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## **THE EFFECT OF THE PSYCHOLOGICAL FACTOR AMONG COMPANIES ONTO THE NAIRU AND ECONOMIC CYCLE ON THE LABOUR MARKET**

### **Abstract:**

The paper focuses on mapping the uncertainties in real economy. It develops a Central European parallel to the VIX fear and uncertainty index in condition of Hungary and Poland. It extends the number of representatives of the demand shock in the standard Gordon's Triangle model with the index of uncertainty perception among companies. The Kalman filter will be used for estimating the value of the Non-Accelerating Inflation Rate of Unemployment and economic cycle without and with the effect of the psychological factor among companies. We verify results with the corresponding real economy data. Five scenarios will describe the relationship between the uncertainty perception among companies and the unemployment rate. The analysis quantifies the intensity of the effect of the psychological factor on the supply side on the labour market in Hungary and Poland. It will outline the consequences for the economic policymakers too.

### **Keywords:**

Index of uncertainty perception among companies, Phillips Curve, NAIRU, Kalman filter, Unemployment gap.

**JEL Classification:** E24, E32, E37

## Introduction

According to Václav Bělohradský (2013) the postmodern society lacks transparency. Lubomír Mlčoch, Pavel Machoni, and Milan Sojka (2000) claim that the lack of rules creates a societal schizophrenia. Eugene F. Fama (1997) perceives long-term anomalies as the results of insufficient reactions to the information. According to Daniel Kahneman (2002) intuition always plays a crucial role in decision-making. Dan Ariely, Daniel Kahneman, and George Loewenstein (2000) consider important the time sequence when obtaining experience. Hans C. Breiter et al. (2001) used magnetic resonance to study decision-making. Kahneman (1999, 2002) studied the evaluation of the intuition by two modes of thinking. Fama (1997) analysed long-term anomalies using two behavioural models of the stock market. Evan W. Anderson, Thomas J. Sargent, and Lars P. Hansen (2003) confirmed that the author of decision uses their model as an approximation of Market process. Dennis Novy and Alan Taylor (2014) incorporated the effect of uncertainty in the model. According to Michal Putna (2014) uncertainty also causes the big trade crisis.

The paper is divided in the following sections. The first part will outline the reflection of the supply-related psychological factor into the standard model for the NAIRU estimate. This part as well defines the indicator of the uncertainty perception among companies. The second part presents empirical analysis of the effect of the uncertainty perception on the labour market. The third part will deal with empirical conclusions for economic policymakers in Hungary and in Poland.

### 1. Literature Review

Thomas M. Humphrey (1985) pointed out that the relationship between inflation and unemployment used authors such as Law, Thornton, Attwood, Mill, Fischer, Tinbergen, Klein, and Goldberger, or Brown and Sultan. In this context, Humphrey mentions Paul A. Samuelson and Robert M. Solow (1960) too. Edmund S. Phelps (1967) applied the time series of aggregated employment. Milton Friedman (1968) mentions two limitations of the currency policy with fixing interest rate and the unemployment rate over a longer period of time. Franco Modigliani and Lucas Papademos (1975) are the authors of the concept of the non-inflationary unemployment rate (NIRU). The founder of the modern version of the Phillips curve (PC) is William A. Phillips (1958). We applied the concept of James Tobin (1997). His Non-Accelerating Inflation Rate of Unemployment (NAIRU) is not the same as the natural unemployment rate. The NAIRU is a result of macroeconomic balancing of pressures onto inflation growth on markets with excessive supply. It is a part of the Keynesian model.

Peter McAdam and Kely McMorrow (1999) consider the Phillips Curve (PC) extended with expectations as the most frequently applied methods to estimate the NAIRU. The Gordon's "Triangle" model (Robert J. Gordon 1996) is based on the unemployment rate consistent with permanent expectations. In the triangle method is the inflation rate explained by means of inflation expectations, demand conditions represented by the unemployment gap, and supply shocks.

We will use the standard inflation model according to Jasjeet S. Sekhon (1999). We will then incorporate the indicators of perceiving uncertainty among Hungary and Poland in the existing group of regressors. They will be controlling supply shocks. The equation of the standard inflation model remains in the following form:

$$\pi_t - \pi_t^e = \beta(u_t - \bar{u}_t) + \delta X_t + v_t, \quad (1)$$

where  $\pi_t$  = estimate of the actual inflation rate,  $\pi_t^e$  = expected inflation rate,  $u_t$  = unemployment rate,  $\bar{u}_t$  = NAIRU,  $X_t$  = regressors controlling supply shocks (oil price and indicators of perception of uncertainty among Hungary and Poland), and  $v_t$  = error member.

Daniel Kahneman and Shane Frederick (2001) dealt with intuitive decision-making using the method of attempt and error. Daniel Kahneman, Dan Lavallo, and Olivier Sibony (2011) analysed the effect of prejudice on judgment using 12 questions model. Eugene F. Fama and Kenneth R. French (1996) explained price anomalies on the stock market using a three-factor regression model. Fama and French (1996) used cross-section regression to identify anomalies. Lars P. Hansen, José A. Scheinkman, and Nizar Touzi (1997) apply spectral methods to identify non-parametric scalar stationary diffusion. For the purposes of measuring the uncertainty and concerns in the economy, Putna (2014) uses the VIX uncertainty index on the stock market. This indicator is popular as the “fear index”. It is a measure of volatility of options prices for the S&P 500 index.

Because we have not found any Central European alternative to this index, we have used an analogy of its calculation. We have developed our own uncertainty and fear index for Hungary and Poland. The volatility of shares and stock markets has been taken from the analytical product developed by the V-Lab Company, which is on the website. The time series may be further perceived as an index of the perception of the uncertainty among companies within the Central European context, or the indicator of the supply-related psychological factor. The data represents the annual volatility in %. The V-Lab Company’s website (<http://vlab.stern.nyu.edu/analysis/>) was used to collect the values for the indicator of the uncertainty perception among companies related to the Budapest Stock Exchange index and the WIG index (Warsaw Stock Exchange Index).

## **2. Empirical analysis of the effect of the uncertainty perception indicators among companies on the labour market**

We will apply the method Kalman filter for the estimating the NAIRU. It will provide the NAIRU variable in time (Božena Kadeřábková and Emilie Jašová 2012). The smoothing coefficient of this unobservable variable will be applied in the amount of 0.6, which will depict the development in transitional economies and in the period of cyclical turbulences. Generally applied smoothing coefficient is of 0.2 (for example Jaromír Beneš and Papa J. N’Diaye, 2004).

For the purposes of determining the effect of the indicator of uncertainty perception among companies on the NAIRU and the economic cycle on the labour market, two models will always be fine-tuned for Hungary and Poland using the Kalman filter. One model will not include the effect of the uncertainty (to be labelled as the original model), whereas the second model will reflect the supply-related psychological factor (also labelled as the extended model). The economic cycle on the labour market or unemployment gap (in percentage point) we obtain when we subtract NAIRU from real unemployment rate.

The Kalman filter in both original models and those extended with the supply-related psychological factor included, as a dependent variable, an annual change in the deflator of the household consumption (in %) taken from national accounts. These time series have been adapted in order to express the adaptive formation of expectations (annual change at time  $t$  - annual change at time  $t-1$ ). In the original model, the explanatory variables included the delayed values of the household consumption deflator, the unemployment rate without and with delay in % (the unemployment rates in individual countries (%) are defined by the International Labour Organization (ILO) and the annual change in the price of oil (%) without delay. As explanatory variables, the models extended with the supply-related psychological factor also included the annual change in the indicators of uncertainty perception among companies (%).

Since it consists in mapping the development of indirect indicators, the following step will include the comparison of our own indicators with the development of published indicators, which will ascertain their accordance with the actual economy data (this action is called the verification). In the case of the indicators of uncertainty perception among companies, this consisted in the indicator of the fixed capital taken from the national accounts. The estimated NAIRU and economic cycle values were verified by means of a time series of the unemployment rate and the gross domestic product.

The following step of the detailed analysis will consist in assessing the character of the relationship and the quantification of the intensity of the effect of the supply-related psychological factor on the labour market development using our five defined scenarios.

In the case of the *first scenario* the indicators of uncertainty perception remain unchanged compared to the same period of the previous year. Companies take a wait-and-see-attitude when creating their development plans and making investments. The unemployment rate annually stagnates on the level of the previous year or shows a slight annual decline. The NAIRU shows stagnation or an annual decline, as well.

*The second scenario* of the supply-related psychological factor and the labour market implies the annual decline of the indicators of uncertainty perceptions among companies, which motivates companies to increase the investment activity and placing new orders. Along with hiring new staff members, the unemployment rate shows an annual decline or stagnates on the level of the previous year, and the NAIRU declines annually or grows, respectively.

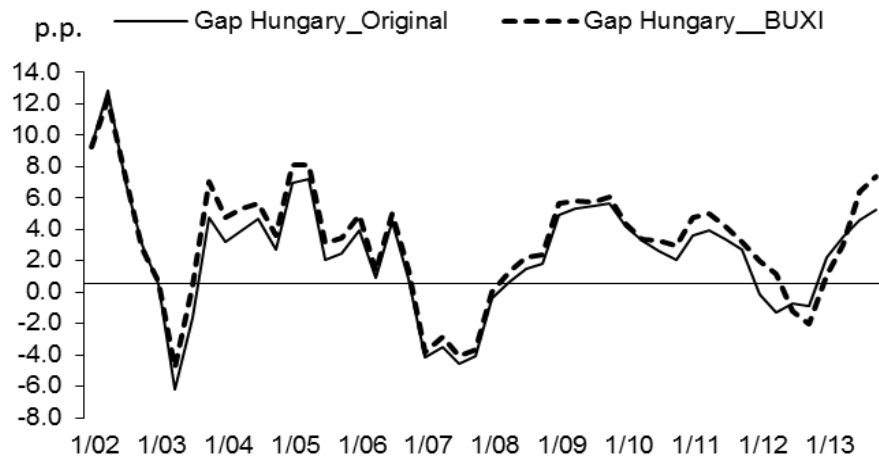
In the case of the *third scenario* of the supply-related psychological factor and the labour market, the indicators of uncertainty perceptions among companies grow annually, which makes them postpone investment activities. The unemployment rate shows an annual growth as hiring new staff members is being postponed as well. At the same time, the NAIRU shows an annual increase or decline. In the case of an annual decline in the NAIRU, there is an acceleration of the growth of cyclical unemployment.

The *fourth scenario* is the so-called first extreme case – a general lack of trust in optimistic signals. In general, the annual decline in the indicators of uncertainty perception does not motivate companies to place new orders and hire new staff members. The unemployment rate continues to grow annually. At the same time, the annual decline in the NAIRU implies the presence of cyclical unemployment and the annual growth in the NAIRU then structural unemployment.

The *fifth scenario* is the so-called second extreme case – a general negligence of pessimistic signals. In general, the annual growth in the indicators of uncertainty perception does not make business entities be more cautious when planning their investment and staff matters. The actual unemployment rate declines annually, while the NAIRU shows an annual decline, as well.

### **2.1 Analysis of the character of the relationship and intensity of the effect of the uncertainty perception indicator among companies on the economic cycle in Hungary**

The application of five scenarios defining the character of the relationship and the intensity of the actual effect of the indicator of uncertainty perception among companies on the economic cycle will be carried out using five selected periods (Figure 1).



Source: Own calculation based on data from the OECD and the V-Lab.

**Figure 1** Development of the unemployment gap according to the original model, and after its expansion to include psychological factor on the supply side in Hungary

*The second scenario* (an annual decline in the indicators of uncertainty perception among companies, increasing the investment activity among companies and placing new orders, an annual decline or at most a stagnation of the unemployment rate, and the annual decline or growth of the NAIRU) was localised in three periods. Specifically, this included the interval of Q1 to Q4 2007, which was the *period of large positive gaps* (NAIRU was higher than real unemployment rate) *on the labour market* (in the amount of 4.1 p.p. or 3.6 p.p. respectively). The indicator of uncertainty perception among companies declined annually (by 3.9 p.p.) and the fixed capital grew annually (by 3.9 p.p. as well). The unemployment rate in the examined period stagnated annually and the NAIRU grew (by 6.6 p.p. and 6.7 p.p. respectively). A lower intensity of the uncertainty perception among companies was not reflected in the development of unemployment gaps. After extending the original model, the positive gaps became smaller (by 0.5 p.p.) and the time interval covering the boom phase remained unchanged.

Another period included the interval of Q1 to Q4 2012, in which the labour market was undergoing the *phase of a short boom following the recession*. Due to the fact that the reason for an annual decline in the indicator of uncertainty perception among companies (of 7.1 p.p.) consisted in an extraordinary fluctuation in its development in the last two periods, we will not consider the annual decline in the fixed capital (of 3.7 p.p.) as a contradiction among these series in the course of the verification. The status of the conditioned verification has also been granted to the indicators of the unemployment rate, which saw an annual decline of 0.1% in this period, which practically means stagnation, and the NAIRU, which saw an annual growth (of 4.1 p.p. and 4.2 p.p. respectively). A positive effect related to a lower intensity of uncertainty perception among companies was not reflected in the development of unemployment gaps, as upon including the indicator of uncertainty perception, the originally positive

unemployment gap closed (- 0.8 p.p. vs. 0.0 p.p) and its original length got two periods shorter.

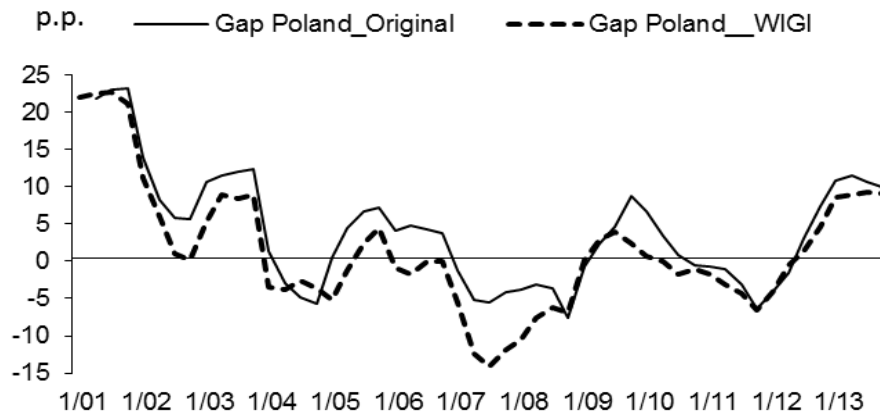
The last period corresponding to this scenario included the interval of Q1 to Q4 2013, when the labour market was experiencing the *second bottom of the previous recession*. The indicator of uncertainty perception among companies declined annually (by 3.1 p.p.), and the fixed capital rose annually (by 5.9%). The unemployment rate declined annually by 0.5% and the NAIRU dropped as well (by 5.1 p.p. and 4.9 p.p. respectively). Even in this period, the positive effect related to a lower intensity of uncertainty perception among companies was not reflected in the development of the unemployment gap, which deepened upon including the indicator of uncertainty perception (by 0.6%), and the interval length remained unchanged.

*The third scenario* (the indicators of uncertainty perception among companies grow annually, the unemployment rate rises annually, and the NAIRU sees an annual growth or decline) is associated with two periods. The first one was the interval of Q1 2002 to Q4 2006, when the labour market was affected by the *economic transformation following the change of the political and economic system*. In this context, it needs to be added that it is impossible to reliably determine the beginning of this phase owing to a limited length of the time series for this country. In the examined period, the unemployment rate grew annually (by 0.4 p.p.), as well as the NAIRU (by 1.8 p.p. and 1.6 p.p. respectively). The indicator of uncertainty perception among companies practically stagnated (an annual growth of 0.3 p.p.) and the fixed capital rose (by 3.6%). A higher intensity of uncertainty perception among companies was reflected in the size of unemployment gaps, whose level rose negatively (by 0.9 p.p.), while the length of the recession phase remained unchanged.

The second period in this scenario includes the interval of Q2 2008 to Q4 2011. Here, the labour market was hit by the *financial and economic recession*. In this period, the unemployment rate rose (by 0.9 p.p.) and the NAIRU declined annually (by 0.8 p.p. and 0.9 p.p. respectively). The indicator of uncertainty perception among companies grew annually (by 1.3 p.p.) and the fixed capital dropped (by 6.3%). A negative effect of a higher intensity of uncertainty perception among companies was reflected in the unemployment gap so that upon including the indicator of uncertainty perception, the original value of the negative gap rose further (by 0.6 p.p.) and the recession period was also extended with one quarter.

## **2.2 Analysis of the character of the relationship and intensity of the effect of the uncertainty perception indicator among companies on the economic cycle in Poland**

In this section, we will apply five scenarios characterising the relationship and the intensity of the actual effect of the indicator of uncertainty perception among companies on the economic cycle on five periods (Figure 2).



Source: Own calculation based on data from the OECD and the V-Lab.

**Figure 2** Development of the unemployment gap according to the original model, and after its expansion to include psychological factor on the supply side in Poland

*The third scenario* (the indicators of uncertainty perception among companies grow annually, the unemployment rate rises annually, and the NAIRU sees an annual increase or decline) is associated only with one period. In the interval of Q4 2010 to Q2 2012, the labour market switched *into a short boom phase immediately following the recession*. In the examined period, the unemployment rate and the NAIRU saw an annual increase (of 0.3 p.p., 5.3 p.p. and 2.7 p.p. respectively). Practically, the indicator of uncertainty perception among companies stagnated annually (an annual growth of 1.3 p.p.) and the fixed capital increased (by 5.2%). A negative effect of a higher intensity of uncertainty perception among companies did not affect negatively the unemployment gap, as its positive gap grew further (by 0.5 p.p.) and the boom phase length was even extended with one quarter.

*The fourth scenario* (a general lack of trust in optimistic signals, an annual decline of the indicators of uncertainty perception, an annual increase in the unemployment rate, and an annual decline in the NAIRU (implying cyclical unemployment) or its annual growth (implying structural unemployment)) was identified in three periods. The first one was the interval of Q1 2001 to Q1 2004, which was characterised by the *economic transformation following a change in the political and economic system*. Again, the analysis of this period could make use of only a limited length of the time series, which raises uncertainty concerning the precision of the beginning of this phase of the economic cycle. The indicator of uncertainty perception among companies declined annually (by 2.8 p.p.), as well as the fixed capital (by 4.3%), corresponding to the scenario definition. In the examined period, the unemployment rate grew annually (by 1.0 p.p.) and the NAIRU rose (by 6.0 p.p. and 7.9 p.p. respectively). A negative effect of the general lack of trust was not reflected in the development of unemployment gaps, as the negative gaps (NAIRU was lower than real unemployment rate) became smaller (by 2.1 p.p.) and the length of this recession phase became one quarter shorter.



Another period consisted in the interval of Q2 2009 to Q3 2010, in which the labour market was hit by the *financial and economic recession*. The indicator of uncertainty perception among companies saw an annual decline (of 6.7 p.p.) and the fixed capital declined annually in accordance with the scenario definition (by 1.6%). The original NAIRU value, as well as the value reflecting the supply-related psychological factor declined annually (by 4.5 p.p. and 2.4 p.p. respectively), with an increase in the unemployment rate (1.3 p.p.). A negative effect of the general lack of trust was not reflected in the development of the unemployment gap, as the negative gap taken from the original model became lower (by 3.1 p.p.) and the length of this recession phase remained unchanged compared to the output of the original model.

The last period of this scenario was the interval of Q3 2012 to Q4 2013, when the labour market was hit by the *second recession bottom*. The indicator of uncertainty perception among companies declined annually (by 4.3 p.p.), as well as the fixed capital (by 1.6%) in accordance with the scenario definition. The unemployment rate grew annually (by 0.2 p.p.) and the NAIRU declined annually (by 9.2 p.p. and 8.1 p.p. respectively). A negative effect of the general lack of trust in optimistic signals was not reflected in the unemployment gap, as it dropped (by 1.9 p.p.) compared to the original model, and the length of the localised phase remained unchanged in comparison with the original model.

*The fifth scenario* (the general neglect of pessimistic signals, an annual increase in the indicators of uncertainty perception among companies, while the actual unemployment rate and the NAIRU decline annually) was identified only in the period of Q1 2007 to Q4 2008. It is the period of *large positive gaps* estimated in the original model and amounting to approx. 9.0 p.p. The unemployment rate declined annually by 3.4 p.p. and the NAIRU growth (of 1.0 p.p. and 0.2 p.p.) may be deemed as a practical stagnation, which will allow considering the whole period as sufficiently valid for drawing conclusions of our analysis. The indicator of uncertainty perception among companies grew annually (by 3.9 p.p.), while the annual growth of the fixed capital (of 13.7%) also corresponds to the scenario definition. A negative effect of the general neglect of pessimistic signals was not reflected in the unemployment gap, which became more intense (by 5.1 p.p.), and the boom phase was even extended with three quarters.

### **3. Summary of empirical conclusions including the consequences for economic policymakers**

For the purposes of estimating the NAIRU and the economic cycle on the labour market, we applied the Kalman filter, which is able to provide the time-varying NAIRU in Hungary and in Poland. One model does not include the effect of uncertainty and the second one reflects the effect of the supply-related psychological factor.

In Hungary, there was a relatively weak and unambiguously negative effect of this psychological factor on the unemployment gaps. We found out room for the economic policy mainly in the period immediately following the recession, when the decline in the uncertainty perception among companies in the economy was not reflected in reducing

the negative unemployment gap, or the positive gap closed and the boom phase length became shorter. This also includes the period of large positive gaps on the labour market and the period of the second recession bottom, when the improved uncertainty perception among companies reduced the positive unemployment gaps or the negative gaps became even deeper. Furthermore, in the time of the transformation after the change of the political and economic system, the higher intensity of uncertainty perception among companies increased the level of the negative gaps and the recession phase became longer. The same effect of increasing the uncertainty perception on the unemployment gap was also demonstrated at the time of the financial and economic recession.

In Poland, none of the established and mainly negative effects was reflected in the development of the unemployment gaps.

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