Received Date: 18 July 2023 I Accepted Date: 26 October 2023

OPUS
Journal of Society Research

RESEARCH ARTICLE

An Econometric Study on the Validity of the Unemployment Hysteresis Hypothesis in EU-15 and EU-28

Mustafa Yılmaz

Dr., Necmettin Erbakan University, Konya/Türkiye
ORCID: 0000-0001-6131-2663
E-Mail: mustafa.yilmaz@erbakan.edu.tr

Corresponding Author:
Mustafa Yılmaz

October 2023
Volume:20
Issue: Special Issue-Human Behavior and Social Institutions
DOI: 10.26466//opusjsr.1329033

Citation:
Yılmaz, M.& (2023). An econometric study on the validity of the unemployment hysteresis hypothesis in eu-15 and eu-28. *OPUS– Journal of Society Research, 20*(Special Issue-Human Behavior and Social Institutions), 842-851.

Abstract

Unemployment is among the main economic problems not only for developed countries but also for underdeveloped countries. The European Union, which was mostly composed of developed Western European countries until 2004, has grown with the participation of Eastern European countries in the following years. In its current form, the European Union consists of countries with different levels of development. The European Union should undoubtedly consider this structure of the union in the economic policies it develops. The existence of unemployment hysteresis, which shows the situation in which unemployment, which increased after an economic shock, does not return to its former levels, is important for policymakers of the union countries, especially in terms of methods of combating unemployment. This study aims to examine unemployment hysteresis for the EU-15 and EU-28 over the average values in the 2001Q1-2019Q4 period. In addition to the traditional unit root tests of Augmented Dickey Fuller (ADF) and Phillips Perron (PP), the Fractional Frequency Fourier ADF Unit Root Test developed by Bozoklu et al. (2020) has been used as the methodology. The data are obtained from Eurostat, the official website of the European Union where statistics are published. As a result of the study, evidence is found that the hysteresis hypothesis is valid in EU-15 and EU-28 according to all three analyzes used. In the study, the use of the Fractional Frequency Fourier ADF Unit Root Test, which is the most up-to-date test, contributes to the literature.

Keywords: *Unemployment Hysteresis, NAIRU, Unemployment, Augmented Dickey Fuller (ADF), Phillips Perron (PP), Fractional Frequency Fourier ADF*

Öz

İşsizlik, azgelişmiş ülkeler için olduğu kadar gelişmiş ülkeler açısından da ana ekonomik sorunlar arasında yer almaktadır. 2004 yılına kadar çoğunlukla gelişmiş batı Avrupa ülkelerinin oluşturduğu Avrupa Birliği, sonraki yıllarda doğu Avrupa ülkelerinin de katılımıyla büyümüştür. Avrupa Birliği şimdiki haliyle farklı gelişmişlik seviyelerini barındıran ülkelerden oluşmaktadır. Avrupa Birliği geliştirdiği ekonomi politikalarında şüphesiz ki birliğin bu yapısını göz önünde bulundurmalıdır. Ekonomik bir şok sonrası artış gösteren işsizliğin geri eski seviyelerine dönmediği durumu gösteren işsizlik histerisinin varlığı, birlik ülkelerinin politika yapıcıları için özellikle işsizlikle mücadele yöntemleri açısından önem arz etmektedir. Bu çalışma, 2001Q1-2019Q4 döneminde AB-15 ve AB-28 için işsizlik histerisini ortalama değerler üzerinden incelemeyi amaçlamaktadır. Çalışmada, metodoloji olarak Augmented Dickey Fuller (ADF) ve Phillips Perron (PP) gibi geleneksel birim kök testlerinin yanı sıra Bozoklu vd. (2020) tarafından geliştirilen Kesirli Frekanslı Fourier ADF Birim Kök Testi kullanılmıştır. Veriler, Avrupa Birliği'nin istatistiklerinin yayınlandığı resmi web sitesi Eurostat veri havuzundan elde edilmiştir. Çalışma sonucunda, kullanılan her üç analize göre de histeri hipotezinin AB-15 ve AB-28'de geçerli olduğuna dair kanıtlar bulunmuştur. Çalışmada, bilindiği kadarıyla literatürde yer alan en güncel birim kök testi olan Kesirli Frekanslı Fourier ADF Birim Kök Testinin kullanılması literatüre katkı sağlamaktadır.

Anahtar Kelimeler: *İşsizlik Histerezisi, Nairu, İşsizlik, Artırılmış Dickey Fuller (ADF), Phillips Perron (PP), Kesirli Frekans Fourier ADF*

Introduction

The deficiencies of Classical Economics, which emerged with the 1929 economic crisis, were tried to be eliminated with Keynesian theories until the 1973 OPEC oil crisis. However, unemployment after the global oil crisis has become permanent. The Phillips curve, which had its golden age in the 1950s, was not sufficient to explain the unemployment experienced in this crisis. In these years, Blanchard and Summers (1986) called "unemployment hysteresis[1]" when unemployment, which increased with an economic shock, did not return to its previous levels (Akcan, 2019, p. 34).

Before the studies on unemployment hysteresis, the generally accepted view was Non-Accelerating Inflation Rate of Unemployment (NAIRU), developed by economists such as Friedman (1968) and Phelps (1967, 1968). NAIRU and natural unemployment rate have similar meanings (Ball & Mankiw, 2002, p. 115). These two results, which emerged as a result of empirical studies, are very important for policy makers. In an economy with unemployment hysteresis, there is much more need for precautionary packages to address this problem, while in economies with natural unemployment, unemployment may automatically return to normal levels (Chang, 2011, p. 2208).

Hysteresis arises from internal and external shocks in economies. Traditional policies might be inadequate in addressing such persistent unemployment, causing shifts in the long-term natural unemployment rate (Yıldırım & İnançlı, 2018, p. 46). European unemployment has been a major subject of research in economics. Debates revolve around whether the elevated unemployment since the 1970s is due to economic shocks or structural factors (Jacobson et al., 1997, p. 1782). Blanchard and Summers (1986) posited that neither Classical nor Keynesian theories can sufficiently account for Europe's rising unemployment, necessitating an exploration into "hysteresis theories".

One central question surrounding European unemployment hysteresis is the potential influence of new EU accession countries. The EU expanded from its original 15 members in 2004 to 28 members after subsequent enlargements. Most countries that joined post-2004 emerged following the Soviet Union's dissolution. The rationale behind analyzing EU-15 and EU-28 separately in this study is to discern potential differences in unemployment hysteresis between the earlier, more established EU members and the broader, post-enlargement EU. Analyzing them separately allows for an exploration of whether newer member states, with their unique economic histories and challenges, have had a distinct impact on the overall unemployment hysteresis of the EU.

The main purpose of this study is to test the unemployment hysteresis in EU-15, representing the pre-2004 European Union, and EU-28, which includes all current members. In doing so, we can ascertain the influence of post-2004 EU accession countries on unemployment hysteresis. This study's primary contributions are twofold: First, to our knowledge, no other research has examined the average unemployment hysteresis of EU member states pre- and post-2004. Second, the unit root test employed in this study incorporates a Fourier function, allowing for a nuanced analysis of subtle shifts, complemented by traditional unit root tests. This article comprises four main sections: following the introduction is a literature review, then a section detailing the dataset and methodology, and finally, a section presenting the results of the applied analyses.

Literature Review

When the literature on unemployment hysteresis is examined, it can be stated that there are many studies dealing with hysteresis and the natural rate hypothesis. From the study of Blanchard and Summers (1986) until now, the hysteresis hypothesis or tests for natural unemployment are analyzed by econometric methods based on the unit root test. The unit root tests used are collected in three different groups as Augmented Dickey-Fuller (ADF), the ones which take into account structural breaks, and panel ones (Camarero et al.,

[1] *Although "hysteresis" was used for the first time in the field of physics, it means "to be late or to be behind" in Greek (Cross, Darby, Ireland & Piscitelli, 1998).*

2004; Carrion-i-Silvestre et al., 2005; Hadri and Rao, 2008; Enders and Lee; 2012).

Traditional tests such as Augmented Dickey-Fuller (ADF) (1979) and Phillips-Perron (PP) (1988) generally support autoregressive and unit root process. On the other hand, they are applied without considering structural breaks. In order to include structural breaks in the analysis, the exact location and number of breaks must be known. A dummy variable is used to solve this problem, but this method has many undesirable results (Chang, 2011, p. 2208). Becker et al. (2004, 2006) used Fourier tests for analyzes that also take into account structural breaks. Afterwards, Enders & Lee (2009) and Pascalau (2010) successfully used the Fourier approach to model structural breaks. In the literature, the hysteresis hypothesis has been tested with many different methods and models.

The studies, methods, periods and results that investigate whether unemployment hysteresis is valid in European Union countries are given as follows in Table-1.

Table 1. *Literature Review*

Study	**Method**	**Countries and Data Period**	**Valid**	**Invalid**
Jaeger & Parkinson (1994)	ADF	Canada, Germany, England and USA (1960:1-1991: 4)	Canada, Germany and England	USA
Jacobson et al., (1997)	Structural VAR Models	Denmark (1971-1990), Norway (1967-90), Sweden (1965-90)	√	
León-Dedesma & McAdam (2004)	Markov-switching analysis, compound root test	CEE countries and EU-15 (1991:1-2002:12)		√
Christopoulos & León-Ledesma (2007)	ADF (MADF), JLR, (DF) GLS-SUR, ADF-SUR, Pesaran's panel unit root test, Choi's panel unit root test	12 EU countries 1988(Q1)-1999(Q4)		√
Dreger & Reimers (2009)	Panel unit roots	51 state of USA ve 14 EU countries (1983:1-2004:4)	√	
Srinivasan & Mitra (2012)	Kalman Filter	Almanya & Fransa (1955-2010)		√
Bolat et al., (2014)	Nonlinear heterogeneous panel unit root tests	17 European Region Countries (2000:1-2013:1)	6 countries	11 countries
Mercan et al. (2015)	Panel Data Analysis	Türkiye, EU-15, EU-27, OECD and G-8 Countries	Other countries	G-8 countries
Klinger & Weber (2016)	Markov switching	Germany (1960:1-2015:6), USA (Weekly)	Germany	USA
Akdoğan (2017)	Unit root testing and linearity testing, AESTAR model (includes structural break)	31 European countries, USA and Japan (each country's timeline differs for quarters)		60 percent of countries
Li et al., (2017)	Panel Stationary Test, Fourier Unit Root Test	PIIGS countries (1960-2011)	Greece	The other countries
Furuoka (2017a)	ADF, FADF, SUR - FADF	France, Germany, Italy, Spain, United Kingdom (1991-2015)	Four countries	Spain
Furuoka (2017b)	ADF, FADF, ADF-SB and FADF-SB	Denmark, Finland, Norway and Sweden (2000Q1-2014Q2)		√
Obradović et al. (2018)	Linear and nonlinear unit root tests	10 countries from South East Europe	8 countries	2 countries

Jump & Stockhammer (2018)	NAIRU estimation method used by the European Commission	EU-15 (1960-2016)	√	
Sigeze et al. (2019)	Fourier- KPSS panel stationarity test	Türkiye and EU countries (1991-2016)	The other countries	Latvia, Belgium, Cyprus, Sweden
Jiang et al., (2019)	Quantile-based unit root testing	G7 countries (1980-2017)		√
Yaya et. al., (2021)	A nonlinear unit root test based on ARNN	5 European countries, 42 African countries, 15 countries from other regions (1983-2018)	√	
Doğaner (2023)	Linear and Nonlinear Unit Root Tests	European countries (1991-2020)	16 European countries	

Dataset and Method

Most of the countries that joined the European Union after 2004 are countries that left the Soviet system or have different economic structures from European countries. The European Union is not only a political, but also an economic. Therefore, in the study, the member countries of the union are divided into two EU-15 and EU-28 and unemployment data are taken as average. Unemployment data for the period 2000Q1 - 2019Q4 of 15 countries that were members of the union before 2004 and the periods 2000Q1 -2019Q4 of 28 countries that were members of the union after 2004 are evaluated together. In addition to the traditional unit root tests such as Augmented Dickey Fuller (ADF) and Phillips Perron (PP), the Fractional Frequency Fourier ADF Unit Root Test, which is the newest unit root test in the literature, is used as a method. The data are obtained from the Eurostat official site. The descriptive statistics of the data are as in Table 2.

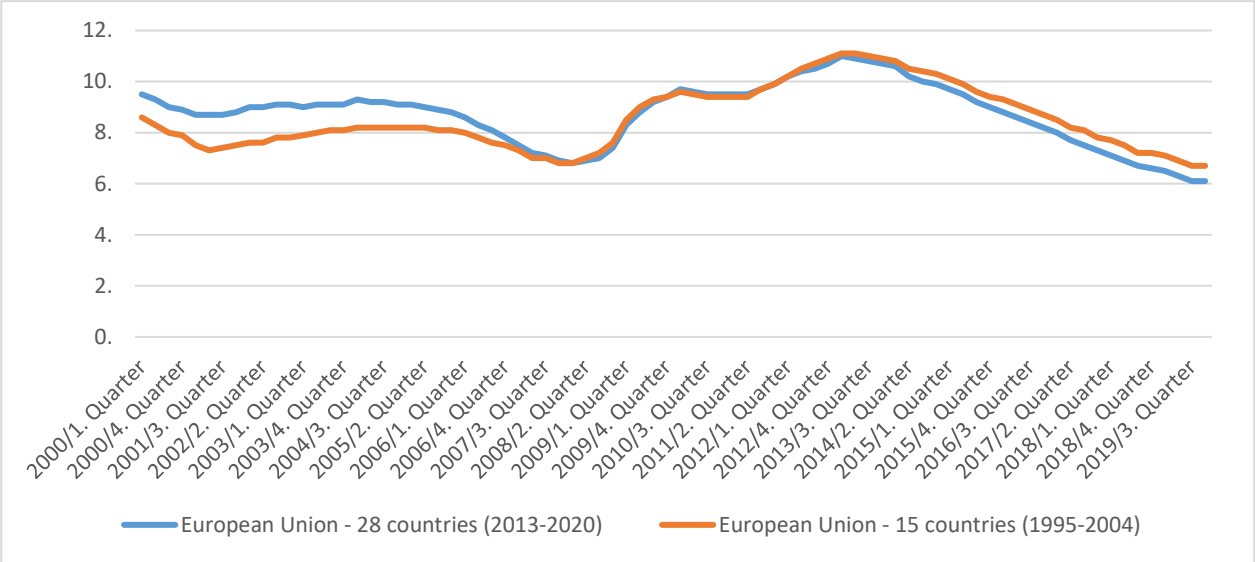
Table 2. *Descriptive Statistics*

Countries	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
EU - 15	8.548750	8.200000	11.10000	6.700000	1.246463	0.511164	2.158649	5.843422
EU - 28	8.737500	9.000000	11.00000	6.100000	1.226643	-0.381485	2.455780	2.927662

Table 2 provides the descriptive statistics for unemployment data of two groups of countries: EU-15 and EU-28, over the period 2000Q1-2019Q4. The mean unemployment rate for EU-15 countries is approximately 8.55%, while it's slightly higher for EU-28 countries at about 8.74%. The medians for both groups are fairly close, with EU-15 at 8.2% and EU-28 at 9%. Both the maximum and minimum unemployment rates for EU-15 and EU-28 are relatively close. For EU-15, the range is between 6.7% and 11.1%, and for EU-28, it's between 6.1% and 11%. This proximity in range indicates a similarity in the spread of unemployment rates among the two groups of countries. The Jarque-Bera test checks whether the given data sample has the skewness and kurtosis matching a normal distribution. For both EU-15 and EU-28, the values are relatively low, which implies that we cannot reject the null hypothesis that the data is normally distributed.

In summary, the descriptive statistics indicate that the two groups of countries, EU-15 and EU-28, have unemployment data sets that are closely aligned in terms of central tendency, spread, and shape. The max and min values' closeness between the two groups emphasizes their similarities. Furthermore, based on the Jarque-Bera test results, it can be concluded that the unemployment data sets for both groups are approximately normally distributed.

The change in average unemployment rates for 15 countries and 28 countries of the European Union between 2000Q1 and 2019Q3 is shown in Graph 1.



Graph 1. *EU-15 and EU-28 Average Unemployment Data*
Source. *Eurostat (2023)*

When Graph 1 is examined, the changes in unemployment rates of both country groups by periods show parallelism. In 2000, the unemployment rate of 15 member countries was lower than the total unemployment rate of 28 member countries, but towards the end of 2019, this situation was the opposite. By 2019Q4, the unemployment rate for 15 member countries was 6.7%, while the unemployment rate for 28 member countries was 6.1%. In this state, at first glance, it can be said that the countries that joined the union after 2004 transferred unemployment to 15 other countries through labor mobility. In addition, the unemployment rate of both country groups tended to decrease before the 2008 global crisis and while it was the same at the beginning of 2008, it increased continuously from 2008 to 2010. While the average unemployment data peaked at 11% in 2013, it decreased steadily in the following years and fell below the 2008 data.

Augmented Dickey Fuller (ADF) Test

As a result of shocks in the economy, the stagnation of the series in macroeconomic time series deteriorates. In these cases, the stationary state of the series is analyzed with unit root tests (Yurdakul, 2000). The first study on unit root testing was done by Dickey and Fuller (1979).

Later, Dickey and Fuller (1981) developed the test and included the autoregressive processes in the analysis and came up with the Augmented Dickey Fuller Unit Root Test (ADF).
Three different models are suggested for the use of the ADF test. In below, Equation (1) is used for tests in which coefficient and trend effect are not included, Equation (2) is used for tests where there is no trend effect but constant coefficient effect, and Equation (3) is used for stability tests where both constant coefficient and trend effect are present.

$$\Delta Y_t = \beta_1 Y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

$$\Delta Y_t = \beta_0 + \alpha t + \beta_1 Y_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (3)$$

The ΔY_t value indicates (Y_t-Y_{t-1}). β_0 indicates constant and *t* represents trend. In the model, β_1 is included as the coefficient of (Y_{t-1}), while the *t* term belonging to β_1 is used as a test statistic. The accuracy of the β_1=0 hypothesis is found by comparing the Dickey-Fuller table values with the *t* value.

$H_0=\beta_1=0$ The series is not stationary and has a unit root,

$H_1=\beta_1<0$ The series is stationary and there is no unit root in the series.

Phillips Perron (PP) Test

ADF unit root tests make two assumptions for the error term, namely that they are independent and have constant variance. Therefore, it is necessary to make sure that the error term does not contain correlation and variable variance (Akcan, 2019, p. 40). Phillips and Perron (1988) presented a method whose assumption was developed for the error term in the ADF unit root test. The regression equations, which were handled according to the least squares method in the Phillips – Perron unit root test, are shown with equations (4) and (5). In the regression equation, T represents the number of observations, $\hat{\mu}_t$ is the error term and ($\hat{\mu}$, $\hat{\alpha}$) and ($\tilde{\mu}$, $\tilde{\beta}$, $\tilde{\alpha}$) are the coefficients of the regression equation.

$$Y_t=\hat{\mu}+\hat{\alpha}Y_{t-1}+\hat{\mu}_t, \quad (4)$$

$$Y_t=\tilde{\mu}+\tilde{\beta}(t-\frac{T}{2})+\tilde{\alpha}Y_{t-1}+\tilde{\mu}_t \quad (5)$$

Fractional Frequency Fourier ADF Unit Root Test

Perron (1989) developed many tests that take into account structural breaks in unit root tests. The Fourier ADF unit root test proposed by Enders and Lee (2012) has been developed for situations where structural breaks are not sudden, but slow and soft. According to Omay (2015), thanks to Faorier tests, there is no need to know the structure (sharp or soft), number and location of structural breaks beforehand. This situation increases the power of the test in unit root analysis.

The following model is used in the application of the Fourier ADF unit root test:

$$\Delta y_t=\delta_0+\delta_1\sin\left(\frac{2\pi kt}{T}\right)+\delta_2\cos\left(\frac{2\pi kt}{T}\right)+\delta_3 y_{t-1}+\sum_{i=1}^{p}\alpha_i\Delta y_{t-i}+v_t \quad (6)$$

In Model (6); T is the number of observations, t is the trend, k is the number of frequencies available, $\pi = 3.1416$, and p is the appropriate lag length. The Akaike information criterion was used to determine the appropriate lag length.

For the frequency value (k), Enders and Lee (2012) used integer values and determined a frequency value range from 1 to 5. Christopoulos and Leon-Ledesma (2011) stated that frequency values can also be fractional. Omay (2015) expanded the range of fractional values. Bozoklu et al. (2020), on the other hand, expanded the frequency values to be k= (0.1,0.2,0.3,…….4.8,4.9,5) between 0.1 and 5 and presented the critical values of the fractional frequency Fourier ADF unit root test. The model for the unit root test proposed by Bozoklu et al. (2020) is as in (7).

$$y_t^*=\alpha_0 1_t^*+\beta_0 t_t^*+\lambda_1\sin_{1,t}^*+\lambda_2\cos_{1,t}^*+\mu_t,$$
$$t=1,2,\ldots,T \quad (7)$$
$$y_t^*=(1-L)^{d_0}y_t, 1_t^*=(1-L)^{d_0}1_t, t_t^*=(1-L)^{d_0}t_t, \mu_t=(1-L)^{d_0}x_t,$$
$$\sin_{1,t}^*=(1-L)^{d_0}\sin\left(\frac{2\pi kt}{T}\right), \cos_{1,t}^*=(1-L)^{d_0}\cos\left(\frac{2\pi kt}{T}\right), x_t^*=(1-L)^{d_0}\mu_t.$$

In equation (7), in cases where μ_t is I(0), the equation is linear and the coefficients can be estimated using the standard least squares method. Equation (7) is estimated for the appropriate frequency and the value that produces the least residual sum of squares for all k values between $0 < k \leq 5$ should be chosen (Bozoklu et al., 2020, pp. 5-6).

Findings and Results

Augmented Dickey Fuller Unit Root Test results for EU-15 and EU-28 unemployment rates are as in Table 3 and Table 4.

Table 3. *EU-15 ADF Unit Root Test Results*

	ADF t statistics	Probability Value	1%	%5	%10
Constant Term	-1.675615	0.4396	-3.516676	-2.899115	-2.586866
Trend and Constant Term	-1.367807	0.8628	-4.080021	-3.468459	-3.161067

Table 4. *EU-28 ADF Unit Root Test Results*

	ADF t statistics	Probability Value	1%	%5	%10
Constant Term	-1.646581	0.4542	-3.516676	-2.899115	-2.586866
Trend and Constant term	-1.768205	0.7107	-4.080021	-3.468459	-3.161067

According to the Augmented Dickey Fuller Test results, it has been observed that the unemployment hysteresis effect is valid in the in constant term and trend and constant term models in EU-28 and EU-15. Phillips Perron Unit Root Test results for EU-15 and EU-28 unemployment rates are as in Table 5 and Table 6.

Table 5. *EU-15 PP Unit Root Test Results*

	PP t statistics	Probability Value	%1	%5	%10
Constant Term	-1.157101	0.6892	-3.515536	-2.898623	-2.586605
Trend and Constant Term	-0.841426	0.9568	-4.07842	-3.467703	-3.160627

Table 6. *EU-28 PP Unit Root Test Results*

	PP t statistics	Probability Value	%1	%5	%10
Constant Term	-0.919802	0.7771	-3.515536	-2.898623	-2.586605
Trend and Constant Term	-1.028746	0.9335	-4.07842	-3.467703	-3.160627

According to Phillips Perron Test results, unemployment hysteresis effect has been observed in EU-28 and EU-15 in constant term and trend and constant term models. In this sense, it has been seen that ADF and PP tests gave the same results. The Fractional Frequency Fourier ADF Unit Root Test results for EU-15 and EU-28 unemployment rates are as in Table 7.

Table 7. *Fractional Frequency Fourier ADF Unit Root Test Results (Constant Term)*

Group of Countries	FADF t statistics	Frequency	1%	5%	10%
EU-15	-3.147381	1.3	−4.2592	−3.6034	−3.2618
EU-28	-3.245163	1.6	−4.1139	−3.43019	−3.07417

Fractional Frequency Fourier ADF Unit Root Test frequency values are wider than conventional tests, so it is expected to give more accurate results. The constant term Fractional Frequency Fourier ADF Unit Root Test results in Table 7 are analyzed according to the critical values in Table A of Bozoklu et al. (2020) and according to the test results, it is found that the unemployment hysteresis effect is valid in EU-28 and EU-15 at the 5% critical value. It should also be noted that the unemployment hysteresis is not valid in EU-28 at the 10% critical value in the model with constant term.

Table 8. *Fractional Frequency Fourier ADF Unit Root Test Results (Trend and Constant Term)*

Group of Countries	FADF t statistics	Frequency	1%	5%	10%
EU-15	-3.129948	1.2	−4.96096	−4.36321	−4.06218
EU-28	-3.601616	1.5	−4.89476	−4.28233	−3.97792

The results of the Fractional Frequency Fourier ADF Unit Root Test for the model with trend and constant term in Table 8 are analyzed according to the critical values in Table B of Bozoklu et al. (2020). According to the test results, the unemployment hysteresis effect is found to be valid in the EU-28 and EU-15. The findings are largely consistent with the results of Sigeze et al. (2019) and Doğaner (2023), who test the unemployment hysteria in all European Union countries with different methods. On the other hand, when the results are evaluated for the EU-15 countries, they are consistent with the results of Dreger & Reimers (2009), Mercan et al. (2015) and Jump & Stockhammer (2018), but contradict León-Dedesma & McAdam (2004).

Conclusion and Evaluation

Unemployment, which surged following economic shocks and persisted at elevated levels, remains a significant concern for European Union countries. Prior to 2004, the European Union had 15 member states, but this number grew to 28 after 2004, mainly due to the accession of Eastern European countries. Addressing hysteresis, a concept related to structural unemployment, is critical in a continually expanding union like the European Union. Given this distinction between member countries, the study divides them into EU-15 and EU-28 groups. Owing to the European Union's dual character as an economic and political union, the unemployment data isn't analyzed for each country individually but is based on averaged figures for EU-15 and EU-28 for the period 2001Q1-2019Q4. This research applies the Fractional Frequency Fourier ADF Unit Root Test alongside traditional unit root tests (ADF, PP).

From the findings, it's evident that economic shocks have brought about enduring alterations in the European Union economy. For both the EU-15 and EU-28 groups, the unemployment hysteresis theory is confirmed across all analyses. To formulate and implement effective policies to counter unemployment, it's crucial to accurately measure the extent of hysteresis. In this context, the Fractional Frequency Fourier ADF Unit Root Test introduced in this study offers a modern methodology to assess the hysteresis hypothesis effectively.

The evaluations suggest that the mean unemployment rates in both EU-15 and EU-28 exhibit a non-stationary trend around an evolving average. This indicates that economic fluctuations have an enduring impact on the natural unemployment rate. It's clear that without interventions, unemployment will not revert to its natural rate autonomously. A combination of expansive monetary and fiscal policies is essential to counteract the long-term hysteresis effects on unemployment in European Union countries.

This research contributes to the academic domain in two significant ways. Firstly, no prior studies in the economics literature have concentrated on the average unemployment rates for both EU-15 and EU-28. Secondly, the Fractional Frequency Fourier ADF Unit Root Test used here represents the latest unit root test that allows for detailed analysis, thanks to its broad differentiation parameters.

While the proximity of the max, min, and mean values between the two country groups suggests similarity, it's essential to interpret the descriptive statistics accurately. A deeper exploration into time variance could provide more comprehensive insights into the dynamics and impact of new memberships on unemployment trends in the European Union. Future research could delve into the time-variance aspect to better understand the factors influencing unemployment trends in the European Union, both historically and prospectively.

References

Akcan, A. T. (2019). Türkiye'de gençlerin işsizlik histerisi. *Kastamonu Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 21(1), 31-47.

Akdoğan, K. (2017). Unemployment hysteresis and structural change in Europe. *Empirical Economics*, 53(4), 1415-1440.

Ball, L., & Mankiw, N. G. (2002). The NAIRU in theory and practice. *Journal of economic Perspectives*. 16(4), 115-136.

Becker, R., Enders, W., Lee, J. (2004). A general test for time dependence in parameters. *Journal of Applied Econometrics*. 19, 899–906.

Becker, R., Enders, W., Lee, J. (2006). A stationarity test in the presence of an unknown number of smooth breaks. *Journal of Time Series Analysis*. 27 (3), 381–409.

Blanchard, O. J., & Summers, L. H. (1986). Hysteresis and the European unemployment problem. *NBER macroeconomics annual*. 1, 15-78.

Bolat, S., Tiwari, A. K., & Erdayi, A. U. (2014). Unemployment hysteresis in the Eurozone area: evidences from nonlinear heterogeneous panel unit root test. *Applied Economics Letters*. 21(8), 536-540.

Bozoklu, S., Yilanci, V., & Gorus, M. S. (2020). Persistence in per capita energy consumption: a fractional integration approach with a Fourier function. *Energy economics*. 91, 104926.

Camarero, M., & Tamarit, C. (2004). Hysteresis vs. natural rate of unemployment: new evidence for OECD countries. *Economics Letters*, 84(3), 413-417.

Chang, T. (2011). Hysteresis in unemployment for 17 OECD countries: Stationary test with a Fourier function. *Economic Modelling*. 28(5), 2208-2214.

Christopoulos, D. K., & León-Ledesma, M. A. (2007). Unemployment hysteresis in EU countries: what do we really know about it?. *Journal of Economic Studies*. 34(2), 80-89.

Christopoulos, D. K., & Leon-Ledesma, M. A. (2011). International output convergence, breaks, and asymmetric adjustment. *Studies in Nonlinear Dynamics & Econometrics*. *15*(3).

Carrion-i-Silvestre, J. L., del Barrio-Castro, T., & Lopez-Bazo, E. (2005). Breaking the panels: an application to the GDP per capita. *The Econometrics Journal*, 159-175.

Cross, R., Darby, J., Ireland, J., Piscitelli, L. (1998). Hysteresis and unemployment: a preliminary investigation. Paper presented at CEF'99 (SCE-Conference), Boston, June 24-26th 1999.

Dickey, D.A., Fuller, W.A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*. 74, 427–431.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica: journal of the Econometric Society*. 1057-1072.

Doğaner, A. (2023). Avrupa Birliği ülkelerinde işsizlik histerisi hipotezinin doğrusal ve doğrusal olmayan birim kök testleriyle tespiti: 1991-2020 dönemi. *İstanbul İktisat Dergisi*, *72*(2), 753-785.

Dreger, C., & Reimers, H. E. (2009). Hysteresis in the development of unemployment: The EU and US experience. *Spanish Economic Review*. 11(4), 267-276.

Enders, W., Lee, J. (2009). The Flexible Fourier Form and Testing for Unit Roots: An Example of the Term Structure of Interest Rates, Working Paper. Department of Economics, Finance & Legal Studies, University of Alabama, Tuscaloosa, AL, USA.

Enders, W., & Lee, J. (2012). The flexible Fourier form and Dickey–Fuller type unit root tests. *Economics Letters*. 117(1), 196-199.

Eurostat (16.02.2023). Data Browser. HuffPost. https://ec.europa.eu/eurostat/databrowser/view/une_rt_q_h/default/table?lang=en

Friedman, M. (1968). The Role Of Monetary Policy. *American Economic Review*. 58, 1–17.

Furuoka, F. (2017 a). A new test for analysing hysteresis in European unemployment. *Applied Economics Letters.* 24(15), 1102-1106.

Furuoka, F. (2017 b). A new approach to testing unemployment hysteresis. *Empirical Economics.* 53(3), 1253-1280.

Hadri, K., & Rao, Y. (2008). Panel stationarity test with structural breaks. *Oxford Bulletin of Economics and statistics*, *70*(2), 245-269.

Jacobson, T., Vredin, A., & Warne, A. (1997). Common trends and hysteresis in Scandinavian unemployment. *European Economic Review*. 41(9), 1781-1816.

Jaeger, A., & Parkinson, M. (1994). Some evidence on hysteresis in unemployment rates. *European Economic Review*. *38*(2), 329-342.

Jiang, Y., Cai, Y., Peng, Y. T., & Chang, T. (2019). Testing hysteresis in unemployment in G7 countries using quantile unit root test with both sharp shifts and smooth breaks. *Social Indicators Research.* 142(3), 1211-1229.

Jump, R. C., & Stockhammer, E. (2018). New evidence on unemployment hysteresis in the EU. https://www.euroframe.org/files/user_upload/euroframe/docs/2018/Conference/Session%204/EUROF18_Jump_Stockhammer.pdf

Klinger, S., & Weber, E. (2016). Detecting unemployment hysteresis: a simultaneous unobserved components model with Markov switching. *Economics Letters*. *144*, 115-118.

Layard, P. R. G., Layard, R., Nickell, S. J., & Jackman, R. (2005). *Unemployment: macroeconomic performance and the labour market*. *Oxford University Press on Demand*.

León-Ledesma, M. A., & McAdam, P. (2004). Unemployment, hysteresis and transition. *Scottish Journal of Political Economy*. 51(3), 377-401.

Li, J. P., Ranjbar, O., & Chang, T. (2017). Unemployment hysteresis in PIIGS countries: a new test with both sharp and smooth breaks. *The Singapore Economic Review*. 62(05), 1165-1177.

Mercan, M., Yurttançıkmaz, Z. Ç., & Çakmak, F. (2015). İşsizlik Histerisi Hipotezinin Türkiye, AB-15, AB-27, OECD ve G-8 Ülkeleri İçin

Yatay Kesit Bağımlılığı ve Yapısal Kırılmalar Altında Testi: Dinamik Panel Veri Analizi. *TISK Academy/TISK Akademi*, *10*(19).

Obradović, S., Ristić, L., & Lojanica, N. (2018). Are unemployment rates stationary for SEE10 countries? Evidence from linear and nonlinear dynamics. *Zbornik Radova Ekonomski Fakultet u Rijeka*. 36(2), 559-583.

Omay, T. (2015). Fractional frequency flexible Fourier form to approximate smooth breaks in unit root testing. *Economics Letters*. 134, 123-126.

Pascalau, R. (2010). Unit root tests with smooth breaks: an application to the Nelson– Plosser data set. *Applied Economics Letters*. 17, 565–570.

Perron, P. (1989). The great crash, the oil price shock, and the unit root hypothesis. *Econometrica: journal of the Econometric Society*. 1361-1401.

Phelps, E. S. (1967). Phillips curves, expectations of inflation and optimal unemployment over time. *Economica*. 254-281.

Phelps, E. S. (1968). Money-wage dynamics and labor-market equilibrium. *Journal of political economy*. 76 (4, Part 2), 678-711.

Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*. 75(2), 335-346.

Sigeze, Ç., Coşkun, N., & Ballı, E. (2019). AB ülkelerinde ve Türkiye'de işsizlik histerisinin Fourier-KPSS birim kök testi ile incelenmesi. *İzmir İktisat Dergisi*, *34*(1), 15-24.

Srinivasan, N., & Mitra, P. (2012). Hysteresis in unemployment: Fact or fiction?. *Economics Letters.* 115(3), 419-422.

Yaya, O. S., Ogbonna, A. E., Furuoka, F., & Gil-Alana, L. A. (2021). A new unit root test for unemployment hysteresis based on the autoregressive neural network. *Oxford Bulletin of Economics and Statistics.* 83(4), 960-981.

The Directorate for EU Affairs. (2023). HuffPost. https://www.ab.gov.tr/p.php?e=109

Yıldırım, S., & İnançlı, S. (2018). Türkiye'de işsizlik histerisis hipotezinin geçerliliğinin ampirik olarak değerlendirilmesi. *Ekonomik ve Sosyal Araştırmalar Dergisi*. 14, 45-54.

Yurdakul, F. (2000). Yapısal kırılmaların varlığı durumunda geliştirilen birim-kök testleri. *Gazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*. 2(2), 21-34.