Hysteresis Effect on Unemployment: Evidence from the Visegrad Countries[1]

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Abstract

Hysteresis effect on unemployment is a much discussed topic in macroeconomics. However, empirical findings regarding the existence of hysteresis effect are contradictory. The present study investigates hysteresis in the unemployment rates of the Visegrad Group countries, namely: the Czech Republic, Hungary, Poland and Slovakia. For this purpose it employs the following three econometric methods: (1) the linear unit root tests; (2) the Seemingly Unrelated Regressions Augmented Dickey-Fuller (SURADF) test; and (3) the Fourier Dickey- -Fuller (FADF) test. The findings revealed that among the Visegrad Group countries hysteresis effect was found to exist in the unemployment rates in Hungary and Poland.

Keywords: *unemployment, hysteresis effect, Visegrad countries*

JEL Classification: E24, C22

1. Introduction

Hysteresis effect on unemployment is a much discussed topic in macroeconomics. However, economists do not have a uniform opinion regarding the existence of hysteresis. The proponents of the natural rate hypothesis argue that hysteresis effect does not exist (Phelps, 1967; 1972; Friedman, 1968). According to them, a higher-than-normal unemployment rate reverts back to the natural rate of unemployment. This hypothesis assumes that the equilibrium unemployment is determined by labour market institutions and not affected by the actual path of the unemployment rate. Unexpected movements in labour supply lead to changes in the rate of inflation and to a return to the non-accelerating inflation

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rate of unemployment (NAIRU) in the long-run (Phelps, 1967; Friedman, 1968). In other words, the natural rate hypothesis proposes that cyclical fluctuations in the economy have an impact on the unemployment rate only in the short run (Smyth, 2003).

The basic idea behind the natural rate hypothesis could be expressed by the expectations-augmented Phillips curve equation (Ball, 2009):

$$\Pi = \Pi_{-1} + \alpha(U - U^*) \tag{1}$$

where
Π – the inflation rate,
Π_{-1} – the lagged inflation that can be used as the expected inflation rate,
α – the constant parameter that should be less than zero,
U – the unemployment rate,
U^* – the natural rate of unemployment.

This means that the current inflation rate is determined by the expected inflation rates and the unemployment gap, which is the difference between the actual unemployment rate and the equilibrium unemployment rate. In other words, the natural rate of unemployment is considered as an exogenous variable.

However, the fundamental principles of the natural rate hypothesis are not universally accepted. The economists who maintain that hysteresis effect on unemployment exists support the alternative hypothesis known as the hysteresis hypothesis (Blanchard and Summers, 1986). According to it, a high unemployment rate can persist and a higher-than-normal unemployment will not eventually revert to the equilibrium level. The proponents of the hysteresis hypothesis argue that hysteresis effect on unemployment will have especially profound negative effects during the economic crises. The implication of the existence of hysteresis effect on unemployment is that high unemployment may be long and protracted.

The basic assumptions behind the hysteresis hypothesis could be expressed by the following equation (Song and Wu, 1998; Ball, 2009):

$$U^* = (1 - \theta)U_{-1}^* + \theta U_{-1} \tag{2}$$

where
U_{-1}^* – the lagged value of the natural unemployment rate,
U_{-1} – the lagged value of the unemployment rate,
θ – another constant parameter that captures the degree of hysteresis in the unemployment rate.

If hysteresis effect on unemployment exists, the hysteresis parameter will take a non-zero value. Otherwise, the hysteresis parameter should be zero.

Based on these theoretical frameworks, the present study investigates the existence of hysteresis effect on unemployment in the Visegrad Group. The four members of the Visegrad Group, also known as the Visegrad Four or V4 are: the Czech Republic, Hungary, Poland and Slovakia. As Figure 1 shows, the movement of the unemployment rates in the Visegrad Four countries has two distinct patterns: the trajectories of the unemployment rates in the Czech Republic and Hungary are very different from those in Poland and Slovakia. The Czech Republic and Hungary enjoyed relatively low unemployment rates until the mid-2000s. In the aftermath of the global economic crisis that had occurred in 2007 – 2008, unemployment in these two countries kept increasing. By contrast, unemployment in Poland and Slovakia remained relatively high until the later part of the decade. Just before the global crisis, these countries enjoyed the lowest unemployment rates in a decade. However, during the economic crisis the unemployment rates in Poland and Slovakia increased and remained high since then.

F i g u r e 1

Unemployment Rates in the Visegrad Countries from 1998Q1 to 2013Q3
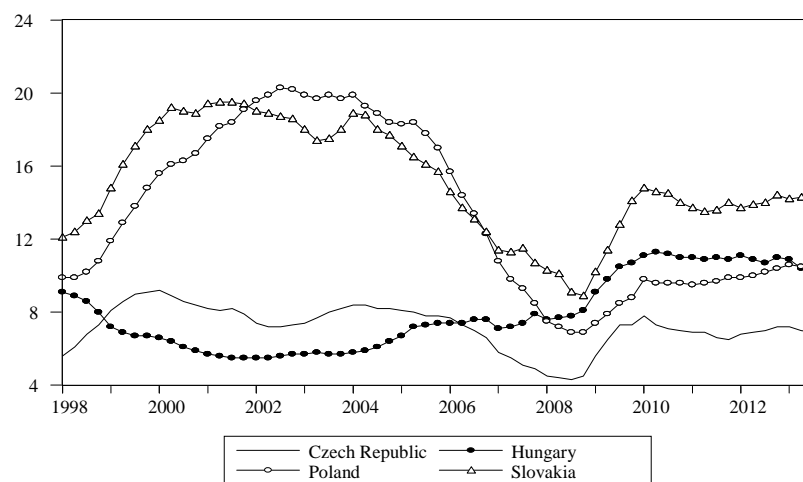
Source: Eurostat (2014).

The basic motivation of this study is to perform more powerful tests in addition to traditionally used linear unit root tests. Therefore, it employs three different econometric methods to investigate hysteresis effect on unemployment in the V4 countries, namely: (1) the linear unit root tests; (2) the Seemingly Unrelated Regressions Augmented Dickey-Fuller (SURADF) test; and (3) the Fourier Dickey-Fuller (FADF) test.

There are several advantages to using the SURADF test and the FADF test. First of all, the important methodological advantage of the SURADF test is that it can take account of economic interdependency among the V4 countries. Robust economic and business ties that these countries enjoy create a higher interdependence and deeper integration of their labour markets. In this connection, the SURADF test would yield more precise results because it employs the Seemingly Unrelated Regression (SUR) that takes into account contemporaneous cross-correlations of the error terms (Breuer, McNown and Wallace, 2002). Secondly, the newly developed FADF test is advantageous for examining nonlinear behaviour of the unemployment rates. According to Enders and Lee (2012a), a Fourier approximation can be used to capture unknown structural breaks or unattended nonlinearity in the deterministic component of the model. For this reason, methods that incorporate a Fourier function into the unit root tests have generated a considerable interest among researchers. For example, Becker, Enders and Lee (2006) employed a nonlinear KPSS-type stationarity test; Rodrigues and Taylor (2012) adopted the DF-GLS de-trending method; and Enders and Lee (2012b) used the Lagrange Multiplier de-trending method.

This article consists of five sections. Following this Introduction, Section 2 offers a brief overview of relevant literature on hysteresis effect. Section 3 informs about the data collection and the research methods adopted in this study. The findings are reported in Section 4. Section 5 contains concluding remarks.

2. Literature Review

Hysteresis effect on unemployment has generated a considerable interest among economists and there are numerous studies on this topic. However, the findings reported in these studies are not consistent. A summary of the results obtained in the previous empirical research studies is provided in Table 1. Generally, three methodological approaches have been employed to analyse hysteresis effect, namely: (1) the linear unit root test; (2) the panel unit root test; and (3) the nonlinear unit root test. Some of the studies were able to detect the existence of hysteresis effects on unemployment (Neudorfer, Pichelmann and Wagner, 1990; Brunello, 1990; Mitchell, 1993; Røed, 1996; Chang et al., 2005; Romero-Avila and Usabiaga, 2007a; 2007b; Lee, Wu and Lin, 2010; Ener and Arica, 2011; Furuoka, 2012). The implication of these findings is that the higher-than-normal unemployment rates in the countries under study will not revert to the normal levels of unemployment and these countries will experience high unemployment for long periods of time. On the other hand, a number of researchers failed to detect hysteresis effect on unemployment (Song and Wu, 1998;

Camarero and Tamarit, 2004; Christopoulos and León-Ledesma, 2007; Lee, Lee and Chang, 2009; Romero-Avila and Usabiaga, 2007b; Sephton, 2009). These results imply that the higher-than-normal unemployment rates will eventually revert to the normal level.

T a b l e 1

Summary of Findings from Previous Empirical Inquiries

	Linear unit root test	**Panel unit root test**	**Unit root test with structural break**
Existence of hysteresis effect	1. Neudorfer et al. (1990), ADF test, Austria 2. Brunello (1990), ADF test, Japan 3. Mitchell (1993), ADF and PP tests, 15 OECD countries 4. Røed (1996), ADF test, 16 OECD countries	1. Chang et al. (2005), 10 EU countries, SURADF 2. Ener and Arica (2011), 15 OECD countries, SURADF 3. Furuoka (2012), 12 countries in Asia--Pacific, SURADF	1. Romero-Avila and Usabiaga (2007a), 50 states in the USA, LM unit root test with structur-al breaks 2. Romero-Avila and Usabiaga (2007b), Spain, LM unit root test with structural breaks 3. Lee et al. (2010), 9 Asian countries, LM test with structural breaks
No hysteresis effect	Nil	1. Song and Wu (1995), panel-based Wald test, 15 OECD countries 2. Camarero and Tamarit (2004), 19 OECD countries, MADF, SURADF 3. Christopoulos and León-Ledesma (2007), 12 EU countries, second generation of panel unit root test, 4. Lee et al. (2009), 19 OECD countries, panel LM test	1. Romero-Avila and Usabiaga (2007b), USA, LM unit root test with structural breaks 2. Sephton (2009), 50 states in USA and Puerto Rico, fractional unit root test with structural breaks

Source: Author's compilation.

The discrepancies in the empirical findings reported by the previous studies can be due to the differences in the methodological approaches. Firstly, the researchers who employed the linear unit root tests – such as the ADF test or the PP test – were able to detect the existence of hysteresis effect on unemployment (Neudorfer, Pichelmann and Wagner, 1990; Brunello, 1990; Mitchell, 1993; Røed, 1996). The same result yielded the studies that used the SUR-based ADF (SURADF) tests (Chang et al., 2005; Ener and Arica, 2011; Furuoka, 2012). Secondly, the studies that performed the panel unit root test – such as the second generation unit root test or the panel LM test – did not find evidence for the existence of hysteresis effect (Song and Wu, 1998; Christopoulos and León-Ledesma,

2007; Lee, Lee and Chang, 2009). Thirdly, the findings were mixed in the research studies that performed the unit root tests with structural breaks: some of these studies could detect hysteresis effect (Romero-Avila and Usabiaga, 2007a, 2007b; Lee, Wu and Lin, 2010) while others failed to do so (Romero-Avila and Usabiaga, 2007b; Sephton, 2009).

The behaviour of the unemployment rates in the V4 countries has been investigated in several studies and their findings are summarized in Table 2.

T a b l e 2

Summary of Findings from Hysteresis Effects in the Visegrad Countries

Authors	Countries	Data	Methods	Finding
Jurajda and Münich (2003)	Czech Republic	Annual data, 1994 – 2001	Probit regression analysis	Welfare benefits have impact on low income families
Münich and Svejnar (2007)	Six countries in Central and East Europe, including all four Visegrad countries	Panel data, 1994 – 2001	Unemployment-vacancy scatter analysis	Hysteresis effect in all four Visegrad countries
Galuscak and Münich (2007)	Czech Republic	Annual data, 1995 – 2004	Log-linear regression analysis	Hysteresis effect in Czech
León-Ledesma and McAdam (2004)	Twelve countries in Central and East Europe, including all four Visegrad countries	Monthly data, 1991:M1-2002:M3	Linear unit root test, panel unit root test and unit root test with structural breaks	No hysteresis effect when using panel unit root test and unit root with structural breaks
Camarero et al. (2008)	Eight countries in Central and East Europe, including all four Visegrad countries	Monthly data, 1991:M1-2002:M11	Panel unit root test and panel unit root test with structural breaks	No hysteresis effect when using panel unit root test with structural breaks

Source: Author's compilation.

In one of the studies, Jurajda and Münich (2003) examined the impact of the welfare benefits on the long run unemployment, which is considered the main cause of hysteresis effect. The results indicated that the welfare benefits had an impact on the low income families only. In another study, Münich and Svejnar (2007) used the unemployment-vacancy (*UV*) scatter analysis to examine hysteresis effect under a condition when the *UV* curve shifted in the rightward direction due to a supply shock. The researchers detected hysteresis effect on the *UV* relationship in all four of the Visegrad Group countries. Galuscak and Münich (2007) used the log-linear regression analysis to examine the *UV* relationship in the Czech Republic between 1995 and 2004. The researchers confirmed the existence of hysteresis effects in the *UV* curve in the country. Furthermore, León--Ledesma and McAdam (2004) investigated hysteresis effect in twelve Central and East European countries. They detected the existence of hysteresis effect

when they employed the linear unit root tests. However, as the researchers pointed out, no hysteresis effect was found when they performed the panel unit root tests and the unit root tests with structural breaks.

A study by Camarero, Carrion-i- Silvestre and Tamarit (2008) focused on eight countries in Central and East Europe. The researchers established the presence of hysteresis effect when they employed the panel unit root tests. However, the results indicated otherwise when the panel unit root tests with structural breaks were performed.

3. Data and Research Methods

The data on the unemployment rates in the V4 countries were obtained from the Eurostat's database. This study used the quarterly data on unemployment ranging from the first quarter of 1998 to the third quarter of 2013. The number of observations was 63 (Eurostat, 2014).

The study employed three different econometric methods, such as: (1) the linear unit root tests; (2) the Seemingly Unrelated Regressions Augmented Dickey-Fuller (SURADF) test; and (3) the Fourier Dickey-Fuller (FADF) test. In other words, besides the conventional linear unit tests, this study performed more powerful SURADF test and FDAF test.

The SURADF test and the FADF test could be considered as extensions of the univariate unit root test. A widely used procedure to test the unit root hypothesis is the ADF test. A standard version of an individual ADF test is based on the following regression (MacKinnon, 2002):

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{j=1}^{l} \delta_j \Delta y_{t-j} + \varepsilon_t \tag{3}$$

where

α, β, and δ_j – the coefficients,
l – the lag length of the autoregressive process,
ε_t – the error term.

The optimal lag length ($\tilde{l}$) was selected by using the Akaike Information Criterion (AIC) (Akaike, 1974). The optimal lag length is a selected lag length that produces the smallest AIC value among the different choices of the lag length. Hayashi (2000) suggested that in order to select the lag length, the researcher needs to specify the upper bound or the maximum lag length (l_{max}). Due to a limited number of observations in the datasets, the present study sets the maximum lag length as 10.

The SURADF tests employ the seemingly unrelated regression (SUR) to estimate the ADF statistics. In the present study, the system of the ADF equations can be expressed as:

$$\Delta y_{1,t} = \alpha_1 + (\beta_1 - 1) y_{1,t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{2,t-i} + u_{1,t}$$

$$\Delta y_{2,t} = \alpha_2 + (\beta_2 - 1) y_{2,t-1} + \sum_{i=1}^{P} \delta_i \Delta y_{2,t-i} + u_{2,t}$$

$$\Delta y_{N,t} = \alpha_N + (\beta_N - 1) y_{N,t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{n,t-i} + u_{N,t}$$

where

δ_i – the autoregressive coefficient for series i.

In the SURADF procedure, the significance of each $(\beta_i - 1)$ can be tested (Breuer, McNown and Wallace, 2002). This study estimates critical values for the SURADF test by using 10,000 replications of the Monte Carlo simulation.

Enders and Lee (2012a) developed an ADF-type unit root test that uses a selected frequency component of a Fourier function to approximate the deterministic component of the model. They proposed employing a Fourier approximation in order to capture unknown structural breaks or unattended nonlinearity in the deterministic component of the model. The nonlinear Fourier ADF statistic (τ_{DF}) is based on the following equation:

$$y_t = \rho y_{t-1} + c_0 + \gamma_1 \sin(\frac{2\pi kt}{T}) + \gamma_2 \cos(\frac{2\pi kt}{T}) + \sum_{i=1}^{l} c_i \Delta y_{t-1} + e_t \qquad (4)$$

where

k – the selected frequency for the Fourier approximation,
γ – the parameters for the Fourier approximation,
t – the trend term,
T – the number of observations,
$\pi = 3.1416$.

The Fourier ADF statistic (τ_{DF}) is the t-statistic for the null hypothesis $\rho = 0$ in Equation 4.

Obviously, the standard ADF test is a special case of the Fourier ADF test where the trigonometric terms are set as zero (i.e. $\gamma_1 = \gamma_2 = 0$). Enders and Lee (2012a) proposed that the usual F-statistic be used to determine whether to include the trigonometric terms into the model. As Equation 4 indicates, the *FADF*

statistic is dependent on the frequency (k) and the lag length (l). Following the suggestion by Enders and Lee (2012a) that a Fourier function where $k = 1$ or $k = 2$ can serve as a reasonable approximation to capture many types of unknown structural breaks, the maximum frequency (k_{max}) in this study was set as 2. The data driven method was used to select the optimal frequency ($\tilde{k}$). The optimal frequency is the one that produces the smallest sum of the squared residuals (SSR) among the different specifications in Equation 4. The optimal lag length ($\tilde{l}$) in this study was selected by employing the Akaike Information Criterion (AIC).

The analysis of the unemployment rates in the V4 countries will be implemented in three steps. First of all, the linear unit root test will examine a stationary process in the unemployment rates. Then, the SURADF test will be performed because it is able to yield more precise results by accommodating economic interdependency among the V4 countries. Finally, the FADF test will be applied to determine whether the unemployment rates in the V4 countries could be described as a stationary process; the FADF can deliver better results because it captures unknown structural breaks or the unattended nonlinearity in the model.

4. Empirical Results

The following four linear unit root tests were performed in the first step of the analysis: (1) the augmented Dickey-Fuller (*ADF*) test (Dickey and Fuller, 1979); (2) the Phillips-Perron Z_t (*PP*) test (Phillips and Perron 1988); (3) the Kwiatkowski, Phillips, Schmidt and Shin (*KPSS*) test (Kwiatkowski et al., 1992); and (4) the Elliott, Rothenberg and Stock point optimal (*ERS*) test (Elliott, Rothenberg and Stock, 1996). The findings from these tests are reported in Table 3.

T a b l e 3

Linear Unit Root Test Results

Countries	ADF	PP	KPSS	ERS
Czech Republic	–3.185(2)**	–2.314[5]	0.347[6]*	1.999(2)**
Hungary	–1.058(1)	–0.826[5]	0.695[6]**	9.680(1)
Poland	–2.001(2)	–1.230[6]	0.477[6]**	2.932(2)**
Slovakia	–2.017(1)	–1.631[5]	0.429[1]*	4.728(1)

Note: Numbers in parentheses indicated the optimal lag length suggested by Akaike Information Criterion (Akaike, 1974). Numbers in brackets indicate the optimal bandwidth suggested by Newey-West bandwidth section method (Newey and West, 1994).
** Indicates significant at the 5 percent level.
* Indicates significant at the 10 percent level.

Source: Author's calculation.

As the results show, the ADF test failed to reject the null hypothesis of hysteresis effect, except for the Czech Republic. In other words, the unemployment rates in three of the Visegrad Group countries – Hungary, Poland and Slovakia – had a unit root and, therefore, could be considered as a non-stationary process. By contrast, the unemployment rate in the Czech Republic was found to be stationary. The findings from the ADF test were largely confirmed by the PP test, which failed to reject the null hypothesis of hysteresis effect for all four countries. The KPSS test produced identical to the PP test findings: it rejected the null hypothesis of hysteresis effect for all four countries. This means that the unemployment rates in the V4 countries could be considered as a non-stationary process. The findings from the ERS test were largely in line with the findings from the ADF test: they failed to reject the null hypothesis of hysteresis effect for Hungary and Slovakia but did reject the null hypothesis for the Czech Republic and Poland.

Despite some discrepancies in the results, the four linear unit root tests produced largely consistent findings. They indicated that the unemployment rates in the V4 countries – with the exception of the Czech Republic – can be considered as a non-stationary process. In other words, the linear unit root tests indicated that hysteresis effect existed in Hungary's, Poland's and Slovakia's unemployment rates. At the same time, no hysteresis effect was found to exist in the Czech Republic's unemployment rate.

In the second step of the analysis, the Seemingly Unrelated Regression (SUR) based on the SURADF test was performed. The findings are reported in Table 4. As the table shows, the SURADF test failed to reject the null hypothesis of hysteresis effect, except for the Czech Republic. Interestingly, the empirical findings from the SURADF test were identical to the results obtained from the linear unit root tests in the first step of the analysis. The results unambiguously showed that hysteresis effect existed in Hungary's, Poland's and Slovakia's unemployment rates. The results also confirmed the absence of hysteresis effect in the Czech Republic's unemployment rate.

T a b l e 4

SURADF Test and its Critical Values

Countries	SURADF statistics	Critical values		
		1 percent	*5 percent*	*10 percent*
Czech Republic	–3.170*	–4.117	–3.460	–3.128
Hungary	–0.630	–3.855	–3.544	–2.593
Poland	–2.504	–4.118	–3.450	–3.104
Slovakia	–2.713	–4.107	–3.396	–3.037

Note: * Indicates significance at the 10 percent level.
Critical values were estimated by 10,000 replications of the Monte Carlo simulation.

Source: Author's calculation.

In the final step of the study, the FADF test was conducted. The findings from this test are shown in Table 5. As explained in the previous section, the optimal frequency ($\tilde{k}$) for the *FADF* statistic must be selected by the data driven method while the optimal lag length ($\tilde{l}$) should be based on the AIC. In this study, the optimal frequencies for all four countries were set as 1 (see Table 5). The optimal lag length was set as: 4 for the Czech Republic; 5 for Hungary; 1 for Poland; and 7 for Slovakia (see Table 5).

T a b l e 5

Nonlinear FADF Test Results

Countries	$\tilde{k}$	SSR	$\tilde{l}$	AIC	$F(\hat{k})$	τ_{DF}
Czech Republic	1	1.958	4	0.089	4.251	−3.779*
Hungary	1	1.656	5	0.014	2.467	−1.750
Poland	1	3.974	1	0.554	7.777**	−2.232
Slovakia	1	4.456	7	1.155	8.480**	−3.874**

Note: The optimal lag ($\tilde{l}$) is the lag length that minimizes the Akaike Information Criterion (Akaike, 1974). The optimal frequency ($\tilde{k}$) was selected by using data-driven grid search method in which the frequency minimized the SSR from Equation 4.
** Indicates significance at the percent level.
* Indicates significance at the 10 percent level.
Source: Author's calculation.

The study performed the *F*-test in order to test the null hypothesis $\gamma_1 = \gamma_2 = 0$ in Equation 4. If the test rejects the null hypothesis of linearity, the study should proceed using the nonlinear unit root test; otherwise, the linear unit root test should be employed. As shown in Table 5, the null hypothesis was rejected for Poland and Slovakia. Therefore, the nonlinear unit root test – the FADF test – must be used for the analysis of these countries' unemployment rates. On the other hand, the *F*-test did not reject the null hypothesis for the Czech Republic and Hungary. This means that the unemployment rates in the Czech Republic and Hungary must be tested using the SURADF test.

The findings also show that in the case of the Czech Republic both the linear unit root tests and the SURADF test rejected the null hypothesis. This means that the unemployment rate in this country could be best described as a stationary process and there was no hysteresis effect on unemployment. By contrast, the linear unit root test and the SURADF test failed to reject the null hypothesis for Hungary, which means that there existed hysteresis effect on Hungary's unemployment rate. Furthermore, as reported in Table 5, the nonlinear FADF test rejected the null hypothesis for Slovakia, which indicates that the unemployment rate in the country could be best described as a stationary process and there did not exist hysteresis effect on unemployment. In the case of Poland, the nonlinear FADF test failed to reject the null hypothesis indicating that hysteresis effect was present.

In short, the linear unit root tests and the SURADF test indicated that – with the exception of the Czech Republic – hysteresis effect could be detected in the V4 countries. These results were in the line with the hysteresis hypothesis. However, the findings obtained from the more powerful newly developed nonlinear FADF test indicated that hysteresis effect did not exist in the unemployment rates of the Czech Republic and Slovakia, which supports the natural rate hypothesis. Overall, hysteresis effect was found to exist in two out of the V4 countries, namely: Hungary and Poland.

Conclusion

This study's empirical findings revealed that the Czech Republic and Slovakia had more vibrant and more resilient labour markets among the V4 countries. In these two countries the external shocks, such as the global financial crisis of 2007 – 2008 and the Euro crisis, did not have a lasting negative impact on employment, and the unemployment rates in the Czech Republic and Slovakia reverted back to the equilibrium levels. By contrast, the findings implied that Poland's and Hungary's labour markets were less flexible.

There are important practical policy implications based on these findings. For example, in the cases of the Czech Republic and Slovakia the high unemployment rates are unlikely to persist. This means that monetary policies introduced by the governments in these two countries may not have a lasting big impact on the unemployment rates. Therefore, policymakers in the Czech Republic and Slovakia have a greater freedom and a larger 'manoeuvre space' for hammering out monetary policies aimed at achieving the targeted level of inflation.

On the other hand, the existence of hysteresis effect in Hungary and Poland indicates that these countries could suffer from prolonged periods of high unemployment. This means that if the governments in Hungary or Poland decide to introduce expansionary monetary policies to control the high inflation rates this decision could produce a negative effect on the unemployment rates in these countries in the long run. Therefore, when devising and implementing economic policies of inflation targeting, policymakers in Hungary and Poland may want to take into account the adverse consequences of hysteresis effect.

Due to constraints in obtaining the data, the present study used the quarterly data of unemployment in the V4 countries from the first quarter of 1998 to the third quarter of 2013. Future studies on hysteresis effect in the V4 countries will need to analyze longer periods of the time series data. This will enrich our understanding of hysteresis effect and help to deal with the problem of unemployment in more efficient ways.

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