Fumitaka Furuoka

Asia-Europe Institute,
University of Malaya,
Kuala Lumpur,
Malaysia

✉ fumitaka@um.edu.my
✉ fumitakamy@gmail.com

Unemployment Hysteresis in the "Nordic Kitten": Evidence from Five Estonian Regions

Summary: Unemployment hysteresis is a much discussed and researched topic in macroeconomics. The present paper examined unemployment hysteresis in five Estonian regions. It used two panel data methods, namely, the Im-Pesaran-Shin (IPS) test and the Fourier Im-Pesaran-Shin (FIPS) test. The originality and value of this paper is that this is the first study that uses the panel unit root tests to examine unemployment dynamics in the Estonian regions. The findings revealed that the unemployment rates in the Estonian regions could be best described as a stationary process. This result is in line with the natural rate hypothesis. A research implication is that this study has illustrated that nonlinear tests could be an appropriate approach to examine unemployment hysteresis because other methods may fail to reject the null hypothesis. A practical implication of this study is that it sheds light on the nature of unemployment dynamics in Estonia at the regional level. As the findings revealed, the unemployment rates in the Estonian regions had the mean-reversion property. Therefore, the higher-than-normal unemployment rates are likely to return to the natural level even in the absence of intervention policies initiated by the government or policy makers.

Key words: Unemployment hysteresis, Estonia, Panel unit root test, Regional economies.

JEL: C22, E24.

A rapid collapse of the US stock market occurred at the end of the 2000s and the European Union (EU) countries have subsequently faced an acute public debt problem in the beginning of the 2010s. This serious economic problem in the Euro area come to be known as the "Euro crisis". In the midst of this turmoil, Estonia remained one of the healthiest economies in Europe. In 2011, Estonia's government debt was only 6.7 percent of the country's gross domestic product (GDP). In comparison, Greece's public debt was 152 percent of the country's GDP (Chris Hannay 2011).

However, it is important to consider the differences in the patterns of economic development as well as in the reactions and responses to the crisis among new EU member countries. In the case of the Baltic countries, Estonia's response to the economic challenges was far more efficient compared to the measures taken by its two neighbours, Latvia and Lithuania. A disciplined and efficient management of the economy aligned Estonia with successful Nordic countries and earned it the moniker "Nordic Kitten" that distinguished Estonia from the ailing "Baltic Tigers", which Latvia and Lithuania had become.

Despite good performance at national level, economic discrepancies among Estonia's five regions raise concerns because some of the regions have been suffering from high unemployment since the early 2000s. High unemployment is among the thorniest issues in any country's economic policy and it is one of the most serious concerns for policymakers. For these reasons, great differences in the unemployment rates among the Estonian regions merit closer attention.

The present study focuses on unemployment dynamics in all five regions in Estonia, including Northern Estonia (*Pohja Eesti*), Central Estonia (*Kesk Eesti*), Northeastern Estonia (*Kirde Eesti*), Western Estonia (*Laane Eesti*) and Southern Estonia (*Louna Eesti*). The main obstacle to conduct an empirical analysis on unemployment hysteresis in the Estonian regions is the lack of systematic data. To overcome this methodological problem, this study performed two panel unit root tests, namely, the Im-Pesaran-Shin test and the Fourier Im-Pesaran-Shin test. The originality and value of this paper is that this is the first study to examine unemployment dynamics in Estonian regions using the panel unit root tests. A methodological novelty of this study is the use of a bootstrap unit root method to estimate critical values (Joon Y. Park 2003).

1. Theoretical and Econometric Perspectives on Unemployment Hysteresis

Unemployment hysteresis is an important and much discussed topic in macroeconomics. An animated academic debate on the existence of hysteresis in unemployment has continued for several decades. Researchers' opinions are divided between two contradictory schools of thought, namely, the natural rate hypothesis and the hysteresis hypothesis. Proponents of the natural rate hypothesis argue that the equilibrium unemployment is determined by labour market institutions in a country and is not affected by the actual level of unemployment. Furthermore, unexpected movements in labour demand and supply cause deviations from the equilibrium unemployment and change the situation with the actual unemployment. These deviations trigger changes in the rate of inflation, which eventually leads to the return to the equilibrium level of unemployment. This line of reasoning is known as the non-accelerating inflation rate of unemployment (NAIRU) (Olivier J. Blanchard and Lawrence H. Summers 1986a). In other words, cyclical fluctuations in an economy would influence the situation with unemployment in the short run. However, provided that there are no interventions from the government, the unemployment rate would eventually revert to the NAIRU in the long run (Russell Smyth 2003).

In contrast, supporters of the hysteresis hypothesis argue that the equilibrium unemployment is dependent on past trends in the actual unemployment rate. In other words, unemployment hysteresis simply means that the equilibrium level of unemployment depends on the actual path of unemployment and that the equilibrium rate of unemployment is *path-dependent* (Wendy Carlin and David Soskice 1990). In their influential study, Blanchard and Summers (1986a) noted that between the mid-1970s and the mid-1980s, the actual unemployment in the European labour market went up in tandem with the equilibrium unemployment as estimated by the Phillips Curve relationship. The researchers pointed out that this phenomenon offered em-

pirical support to the alternative theory of unemployment, or the unemployment hysteresis hypothesis. This hypothesis presumes that cyclical fluctuations in an economy would have a permanent effect on unemployment level (Smyth 2003). Therefore, in the absence of intervention policies aimed at curbing a rising unemployment, high unemployment rates would not revert to the NAIRU in the long run.

Membership theories offer a solid theoretical foundation to explain unemployment hysteresis (Assar Lindbeck and Dennis J. Snower 1985; Blanchard and Summers 1986a, b; Robert G. Gregory 1986). These theories assume that the wage setting is mainly determined by insiders in a firm rather than by outsiders. The employment function can be expressed as:

$$n_t = n_{t-1} + (m - em) \tag{1}$$

where n_t is employment in the year t, m is the nominal money, em is the expected nominal money. In other words, employment at a certain point of time would be equal to employment in the previous period plus a random disturbance. In Equation (1) the disturbance is equal to the unanticipated movement in the nominal money. Implications of this equation are quite drastic because the formula indicates that employment could follow a random walk (Blanchard and Summers 1986a).

From an econometric perspective, unemployment hysteresis could be seen as a near non-stationary process where unemployment level would not revert to the NAIRU. This means that there is a unit root in unemployment time series. In contrast, the natural rate hypothesis assumes that unemployment time series do not have a unit root. This is because unemployment is seen as a stationary process in which the level of unemployment would eventually revert to the NAIRU. Some economists argue that there exists yet another hypothesis concerning unemployment dynamics known as the persistence hypothesis (Edmund S. Phelps 1972; Smyth 2003). The persistence hypothesis postulates that it would take many periods for the unemployment rate to revert to the NAIRU. Under this hypothesis, the unemployment rate could be seen as a near unit root process, which is similar to the hysteresis hypothesis' line of reasoning. The current paper considers persistence in unemployment as a special situation of unemployment hysteresis and the persistence hypothesis is incorporated into a wider hysteresis hypothesis.

2. Literature Review

A proposition regarding the existence of unemployment hysteresis was first put forward by Phelps (1972) in his seminal book *Inflation and Unemployment Theory*. Phelps defined unemployment hysteresis as a situation in which equilibrium unemployment is determined by the path of the actual unemployment rate. In the following decade, an important study by Blanchard and Summers (1986b) examined the unemployment rates in Europe. The researchers defined unemployment hysteresis as a situation in which the current unemployment rate is mainly determined by the past level of unemployment. Blanchard and Summers proposed that unemployment could exhibit hysteresis when the current level of unemployment depends on the level of unemployment in the past. In other words, unemployment persistence could be considered as hysteresis (Blanchard and Summers 1986b).

These two important studies initiated a voluminous empirical research into the problem of unemployment and unemployment hysteresis. As far as the research methods are concerned, in the 1990s, researchers mainly relied on the univariate unit root tests, such as the Augmented Dickey-Fuller (ADF) test (David A. Dickey and Wayne A. Fuller 1979) and the Phillips-Perron (PP) test (Peter C. B. Phillips and Pierre Perron 1988). Since the 2000s, investigators began employing the panel methods. The panel-based analyses remain a popular research tool in studies on unemployment hysteresis. For example, Jun-De Lee, Chien-Chiang Lee, and Chun-Ping Chang (2009) examined the unemployment hysteresis hypothesis based on the data for 19 OECD countries over the period from 1960 to 2004. The researchers performed the panel lagrange multiplier (LM) unit root tests with heterogeneous structural breaks in which two structural breaks were incorporated into the analysis. The findings from the panel LM test rejected the null hypothesis of unemployment hysteresis. Based on these findings the researchers concluded that shocks to the unemployment rates in the 19 OECD countries under study had been temporary and, in the long run, the unemployment rates would revert to the natural level of unemployment. An important study by Hsin-Yun Lee, Jyh-Lin Wu, and Chung-Hsiang Lin (2010) examined the existence of unemployment hysteresis in nine East Asian countries for the period of 1976-2004. The researchers employed three different unit roots tests, namely, the univariate unit root test, the LM unit root test and the panel unit root test. The findings from these econometric analyses failed to reject the null hypothesis. Furthermore, Suleyman Bolat, Aviral Kumar Tiwari, and Ahmet Utku Erdayi (2014) employed the nonlinear panel KSS (Kapetanios-Shin-Snell) test to examine unemployment hysteresis in 17 EU countries between 2000 and 2013. The results rejected the null hypothesis of a unit root and indicated that the unemployment rates in the 17 EU countries had the mean-reversion tendency. Ming-Jen Chang and Che-Yi Su (2014) used the panel KSS test to examine unemployment situation among people with different educational attainments in Taiwan over the period 1978-2012. The researchers detected the existence of hysteresis in the unemployment rates.

Several research studies of unemployment dynamics employed such advanced econometric methods as the fractional integration, the bootstrap method and the seemingly unrelated regressions (SUR) approach. For example, Magnus Gustavsson and Par Osterholm (2011) used the bootstrapped out-of-sample method to examine unemployment hysteresis in the United States from the first quarter of 1948 to the fourth quarter of 2005. The findings from the ADF test rejected the null hypothesis of hysteresis while the results of the KPSS test rejected the null hypothesis of mean reversion. Based on these results, Gustavsson and Osterholm argued that the findings were not conclusive in the short run. However, in the long run, the out-of-sample method indicated that the USA unemployment rate could be described as a mean reverting process. Focusing on the Asia-Pacific region Fumitaka Furuoka (2012) employed the SUR method to analyse unemployment hysteresis in 12 countries in the region from 1980 to 2009. The univariate unit root test failed to reject the null hypothesis of a unit root, except for South Korea, while the SUR-based unit root tests rejected the null hypothesis for South Korea and New Zealand. Furuoka concluded that the study's findings provided empirical support to the validity of the hysteresis hypothesis.

More recently, Cheng et al. (2014) used the Fourier LM test to examine unemployment hysteresis in Portugal, Ireland, Italy, Greece and Spain for the period of 1960-2011. The findings indicated the presence of hysteresis in the unemployment rates for these EU countries. Focusing on Australia, Tiwari (2014) performed the LM unit root test with structural break to examine unemployment hysteresis for the period of 1978-2010. The findings of their study failed to reject the null hypothesis of a unit root, which indicated the existence of hysteresis in the Australian unemployment rate. Atanu Ghoshraya and Michalis P. Stamatogiannis (2015) adopted the Kejriwal-Perron-Zhou (KPZ) method to examine unemployment dynamics in the United Kingdom and United States for the period of 1855-2012. The researchers noted a shift in the unemployment dynamics. Thus, unemployment in these two countries could be described as a stationary process until the beginning of the 20th century; after that, it would be best characterised as a unit root process.

Some researchers focused on the regional, rather than the national, unemployment rates. For example, Peter S. Sephton (2009) re-examined unemployment hysteresis in the USA states using the Wald test for fractional integration. The findings from the fractional integration tests supported the existence of the hysteresis hypothesis when only one break was incorporated into the analysis. However, when two breaks were incorporated into the statistical procedure the unemployment rates in the USA states could be described as a stationary process. These contradictory results led Sephton to a conclusion that the unemployment rates in the USA states could be best described as stationary fluctuations around a shifting trend. Furuoka (2014) applied the nonlinear unit root test to examine unemployment dynamics in 14 regions of the Czech Republic between 2005 and 2013. He concluded that the unemployment rates in the Czech regions could be considered as a unit root process in accordance with the natural rate hypothesis. Furthermore, Alejandro García-Cintado, Diego Romero-Ávila, and Carlos Usabiaga (2015) performed unit root tests with structural break to investigate unemployment behaviour in 17 Spanish regions for the period of 1976-2014. They were able to detect unemployment hysteresis in the Spanish regional labour markets.

3. Data Collection and Research Method

Econometric analysis in this study is based on the annual data on unemployment in Estonia from 1993 to 2011, which was compiled by the Statistics Estonia (2012)[1]. The number of observations was nineteen only. In order to overcome constraints posed by the limited data, this study performed the panel unit root tests, such as, the Im-Pesaran-Shin test and the Fourier Im-Pesaran-Shin test. The empirical analysis was conducted with the aid of the OxEdit program, which Professor Jurgen A. Doornik of Oxford University has put online to be used free of charge for academic purposes. The data set for the unemployment rates in the five Estonian regions and the OxGauss codes used in the current study are available at the website: https://sites.google.com/site/fumitakafuruokaswabpage/.

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[1] **Statistics Estonia.** 2012. Unemployment Rate by Region. http://pub.stat.ee/ (accessed June 30, 2012).

There is a notable advantage in using the panel data method, because standard unit root tests, such as the ADF test, tend to have a limited power when time-series data exhibit high deviations from mean values. This problem gets particularly acute when the number of observations is small (Andrew Levin, Chien-Fu Lin, and Chia-Shang James Chu 2002), such as was the case in the current study. Therefore, first of all, this study employed a heterogeneous panel unit root test or the IPS test suggested by Kyung So Im, Mohammad H. Pesaran, and Yongcheol Shin (2003). The researchers proposed a dynamic heterogeneous panel unit root test which is based on the mean value of individual unit root statistics. The IPS test is expressed by the following equation:

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{p} \delta_{j,i} \Delta y_{t-j} + \varepsilon_{i,t} \tag{2}$$

where Δ is the difference operator, y is the variable of interest, α is the intercept, ρ and δ are the slope coefficients, p is the lag length for lagged difference, and ε is the error term. Due to an insufficient number of observations, the lag length in this study was set as one. The IPS test estimated the following *t-bar* (τ_{IPS}) statistic:

$$\tau_{IPS} = \frac{1}{N} \sum_{i=1}^{N} t_i \tag{3}$$

where t_i is the *t*-statistic estimated from Equation (2) and N is the number of cross-sectional subjects. Critical values for the τ_{IPS} statistic were estimated by a bootstrap simulation with 10,000 replications (Park 2003). Park proposed that a bootstrap estimation of critical values would have a sample rejection probability which is closer to the asymptotic probability. He suggested using fitted residuals from the following equation for the purpose of bootstrap resampling methods:

$$\Delta y_t = \sum_{i=1}^{p} \alpha_i \Delta y_{t-j} + \varepsilon_t \tag{4}$$

where y is the variable of interest, Δ is the difference operator, α is the slope coefficient, p is the lag order of the autoregressive process, and ε_t is the residual.

Secondly, the present study proposes using the FIPS test in order to take account of nonlinearity in the Estonian regions' unemployment rates. The FIPS test can be based on the following equation:

$$\Delta y_{t,i} = \alpha + \rho y_{t-1,i} + \gamma_{1,i} \sin\left(\frac{2\pi kt}{T}\right) + \gamma_{2,i} \cos\left(\frac{2\pi kt}{T}\right) + \sum_{j=1}^{p} \delta_{j,i} \Delta y_{t-j,i} + \varepsilon_{t,i} \tag{5}$$

where γ is the slope coefficient, k is the frequency, t is the deterministic trend, T is the number of observations, $\pi = 3.1416$. Due to insufficient number of observations, the lag length for lagged difference was set as one. Optimal frequency is the rounded mean value of the individual frequency. The mean value was 1.80. Therefore, optimal frequency was set as two. The FIPS test estimated the Fourier *t-bar* (τ_{FIPS}) statistic as:

$$\tau_{FIPS} = \frac{1}{N} \sum_{i=1}^{N} ft_i \tag{6}$$

where ft_i is the Fourier t-statistic estimated from Equation (5). Critical values for the τ_{FIPS} statistic were estimated in this study by a bootstrap simulation with 10,000 replications. The linearity test for the FIPS test, or the Fourier F (FF) linearity test, was based on the following equation:

$$FF(k) = \frac{1}{N} \sum_{i=1}^{N} \frac{(SSR_{0,i} - SSR_{1,i})/q_i}{SSR_{1,i}/(T_i - s_i)} \tag{7}$$

where SSR_1 is the SSR from Equation (5), SSR_0 is the SSR from the regression without trigonometric terms, q is the number of restrictions, and s is the number of regressors in Equation (6).

4. Empirical Findings

The present study is the first empirical analysis to employ the panel unit root tests - such as the IPS test and the FIPS test - to examine unemployment hysteresis in five Estonian regions; critical values for these panel unit root tests were estimated by a bootstrap method. Table 1 demonstrates the findings from the IPS test and the results of the bootstrap estimations for critical values. As can be seen from the table, the IPS test rejected the null hypothesis of hysteresis. In other words, the results of the test indicated that the unemployment rates in five Estonian regions could be considered as a stationary process.

Table 1 Findings from the IPS Test, FIPS Test and FF Linear Test

Names of test	Test statistics	Critical values		
		1 percent	5 percent	10 percent
τ_{IPS}-statistic	-3.256***	-2.669	-2.275	-2.081
τ_{FIPS}-statistic	-3.926***	-2.697	-2.157	-1.932
FF-statistic	3.901*	8.266	4.292	2.991

Notes: Critical values were estimated by a bootstrap simulation with 10,000 replications. *** indicates significance at the 1 percent level; * indicates significance at the 10 percent level.

Source: Author.

The findings from the FIPS test and the FF linearity test are also presented in Table 1; besides, the table includes the bootstrap estimations of critical values for these two tests. The results revealed that the FIPS test rejected the null hypothesis of hysteresis while the FF linearity test rejected the null hypothesis of linearity. In other words, the findings suggested that the unemployment rate time-series in the Estonian regions could be described as a stationary process.

In short, the empirical results of the panel data analysis indicated that the unemployment rates in the Estonian regions could be considered as a stationary process. This means that the unemployment rates had a mean-reversion property, which is in line with the natural rate hypothesis.

5. Discussion

This section offers a discussion on several important labour market variables in the context of the Estonian economy. These variables include labour mobility, labour supply and unemployment-employment levels. Due to a lack of systematic and sufficient data, thus far, no studies have examined the impact of these labour market variables on the unemployment dynamics at the regional level in Estonia. However, some important research studies have been done at the country level.

Undoubtedly, there are close links between labour mobility and level of unemployment. Tito Boeri and Christopher J. Flinn (1999) argued in their important study that during the economic transition period, labour mobility in the formerly planned economies was low. One reason for this was workers' reluctance to leave their secure jobs in state enterprises as this step would entail a loss of various social benefits provided by the state. However, as some researchers have pointed out, compared to other transitional economies labour mobility in Estonia was at higher levels. For example, John C. Haltiwanger and Milan Vodopivec (1999) considered that labour market in Estonia was sufficiently dynamic. They also maintained that in the 1990s, Estonia experienced an enhanced labour mobility. According to the researchers, at the initial stage of the economic transition in the early 1990s, there occurred a drastic increase in labour mobility from employment to unemployment. However, this trend was reversed in the middle of the 1990s. Based on their observations, Haltiwanger and Vodopivec proposed that labour mobility in Estonia was an important factor contributing to the low unemployment rates in the country. To concur, a study by Marit Rõõm (2002) concluded that workforce in Estonia was highly mobile. According to the researcher, workers rapidly moved from the unemployment to employment status, but not *vice versa*. Rõõm also detected an inverse association between unemployment and labour mobility in Estonia.

Labour supply is another labour market variable that has a substantial impact on unemployment. In their seminal study on unemployment in transition economies, Philippe Aghion and Blanchard (1994) proposed that unemployment dynamics in transition economies could be determined by the speed of reconstruction that takes place in state-owned companies and also by the job creation process that occurs in the private sector. This line of argument implicitly assumes that labour supply during a transition period would be constant.

Finally, there is an intrinsic linkage between the levels of the employment and unemployment rates. Analysing the employment-unemployment relationship could lead to a better understanding of unemployment dynamics in a country. However, it is difficult to establish the direct relationship between the levels of employment and unemployment. Robert Shimer (2005) proposed that separation shocks during economic crises tend to increase both the unemployment rate and the vacancy rate, if the employment rate remains constant. Lembo Tanning and Toivo Tanning (2012) highlighted the complex nature of the associations between employment and unemployment in their detailed analysis of the employment and unemployment rates in Estonia. The researchers argued that a low level of employment was an interesting phenomenon that had occurred in the Estonian labour market during the European economic crisis. Tanning and Tanning observed that during the crisis, the level of em-

ployment in Estonia decreased while the unemployment rates increased. Thus, the employment rate in the country decreased from 63.0 percent in 2008, and to 57.4 percent in 2009; then it further declined to 55.2 percent in 2010. Tanning and Tanning pointed out that the level of employment in Estonia recovered to 59.1 percent in 2011, as by that time the country had recovered from the economic recession.

6. Conclusion

Unemployment hysteresis is one of the most important and widely researched topics in scholarly economic literature. This considerable interest is explained by the fact that the answer to the question whether unemployment hysteresis is a *bona fide* economic phenomenon has far-reaching policy implications. This article focused on five regions in Estonia as the case studies to examine the unemployment hysteresis hypothesis. Two panel unit root tests, namely the IPS test and the FIPS test, were performed in this study. According to the findings, unemployment dynamics in the Estonian regions could be best described as a stationary process. This gives empirical support to the validity of the natural rate hypothesis, which is the main pillar of the macroeconomic theory.

In a nutshell, the findings indicated that the unemployment rates in all five Estonian regions had a mean-reversion property. Based on this result it can be proposed that the Estonian regions are not likely to experience a prolonged problem with high unemployment. Some policy implications can be drawn based on this finding. First of all, since the higher-than-normal levels of unemployment are not likely to persist, the unemployment rates in the Estonian regions are expected to revert back to the natural level without any intervention from the government or policymakers. Generally, in the short run, unemployment rates during economic crises are higher compared to their normal levels. Accordingly, the unemployment rates in all five Estonian regions were higher during the European financial crisis. As the findings of the current study suggest, the discrepancies between the natural level and the actual level of unemployment in the Estonian regions could be viewed as temporary deviations because the unemployment rates were found to have a mean-reversion tendency.

Policymakers in Estonia may want to consider these findings when they devise policies aimed at abating unemployment at the regional level. As discussed earlier, the findings indicate that the deviations from equilibrium level in the unemployment rates in the Estonian regions could be viewed as a short-term phenomenon. Therefore, a good policy option would be to introduce regulations aimed at improving labour market foundations and enhancing efficacy and functionality of the regional labour markets in the long-term. In addition, improving human resource conditions and taking into account the demographic trends while making future projections also deserve the attention of policymakers in Estonia.

Due to the lack of systematic data on the Estonian labour market condition at the regional level (e.g., the data on labour mobility, labour supply and the employment level), the current study has been limited to an empirical examination of the unemployment hysteresis. In future studies, researchers may want to seek more extensive and detailed data sets from labour market surveys. Also, a comprehensive research is needed to be done at the regional level to explore the relationships be-

tween labour mobility and unemployment; between labour supply and unemployment; between the employment rates and the unemployment rates in Estonia. The present study is based on the quarterly data on unemployment between 2003 and 2011. Future studies on unemployment hysteresis in Estonia may want to use longer periods of the time series data. The findings of such studies would give much needed insights into unemployment dynamics at the regional level and help in searching effective solutions to the problem of unemployment in the country.

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