4. BÖLÜM / CHAPTER 4

ARE SHOCKS TO UNEMPLOYMENT RATE IN OECD COUNTRIES PERMANENT OR TEMPORARY? EVIDENCE FROM UNIT ROOT TESTS WITH NON-NORMAL ERRORS

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ABSTRACT

In this paper, we tested the validity of unemployment hysteresis for the 21 Organisation for Economic Co-operation and Development (OECD) countries in the 1990Q1–2017Q3 period using recently developed unit root tests with structural breaks and non-normal errors. There are three different economic approaches to unemployment in the literature: natural-rate hypothesis, structuralist hypothesis, and unemployment hysteresis. Overall, we found support for unemployment hysteresis in 11 of the 21 OECD countries (Australia, Canada, Spain, Finland, France, Italy, Japan, Mexico, Norway, Portugal and Sweden). According to this hypothesis, shocks on unemployment have a permanent effect, and unemployment rates have no tendency to revert to a steady state in the long run. Conversely, the hysteresis hypothesis was rejected for 10 of the 21 OECD countries (Belgium, Chile, Denmark, Ireland, Korea, Luxemburg, Netherlands, New Zealand, the United Kingdom, and the United States) in at least one unit root test. We found the structuralist hypothesis in all 10 of these countries, whereas we could not find the natural-rate hypothesis.

Keywords: Unemployment hysteresis, RALS, unit root tests, OECD countries, structural breaks

1. Introduction

Unemployment is defined as a circumstance in which people are unable to find work. In other words, unemployment is a situation where a person who is able, ready, and wants to work cannot find a valid wage and job. Unemployment rate is defined as the ratio of the unemployed population in the labor force. Unemployment, which is one of the main macroeconomic problems of many countries, affects individuals and society psychologically, sociologically, and economically; it is also seen as the most important cause of poverty. For this reason, economic managers try to develop policies to reduce unemployment through production, investment, and economic growth. The rapid increase in unemployment rates in the world, especially due to the oil crisis that emerged after the Arab–Israeli war in the 1970s and the fact that these unemployment ratios did not return to former levels, have led economists to intensify their research on this subject.

There are three different economic approaches to unemployment in the literature: natural-rate hypothesis, structuralist hypothesis, and unemployment hysteresis. The first approach, the natural rate of unemployment hypothesis, was proposed by Friedman (1968) and Phelps (1967). According to this hypothesis, shocks experienced in the economy have a temporary effect on the unemployment rate. In other words, unemployment approaches a level of equilibrium in the long run, which occurs when expected inflation equals actual inflation. This level is called the natural rate of unemployment. The second approach is the structuralist hypothesis. According to this approach, shocks to the unemployment rate are temporary. But the natural rate of unemployment is constantly affected, along with changes in structural factors. As a result, when structural breaks are taken into account, the unemployment rate is stationary (Romero-Ávila and Usabiaga 2007).

Blanchard and Summers (1986) criticized the hypothesis of the natural rate of unemployment and introduced the third and last approach, the unemployment hysteresis hypothesis, to the literature. According to this hypothesis, shocks on unemployment have a permanent effect, and unemployment rates do not revert to a steady state in the long run. In the literature, there is no consensus on how the unemployment rate persists. Pissarides (1992) argued that the unemployment period negatively affects human capital. The length of the unemployment period causes people to lose their skills and motivation. In this case, the demand for employment will decrease. However, the increase in unemployment insurance and unemployment pensions will cause the unemployment rate to be permanent (Hoorelbeke 2010).

Lindbeck and Snower (1986) explained the persistence of the unemployment rate with the insider–outsider theory. According to this theory, union members (i.e., insiders) obstruct the recruitment of outsiders by pointing out the training costs of new workers and strike threats. In short, it is argued that insiders prevent employment. In this case, the current labor force will remain stable, and the unemployment rate will be permanent. Burda (1988) argued that a decrease in the stock of materials used in production due to a decline in labor force negatively affects the demand for labor in the next period. This situation has a permanent effect on unemployment and causes a long unemployment period (Saraç 2014). In contrast, according to Sessions (1994), the increase in the unemployment rate will cause society to adapt to this situation, which would result in a permanent increase in the effectiveness of the salaries as well as a decline in the labor force (Christopoulos and Ledesma 2007).

The empirical validity of the structuralist, natural-rate, and hysteresis hypotheses is tested by unit root tests. The fact that the unemployment rate is stationary indicates that the structuralist and natural-rate hypotheses are valid. In this case, the unemployment rate series will show a structure that returns to the average. Conversely, if the unemployment rate series has a unit root, the hysteresis hypothesis is valid (Christopoulos and Ledesma 2007). Because shocks have persistent effects on unemployment, governments need to intervene by creating policies that will overcome the problem of unemployment. These policies would play a vital role, especially during a recession period (Smyth 2003). In short, in the case of hysteria, high unemployment rates will become a problem that cannot be solved without government intervention in the long run.

In this study, we examined the validity of the unemployment hysteresis hypothesis using quarterly data for 21 Organisation for Economic Co-operation and Development (OECD) countries (Australia, Belgium, Canada, Chile, Denmark, Finland, France, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Switzerland, United Kingdom and United States) for the period 1990Q1–2017Q3. The work in this study is expected to contribute to the literature on the following points: the range of data used includes the U.S. financial crisis and periods of economic stagnation in the world; 21 of the 34 OECD countries are included in the analysis; if the errors are non-normal, conventional linear unit root tests are inadequate. The use of this information leads to stronger results. In this study, we used unit root tests that allow for non-normal errors, which have been overlooked in studies about the subject.

The remainder of this paper is organized as follows: The next section introduces the literature and is followed by the presentation of the methodology and data and empirical results; the final section offers conclusions and policy recommendations.

2. Literature Review

In the unemployment hysteresis case, the effects of shocks are permanent. In other words, the rate of unemployment does not return to the natural rate after the shock. We examined the validity of this hypothesis in the context of unit root tests. In the literature, the investigation of unemployment hysteresis, with the help of unit root tests, became widespread after the 1980s. Many studies have examined countries and country groups using different unit root tests.

Blanchard and Summers (1986) conducted one of the first studies to test unemployment hysteresis using unit root tests. Using the Augmented Dickey–Fuller (ADF) unit root test, they examined the hysteresis hypothesis for France, Germany, the United States, and the United Kingdom using 1953–1984 data. The results showed that the unemployment hysteresis is valid for France, Germany, and the United Kingdom, but not for the United States. Furthermore, Jaeger and Parkinson (1994), Røed (1996), and Neudorfer et al. (1990) used the same test to determine the validity of the hysteresis hypothesis for different country groups. Neudorfer et al. concluded that the hysteresis hypothesis is valid for Austria, and Jaeger and Parkinson concluded that the hysteresis hypothesis is valid for Canada, Germany, the United Kingdom, and the United States. Røed tested the same hypothesis for 16 OECD countries, and the results showed that the hysteresis hypothesis is valid in all countries except in the United States. Ledesma and McAdam (2004) used unit root tests and panel unit root tests, which allowed a structural break in their work. The results supported the hysteresis hypothesis as a result of individual tests, whereas the panel tests rejected the hysteresis hypothesis.

Romero-Ávila and Usabiaga (2007) studied the hysteresis hypothesis for the United States and Spain in 1976–2004 using the Lagrange Multiplier (LM) unit root test. The results showed that the hysteresis hypothesis is valid for Spain. Yildirim (2011) examined the validity of the hysteresis hypothesis for Turkey for the period from 1923 to 2010. The results showed that the hysteresis hypothesis is valid for that time frame. Furuoka (2014) examined the validity of unemployment hysteresis in 14 regions of the Czech Republic by using SURADF and FADF unit root tests and reached the conclusion that the hysteria hypothesis is valid for all but five of the 14 regions. Guris et al. (2017) examined unemployment hysteria using nonlinear unit root tests for Turkey for the period from 1970 to 2014. The results showed that the hysteresis hypothesis is not valid for Turkey.

Mitchell (1993) tested the hysteresis hypothesis using a unit root test that allowed one structural break for OECD countries for the period 1960–1991. The results showed that the hysteresis hypothesis is supported for 15 OECD countries. Papell et al. (2000) examined the

hysteresis hypothesis for 16 OECD countries using a unit root test that allowed for one structural break. The results supported the unemployment hysteresis in six OECD countries with one structural break. Lin et al. (2008) tested unemployment hysteresis at different time periods for 16 OECD countries using nonlinear unit root tests. The results showed that hysteresis is not valid in Australia, Canada, Finland, France, Germany, Ireland, Japan, the Netherlands, and the United States. Meng et al. (2017) examined the unemployment hysteresis hypothesis for 14 OECD countries using the residual augmented least squares (RALS) method for the period 1983Q1–2013Q3. The results supported the hysteresis hypothesis for 4 OECD countries.

3. Econometric Methodology

The existence of a series with non-normal distribution in an economic or financial time series should not be underestimated. The method that should be used in cases where the errors have a non-normal distribution is a topic that has recently been of interest in the literature. This is seen as a deficiency for unit root tests. However, using information about non-normal errors in the unit root tests may increase the power of the unit root tests. The important point here is how to use this information when errors have a non-normal distribution. If the true distribution of the error term is known, it is possible to use the appropriate estimation method with the aid of the known density function. However, in the case where the errors are not normally distributed, the true density function is rarely known, and it is difficult to predict the underlying distribution. If incorrect information is used about the distribution of errors or the functional form of the relationship, the result may be worse than before. For this reason, in the tests applied in this study, without first specifying a certain density function or functional form, the information on the distribution of the error term is not normal.

To obtain more robust results about the validity of the unemployment hysteresis in our study, we used different unit root test theories in the case of non-break, structural breaks, and non-normal errors. For this purpose, the RALS form is used, which takes into account that the LM test is non-break, that structural breaks are allowed, and that the errors are not normally distributed. For the same series, the use of different forms of the LM test will show whether the forms used are useful if different results are obtained concerning the validity of the hysteresis.

The RALS-LM procedure will be explained on the LM principle. The LM unit root test statistics can be obtained from the regression below:

$$\Delta y_t = \Omega' \Delta z_t + \varphi \tilde{y}_{t-1} + \sum_{j=1}^{p} c_j \Delta \tilde{y}_{t-j} + e_t \tag{1}$$

where, $\tilde{y}_t = y_t - \tilde{\psi} - z_t\,\tilde{\Omega},\ t = 2.....T; \tilde{\Omega}$ is the vector of coefficients in the regression of Δy_t on $\Delta z_t.\tilde{\psi}$ is the restricted MLE of $\tilde{\psi}$ given by y_1 - $z_1\tilde{\Omega}$: y_1 and $z_1$denote the first observation of y_t and $z_t.\Delta$ is the difference operator and e_t is an iid error term with zero mean and finite variance. In this study, we adopted a two-step procedure following the RALS method recommended by Im and Schmidt (2008) to increase the power of the unit root test and use the information about non-normal errors. $x_t = (1, z_t')'$ moment is defined. In addition, suppose we have the following moment conditions:

$E[g(e_t) \otimes x_t] = 0, t = 1,2,\ldots,T$, where $g(e_t)$ is defined as follows:

$g(e_t) = (e_t, [h(e_t) - K]')'$ and $K = E(e_t)$ and $h(e_t)$ is the nonlinear function of the error term. After this phase, the moment conditions for RALS become the following:

$$E[e_t \otimes x_t] = 0$$

$$E[(h(e_t) - K) \otimes x_t] = 0$$

The first condition is the usual moment condition of the estimation of least squares. The second condition is based on the moment condition nonlinear functions of $e_t.\widehat{e_t}$, to show the results obtained from the test regression we can get the following term:

$$\widehat{w}_t = h(\hat{e}_t) - \bar{K} - \hat{e}_t\hat{D}_2, \quad t = 1,2,\ldots,T$$

$$\bar{K} = \frac{1}{T}\sum_{t=1}^{T} h(\hat{e}_t)\,,\ \hat{D}_2 = \frac{1}{T}\sum_{t=1}^{T} h'(\hat{e}_t) \text{ and } h(\hat{e}_t) = [\hat{e}_t^2, \hat{e}_t^3]'.$$

After this step, sufficient moment conditions must be determined for the RALS test to be carried out. For this, Meng et al. (2014) suggested using the moment conditions of the second and third moments of the errors that are not correlated with the lagged dependent variables.

Meng et al. (2014) described the following variables for the test procedure they developed using the second and third moment conditions.

$$m_j = T^{-1}\sum_{t=1}^{T} \hat{e}_t^{\,j}\,, j = 2,3.$$

$$\widehat{w}_t = [\hat{e}_t^2 - m_2, \hat{e}_t^3 - m_3 - 3m_{2t}\hat{e}_t]', t = 1,2,\ldots,T$$

From this step, the LM test equation given in the first equation will be expanded by the RALS procedure. In this context, using the knowledge of the non-normal distribution of errors, the LM test equation can be extended with $\widehat{w}_t$ as follows:

$$\Delta y_t = \Omega'\Delta z_t + \varphi\,\tilde{y}_{t-1} + \sum_{j=1}^{p} g_j \Delta\,\tilde{y}_{t-j} + \hat{w}_t' + u_t \qquad (2)$$

where the corresponding unit root test statistic for $\varphi = 0$ and is denoted as $\tau_{RALS-LM}$. When information that errors are not normally distributed is included in the test, the variance of the error term will be reduced and robust results will be obtained. If this process is repeated when structural breaks are added to the LM model, the RALS-LM test with structural breaks can be conducted.

4. Data and Empirical Results

In this study, the validity of the unemployment hysteresis hypothesis was examined using quarterly data for 21 OECD countries (Austria, Belgium, Canada, Chile, Denmark, Finland, France, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Switzerland, the United Kingdom and the United States) for the period 1990Q1–2017Q3. We used harmonized unemployment data to account for differences in the way national unemployment rates are calculated. The data were obtained from the World Bank database. Because the time interval used in the study includes the 2008 U.S. economic crisis and the global recession, the variables examined are likely to be subject to structural breaks. Summary statistics of unemployment rates are calculated and given in Table 1.

Table 1
Descriptive Statistics, Unemployment Rates, 1990Q1-2017Q3 (111 Observation)

Country	Mean	Median	SD	Minimum	Maximum
Australia	6.69	6.04	1.86	4.08	11.13
Belgium	8.04	8.10	0.99	6.06	9.86
Canada	7.96	7.50	1.50	5.93	11.73
Chile	7.76	7.42	1.45	5.52	10.86
Denmark	6.06	6.03	1.54	3.20	9.90
Finland	9.62	8.93	3.08	2.93	17.53
France	9.97	9.66	1.41	7.26	12.50
Ireland	9.81	10.10	4.28	4.00	15.90
Italy	9.58	9.16	1.80	5.93	12.80
Japan	3.86	4.00	0.98	2.06	5.43
Korea, Rep.	3.46	3.40	1.13	1.93	8.13
Luxembourg	3.85	4.03	1.51	1.50	6.56
Mexico	3.91	3.70	1.05	2.20	7.03
Netherlands	5.55	5.63	1.35	3.10	8.40
Norway	4.17	3.83	1.17	2.40	6.73
New Zealand	6.20	5.90	1.92	3.30	11.20
Portugal	8.80	8.00	3.27	4.80	17.36
Spain	16.68	16.83	5.24	7.96	26.23
Sweden	7.14	7.36	1.82	1.43	10.30
United Kingdom	6.64	6.20	1.68	4.20	10.40
United States	6.00	5.60	1.54	3.90	9.93

Note: SD indicates the standard deviation.

As shown in Table 1, there are large differences in unemployment rates in some countries. These differences can be expressed by the presence of structural breaks that may occur in unemployment rates in some countries.

For the reasons stated above, the validity of the unemployment hysteresis in the study was examined with both the breaks and non-break forms of the LM test. Also, for both LM tests, the RALS procedure, which gives robust results with knowledge of the non-normal distribution of errors, has been adopted. Table 2 shows the test results obtained using non-break LM and RALS-LM methods.

Table 2
LM and RALS-LM Unit Root Test Results

Country	**LM**	**RALS-LM**	P^2
Australia	-1.819	-1.414	0.93
Belgium	-3.653[c]	−3.073[b]	0.93
Canada	-2.047	-2.218	0.61
Chile	-1.701	-2.477	0.74
Denmark	-2.476	-2.832[a]	0.94
Finland	-1.709	-1.709	0.87
France	-1.781	-2.111	0.98
Ireland	−1.371	−1.491	0.68
Italy	−2.097	−2.533	0.91
Japan	−2.633	−2.578	0.82
Korea, Rep.	−2.538	−3.907[c]	0.59
Luxembourg	−1.824	−2.182	0.99
Mexico	−1.186	−2.101	0.80
Netherlands	-3.100[b]	-3.249[b]	0.94
Norway	-1.928	-1.755	0.98
New Zealand	-2.903[a]	-2.805[a]	0.96
Portugal	-2.091	-2.185	0.93
Spain	-2.317	-1.956	0.89
Sweden	-1.699	-2.517	0.71
United Kingdom	-3.416[b]	-4.273[c]	0.77
United States	-1.831	-2.696[a]	0.72

Notes: ρ is the long-run correlation between e_t in equation (1) and u_t in equation (2). a, b, and c denote that the null hypothesis of a unit root was rejected at the 10%, 5%, and 1% level of significance, respectively.

When the results were evaluated, the null hypothesis for Belgium, the Netherlands, New Zealand, and the United Kingdom was rejected for both test results. According to the results of the LM test, the null hypothesis—namely, the hysteresis hypothesis—for four (Belgium, the Netherlands, New Zealand, and the United Kingdom) out of the 21 countries was rejected.

This number was obtained in the RALS-LM test as seven (Belgium, Denmark, Korea, the Netherlands, New Zealand, the United Kingdom, and the United States). Unlike the LM test, the hysteresis hypothesis was rejected in Denmark, Korea, and the United States when we used the information in a case where the errors are non-normally distributed, using the RALS-LM results. These results showed that it is useful to use information about non-normally distributed errors in the non-break LM unit root test.

Tests applied in the first part of the analysis did not allow for structural breaks. However, structural breaks may occur due to many factors, including crises, natural disasters, and policy changes in the economic time series. Taking these structural breaks into consideration, as well as the knowledge of non-normally distributed errors, leads to more robust results. Table 3 shows the results of the LM unit root test, which allows structural breaks and information on non-normally distributed errors. We check the t-statistics on the break terms to determine the number of breaks.

Table 3
LM and RALS-LM tests with structural breaks

Country	**LM**	**Estimated breaks**	**RALS-LM**	P^2
Australia	-2.278	1995Q3, 2008Q4	-2.423	0.98
Belgium	-3.653[c]	2004Q2, 2011Q2	-3.073[b]	0.92
Canada	-1.870	1992Q4, 2008Q4	-2.308	0.87
Chile	-3.306[b]	1998Q3, 1999Q1	-3.530[b]	0.95
Denmark	-2.779[a]	1999Q4, 2007Q3	-3.144[b]	0.91
Finland	-2.145	1993Q4, 1996Q2	-1.718	0.94
France	-1.756	2008Q2	-1.763	0.88
Ireland	-2.646	2008Q2, 2008Q4	-4.028[c]	0.66
Italy	-1.976	1994Q3, 2011Q3	-2.048	0.97
Japan	-1.729	2008Q4	-2.287	0.85
Korea, Rep.	-5.326[c]	1997Q4, 2001Q1	-3.687[c]	0.51
Luxembourg	-3.023[a]	2010Q3, 2011Q3	-3.020[b]	0.94
Mexico	-2.113	1995Q1, 1996Q4	-2.152	0.74
Netherlands	-3.554[b]	2004Q2, 2014Q3	-3.523[b]	0.96
Norway	-2.495	1994Q1, 2005Q4	-2.628	0.84
New Zealand	-2.899[a]	2009Q4, 2012:Q4	-4.153[c]	0.75
Portugal	-1.933	2011Q3, 2013Q1	-1.805	0.98
Spain	-2.317	1995Q2, 2009Q1	-1.746	0.87
Sweden	-2.164	1992Q4, 2000Q4	-2.517	0.70
United Kingdom	-3.112[b]	2008Q2	-2.339	0.77
United States	-2.336	2008Q2, 2008Q4	-3.503 [c]	0.72

Notes: ρ is the long-run correlation between e_t in equation (1) and u_t in equation (2). a, b, and c denote that the null hypothesis of a unit root was rejected at the 10%, 5%, and 1% level of significance, respectively

When the results given in Table 3 are evaluated, differences with the results obtained in the non-break form are seen. This means that, for some countries, breaking is meaningful. When the LM test results were examined under structural breaks, the null hypothesis was rejected for eight (Belgium, Chile, Denmark, Korea, the Netherlands, Luxembourg, New Zealand, and the United Kingdom) of the 21 countries, using the RALS-LM test for nine (Belgium, Chile, Denmark, Ireland, Korea, Luxembourg, the Netherlands, New Zealand, and the United States) of the 21 countries. According to the LM test results, the null hypothesis could not be rejected for Ireland and the United States, but it was rejected in these two countries according to the RALS-LM test results. This result suggests that it is useful to use information about non-normal errors under breaks.

5. Conclusions and Policy Recommendations

In this study, we examined the validity of unemployment hysteresis using data from the 1990Q1–2017Q3 period for 21 OECD countries. In the empirical analysis, an LM unit root test that allows structural breaks and the RALS-LM unit root test with non-normal distribution information were used. When the break dates are examined, it is seen that for 2008, most of the series of the countries had a structural change. This change can be explained by the effects of the 2008 financial crisis that emerged in the United States and that affected the whole world. The findings of this study mostly confirm the findings of Meng et al. (2017). When the results are considered as a whole, the hysteresis hypothesis cannot be rejected according to the LM test results, but it can be rejected according to the results of the RALS-LM test. This result suggests that it is useful to use information about non-normal errors. These findings lead to permanent changes in the natural rate of unemployment, in the shocks experienced in the economy, and in the stabilization policies applied for countries where unemployment hysteria is valid. This hysteria effect on unemployment, if it is costly in the short term, can be destroyed, and weight should be given to expanding monetary and fiscal policies in the long run.

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