and after we establish period of lag (two), we implemented the Johansen cointegration test. This test showed that in the case of the Czech Republic and Hungary there is no cointegration relationship. In the case of Poland was evident, although one cointegration relationship, ECT, however, showed that residues are not stationary at I (0). Cointegration relationship (a negative effect of unemployment on output) thus has been demonstrated only in the case of Slovakia.

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