

# Estimating the Regional Natural Rate of Unemployment: the Evidence from Slovakia

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*Abstract:* The paper deals with development of the regional unemployment rate in Slovakia. The unemployment rate differed significantly among the Slovak NUTS 3 regions during the period between 2005 and 2012. According to previous studies high unemployment is caused by drop in economic performance or by some structural problems in the region. During economic growth the unemployment rate was decreasing and during economic downturn it was increasing. We used monthly seasonally adjusted data during the observed period between the years 2005 and 2012. In total, we had 96 observations. We also applied the Hodrick-Prescott filter for estimating the natural rate of unemployment. This method is often used for estimating the potential output and is possible to use in the case of unemployment. Our empirical results show that in most regions the real unemployment rate was lower than the natural rate of unemployment during the pre-crisis period. In other words, it means that the Slovak labour market was in positive unemployment gap. However, this gap was not the same in all regions.

*Key-Words:* Hodrick-Prescott filter, natural rate of unemployment, NUTS 3, regional disparities, Slovakia.

## 1 Introduction

One of the key macroeconomic indicators is the unemployment rate which shows labour market performance. The traditional understanding means that if this indicator is increasing, labour market performance is worsening and vice versa. In addition, labour market development is closely associated with the economic cycle and we can say that economic performance influences the situation on the labour market. A deterioration of labour market performance could be also associated with a widespread expansion of the informal economy [3]. Moreover, sufficient labour market performance is subject to a corresponding economic performance. The past economic crisis has hit the European Union Member States' labour markets especially hard. Unemployment has been a recurrent problem in most European Union Member States including the Slovak Republic for the last decades and it has become a major concern among not only policymakers but also the society as a whole.

The aim of this paper is to compare labour market development in the Slovak NUTS 3 regions in the period between the years 2005 and 2012. We also compare development of the registered unemployment rate in comparison with the natural rate of unemployment. For this purpose, we applied the Hodrick-Prescott filter as the method how to

estimate the natural rate of unemployment. The paper is structured as follows: the introductory section deals with methodological-theoretical aspects of the natural rate of unemployment and its relationship with the real unemployment rate and economic performance. In the second part, we described the method (the Hodrick-Prescott filter) used in the paper and in the third, empirical, section, we compared labour market development among the Slovak NUTS 3 regions and the last part concludes.

## 2 Theoretical background

The concept of the natural rate of unemployment (NRU) represents the hypothetical unemployment rate consistent with aggregate production being at the "long-run" level. This level is consistent with aggregate production in the absence of various temporary frictions such as incomplete price adjustment in labour and goods markets. The natural rate of unemployment therefore corresponds to the unemployment rate prevailing under a classical view of determination of activity. It is mainly determined by the economy's supply side, and hence production possibilities and economic institutions. If these institutional features involve permanent mismatches in the labour market or real wage rigidities, the natural rate of unemployment may feature involuntary unemployment.

Romer [14] argues that the development of the theory of the natural rate of unemployment came in the 1960s where economists observed that the Phillips-curve relationship between inflation and unemployment began to break down. Until then, it was widely believed that a stable negative relation between inflation and unemployment existed. This belief had the policy implication that unemployment could be permanently reduced by expansive demand policy and thus higher inflation. Nevertheless, if we look at the original Friedman's paper [1] we do not find a clear, well-defined characterization of this concept, but rather description of some features that it should have. This resulted in the hysteresis hypothesis, which states that cyclical fluctuations in the labour market might affect the unemployment rate permanently and might lead to a long-term persistence. This means that the unemployment should be an integrated process (see [3]).

According to Weiner [18] when the economy is at the natural rate of unemployment, inflation tends to be constant from one year to the next. Individuals come to expect this inflation rate and base their decisions on it. Any attempt to use monetary or fiscal policy to reduce unemployment below the natural rate of unemployment ultimately results in higher inflation. Under such a scenario, aggregate demand increases, prices rise, but wages initially lag behind. As a result, firms have an incentive to hire more workers to produce more output and the unemployment rate declines. The decline in unemployment is temporary, however, because workers eventually demand higher wages. The increase in inflation, in contrast, is permanent. The central bank can set the inflation or the economic cycle. If the central bank follows the inflation variability, the society must tolerate the output gap variability. On the other side central bank can set the economic cycle goal. It means the central bank minimises the output gap variability (for more detailed analysis see Kotlán [10]).

The OECD distinguishes between a long-run structural rate of unemployment (NRU), corresponding to Friedman's original natural rate, determined by economic fundamentals, and the non-accelerating inflation rate of unemployment (NAIRU) as a short-run phenomenon. The latter may differ from the NRU, when structural or demand shocks occur. In general, the NAIRU is considered an extension of Friedman's natural rate when labour markets are not competitive and most of the literature overlaps the two concepts (see [8]).

### 3 Methodology

Based on Němec [12], Tasci [16], Tvrdon, Tuleja and Verner [17] and da Silvia Filho [15] we applied the Hodrick-Prescott filter (HP filter) for estimation natural rate of unemployment (NRU). This method is quite frequently used to filter the trend and the cyclical time series. To estimate the natural rate of unemployment, it is necessary to have just the time series of the unemployment rate – in our case the registered one. The only input parameter for the optimal filter, we have to specify, is an appropriate smoothing constant  $\lambda$ . It is defined as the ratio of dispersion of shock causing cyclical fluctuations and shocks affecting the growth trend [7].

The filter is characterized by this formula [6]:

$$\text{Min} \left\{ \sum_{t=1}^T (\ln U_t - \ln U_t^*)^2 + \lambda \sum_{t=2}^{T-1} [(\ln U_{t+1}^* - \ln U_t^*) - (\ln U_t^* - \ln U_{t-1}^*)]^2 \right\} \quad (1)$$

where  $U$  denotes the registered unemployment rate,  $U^*$  is the natural rate of unemployment,  $\lambda$  is a parameter determining the smoothness of the trend smoothing. For  $\lambda = 0$  the natural rate of unemployment is equal to the real unemployment rate, for  $\lambda \rightarrow \infty$  the trend will be a straight line.

When choosing a value of smoothing constant  $\lambda$ , we then drew on generally accepted recommendations – experts consider optimal value 14400 for monthly data, 1600 for quarterly data and 100 for annual data (Rozmahel [13], Gerlach and Yiu [2], Zimkova and Barochovský [19] or Hájek and Bezděk [6]).

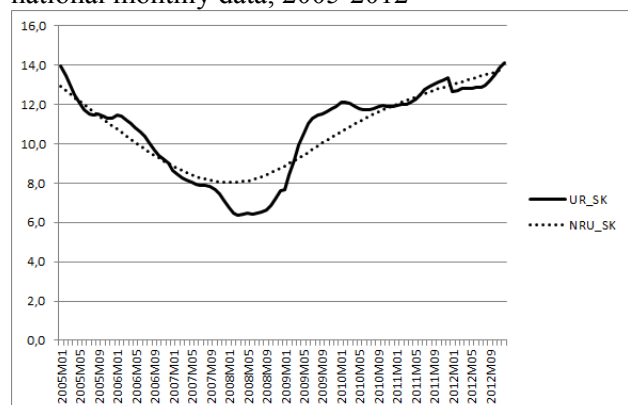
Monthly national and regional (NUTS 3 level) unemployment rate between the years 2005 and 2012 obtained from Ministry of Labour, Social Affairs and Family of the Slovak Republic database were applied. The standard ANOVA (analysis of variance) was carried out in order to determine the presence of monthly seasonality in the unemployment rates series. Unemployment rates usually exhibit significant seasonality. There are several methods and techniques to adjust time series, e.g. Census X12 and TRAMO/SEATS. The first program is produced and widely used by the U.S. Census Bureau.

TRAMO (Time series regression with ARIMA noise missing observations and outliers) and SEATS (Signal extraction in ARIMA time series), was developed by Gómez and Maravall [4]. For more details to seasonal adjustment and TRAMO/SEATS method see Gómez and Maravall [5]. TRAMO preadjust the series to be adjusted by SEATS [11]. Both of them are officially used by Eurostat. Hence this method was applied to seasonal adjustment.

## 4 Empirical results

Figure 1 shows development of the real unemployment rate and the estimated natural rate of unemployment at the national level. As seen from figure, the real unemployment rate was below the natural rate of unemployment in the pre-crisis period (from January 2007 till February 2009). We can also say that the labour market reacted on lower economic performance with some delay. However, the unemployment rate increased sharply at the beginning of the crisis. The period from March 2009 till February 2010 can be characterized as the economic crisis with relatively high national unemployment rate which was higher compared to the estimated natural rate of unemployment. Signs of recovery started during the year 2010 when the real unemployment rate was close to the level of the natural one. Nevertheless, the both the real unemployment rate and the natural rate of unemployment were higher in the comparison with the pre-crisis period. Moreover, we can say that the levels of both rates were still growing.

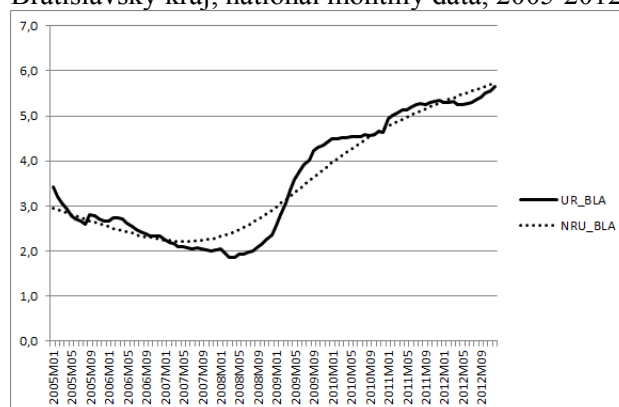
Fig. 1: Slovakia natural and real unemployment rate, national monthly data, 2005-2012



Source: Ministry of Labour, Social Affairs and Family of the Slovak Republic

One of the main questions of this paper is if this development has experienced rest of the regions. As written above there are 8 NUTS 3 regions in the Slovak Republic. These regions have similar economic level with the exception of the capital city of Bratislava. However, their competitiveness is different (for more detailed analysis see [9]).

Fig. 2: Natural and real unemployment rate in Bratislavský kraj, national monthly data, 2005-2012

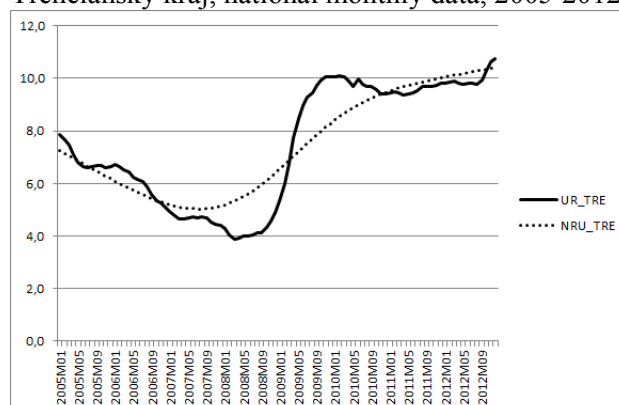


Source: Ministry of Labour, Social Affairs and Family of the Slovak Republic

Firstly, we have chosen region with the lowest unemployment rate (Bratislavský kraj). Both the real unemployment rate and the estimated natural rate of unemployment were significantly lower than in the rest of regions. This is mainly due to the position of the capital city which is the heart of Slovak economy. Its position is similar to which has Prague in the Czech Republic.

Economy of this region is mainly focused on the tertiary sector which consists of sectors with higher added value. Moreover, the labour force in the Bratislava region is significantly higher qualified in comparison with other regions (together with traditional skills and abilities of professional flexibility).

Fig. 3: Natural and real unemployment rate in Trenčianský kraj, national monthly data, 2005-2012



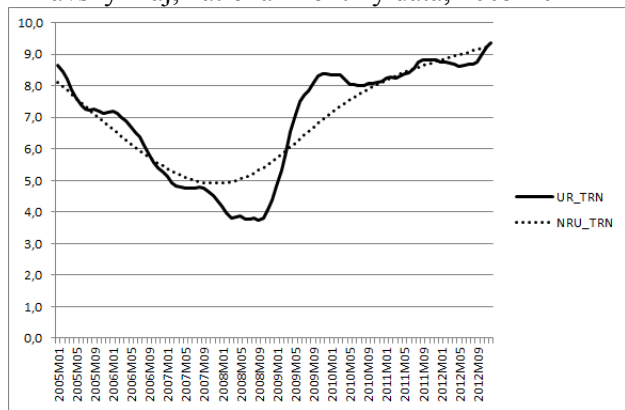
Source: Ministry of Labour, Social Affairs and Family of the Slovak Republic

The situation in the rest of the regions was similar – the real unemployment rate was remarkably lower than the natural rate of unemployment in the pre-crisis period. After the outbreak of the crisis in the real economy, the

unemployment rate increased rapidly and was higher during the crisis compared with the natural rate of unemployment.

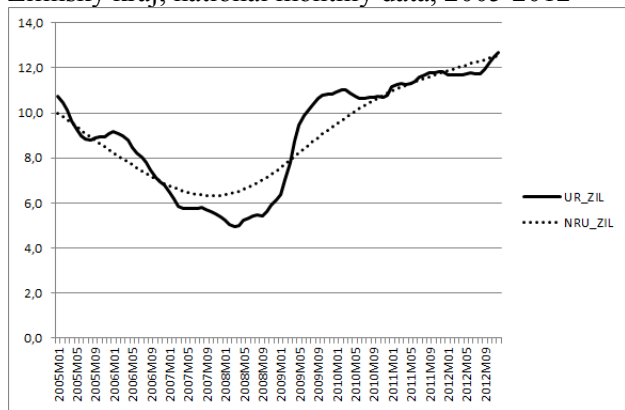
We can find four regions that had similar development of labour market performance – Trenčianský, Trnavský and Žilianský kraj. The real unemployment rate attacked very low level (5 %) on the peak of economic growth. However, labour market performance deteriorated very quickly and the both the real unemployment rate and the estimated natural rate of unemployment reached levels at the beginning of the observed period and even they were higher (see Fig. 3, 4, 5 and 6).

Fig. 4: Natural and real unemployment rate in Trnavský kraj, national monthly data, 2005-2012



Source: Ministry of Labour, Social Affairs and Family of the Slovak Republic

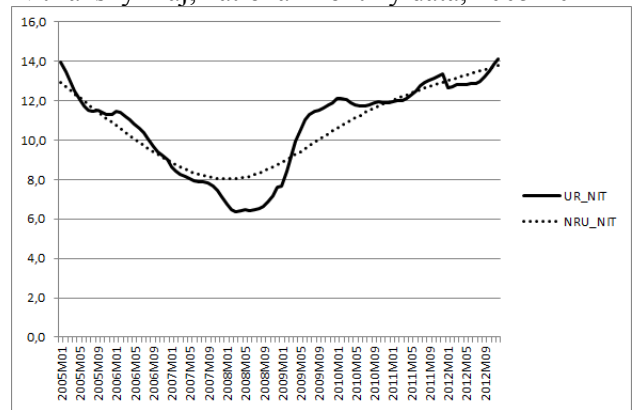
Fig. 5: Natural and real unemployment rate in Žilinský kraj, national monthly data, 2005-2012



Source: Ministry of Labour, Social Affairs and Family of the Slovak Republic

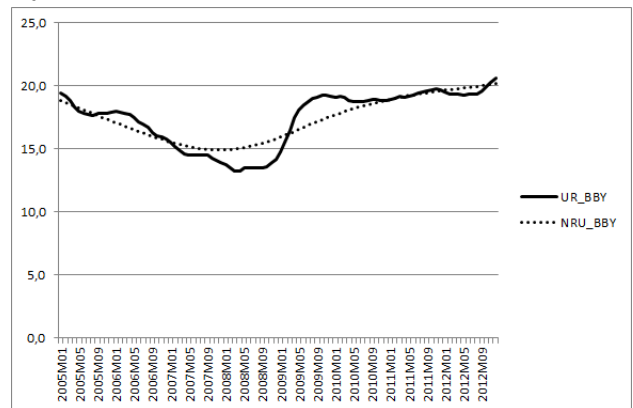
In addition, these regions have an advantage that is based on its position which is closed to the capital city. Moreover, e.g. Žilinský region is also attractive for direct foreign investment. Lower unemployment rate in comparison with other regions is mainly determined by the strong position of the automotive industry in this region.

Fig. 6: Natural and real unemployment rate in Nitrianský kraj, national monthly data, 2005-2012



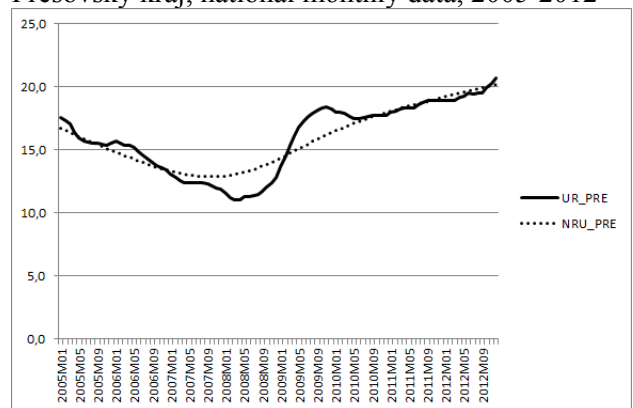
Source: Ministry of Labour, Social Affairs and Family of the Slovak Republic

Fig. 7: Natural and real unemployment rate in Banskobystrický kraj, national monthly data, 2005-2012



Source: Ministry of Labour, Social Affairs and Family of the Slovak Republic

Fig. 8: Natural and real unemployment rate in Prešovský kraj, national monthly data, 2005-2012

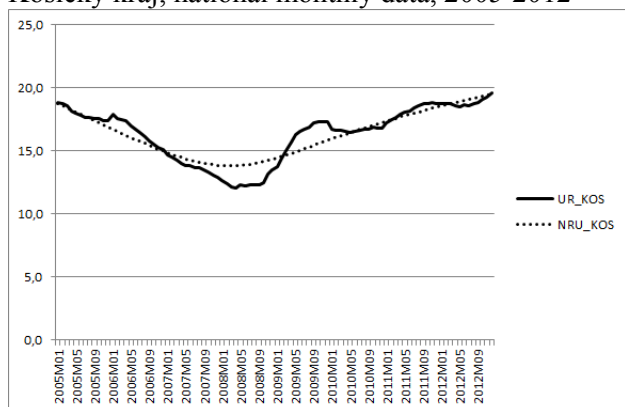


Source: Ministry of Labour, Social Affairs and Family of the Slovak Republic

Figures 7, 8 and 9 illustrate situation in the most problematic Slovak regions – Banskobystrický, Prešovský and Košický regions. Economic

transition and restructuring of production after 1989 (loss of some traditional industries and sectors – especially mining and quarrying, metallurgy and some engineering fields, construction and chemical industry), among other things led to extensive changes in industry structure and changes in the distribution of economic activities of the regions' economic base. Firstly, both the real unemployment rate and the natural rate of unemployment were significantly higher than in other regions during the observed period. However, deterioration of labour market performance did not have so dynamic development. Secondly, an interesting fact is that levels of both rates did not differ remarkably, especially in the pre-crisis period. It means that some structural problem still existed in these regions.

Fig. 9: Natural and real unemployment rate in Košický kraj, national monthly data, 2005-2012



Source: Ministry of Labour, Social Affairs and Family of the Slovak Republic

If most of the unemployed labour force was without job longer than a year, it essentially has to have a number of undesirable consequences in these regions as well as in the relation with other regions or government, which can have partly social, economic or national meaning. Possible reasons for this state were a relatively mild approach to providing social benefits, opportunities to secure income in another way (informal economy) and a low level of education of (mostly long-term) unemployed persons in the country, which substantially reduces the chances to find a job. For example, the unemployment rate of workers with tertiary education was relatively negligible – 3.2 % in 2006, while that of persons having completed only primary education reached as much as 48 % [9]. As in other V-4 regions, widespread social exclusion prevents the Roma population from accumulating labor market relevant skills and contributes significantly to very high unemployment

and low income among this ethnic minority. If the share of Roma population is remarkably higher than in other regions we can assume that the data were affected by this group significantly. These regions had also migration losses between regions, particularly among college-educated population.

## 4 Conclusion

The aim of this paper was to examine development of labour market performance, especially in the regions during the period 2005–2012. We compared development of the registered unemployment rate and the estimated natural rate of unemployment. We applied the Hodrick-Prescott filter (HP filter) for estimation the natural rate of unemployment. This method is quite frequently used to filter the trend and the cyclical time series. Research in this study is based on regional monthly data between the years 2005 and 2012 (registered unemployment rate) which were published by Ministry of Labour, Social Affairs and Family of the Slovak Republic. As is evident from the analysis the Slovak labour market was in a relatively strong positive unemployment gap before the crisis of the real economy. We argue that the decline of labour market performance during the crisis was the first step to return to a state of long-term equilibrium. This argumentation may seem at least controversial, but if we look at the situation before the outbreak of the economic crisis, then we can see that the Slovak economy was in a relatively strong expansion. This resulted in usage the production factors (especially labour) with the too much intensity in the Slovak Republic, and it was untenable in the long-run view. We found out the difference between the estimated natural rate of unemployment and the unemployment differed among the regions. We found that the positive unemployment gap was lower in the problematic regions like the Banskobystrický, Košický and Prešovský region. These findings suggest that these regions still have to face some structural problems and the labour market is not as flexible as in the rest of regions. In addition, we also found that the natural rate of unemployment has shifted permanently higher in comparison with the pre-crisis period.

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