ANALYSIS OF THE DEVELOPMENT OF THE UNEMPLOYMENT RATE IN LITHUANIA: APPLICATION OF THE SVAR MODEL

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Abstract. *The paper analyses the dynamics of unemployment in Lithuania, using a structural vector autoregressive model (sVAR) with long-term restrictions proposed by Fabiani et al. (2001). In accordance with it, the unemployment rate is predetermined by economic shocks, some of them with long-term effects (structural) and some with short-term ones (cyclical). The greater part of changes in unemployment in the period of 2002 to 2014 were predetermined by cyclical shocks (of productivity and labour supply and demand). The cyclical unemployment, peaked in the years 2010 to 2011, amounted to ca. 6%. On the other hand, structural unemployment is slow to change, in the years of the economic boom (2006 to 2007) it amounted to ca. 8% (at the time, the cyclical unemployment was negative and the economy encountered overheating, while in 2014 structural unemployment was slightly higher and amounted to ca. 11%).*

Key words: *unemployment, hysteresis, sVAR.*

Introduction

In 2009, due to a sharp economic decline caused by the global financial crisis in quite a few countries, the unemployment rate in them reached the heights unseen since the time of the Great Depression. Currently, six years after the beginning of the crisis, the unemployment rate in many of the EU member states stays considerably higher than in the pre-crisis period, while national economies are still far behind their pre-crisis growth trends. Under the persistence of the said trends, a question arises whether the high unemployment in the countries is a "new equilibrium" or whether it is a temporary condition, with the unemployment rate tending to return to its pre-crisis level.

The discussions of the issue were closely related to the continuing debates on the economic policy actions. Some economists kept supporting further expansionary policies (e.g., Krugman (2012); DeLong et al. (2012)): they emphasised that economic growth remained rather sluggish and the unemployment rate was still high, which indicated that the economy had not yet reached its potential. Other economists (e.g., Taylor (2014)) emphasised the ineffectiveness of the fiscal policy and the fact that it was crowding out

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private consumption; he noted that over several years the economy was already to have reached its potential level, therefore, the remaining unemployment should be considered as structural; so, such a problem could not be solved by expansionary fiscal policies: structural reforms were necessary.

To have optimal policies in the after-crisis period, it is important to understand how short-term economic fluctuations affect the unemployment rate. Summers (2013)[1] and DeLong et al. (2012) reminded the concept of the hysteresis in unemployment[2], proposed by Blanchard et al. (1986): a persisting high cyclical unemployment could become structural and thus reduce the potential of the economy.

Although currently the unemployment rate in Lithuania is lower than in most of the EU member states, it remains at a significantly higher than the pre-crisis (e.g., in 2007) level. This paper uses structural vector autoregressive model to analyse the factors that predetermined the development of unemployment in Lithuania and to distinguish between the structural and cyclical factors.

The paper consists of three parts. In part one, the conception of natural unemployment and the hysteresis effects are briefly discussed. In part two we introduce the research methodology, while in part three we discuss the research results. Finally, the conclusions of the research are presented.

1. The conception of natural unemployment and the hysteresis effects

Hysteresis effects can be considered in a broad and in a narrow sense. In a broad sense, a hysteresis effect can be understood as the harm for the economic potential made by the economy staying below its potential level, i.e., when the economic decline persists, it affects the long-term economic growth trend. The roots of the idea can be attributed to the work of Phelps (1972), however, the authorship of the term has been attributed to Blanchard et al. (1986) in which the hysteresis effects were analysed in a narrow sense, i.e. the impact of the persisting unemployment on future unemployment. The impact of the decline in investment on long-term economic growth or other processes that were also likely to affect the economic growth potential were not considered.

One of the major aspects is the fact that hysteresis effects were mostly ignored in the period of Great Stability because of the lack of a deep and long economic decline. So, there was no need to analyse their impact on long-term economic growth (Laurence Ball's studies can be is an exception (Ball (1997); Ball et al. (2002); Ball (2009); Ball (2014)). However, the hysteresis effects can be crucial to understand the optimal poli-

[1] A speech made by Summers in the IMF conference at: http://www.imf.org/external/NP/Res/seminars/2013/arc/index.htm

[2] Blanchard et al. (1986) used the concept of the hysteresis effect to analyse merely the changes in the unemployment rate, i.e. its dependence on the unemployment in the past. However, other authors, e.g., DeLong et al. (2012), did a broader and more general analysis of the hysteresis effects, i.e. hysteresis effects could also cover other processes that predetermined the slower economic growth.

cies to fight the economic downturn. As stated by DeLong et al. (2012), if the economic potential was affected by an economic decline (i.e. the hysteresis effects existed), this should encourage policy makers to seek a prompt recovery of demand and thus reduce the impact of the hysteresis effects on the long-term economic growth.

A severe economic decline could also result in negative changes in the labour market. Blanchard et al. (1986) raised the idea that economic cycles could have been of great importance for the long-term economic growth trends. As stated by Blanchard et al. (1986), on the basis of the European experience of the 60s to 70s, cyclical unemployment fluctuations during the recession could be significant for the level of "natural" unemployment (i.e. the level of natural unemployment was not stationary and could be partly driven by short-time fluctuations). Their ideas significantly differed from the predominant classical approach at the time when demand shocks do not cause long-term unemployment fluctuations. However, subsequent studies confirmed Blanchard et al. (1986) ideas: as stated by Ball (1997), the European countries that in the 70s had a long period of slow recovery and low inflation, had a noticeably higher natural unemployment level in the 80s as compared to the countries that experienced a sharp economic decline and deflation (for a short period of time).

In their article, Blanchard et al. (1986) proposed two different conceptions why the persistent unemployment could affect the "equilibrium" unemployment rate: a conflict of insiders–outsiders and different effects of persistent unemployment on the pricing process.

The insider–outsider "conflict". Standard economic models mainly perceive equilibrium unemployment as a rather inflexible rate that depends on institutional restrictions and other structural factors; however, the equilibrium unemployment may also depend on the previous unemployment rate. That can particularly be noticed in the unemployment trends of individual European countries in the 60s to 70s of the 20th century.

If the insiders have a strong bargaining power in the determining of wages (and in extreme cases the wages would depend merely on the collective judgement of the employees), then after a negative economic shock the remaining insiders are not interested in reducing their own wages with the aim of achieving the previous unemployment rate. Meanwhile, after a positive economic shock (productivity increase), it does not make sense for the employees to increase their wages, as in such a case part of them would simply lose jobs (the employer could get the same output by using less labour).

In such a case

$$n = n(-1) + \varepsilon, \tag{1.1}$$

where n is the number of insiders, and means the shocks affecting the said level. In that case, the number of employees is a random walk and depends merely on economic conditions.

Naturally, as stated by Blanchard et al. (1986), one equation is not sufficient for the justification of all the processes, however, the very mechanism (of natural unemployment) can be affected by economic conditions. Another important aspect is the behaviour of the unemployed: if they feel inclined to have their wages reduced to a very low level, i.e. if they are willing to receive less than the currently employed workers, the employer may wish to employ them, even if that would outrage the current staff[3]. Therefore, the unemployment rate is also likely to depend on the unemployed.

$$n - \overline{n} = b(\widetilde{n - \overline{n}}) + (1 - b)(n(-1) - \overline{n}) + \varepsilon . \quad (1.2)$$

If $\overline{n}$ is labour, then $n - \overline{n}$ is the unemployment rate which depends on the previous unemployment rate and the equilibrium unemployment rate $(\widetilde{n - \overline{n}})$ (if the coefficient *b* is equal to 1, then the unemployment is always equal to equilibrium unemployment, and if it is equal to 0, then unemployment is random walk, while if 1 > b > 0, then the unemployment rate tends to go back to a certain (natural) value, however, at a different speed).

Blanchard et al. (1986) also proposed a second alternative which could explain the unemployment dependence on the past values. The principal idea of the second model implied that the wage setting process was affected merely by the short-term unemployed, while the long-term unemployed did not affect the wage setting mechanism and therefore also the unemployment level. The general conclusion of Blanchard et al. (1986) was that European countries should seek to reduce the current levels of unemployment and thus prevent it from becoming "natural".

Later, the hysteresis ideas were mostly ignored, and after the article by Blanchard et al. (1986) they were analysed only by a few authors: merely Ball's (1997; 2014) works could be noted. Moreover, hysteresis effects were thought to be an exclusively European problem due to active (compared to the US) trade union movements there that could affect the bargaining power and thus prevent the economy self-correction mechanism. However, after the crisis of 2009 (cf. DeLong et al. (2012) and Coibion et al. (2013)), the prolonged high unemployment rate was also observed in the US, as the employees, upon having lost their jobs, tended to "break away" from the labour force, i.e. they stopped actively looking for work; those effects, in accordance with DeLong et al. (2012), were also to be considered as hysteresis effects.

2. Research methodology

In this part, a brief introduction of a theoretical model is made, on the basis of which the empirical sVAR model will be identified. In general, VAR models proposed by Sims (1980) have been widely used for the analysis of different macroeconomy issues. How-

[3] That is undoubtedly a hypothetical mechanism, however, it depends on the powers of the employee and the employer: provided all the currently employed workers threaten to leave jobs as soon as a new worker is employed, the employer could face difficulties he does not want (training, etc.).

ever, standard VAR models can not be used to obtain the structural shocks. To identify structural shocks, the model needs to be supplemented by a "structure". That can be done in two ways: by setting either short-run or long-run restrictions. The imposing of long-run restrictions was proposed by Blanchard et al. (1989) who restricted the long-run effect of structural shocks for individual variables. The restrictions are usually made on the basis of economic theories. In the remaining part, empirical restrictions to be applied in the identification of the sVAR model used in the present paper are discussed.[4]

The model in this paper is a replication of the model proposed by Layard et al. (1991). This model extends a two-variable model proposed by Blanchard et al. (1989), supplementing it by labour market. Such a model has been quite widely used in the analysis of the labour market dynamics (e.g., Fabiani et al. (2001); Dolado et al. (1997); Linzert (2001)). All the variables are to be understood as the logarithm values of their level.

$$y_t = \theta(d_t - p_t) + a\vartheta_t \tag{2.1}$$
$$y_t = n_t + \vartheta_t \tag{2.2}$$
$$p_t = w_t - \vartheta_t + \beta u_t \tag{2.3}$$
$$l_t = \alpha E_{t-1}(w_t - p_t - \vartheta_t) + \tau_t \tag{2.4}$$
$$w_t = E_{t-1}(p_t + \vartheta_t) + k_t - \sigma E_{t-1} u_t \tag{2.5}$$
$$u_t = l_t - n_t \tag{2.6}$$
$$\vartheta_t = \vartheta_{t-1} + \varepsilon_t^s \tag{2.7}$$
$$\tau_t = \tau_{t-1} + \varepsilon_t^l \tag{2.8}$$
$$k_t = \rho k_{t-1} + \varepsilon_t^w \tag{2.9}$$
$$d_t = d_{t-1} + \varepsilon_t^d \tag{2.10}$$

In accordance with Equation 2.1, the aggregate demand depends on policy changes (d_t), and productivity changes (ϑ_t) modelled as random walk by Equations 2.10 and 2.7 (d_t) can be understood as changes in fiscal or monetary policies (in the current case related also to the credit market), while ϑ_t, as the effect of productivity on income. Equation 2.2 is a constant return production function. Equation 2.3 is a pricing equation: companies have market power and set prices based on the cost of labour and given the unemployment situation. Equation 2.4 is a labour supply equation, which depends on demography and exogenous factors modelled by Equation 8. The equation implies an assumption that, in the long-term period, labour supply shall depend on the gap between real wages and productivity. Equation 2.5 defines the wage setting mechanism: wages depend on the level of prices, productivity, and the exogenous parameter modelled by Equation 2.9 which defines wage-push shocks or simply windows of opportunity elsewhere. Equation 2.6 defines the unemployment rate which is the difference between

[4] The identification methodology itself shall not be presented in the paper, as it does not differ from that by Blanchard et al. (1989). Before the identification of the sVAR model and the selection of a delay period, standard tests shall be carried out.

the labour force and the working-age population. Equations 2.1 and 2.10 can be solved expressing endogenous variables as a function of exogenous variables. If we accept the assumption that wages are set at the beginning of the period, before all except wage shocks (ε_t^w)„ and the companies set prices when they have full information, by means of Equations 2.3 and 2.5, $E_{t-1}u_t$, can be expressed as

$$E_{t-1}u_t = \frac{1}{\sigma - \beta} k_t \,. \tag{2.11}$$

By inserting it into Equation 2.4, we shall get:

$$l_t = \tau_t - \frac{\alpha\beta}{\sigma - \beta} k_t \,. \tag{2.12}$$

In order to express the unemployment rate as the function of exogenous variables, it is necessary to express labour (n_t) using the production function (2.2). Then, by means of Equations 2.1 and 2.3 and changing y_t and p_t, we express labour (n_t) as exogenous variables and the wage function. Finally, by means of that expression and Equations 2.4 and 2.6, we get:

$$u_t = \frac{1}{1 - \theta\beta}\left[\tau_t - \frac{\alpha\beta}{\sigma - \beta} k_t - \theta d_t + \theta w_t - (a + \theta - 1)\vartheta_t\right]. \tag{2.13}$$

By means of Equation 2.11, we can express the wage equation:

$$w_t = \frac{1}{\theta}\left[\frac{1 - \theta\beta}{\sigma - \beta} k_t - \tau_{t-1} + \frac{\alpha\beta}{\sigma - \beta} k_t + \theta d_{t-1} - (a + \theta - 1)\vartheta_{t-1}\right]. \tag{2.14}$$

If we accept the assumption that |ρ| < 1, Equation 2.14 shall indicate that, in the long-term period, nominal wages shall depend on aggregate demand, productivity, and demographic changes. If we use the said expression and replace the wages in Equation 2.13 with it, we shall get:

$$u_t = \frac{\alpha\beta}{\sigma - \beta} k_t + \frac{1}{1 - \theta\beta}\left[\varepsilon_t^l - \theta\varepsilon_t^d - (a + \theta - 1)\varepsilon_t^s\right]. \tag{2.15}$$

The unemployment inflexibility is defined by the parameter ρ in Equation 9: provided ρ = 1, the unemployment rate is integrated in the first order *I(1)*, and when |ρ| < 1, the unemployment rate is a stationary process. In that case, the price level (2.3) depends merely on wages and productivity. The aggregate demand can be expressed as follows:

$$y_t = l_t - (l_t - n_t) + \vartheta_t = l_t - u_t + \vartheta_t \,. \tag{2.16}$$

Upon using that, we can state that when |ρ| < 1, the following long-run restrictions of the sVAR identification can be used:

$$\begin{bmatrix} \Delta(w_t - p_t) \\ \Delta y_t \\ \Delta p_t \\ u_t \end{bmatrix} = \begin{bmatrix} c_{11} & 0 & 0 & 0 \\ c_{21} & c_{22} & 0 & 0 \\ c_{31} & c_{32} & c_{33} & 0 \\ c_{41} & c_{42} & c_{43} & c_{44} \end{bmatrix} \begin{bmatrix} \Delta\varepsilon_t^s \\ \Delta\varepsilon_t^l \\ \Delta\varepsilon_t^d \\ \Delta\varepsilon_t^w \end{bmatrix} + C^*(L) \begin{bmatrix} \Delta\varepsilon_t^s \\ \Delta\varepsilon_t^l \\ \Delta\varepsilon_t^d \\ \Delta\varepsilon_t^w \end{bmatrix}. \quad (2.17)$$

By using the sVAR model specification presented in 2.17, the unemployment dynamics can be explained as a process affected by individual shocks, among which just the wage-push shocks have a permanent effect, while the remaining ones have only a temporary effect.

In the identification of the VAR model, the national data on the wages in the period of 2000 to 2014, inflation, GDP (the prices of 2005), and unemployment rate have been used.[5] The results are presented in the following chapter.

3. The outcomes

Using the sVAR model we can break down the unemployment rate into the effects of its moving average and the effects of individual structural shocks (see Fig. 1). As shown in Fig. 1, the largest share of the unemployment dynamics during an economic cycle can be explained by productivity shocks. Such an explanation would be close to the real business cycle theory which explains the cyclical nature of economy by changes in productivity. However, the remaining shocks also account for a significant part of the changes in unemployment.

Productivity shocks predetermined up to 6% of changes in the unemployment rate, while the remaining ones up to 2%.

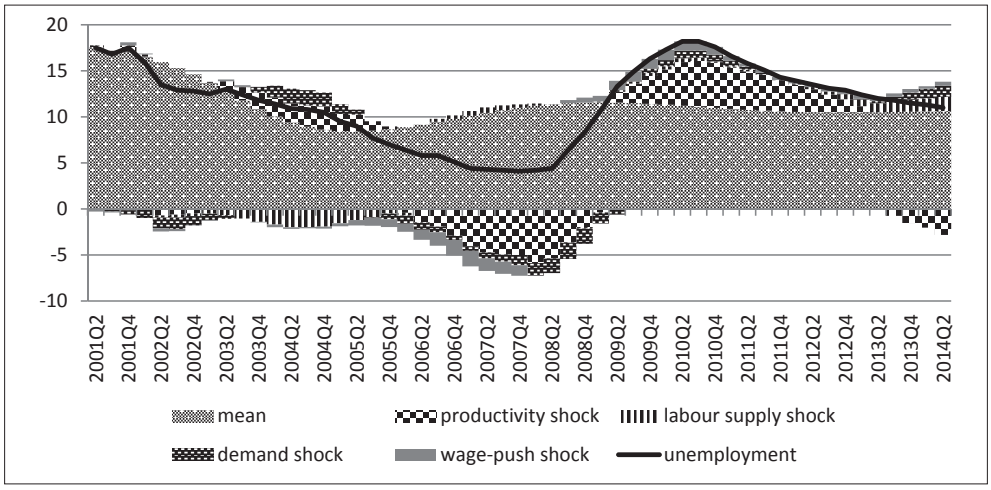

FIG. 1. **The break-down of the unemployment rate into several components that predetermined it.**
Source: compiled by the author.

[5] Unemployment rate is stationary while all other variables are stationary.

On the basis of the previously discussed logic (2.17), the impact of individual shocks can be divided into cyclical, with just short-term effects (the productivity, demand, and labour supply shocks), and structural (the wage-push shock). The sum of the impact of productivity, demand and wage push shocks can be respectively considered as cyclical, while the sum of mean and wage-push shock is structural unemployment. The break-down of the cyclical and structural unemployment based on the said logic is presented in Fig. 2.

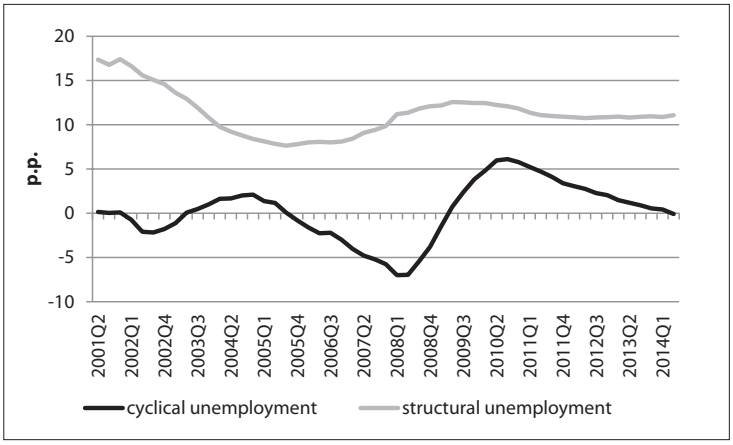

FIG. 2. **Cyclical and structural unemployment in Lithuania.**

Source: compiled by the author.

The greater part of the changes in unemployment in the period of 2002 to 2014 were predetermined by cyclical shocks (of productivity and labour supply and demand). During the economic decline, the cyclical unemployment in the years 2010 to 2011 amounted to ca. 6% of the overall unemployment, while in the years of the economic boom 2005 to 2008 it was negative and showed the economy overheating trends.

In the cycle of 2004 to 2014, structural unemployment was changing slowly, although before that it had been decreasing noticeably. In the years of the economic boom (2006 to 2007), it amounted to ca. 8% (at the time, the cyclical unemployment was negative, and the overall unemployment rate was below 6%), therefore, the economy faced overheating. However, with the steep rise in factual unemployment after the economic decline, the structural unemployment also increased and amounted to 12% in the years 2009 to 2010, while in 2014 it was somewhat lower and amounted to 11%.

Conclusions

The main aim of the paper was an analysis of the factors that predetermined the unemployment rate in Lithuania. The factors with long-term and short-time effects have been identified, which were simultaneously predetermined by both the demand and supply

shocks. That has been done using the sVAR model with long-term restrictions, proposed by Fabiani et al. (2001). Using the model, Lithuanian unemployment was broken down into cyclical and structural.

The largest part of the changes in unemployment over the period of 2002 to 2014 was predetermined by cyclical shocks (those of productivity and of labour demand and supply). The cyclical unemployment in 2010 to 2011 amounted to ca. 6% of the overall unemployment. On the other hand, the structural unemployment was changing slowly, as well as the shocks that predetermined it (that of wage push), and in the economic boom years (2006 to 2007) it amounted to ca. 8% (at the time, cyclical unemployment was negative, and the economy faced overheating, while in 2014 it was slightly higher and amounted to ca. 11%).

The fact that productivity shocks had the greatest impact on the unemployment rate during the recent economic cycle is compatible with the classical business cycle theory which argues that business cycles are predetermined by fluctuations in productivity (for more details, see Stadler (1994)). However, such results would be difficult to justify by the predominant (New Keynesian) economic theory which argues that economic cycles are mainly predetermined by demand shocks.

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