Eng. Emilie JAŠOVÁ, PhD Student
E-mail: ekonomka_2@hotmail.com
The University of Economics, Prague

REFLECTING THE DEMAND SHOCKS IN THE NAIRU OF THE VISEGRAD GROUP COUNTRIES AND THE CONSEQUENCES FOR THE ECONOMIC POLICY

Abstract. The paper extends the standard model, as adapted by S. Sekhon, for the inflation estimate with the demand shocks arising from our defined subjective discount rate of the consumer. Extending the commonly used model for estimating the inflation has revealed a moderately strong effect of the estimated demand shock on the NAIRU in the V4 countries. The analysis has also found a rather weak effect of the demand shock in the V4 countries in the period of financial and economic recession and in the period immediately following this substantial system-level change. Nevertheless, the proposed recommendations for the economic policymakers imply that it should more encouragement for the spillover of positive expectations in the real economy and the NAIRU values. On the other hand, it should prevent the occurrence or transfer of negative emotions on the labour market and act on the existing vague expectations.

Keywords: unemployment gap, demand shocks, Kalmanfilter, Phillips curve, NAIRU.

1. Introduction

According to Bělohradský (2013), it is possible to understand the description of the world only in the case of describing social relations, attitudes and objectives. Mlčoch et al. (2000) perceive as the transformation basis the comprehensive strategy of modernizing the society and economy based on reforms, institutional changes, and restructuring according to structural and regional policies. After Stock and Vogler-Ludwig (2010) basic categories were the economic growth, inflation and unemployment rate. The relationships between these indicators may then be understood only by means of the concepts such as the Phillips curve (hereinafter only as the "PC"), Non-Accelerating inflation rate of unemployment (hereinafter only as the "NAIRU") or the Okun's law.

_____

2. Overview of the development of concepts of substitution between inflation and unemployment

According to Humphrey (1985), the concept of substitution between inflation and unemployment was introduced by authors such as Law, Thornton, Attwood, Mill, Fischer, Tinbergen, Klein and Goldberger, and Brown and Sultan, who are considered as predecessors of the modern version of the PC. In addition, this list needs to be extended with authors who developed the modern version of the trade-off between inflation and unemployment. In particular, this group includes Samuelson and Solow (1960), who transferred the Phillips' relationship into the relationship with different unemployment levels that were necessary for every degree of the price level change. In addition, we speak of Phelps (1967), who use the time path of the aggregated unemployment to derive the time path of the current inflation rate. Friedman (1968) was aware of two limitations of the monetary policy arising from the impossibility to fix the interest rate and unemployment rate for a longer period of time. Modigliani and Papademos (1975) developed a concept of non-inflation rate of unemployment (hereinafter only as the "NIRU) according to which the inflation declines if unemployment is above it. Humphrey considers Phillips (1958) to be the founder of the modern PC version. The strong curvature in the section with low unemployment leads to a lower average wage growth at constant unemployment than in the case of unemployment oscillating around such a level.

This paper will follow the concept called as the NAIRU by Tobin (1997). Creating this concept, the author attempted to differentiate from the term of the natural unemployment rate. The NAIRU is thus a product of macroeconomic balancing of pressures for inflation growth on markets with excessive demand and pressures for inflation decline on markets with excessive supply. The author considers the NAIRU as part of the Keynesian model. His successors include, for instance, Akerlof et al. (1996) and Ball and Moffitt (2001).

3. Groups of methods and corresponding models for estimating the NAIRU, including the extension of the standard model with our model of demand shocks

Before application in the course of political decision-making by economic policy makers, the unobservable variable of the NAIRU needs to be quantified(Richardson et al., 2000). According to these authors, the methods for estimating the NAIRU are divided into three basic groups. Within the structural methods, the NAIRU is obtained only on the condition that the market are fully or at least partially balanced. The representatives of the purely statistical techniques estimate the NAIRU by separating the effect of the trend (being the NAIRU) and the effect of the cycle from the actual unemployment rate. The third group, called by the authors the method of the reduced form, estimates the NAIRU using the behavioural equations and identification limitations for fluctuations in the NAIRU development and unemployment gap.Fabiani and Mestre (2000) include in the

group of purely statistical methods the Hodrick-Prescott filter (hereinafter only as the "HP filter") and Baxter-King filters. According to these authors, the group of the reduced form methods consists of the Kalman filter, which, apart from the inflation equation, includes the assumption of the law of the NAIRU variability.

McAdam and McMorrow (1999)consider as the most frequently used methods for estimating the NAIRU the PC method extended with expectations .Using this system, the NAIRU estimate is perceived as a calculation of the balanced unemployment rate or the unemployment rate in the permanent state (i.e. permanent inflation).The NAIRU is then located at the point where there is a stable relationship between the unemployment deviation from the NAIRU and unexpected inflation. According to the authors, the leading systems of the NAIRU estimates include the Gordon's "Triangle" model. The model follows the unemployment rate which is consistent with permanent expectations (the PC extended with expectation).The triangle method serves as the most common expression of it. In this so-called Gordon's framework, the inflation rate is explained by the inflation expectation, demand conditions represented by the unemployment gap, and the supply shocks.

According to Sekhon (1999),the standard inflation model may be expressed as follows:

$$\pi_t - \pi_t^e = \beta(u_t - \bar{u}_t) + \partial X_t + v_t$$

where π_t represents the estimate of the actual inflation rate, π_t^e represents the expected inflation rate, u_t expresses the unemployment rate, $\bar{u}_t$ means the NAIRU, X_t represents other regressors controlling supply shocks in the economy (in particular, this may include the exchange rate, import prices, indirect taxes, and the Brent oil price), and v_t is the error member.

The demand-related psychological factor is a representative of another group of regressors which needs to be added to the existing standard model. In addition to the inflation expectation, demand incentives represented by the unemployment gap, and supply shocks, the Gordon's Triangle model (Gordon, August 1996), as adapted bySekhon (1999), also contains the representative of demand shocks (see εY_t in equation below). The input quantities of the newly extended model thus include four indicators: unemployment, inflation, supply shocks, and demand shocks in terms of the CDI indicator as a representative of the demand-related psychological factor.

After including the new group of regressors controlling the demand shocks, the form of the newly created combined quadrate model of inflation is as follows:

_____

$$\pi_t - \pi_t^e = \beta(u_t - \overline{u}_t) + \partial X_t + \varepsilon Y_t + v_t$$

where π_t represents the estimate of the actual inflation rate, π_t^e represents the expected inflation rate, u_t is the unemployment rate, $\overline{u}_t$ is the NAIRU, X_t means the regressors controlling supply shocks (apart from the oil price, import prices, and the exchange rate), Y_t is the new variable representing the regressors controlling demand shocks in terms of the CDI indicator, and v_t is an error member.

4. Characteristics of the postmodern and modern society and economy, including the transformation process and the definition of the demand shock

This chapter will deal with the analysis of the postmodern and modern society and economy, including the transformation process. On the basis of its results and the result of the summary of the theory of the subjective discount rate, we will infer the current discount indicator to be used for determining the effect of demand shocks on the labour market and possibly on the economy as a whole.

4.1 Characteristics of the postmodern and modern society and economy, including the transformation process

According to Bělohradský (2013), the current state of society is based on the decline in the responsiveness to criticism, thus producing no alternative to the system. Public space, affected for instance by entertainment industry, results in the distortion of experience and arguments corresponding to the governing oligarchy. Understanding the description of the world is possible only upon mapping social relations, attitudes and objectives. Shaping the modern civil society is based on people's self-confidence, rational logic of public administration, market, and criticism of historical prejudices. The modernity is given by the permanent change in attitudes, relativizing everything, increasing subjectivity, and the change in the cultural and social fashion. The communication abundance disintegrates the communication process and causes the leak of relevant information.

Mlčoch et al. (2000) deal with modernisation in relation to the transformation of the soviet-type society and economy into the society based on the western-style market economy. The transformation is based on the strategy of modernising the society and economy, which is based on reforms, institutional changes, and restructuring according to structural and regional policies. The primary role is taken by the institutional changes as they create conditions for modernisation in other areas of societal and economic development. Instrumental rationality based on egoistic rationality of economic causes the detachment of economic behaviour from the moral foundations of the market economy.

_____

4.2 Definition of the demand shock

There are a number of authors dealing with discounting, both in terms of the theory (Ramsey, 1928; Samuelson, 1937,etc.), and on the basis of empirical studies (Hausman, 1979; Loewenstein, 1987, and many others). In their contributions, these authors focused on the development of the subjective discount rate and deriving the function of the subjective discount factor of the consumer under the ceteris paribus conditions, which may not be anticipated in accordance with previous paragraphs. Nevertheless, Rotschedland Jašová (2014) took a different approach to the subjective discounting rate. They consider the subjective discount rate to be variable on the grounds of several factors: psychological, sociological, institutional and economic ones. For these reasons, they perceive the theoretical model of the subjective discounting factor as purely theoretical and unsuitable for an economic or econometric analysis. As a result, in their contribution, they introduced a new quantity that should replace the subjective discount rate (the so-called "current discount indicator", CDI).

The equation for calculating the CDI is as follows:

$$CDI_t = \left(\frac{\alpha_t}{\alpha_{t-1}} - 1 \right) * 100 \,, [CDI] = \%$$

where the CDI is the current discount indicator, α_t is the ratio of the amount of loans to the amount of deposits at time t, and α_{t-1} is the ratio of the amount of loans to the amount of deposits at time t-1.

The quantity expresses the relationship of households to current and future consumption, while this relationship is derived indirectly from macroeconomic data.

5. Detailed analysis of the effect of the demand shock on the unemployment rate and NAIRU in terms of the labour market in the V4 countries

This section will compare the NAIRU estimated using the Kalman filter method. In the case of the NAIRU estimate without the demand shock, we used the standard Gordon's "Triangle" model, as adapted by the S. Sekhon. In the case of the NAIRU containing the effect of the demand shock, we extended this classical model with the current discount indicator (CDI), while we maintained the commonly applied PC concept extended with expectations.

According to the research (Kadeřábková and Jašová, 2012), this method will provide the NAIRU variable in time, which will allow depicting the volatile environment on the labour market and in the economy as a whole. This method reflects the development in small open economies, and thus in the environment of

_____

permanent economic and societal changes. In this respect, we use the previously well-established smoothing of the estimated NAIRU in the amount of 0.6, which (unlike the commonly used smoothing coefficient of 0.2; Beneš and N'DIAYE, 2004) depicted satisfactorily the changes in the trend development of the transitional economy or economies in the period of cyclical turbulence.

The price development in the V4 countries was represented by the deflator of the household consumption according to the national accounts. Their time series were transformed in such a manner that they should express the adapting shaping of expectations (annual change at time t – annual change at time t-1). The description of the development on the labour market makes use of the unemployment rates defined by the International Labour Organization (ILO)in %.

In the case of the original model and the models extended with the demand shock (CDI), the Kalman filter made use of the annual change in the deflator of household consumption (%) as a dependent variable. The fixed regressors in the original model were represented by the delayed values of the deflator of household consumption, the unemployment rate with and without the delay (%), the delayed annual change in the exchange rate (%), and the annual change in import prices (%) without delay. The fine-tuned models following the extension with the demand shock also include, as explanatory variables, the annual changes in the Brent oil prices (%) without delay and the annual change in indirect taxes (%) without delay. The overview of parameters, p-values, and selected characteristics of the models of the NAIRU estimate for individual V4 countries with and without the demand shock is included in the Appendix, specifically in Table 1 and Table 2.

As we also work with indirect indicators, they will first be compared, in detail, with the development of the relevant indicators which are commonly officially published (see Appendix, Table5). In the case of the CDI, it was the comparison with the time series of the household consumption and the real available income. In the case of the NAIRU, it was the comparison with the time series of the unemployment rate and the GDP as well.

When analysing the relationship between the development of the demand shock and the labour market and the NAIRU, in particular, several possible scenarios were revealed, describing the connection of the character of the perception of the present and future by the consumer, represent by the CDI, with the development of the unemployment rate and its two types, i.e. structural unemployment (in our analysis, consciously omitting frictional unemployment, it is identical to the NAIRU development) and cyclical unemployment (Brožová, 2006).

The first scenario describing the relationship of the demand shock and the labour market is that **there is no annual change in the CDI**, which implies that the consumer has the relationship to the future and present on the same level, and at the same time, **the unemployment rate annually grows or stagnates on the level of the previous year, the NAIRU shows an annual decline, and there is cyclical unemployment in the economy**.

_____

In the *second scenario* of the relationship of the demand shock and the labour market, there is **an annual growth in the CDI**, and the consumer has an increasing tendency to prefer current consumption to future consumption, being willing to take more loans (as they believe in better future and they are not afraid that they will be unable to repay the loans in the future).**At the same time, there is an annual decline in the NAIRU and the unemployment rate.**

In the *third scenario* of the relationship of the demand shock and the labour market, there is **an annual decline in the CDI**, and the consumer has an increasing tendency to prefer future consumption to current consumption, not being willing to take more loans, while opting for making higher reserves (as they do not believe in a better development in the future or the indebtedness has reached the level in which it is impossible to run into more debt).**If there is a simultaneous annual increase in the unemployment rate and the NAIRU, we speak of the presence of structural unemployment. If there is an annual increase in the unemployment rate with an annual decline in the NAIRU, it is possible to forecast the existence of cyclical unemployment in the economy.**

The fourth scenario of the relationship is the so-called first extreme case of excessive optimism in which there is **an annual growth of the CDI**. The consumer increases the preference of consumption and takes loans (they believe in better future) **even though there is an annual growth of the unemployment rate**. **The annual decline in the NAIRU then implies the presence of cyclical unemployment, while the annual increase in the NAIRU structural unemployment**.

The fifth scenario of the relationship is the so-called second extreme case of excessive pessimism. There is **an annual decline in the CDI**, the consumer increases excessively the preference of saving (they do not believe in better future), **while there is an annual decline in the unemployment rate and the NAIRU shows an annual decline, as well**.

5.1 The development of the NAIRU according to the standard model and following its extension with the demand shock in the Czech Republic

In the period of Q4 1999 to Q4 2001, the CDI corresponded to the development of household consumption (see Appendix, Table3). The original NAIRU value grew annually by 3.7% and by 4.1% upon reflecting the CDI. Due to the fact that the unemployment rate also grew annually in this period, the presence of structural unemployment was detected. It thus corresponds to scenario No. 4, the so-*called first extreme case of excessive optimism*. This optimism did not have any effect on the NAIRU values development, as after including the CDI, it grew by 0.4% compared to the basic scenario.

In the following period (from Q4 2007 to Q3 2008), the CDI corresponded to the development of household consumption. The original NAIRU grew annually

_____

by 1.4% and the CDI-extended version by 1.7%. With the annual decline in the unemployment rate of 1.5% in this period, one may observe an inconsistency between the model NAIRU estimate and the actual economy data, which prevents formulating an unambiguous conclusion on the CDI's effect on the labour market. In the case of the positive NAIRU verification, it should thus correspond to *scenario No. 2*. After including the CDI, the NAIRU value, which must be perceived as indicative in this case, grew annually more than the NAIRU value from the original model by 0.3%, which however does not correspond to the established positive perception of the future development among consumers, while supporting doubts on the correctness of the NAIRU estimate using the model.

Even though in the whole period from Q4 2008 to Q4 2010, the CDI declined annually by 7.7% and the household consumption grew annually by 0.8%, we will consider the conclusions as unambiguous owing to the annual growth of the real available income in this period. The original NAIRU dropped annually by 2.3% and the CDI-extended version by 2,5%. In this period, the unemployment rate grew annually by 1.6%, thus implying the occurrence of cyclical unemployment in the economy. This case thus corresponds to *scenario No. 3*. After including the CDI, the NAIRU value dropped 0.2% more than in the case of the original NAIRU, which does not correspond to the negative perception of the future among consumers.

In the period of Q1 2011 to Q2 2012, the CDI fully corresponded to the development of household consumption. The original NAIRU grew annually by 2.4%, while the CDI-extended version by 2.6%. However, this development did not correspond to the development of the actual unemployment rate, which implied an inconsistency between the NAIRU's model estimate and the real economy data, as well as the difficulty in usability of the conclusion of the CDI's effect on the NAIRU. In the case of the positive NAIRU verification, this period would then correspond to *scenario No. 5, the so-called second extreme case of excessive pessimism*. The NAIRU estimated using the original model would grow annually less than in the case of the CDI-extended NAIRU, thus corresponding to the prevailing pessimism within society.

In Q3 and Q4 2012, the CDI stagnated on the level of the previous year and the household consumption showed an annual decline of 2.2%. The NAIRU grew annually by 0.8% and the CDI-extended version by 1.0%. In this period, the unemployment rate grew annually by 0.2%, which corresponds to the presence of structural unemployment on the labour market. According to the CDI, this period needs to be assessed as *scenario No. 1*. The NAIRU value after including the CDI showed an annual growth of 0.2% higher than in the case of the NAIRU before its application, which corresponds to the negative perception of the future development arising from the analysis of the nature of the demand shock.

In Q1 and Q2 2013, the CDI saw an annual decline of 0.7% and the household consumption dropped annually by 1.6%. The original NAIRU dropped annually by 0.8% and the CDI version by 1.3%. In this period, the unemployment

rate grew annually by 1.0%, which thus proves the presence of cyclical
unemployment. This period may be characterised as *scenario No. 3*. Despite the
negative perception of the future economic development, the NAIRU value after
including the CDI dropped annually 0.5% more than in the case of the original
model value.

In the final part of the analysis (Q3 and Q4 2013), the CDI grew annually
by 1.3% and the household consumption by 0.5%. The original NAIRU dropped
annually, as well as the CDI version. The annual growth of the unemployment rate
amounted to 1.2%, which implied the presence of cyclical unemployment. This
period corresponded to *scenario No. 4, the so-called first extreme case of excessive
optimism*. Owing to the positive perception of the future, the CDI-extended
NAIRU value dropped annually more than in the case of the original model value.

**Figure1. Development of the NAIRU according to the original model
and an extension of the demand shock in the Czech Republic**
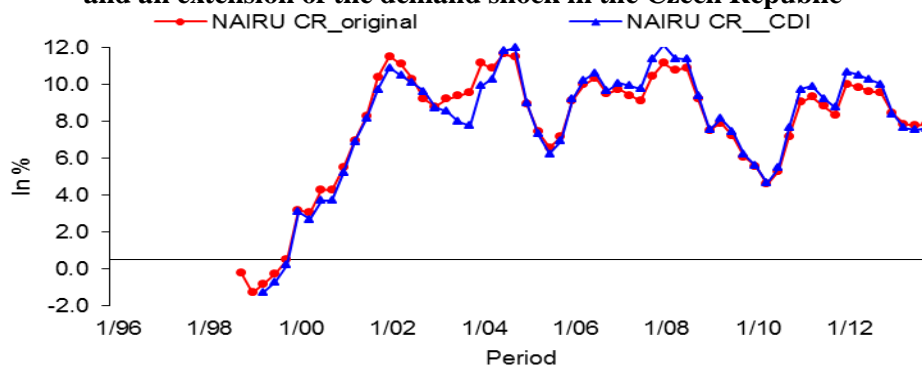
Source: Own calculation on the basis of data from the Ministry of Labour and
Social Affairs, the Czech Statistical Office, the Czech National Bank and the
OECD.

5.2 The NAIRU development according to the original concept and after its extension with the demand shock in Slovakia

In the period of Q1 to Q4 2010, the CDI grew annually by 10.1%, while
household consumption declined annually by 0.7%, and as the real available
income grew annually in this period, we consider the development of the demand
shock to remain inconsistent with the development of household consumption (see
Appendix, Table3).The original NAIRU value grew annually by 0.3% and the
NAIRU after reflecting the CDI by 19.7%. As the unemployment rate in this
period also grew by 2.3%, we speak of the presence of structural unemployment. *In
the case of the verification of the CDI, this would again mean scenario No. 4, the
so-called first extreme case of excessive optimism. Nevertheless, even in this case,
the consumer's positive perception of the future was accompanies with a higher*

_____

annual growth of the NAIRU value estimated after incorporating the CDI than the annual increase in the NAIRU value without the effect of the demand shock, which may be related to the uncertainty concerning the estimate of the demand shock.

In the following period (from Q1 2011 to Q4 2012), there was no longer any inconsistency between the development of the CDI and household consumption. The original NAIRU grew annually by 5.4% and the CDI-extended version by 1.9%. In this context, we may speak of *scenario No. 5, the so-called second extreme case of excessive pessimism*. Fortunately, the negative mood of consumers was not reflected in the NAIRU development after incorporating the demand shock (CDI), as the NAIRU value grew annually at a lower rate than in the case of the original model.

The period of Q1 2013 to Q4 2013 is characterised by an annual growth of the CDI at the rate of 2.2%.The NAIRU taken from the original model dropped annually by 14.8% and the CDI-extended version by 11.6%.The annual growth of the unemployment rate of 0.5% alongside the contrary trend in the NAIRU development indicates the growth of cyclical unemployment. In this period, we localised *scenario No. 4, the so-called first extreme case of excessive optimism*. The positive future outlook, however, was not reflected in the NAIRU value, which after incorporating the CDI, dropped annually even less than in the case of the NAIRU taken from the original model.

Figure 2. Development of the NAIR according to the original model and an extension of the demand shock in Slovakia
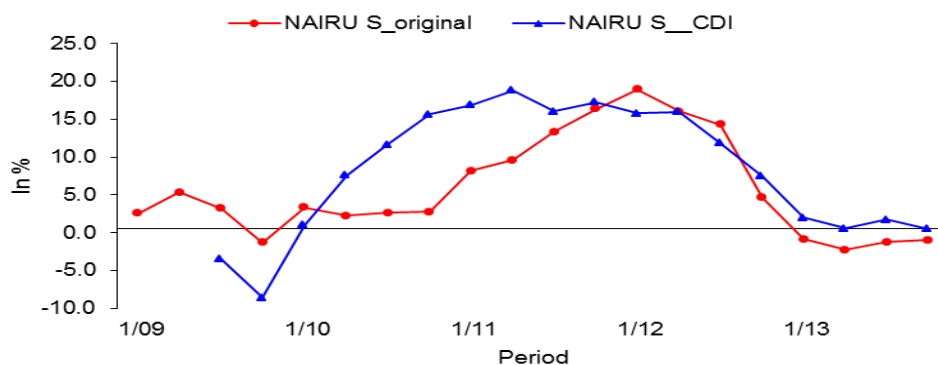
Source: Own calculation on the basis of data from the OECD.

5.3 The NAIRU development according to the original concept and after its extension with the demand shock in Hungary

In the period of Q1 2007 to Q2 2010, the CDI development corresponded to household consumption (see Appendix, Table3).The NAIRU value taken from the original model grew annually by 0.3% and by 2.1% after reflecting the CDI in the model. Due to the fact that the unemployment rate rose annually, we identified

the presence of structural unemployment in the case of the NAIRU from the original model and the model after incorporating the CDI. Once again, we may anticipate the presence of *scenario No. 3*.The negative view of the future development was obvious in the NAIRU value after incorporating the CDI, which exceeded the annual growth of the NAIRU taken from the original model by 1.8%.

The period of Q3 2010 to Q1 2011 saw the annual CDI growth of 11.9%. As household consumption declined annually, but it is accompanied with an annual decline of the real available income of households, and the conclusion may thus be deemed reliable.The original NAIRU grew annually by 3.2% and the CDI-extended version by 1.9%. In this period, the annual growth of the unemployment rate amounted to 0.8% and was accompanied with an increase of structural unemployment. This period is thus assessed as *scenario No. 4, the so-called first extreme case of excessive optimism*. Owing to this positive view of the future development, the NAIRU value after incorporating the CDI saw a lower annual growth than in the case of the original NAIRU.

In the following period (Q22011 to Q4 2012), the CDI declined annually by 11.3% and household consumption by 0.5%. The original NAIRU grew annually by 1.9% and the CDI-extended version by 2.2%. The annual decline of the unemployment rate by 0.2% in this period thus produces an inconsistency with the data taken from the models and the actual economy data, and therefore, the conclusions will be deemed as unconvincing. In the event of the NAIRU verification, this period would correspond to *scenario No. 5, the so-called second extreme case of excessive pessimism*. The NAIRU estimated in the original model grew less than the NAIRU after incorporating the CDI, which would correspond to the prevailing pessimism within society.

In the final period (Q1 to Q4 2013), the CDI corresponded to the household consumption development. In this period both the original and CDI-extended NAIRU declined annually by 5.2% and the unemployment rate by 0.5%. This period thus saw *scenario No. 2*.After incorporating the CDI, the NAIRU value declined annually 0.1% more than in the case of the NARU taken from the original model, which corresponded to including the positive expectations in the economy in the model.

_____

**Figure 3. Development of the NAIRU according to the original model
and an extension of the demand shock in Hungary**
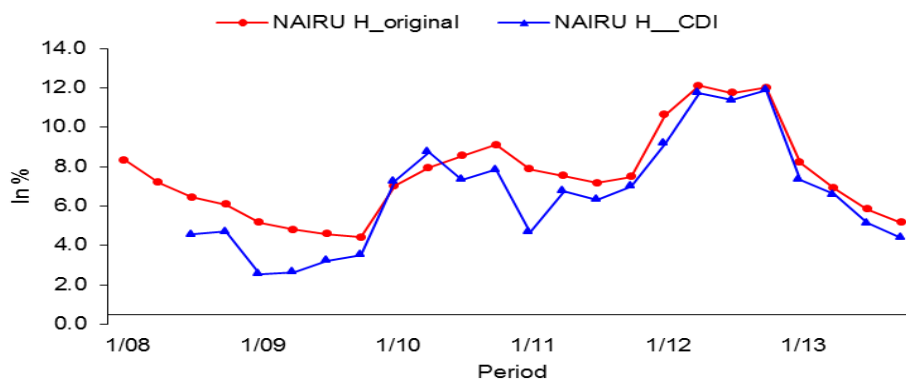
Source: Own calculation on the basis of data from the OECD.

5.4 The NAIRU development according to the original concept and after its extension with the demand shock in Poland

Owing to the fact that the CDI in 2010 declined annually by 7.9%, it did not correspond to the development of household consumption; nevertheless, at the same time, this period also saw an annual growth in the real available income (see Appendix, Table3). The original NAIRU value rose annually by 2.5% and after reflecting the CDI, by 7.3%. In this period, the unemployment rate also experienced an annual growth, thus indicating the presence of structural unemployment. This period thus corresponded to *scenario No. 3*.Owing to this more pessimistic feeling concerning the future development, the value of the NAIRU's annual growth obtained after incorporating the CDI rose by 4.8% compared to the value taken from the original model.

In Q1 andQ2 2011, the demand shock (CDI) showed the identical trend as household consumption. The original NAIRU grew annually by 5.8% and the CDI-extended version by 4.6%. In this period, the unemployment rate declined annually by 0.2% and it did not correspond to the NAIRU's model estimate, which means that the conclusion on the CDI's effect on the labour market will not be absolutely precise. In the case of the NAIRU's positive verification, this period should correspond to scenario No. 2.Owing to the effect of the positive perception of the future development on the labour market, the NAIRU value after incorporating the CDI would grow annually 1.2% less than the NAIRU value taken from the original model, which would correspond to the development of the demand shock and the unemployment rate.

In the period of Q3 2011 to Q2 2013, the CDI had a different development than household consumption, while the real available income grew annually by 0.1%. The original NAIRU declined annually by 3.8% and the CDI-extended version by 7.2%. In this period, the unemployment rate grew annually by 0.4%,

while the annual decline in the NAIRU implied the presence of cyclical unemployment. This period corresponded to *scenario No. 3*.However, after incorporating the CDI, the value of the NAIRU's annual decline did not drop owing to a worsened feeling of the future development, while on the contrary, it grew by 3.4%.

In the last period (Q3 and Q4 2013), the CDI corresponded to the development of household consumption.In this period, the original NAIRU dropped annually by 4.8%, while the CDI-extended version grew annually by 0.3%. The unemployment rate grew annually by 0.3%. After incorporating the demand shock in the labour market analysis, we identified *scenario No. 4, the so-called first extreme case of excessive optimism*. However, this optimism was not reflected in the NAIRU values extended with the demand shock, as they showed an annual growth of 0.3% compared to the NAIRU from the original model, whereas the original NAIRU declined annually by 4.8%.

Figure 4. Development of the NAIRU according to the original model and an extension of the demand shock in Poland
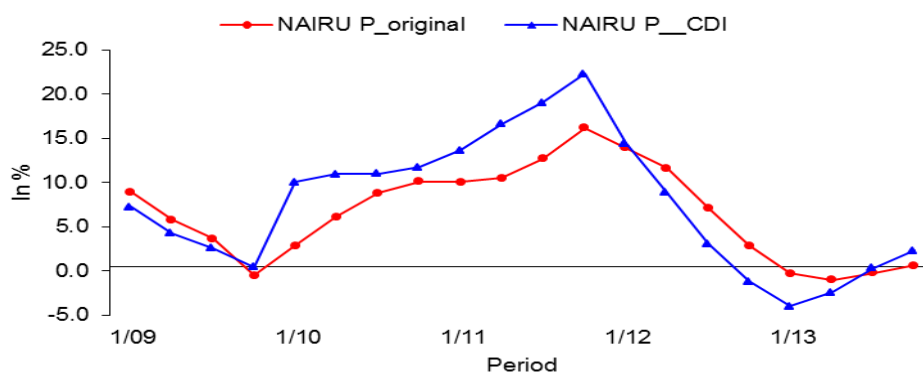
Source: Own calculation on the basis of data from the OECD.

6. Summary of conclusions of the theoretical and empirical part of the analysis and drawing recommendations for economic policymakers

The article aims at extending the standard model for estimating inflation, as adapted by Sekhon (the so-called Gordon's Triangle), with demand shocks related to the consumer's subjective discount rate (the current discount indicator, CDI). The model remains to be based on the unemployment value, which is consistent with permanent expectations (i.e. the PC extended with expectations).

Reflecting the effect of the demand shock in the development of the NAIRU and economic cycle was mapped through the comparison of their values from the original model (not taking into account the effect of the current discount

Emilie Jašová

_____

indicator, CDI) with the values reflecting the CDI. The Kalman filter was used for the purposes of estimating the NAIRU and the related economic cycle on the labour market, whereas the filter worked with a higher smoothing coefficient of the fluctuation of the estimated NAIRU (0.6) than commonly used (0.2).

As we proceed from indirect indicators, we first compare them with the development of their relevant indicators which are commonly officially published (see Appendix, Table 4).The estimated demand shock was verified by real economy data in 24 periods. In the event of the verification of NAIRU with the development of the actual unemployment rate was ascertained a positive result of consistency in all the V4 Member States.

Altogether, it was found out that in the Czech Republic, the effect of the character of the consumer's perception of the present and future on the NAIRU tends to be moderately strong (see Appendix, Table 6).In Hungary, we localised a very strong influence of the demand shock on the NAIRU value. On the contrary, in Slovakia, the effect of the consumer confidence in the future was not at all established. In Poland, the effect of the demand shock on the NAIRU may be deemed as rather weak.

The conclusion on the moderately strong effect of the estimated shock on the NAIRU in the V4 Member States confirmed the suitability of including another dimension of the perception of the real economy, which implied the validity of the words of **Humphrey** (1985),who considers the relationship between the inflation and unemployment as permanently developing, as it is necessary to enhance its explanatory strength and improve the theoretical content and political relevance so that it better corresponds to the facts.

The economic policy should focus mainly on the support of the spillover of the positive expectations into the actual economy, on preventing the occurrence or transfer of negative emotions, and on influencing the existing ambivalent expectations. The analysis revealed a rather weak effect of the demand shock in the V4 countries at the time of structural changes in the economy and society (the period of deep cyclical changes) and in the period immediately following these substantial system changes.

ANNEXES

Table 1. Overview of parameters, P-values and characteristics of selected models to estimate the NAIRU without a current discount rate (CDI)

Name of method	Parameter of model	Value of regression coefficient	P-value	Selected characteristics of the model	
				R-squared	Durbin-Watson stat.
Czech Republic					
	Constant	6.43	0,00		
	Unemployment rate (t)	-0,82	0,00		
	Exchange rate (t-3)	0,25	0,00		
	Import prices (t)	0,30	0,00		
	Characteristics of the model			0,89	1.76
Slovakia					
	Constant	0.17	0.90		
	Unemployment rate (t)	-0,17	0,02		
	Consumption deflator (t-1)	0,49	0,00		
	Exchange rate (t-2)	0,16	0,03		
	Price of oil (t)	0,02	0,04		
	Indirect taxes (t)	1,28	0,10		
	Characteristics of the model			0,77	1,94
Hungary					
	Constant	1,41	0,30		
	Unemployment rate (t-11)	-0,27	0,09		
	Consumption deflator (t-1)	0,29	0,01		
	Characteristics of the model			0,50	2,08
Poland					
	Constant	0.14	0.90		
	Unemployment rate (t)	-0,24	0,00		
	Price of oil (t)	0,02	0,01		
	Characteristics of the model			0.81	1.53

Source: Own calculation on the basis of data from the Ministry of Labour and Social Affairs, the Czech Statistical Office, the Czech National Bank and the OECD.

Table 2. Overview of parameters, P-values and characteristics of selected models to estimate the NAIRU with a current discount rate (CDI)

Name of method	Parameter of model	Value of regression coefficient	P-value	Selected characteristics of the model	
				R-squared	Durbin-Watson stat.
Czech Republic					
	Constant	5,45	0,00		
	Unemployment rate (t)	-0,71	0,00		
	Exchange rate (t-3)	0,24	0,00		
	Import prices (t)	0,25	0,00		
	Current discount indicator CDI (t-2)	0.05	0.07		
	Characteristics of the model			0,88	1.71
Slovakia					
	Constant	0.09	0,93		
	Unemployment rate (t-1)	-0,18	0,10		
	Current discount indicator CDI (t)	0,08	0,04		
	Characteristics of the model			0.88	1.81
Hungary					
	Constant	0.37	0.65		
	Unemployment rate (t-8)	-0,31	0,10		
	Consumption deflator (t-1)	0,23	0,10		
	Import prices (t)	0,50	0,00		
	Current discount indicator CDI (t-8)	0,07	0,10		
	Characteristics of the model			0.86	2,00
Poland					
	Constant	0,54	0.55		
	Unemployment rate (t-7)	-0,25	0,62		
	Current discount indicator CDI (t-5)	0.03	0.26		
	Characteristics of the model			0.98	2.03

Source: Own calculation on the basis of data from the Ministry of Labour and Social Affairs, the Czech Statistical Office, the Czech National Bank and the OECD.

Emilie Jašová

_____

Table 3. Overview of basic indicators of a number of scenarios for the different periods in the V4 countries

Member country V4	Number of localized period	NAIRU/GAP original in %	NAIRU/GAP with CDI in %	CDI in %	Unemployment rate in %	Household consumption in %	Real disposable income in %	Number of scenario
Czech Republic								
Part of NAIRU								
	4/1999-4/2001	5.2	4.8	5.9	7.9	2.0	2.1	4
	1/2002-3/2002	11.0	10.5	2.5	8.1	3.0	3.0	3
	4/2002-4/2003	9.2	8.5	26.8	8.8	4.9	3.8	4
	1/2004-4/2004	11.3	11.0	24.1	9.2	3.1	1.8	3
	1/2005	9.0	9.0	24.3	9.6	3.0	5.1	1
	2/2005-1/2006	7.6	7.4	25.8	8.8	3.2	5.2	2
	2/2006-3/2007	9.7	10.0	20.5	7.3	4.4	4.7	-
	4/2007-3/2008	10.8	11.6	19.6	5.5	3.1	2.5	-
	4/2008-4/2010	6.7	6.9	4.7	8.2	0.8	1.6	3
	1/2011-2/2012	9.2	9.8	1.0	8.6	-0.3	-0.8	-
	3/2012-4/2012	9.6	10.3	0.5	8.3	-2.2	-1.3	1 and 3
	1/2013-2/2013	8.6	8.7	-0.1	9.5	-1.6	-1.4	3
	3/2013-4/2013	7.8	7.6	1.4	9.8	0.5	-1.7	4
Part of GAP								
	4/1998-1/2001	5.9	5.9	-1.8	7.7	1.6	1.5	4
	4/2007-4/2008	-5.0	-5.6	18.0	5.5	3.0	2.4	5
	3/2009-1/2011	2.5	2.3	2.9	9.0	0.9	0.9	3
	2/2011-4/2012	-0.9	-1.5	0.6	8.4	-1.0	-1.0	5
	1/2013-4/2013	1.8	2.0	0.7	9.8	-0.4	-1.6	4
Slovakia								
Part of NAIRU								
	1/2010-4/2010	2.8	9.0	9.0	14.4	-0.7	3.2	-
	1/2011-4/2012	12.7	15.0	3.9	13.7	-0.4	-1.6	5
	1/2013-4/2013	-1.3	1.2	5.0	14.4	0.3	-	4
Part of GAP								
	1/2009-3/2011	8.6	5.3	4.4	13.4	-0.3	1.2	3
	4/2011-3/2012	-2.8	-1.6	2.9	13.7	-0.2	-1.7	-
	4/2012-4/2013	14.5	10.3	2.8	14.2	0.1	-1.7	4
Hungary								
Part of NAIRU								
	1/2007-2/2010	7.7	4.7	11.1	8.9	-2.4	-2.9	3
	3/2010-1/2011	8.5	6.6	9.1	11.3	-1.5	-0.5	4
	2/2011-4/2012	9.8	9.2	-7.9	10.8	-0.5	-1.4	-
	1/2013-4/2013	6.5	5.9	2.5	10.4	0.5	-	2
Part of GAP								
	2/2008-4/2011	3.4	4.8	5.9	10.2	-2.7	-1.3	3
	2012	-0.8	-0.2	-12.2	10.9	-1.6	-4.6	-
	2013	3.9	4.5	-1.0	10.4	0.5	-	2
Poland								
Part of NAIRU								
	2010	7.0	10.9	1.1	9.6	3.1	2.2	3
	1/2011-2/2011	10.3	15.1	2.4	9.4	3.2	0.4	-
	3/2011-2/2013	10.7	11.1	-2.8	10.0	1.1	0.1	3
	3/2013-4/2013	0.2	1.3	-3.0	10.5	1.2	0.3	4
Part of GAP								
	2/2009-3/2010	4.5	2.4	3.4	8.9	3.4	7.5	3
	4/2010-2/2012	-2.5	-5.6	0.8	9.7	0.8	5.4	3 and 1
	3/2012-4/2013	8.9	10.7	-5.4	10.4	-5.4	-1.8	3

Source: Own calculation on the basis of data from the Ministry of Labour and Social Affairs, the Czech Statistical Office, the Czech National Bank and the OECD.

Table 4. Comparison of verification of the demand shock (CDI) with household consumption and real disposable income (the number of periods)

Member country V4	Number of analyzed period in each category	The indicator used to verify the analysis NAIRU		The indicator used to verify the analysis of the economic cycle	
		Household consumption	Real disposable income	Household consumption	Real disposable income
Czech Republic					
	Total	14	14	5	5
	Compliance / verification	9	14	2	5
	Conditional compliance / verification	2	0	2	0
	The discrepancy in the develop. of both time series	3	0	1	0
Slovakia					
	Total	3	3	3	3
	Compliance / verification	2	2	3	3
	Conditional compliance / verification	0	0	0	0
	The discrepancy in the develop. of both time series	1	1	0	0
Hungary					
	Total	4	4	3	3
	Compliance / verification	3	4	3	3
	Conditional compliance / verification	1	0	0	0
	The discrepancy in the develop. of both time series	0	0	0	0
Poland					
	Total	4	4	4	4
	Compliance / verification	2	4	0	4
	Conditional compliance / verification	0	0	0	0
	The discrepancy in the develop. of both time series	2	0	4	0
Total for V4					
	Total	25	25	15	15
	Compliance / verification	16	24	8	15
	Conditional compliance / verification	3	0	2	0
	The discrepancy in the develop. of both time series	6	1	5	0

Source: Own calculation on the basis of data from the Ministry of Labour and Social Affairs, the Czech Statistical Office, the Czech National Bank and the OECD.

Table 5. Number period with verification and with proven influence of the demand shock (the number of the analyzed period)

Member country V4		Number of verification period		Number of period with a proven influence of demand shock	
	Ranking of scenarios	Analysis of the NAIRU	Analysis of the economic cycle	Analysis of the NAIRU	Analysis of the economic cycle
Czech Republic					
	1	2	0	0	0
	2	1	0	1	0
	3	5	1	2	0
	4	3	2	2	1
	5	0	2	0	0
Slovakia					
	1	0	0	0	0
	2	0	0	0	0
	3	0	1	0	0
	4	1	1	0	1
	5	1	0	0	0
Hungary					
	1	0	0	0	0
	2	1	1	1	0
	3	1	1	1	1
	4	1	0	1	0
	5	0	0	0	0
Poland					
	1	0	1	0	1
	2	0	0	0	0
	3	2	3	1	1
	4	1	0	0	0
	5	0	0	0	0
Total for V4					
	1	2	1	0	1
	2	2	1	2	0
	3	8	6	4	2
	4	6	3	3	2
	5	2	2	0	0

Source: Own calculation on the basis of data from the Ministry of Labour and Social Affairs, the Czech Statistical Office, the Czech National Bank and the OECD.

Table 6. Quantification of the impact intensity of the demand shock on the NAIRU and the business cycle (the number of the analyzed period)

Member country V4		The indicator used to verify the analysis of the NAIRU		The indicator used to verify the analysis of the economic cycle	
	Number of analyzed period in each category	Household consumption	Real disposable income	Household consumption	Real disposable income
Czech Republic					
	Total number of period	14	14	5	5
	Number of verified period	9	11	4	5
	Number of period with a proven influence of demand shocks	5	5	1	1
Slovakia					
	Total number of period	3	3	3	3
	Number of verified period	2	2	2	2
	Number of period with a proven influence of demand shocks	0	0	1	1
Hungary					
	Total number of period	4	4	3	3
	Number of verified period	3	3	2	2
	Number of period with a proven influence of demand shocks	3	3	1	1
Poland					
	Total number of period	4	4	4	4
	Number of verified period	1	3	0	4
	Number of period with a proven influence of demand shocks	0	1	0	2
Total for V4					
	Total number of period	25	25	15	15
	Number of verified period	15	19	8	13
	Number of period with a proven influence of demand shocks	8	9	3	5

Source: Own calculation on the basis of data from the Ministry of Labour and Social Affairs, the Czech Statistical Office, the Czech National Bank and the OECD.

Emilie Jašová

_____

REFERENCES

[1] **Akerlof, G. A., Dickens, W. T., Perry, G. L.(1996), The** *Macroeconomicsof Low Inflation.BrookingsPapers on EconomicActivity, BrookingsInstitution. Washington, D.C.;*

[2] **Ball, L., Moffitt, R. (August 2001),***Productivity Growth and thePhillips Curve.NBER workingpaperseries, NationalBureauofEconomicResearch. Cambridge;*

[3] **Bělohradský, V. (2013),***Mezi světy&mezisvěty.* *Novela bohemika 1997.* ISBN 978-80-87685-04-0;

[4] **Beneš, J., N'DIAYE, P. (2004),** *A MultivariateFilterforMeasuringPotential Output and the NAIRU***:** *Application to the Czech Republic.IMF WorkingPaper,* no. 04/45, 117;

[5] **Brožová, D. (2006),***Kapitoly z ekonomie trhů práce.Vysoká škola ekonomická Praha,* ISBN 80-245-1120-7, 107-110;

[6] **Fabiani, S., Mestre, R. (March 2000),** *Alternative Measures of the NAIRU in the Euro Area: Estimates and Assessment.ECB WP,* 10;

[7] **Friedman, M. (1968),***The Role of Monetary Policy.The American EconomicReview,* 58: 1-17, 7;

[8] **Gordon, R. J. (August 1996),***TheTime-varying NAIRU and its Implications for EconomicPolicy***.** *National Bureau of Economic Research. Cambridge;*

[9] **Hausman, J. A. (1979),** *Individual Discount Rates and thePurchase and Utilization of Energy-Using Durables.Bell JournalofEconomics.* Vol. 10, No. 1, 33-54;

[10] **Humphrey, T. M. (September/October 1985),***The Early Historyof the Phillips Curve***.** *EconomicReview. Federal Reserve Bank of Richmond,* 18-23;

[11] **Kadeřábková, B., Jašová, E. (2012),***Comparing NAIRU and Economic Cycle from the Perspective of Labour Market in the Countries of the Visegrad Group***.***EconomicStudiesjournal, BulgarianAcademyofSciences - Institute ofEconomics, Sofie, Bulharsko,* 7, 16, 17;

[12] **Loewenstein, G. (1987),***Anticipation and the Valuation of Delayed Consumption.EconomicJournal.* Vol. 97, No. 387, 666-684;

[13] **McAam, P., McMorrow, K. (1999),***The NAIRU Concept − Measurement Uncertainties, Hysteresis and Economic Policy Role***.** 3;

[14] **Mlčoch, L., Machoni, P., Sojka M. (2000),** *Ekonomické a společenské změny v české společnosti po roce 1989/alternativní pohled/.Univerzita Karlova v Praze, Nakladatelství Karolinum,* ISBN 80-246-0119-2;

[15] **Modigliani, F., Papademoc, L. (1975),***Targets for Monetary Policy in the ComingYear***.** *BrookingsPapers on EconomicActivity, BrookingsInstitution. Washington, D.C.,* 142;

[16] **Phelps, E. S. (August 1967),***Phillips Curves, Expectations o fInflation and Optimal Unemployment OverTime*. *Economica,* 254;

[17] **Phillips, A. W. (1958),** *The Relationship between Unemployment and the Rate of Change of Money Wages in the United Kingdom 1861-1957.**Economica,* 284;

[18] **Ramsey, F. P. A (1928),** *Mathematical Theory of Saving*. *The Economic Journal.* Vol. 38, No. 152, 543-559;

[19] **Richardson, P., Boone, L., Giorno, C., Meacci, M., Rae, D., Turner, D. (2000),** *The Concept, Policy Use and Measurement of Structural Unemployment: Estimating a Time Varying NAIRU across 21 OECD Countries**.OECD WP,* 38;

[20] **Rotschedl, J., Jašová, E. (2014),***Odvození psychologického faktoru spotřebitelů tzv. okamžitého diskontního indikátoru z makroekonomických dat**.Workingpaper:* 31/01/2014/CPP-2013-04MA [online]. [cit. 2014-03-02]; Dostupné z: http://www.ceppro.cz/diskontovani-spotreby-domacnosti.html

[21] **Samuelson, P. A., Solow, R. M. (May 1960),** *Analytical Aspectsof Anti-inflation Policy*. *AmericanEconomicAssociation,* 127;

[22] **Samuelson, P. A. (1937),** *A Note on Measurement of   Utility. Review of Economic Studies.* Vol. 4, 155-161;

[23] **Sekhon, J. S. (1999),***Estimation of the Natural Rate of Unemployment: 1955:01-1997:12.**Harvard University, Berkeley;*

[24] **Stock, L. , Vogler-Ludwig, K. (2010**), *NAIRU and Okun´sLaw – The Macro-Economy in a Nutshell? Thematic Paper for the European Commission Directorate general for Employment, Social Affairs and Equal Opportunities,* 4 – 5;

[25] **Tobin, J. (1997),***Supply Constraints on Employment and Output: NAIRU versus Natural Rate*. *CowlesFoundationPaper 1150. Yale University, New Haven,* 1003B.