VOLUME 1, 2011

ISSN 2045-3345

RESEARCH JOURNAL OF ECONOMICS, BUSINESS AND ICT

UNEMPLOYMENT HYSTERESIS IN TURKEY AND 15 EU COUNTRIES: A PANEL APPROACH

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ABSTRACT

This study investigates empirically the presence of unemployment hysteresis in 16 countries which consist Turkey and fifteen EU countries, applying annual unemployment rates covering 1985-2005 periods. Hysteresis is tested by using panel unit root tests, which allow for structural breaks. We test whether unemployment rates are stationary by using first generation, second generation test and panel unit root test based on structural break advanced by Carrion-i Silvestre et al. (2005) as a final point. We find series as a stationary process with structural breaks according to Carrion-i Silvestre et al.(2005) test, while we find series as unit root process with first and second generation panel unit root tests. Thus, according to the Carrion-i Silvestre et al. (2005) test, we find evidence absence of hysteresis in countries analyzed. So, there still exists a unique natural rate of unemployment to which the economy eventually will converge.

JEL CLASSIFICATION & KEYWORDS

C23 | J64 | Structural Break | Unemployment | Cross-section | Dependency | Panel Unit Root Tests

INTRODUCTION

After first OPEC shock in 1973, especially in the European countries the rate of unemployment has increased. Hence, the number of studies based on hysteresis in unemployment is being focal point in literature. For example Friedman (1968), Phelps (1967, 1968, 1994), Blanchard and Summers (1986), Arestis and Mariscal (2000), Camarero and Tamarit (2004), Gustausson and Österholm (2006), Kapetanios etc. (2003) have contributed in literature. The theory applied by Friedman (1968) and Phelps (1967, 1968) assume dynamic of unemployment as a stationary process. According to their theory, the rise in rate of unemployment has transitory effects. That is, rate of unemployment converges to equilibrium state or constant state in long run.

The natural rate of unemployment hypothesis is one of the important ideas macroeconomics. The natural rate of unemployment is determined by labor supply and demand. When fluctuations in demand or supply can cause deviations of actual unemployment rate from natural rate. In turn the deviations will spur changes in inflation. Changes in inflation lead to the unemployment rate to eventually return to the natural rate.

Blanchard and Summers (1986) propose the so-called hysteresis hypothesis of unemployment to describe the long-lasting influence of unemployment on the natural rate. Blanchard and Summers (1986) test for unit roots using data France, Germany, the United Kingdom and the United States for the period from 1953 to 1984 and cannot reject nonstationarity of unemployment rates for the three countries. The hysteresis of hypothesis in unemployment means that process of unemployment rates is affected permanently from cyclical change. Blanchard and Summers (1986) specially focused on wage bargaining. According to Blanchard and Summers, wage bargaining determines the nominal wage, with firms being free to choose employment ex post. They started with the pure insider case, in which the wage is set by insiders, with no pressure from outsiders on wage setting and then considered the more general case where outsiders exert some pressure. It is assumed to be importance to role of insider. It is assumed that wages are set primarily with regard to interest of incumbent workers (insiders) is easily justified. Incumbent workers are likely to have bargaining power because of the fixed costs of hiring new worker, threat of strike. Hence, incumbent worker prevents to be employed outsider. As a result, employer wants to hire worker from other firms. In existing labor force doesn't occur an increasing, so rate of unemployment will be continuity.

They have also emphasized that recessions can have a permanent impacts if they change the characteristics or altitude of those who lost their jobs as a results of recessions. of capital, dismissal cost can be shown as sources of hysteresis in unemployment. In this case, occurring shock in labour force will be permanent and economy doesn't converge to initial equilibrium level (Christopoulos and Leon-Ledesma, 2007:81).

According to Camarero and Tamarit (2004), hysteresis hypothesis states that cyclical fluctuations have permanent effects on the level of unemployment due to labor market rigidities. As result of, the level of unemployment can be characterized as a non-stationary process.

Summers (1986) argues that a rise in occurring unemployment rate since mid-1960s in U.S has in large part resulted from high and growing noncompetitive wage differentials. A recession can have permanent effects if it changes the attitudes of those people who become unemployed. For instance, when a worker is laid off in a recession, worker loses his job skills and hence unable to find a new job and reduce the desire to look for employment even after the recession ends (Layard, Nickell and Jackman; 1991).

Phelps (1994) characterize rate of unemployment as a process about varying mean. Brunello (1990) cannot reject the null hypothesis of a unit root using Japanese unemployment data from 1955 to 1987. Mitchell (1993) argues that the natural rate hypothesis can be represented as a trend stationary process, while the hysteresis hypothesis can be represented as a difference stationary process. Mitchell (1993) finds that the null hypothesis of a unit root in unemployment rates for fifteen OECD countries cannot be rejected even after accounting for structural breaks in the trend function.

There are many studies analyzing structural of unemployment. For example, Arestis and Mariscal (2000) tested using Perron (1997) unit root test for 22 OECD countries. They accepted to presence hysteresis for 10 OECD countries. Camarero and Tamarit (2004) analyzed whether rate of unemployment is stationary over 1956-2001 period for 19 OECD countries. They found that unemployment had stationary process, i.e., it was accepted to presence hysteresis of unemployment. Gustavsson and Österholm (2006), Kapetanios etc. (2003) examined rates of unemployment for Australia, Canada, Finland, Sweden, U.S using nonlinear unit root test. The results suggested that hysteresis is no validity in all countries except Australia. Lee and Chang (2008) investigated whether rate of unemployment is stationary using LM unit root test and deduced that rate of unemployment has stationary structure. Roed (1996) investigated that the presence of unemployment hysteresis in 16 OECD countries. The results suggested that only in the USA, the presence of unemployment hysteresis is strongly and consistently rejected.

The aim of this paper's is to examine the validity of hysteresis unemployment. In this paper, we analyze a panel of unemployment rates of for 16 countries using a panel-based unit root tests. The test exploits the cross-section variations and structural breaks of the constituent series and is more powerful. With this aim, Section II describes the econometric methodology used in this paper. Section III presents and discusses the empirical results and Section IV presents conclusions.

EMPIRICAL METHODOLOGY

Our central interest lies on testing whether the unemployment rate contains a unit root for each country analyzed. The annual data covering the period of 1985-2005 for sixteen countries is used for empirical analysis. The countries consist of Austria, Belgium, Denmark, Germany, Greece, France, Spain, Ireland, Italy, Luxemburg, Netherlands, Portugal, Finland, Sweden, United Kingdom, and Turkey. We obtain the rate of unemployment rate from United Nations Data Retrieval System (Undata).

This paper is utilized from Im, Pesaran and Shin's test (2003) (hereafter IPS), Fisher-type test proposed first by Maddala and Wu (1999) (hereafter MW) then developed Choi (2001), Levin, Lin and Chu (2002) (hereafter LLC), Hadri (2000)'s test as first generation tests, Cross-sectionally augmented dickey fuller test (hereafter CADF) as second generation test and Carrion-i Silvestre et al.(2005) test (PANKPSS) measuring presence of structural break. Firstly we analyze first generation test, then second generation test. A first generation of models has analyzed the properties of panel-based unit root tests under the assumption that the data is independent and identically distributed (i.i.d) across individuals.

In general, this type of panel unit root tests is based on the following regression:

$$\Delta Y_{i,t} = \beta_i . Y_{i,t-1} + Z_{i,t} . \gamma + u_{i,t}$$

where i = 1,2,…,N is individual, for each individual T=1,2,…,T time series observations are available, $Z_{i,t}$ is deterministic component and $u_{i,t}$ is error term. The null hypothesis of this type is ρ_i=0 for $\forall_i$.

The first of first generation panel unit root tests is LLC (2002) that allow for heterogeneity of individual deterministic effects and heterogeneous serial correlation structure of the error terms assuming homogeneous first order autoregressive parameters. They assume that both N and T tend to infinity but T increase at a faster rate, so N/T $\rightarrow$ 0. They assume that each individual time series contains a unit root against the alternative hypothesis that each time series stationary. Thus, referring to the model (1), LLC assume homogeneous autoregressive coefficients between individual, i.e. $\beta_i = \beta$ for all i, and test the null hypothesis $H_o : \beta_i = \beta = 0$ against the alternative $H_A : \beta_i = \beta \prec 0$ for all i. The structure of the LLC analysis may be specified as follows:

$$\Delta Y_{i,t} = \alpha_i + \beta_i . Y_{i,t-1} + \delta_i . \tau + \sum_{j=1}^{pj} \phi_{ij} . \Delta Y_{i,t-j} + u_{it}$$

for i = 1,…, N and t= 1,…,T, where τ is trend, α_i is individual effects, u_{it} is assumed to be independently distributed across individuals. LLC estimate to this regression using pooled OLS. In this regression deterministic components are an important source of heterogeneity since the coefficient of the lagged dependent variable is restricted to be homogeneous across all units in the panel (Barbieri, 2006).

Other test, IPS (2003) test allows for residual serial correlation and heterogeneity of the dynamics and error variances across units. Hypothesis of IPS may be specified as follows:

$$H_0 : \beta_i = \beta = 0 \; ; \; H_A : \beta_i \prec 0 \text{ for all } i$$

The alternative hypothesis allows that for some (but not all) of individuals series to have unit roots. IPS compute separate unit root tests for the N cross-section units. IPS define their t-bar statistics as a simple average of the individual ADF statistics, t_i, for the null as:

$$\bar{t} = \sum_{i=1}^{N} t_i / N$$

It is assumed that t_i are i.i.d and have finite mean and variance and E(t_i), Var(t_i) is computed using Monte-Carlo simulation technique. Other test MW consider deficiency of both the LLC and IPS frameworks and offer an alternative testing strategy (Barbieri, 2006). MW is based on a combination of the p-values of the test statistics for a unit root in each cross-sectional unit.

Hadri (2000) test permits an easy formulation for a residual based LM test of stationary. Hadri adopts the following components representation:

$$Y_{it} = Z'_{it} . \gamma + r_{it} + \varepsilon_{it}$$

where Z_{it} is deterministic component, r_{it} is a random walk: $r_{it} = r_{i,t-1} + u_{it}$ where $u_{it} \sim iid(0, \sigma_u^2)$ and $\varepsilon_{i,t}$ is stationary process. Hypothesis of Hadri's test is different from other first generation tests. The null of hypothesis of trend stationary corresponds to the hypothesis that the random walk equals zero. Further, this test allows the disturbance terms to be heteroscedastic across *i.*

It has to be controlled whether there is dependency across cross-section in regression. Thus, we test Breusch and Pagan (1980)'s cross-section LM testing. Since number of cross-section observation is smaller number of time series observation in our model, it is take into accounted CDLM1 test of Pesaran (2004). CDLM1 test statistic is following as:

$$\text{CDLM1} = T.\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^2 \sim \chi^2_{N.(N-1)/2}$$ where

$\hat{\rho}_{ij}$ is correlation of coefficient across residuals obtained from each regression estimated by OLS estimator. One of second generation tests is CADF testing. Pesaran (2003) presents a new procedure for testing unit root in dynamic panels subject to possibly cross sectionally dependent in addition to serially correlated errors. Pesaran (2003) proposes a test based on standard unit root statistics in a CADF regression. CADF process can be reduced with estimated to this equation:

$$\Delta Y_{it} = \alpha_i + \beta_i.Y_{i,t-1} + \sum_{j=1}^{p_i}\delta_{ij}\Delta Y_{i,t-j} + d_i.\tau + c_i.\bar{Y}_{t-1} + \sum_{j=0}^{p_i}\varphi_{ij}.\Delta\bar{Y}_{i,t-j} + \varepsilon_{it}$$

where $\bar{Y}_t = N^{-1}.\sum_{j=1}^{N} Y_{jt}$, $\Delta\bar{Y}_{i,t} = N^{-1}\sum_{j=1}^{N}\Delta Y_{jt}$ and ε_{it} is regression errors. Let $CADF_i$ be the ADF statistics for the i^{th} cross-sectional unit given by the t-ratio of the OLS estimate $\hat{\beta}_i$ of β_i in the CADF regression. Individual CADF statistics are used to develop a modified version of IPS t-bar test (denoted CIPS for Cross-sectionally Augmented IPS) that simultaneously take account of cross-section dependence and residual serial correlation:

$$CIPS = N^{-1}\sum_{i=1}^{n} CADF_i$$

Hypotheses of both CADF and CIPS are the same. The null hypothesis is formulated as:

$H_o : \beta_i = 0$ This hypothesis implies that all the time series are nonstationary.

$H_A : \beta_i \prec 0$ This hypothesis implies that all the time series are stationary.

A. Carrion-i Silvestre et al.'s (2005) Panel Stationary Test with Structural Breaks

So far, unit root tests analyzed have assumed that data is produced by a linear process and a structural break occurs in data generating process. But when we ignore to presence of break, we can obtain biased results. Im and Lee (2001) and Carrion-i Silvestre et al. (2002) are pioneer to this addition. Im and Lee (2001) analyzed the case of structural break that changes mean of series in individual effects and model which has trending regressor. Carrion-i Silvestre et al's (2005) panel stationary test allows for multiple structural breaks through the incorporation of dummy variables in the deterministic model. Carrion-i Silvestre et al (2005) allow for structural changes to shift the mean and trend of individual time series. Further, they allow that each individual in the panel can have different number of breaks located at different dates. In this case, under the null hypothesis the data generating process for the variable is assumed to be:

$$Y_{i,t} = \alpha_{i,t} + \delta_{i,t} + u_{i,t} \quad (2)$$

$$\alpha_{i,t} = \sum_{k=1}^{m_i}\varphi_{i,k}.D(T^i_{b,k})_t + \sum_{k=1}^{m}\phi_{i,k}.DU_{i,k,t} + \alpha_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

$$\alpha_{i,0} = \alpha_i$$

where $\varepsilon_{i,t} \sim \text{i.i.d}(0, \sigma^2_{\varepsilon_i})$ and $\alpha_{i,0} = \alpha_i$ a constant with *i = (1,…,N)* individuals and *t = (1,…,T)* time periods. The dummy variables $D(T^i_{b,k})_t$ and $DU_{i,k,t}$ are defined as:

$$D(T^i_{b,k})_t = \begin{cases} 1 & t = T^i_{b,k} + 1 \\ 0 & \text{elsewhere} \end{cases}$$

$$DU_{i,k,t} = \begin{cases} 1 & t \succ T^i_{b,k} \\ 0 & \text{elsewhere} \end{cases}$$

where $T^i_{b,k}$ is date of the break for i-th individual.

m is allowed to be max number of breaks since *k = 1,…, m*. It is assumed that $u_{i,t}$ and $\varepsilon_{i,t}$ are independent as in Hadri's test. But their null of hypothesis different from panel data test of Hadri (2000), $Ho : \sigma^2_{\varepsilon,i} = 0$ under null of hypothesis, which the model given by (2) and (3) becomes: (4)

$$Y_{i,t} = \alpha_i + \sum_{k=1}^{m_i}\varphi_{i,k}.DU_{i,k,t} + \sum_{k=1}^{m_i}\Theta_{i,k}.DT^*_{i,k,t} + \delta_{i,t} + u_{i,t}$$

where $DT^*_{i,k,t} = t - T^i_{b,k}$, $t > T^i_{b,k}$, $DT^*_{i,k,t} = 0$ elsewhere

This model (4) includes individual structural break effect (shifts in the mean caused by structural breaks), temporal effects (for $\delta_i \neq 0$), temporary structural break effect (for $\Theta_{i,k} \neq 0$ that is only there are changes in individual time trends).

The specification given by (4) is general enough to allow three characteristics:

a) The structural breaks have different effects on each individual time series. This effects are measured by $\Theta_{i,k}$ and $\varphi_{i,k}$ .b) Structural breaks may occur in different dates for each individual time series. c) The number of structural break may change from individual to individual.

The test null of hypothesis of a stationary panel ($\sigma^2_{\varepsilon,i} = 0$) that proposed by Hadri (2000) and advanced Carrion-i Silvestre et al. (2005) with representation given by:

$$LM_{\text{hom}(\lambda)} = N^{-1}.\sum_{i=1}^{N}(\hat{\omega}^{-2}.T^{-2}.\sum_{t=1}^{T} S_{i,t}^2) \quad (5)$$

where $S_{i,t} = \sum_{j=1}^{t} \hat{u}_{i,j}$ and $S_{i,t}$ denotes the partial sum process that obtained when it is used the estimated OLS residuals of (4) and where $\hat{\omega}_i^2$ is a consistent estimate of the long-run variance $\varepsilon_{i,t}$. λ in (5) denotes the dependence of LM statistic on the dates of break. For each individual i, it is defined as the vector $\lambda_i = (\lambda_{i,1},...,\lambda_{i,m_i})' = (T_{b,1}^i / T,...,T_{b,m_i}^i / T)'$ which indicates the relative positions of the dates of the breaks on the entire the period, T. If variance is allowed to change across cross-section individual, then LM test statistic is can be expressed as:

$$\text{LM}_{\text{het}(\lambda)} = N^{-1}.\sum_{i=1}^{N}(\hat{\omega}_i^{-2}.T^{-2}.\sum_{t=1}^{T} S_{i,t}^2) \quad (6)$$

LM statistics is standardized as:

$$Z(\lambda) = \frac{\sqrt{N}(LM(\lambda) - \bar{\xi})}{\bar{\varsigma}} \sim N(0,1)$$

They showed that $Z(\lambda)$ statistic normally distributed as firstly $T \to \infty$ followed by $N \to \infty$. For variable $Z(\lambda)$, the expectation (ξ_i) and variance (ς_i^2) are given as

$$\xi_i = A.\sum_{k=1}^{m_i+1}(\lambda_{i,k} - \lambda_{i,k-1})^2 \text{ resp. } \varsigma^2{}_i = B.\sum_{k=1}^{m_i+1}(\lambda_{i,k} - \lambda_{i,k-1})^4$$

Carrion-i Silvestre et al. (2005) accept to being $\lambda_{i,0} = 0$, $\lambda_{i,m+1} = 1$, A = 1/6, B = 1/45 subject to $\alpha_i = \Theta_{i,k} = 0$ while they accept to being A=1/15, B=11/6300 under hypothesis of $\alpha_i \neq \Theta_{i,k} \neq 0$.

A.1 Estimating and Testing Breaks

Since computed to $Z(\lambda)$ statistics, it must be detected the breaks in each one of the individual time series. Carrion-i Silvestre et al.(2005) determine endogenously structural break. Thus they follow Bai and Perron (1998)'s the global minimization of sum of squared residuals process (SSR). They choose as the estimate of the dates of the breaks the argument that minimizes the sequence of individual SSR $(\hat{T}_{b,1}^i,...,\hat{T}_{b,mi}^i)$ computed from (4),

$$(\hat{T}_{b,1}^i,...,\hat{T}_{b,mi}^i) = \arg\min_{T_{b,1}^i,...,T_{b,mi}^i} .SSR(T_{b,1}^i,...,T_{b,mi}^i) .$$

After the dates for all possible values of $m_i \leq m^{\max}, i = (1,...,N)$ have been estimated, the point is to select the suitable number of structural breaks and determine optimal value for m_i. Bai and Perron (1998) propose this concern using two different procedures. The first procedure makes use of information criteria or more specifically the Bayesian Information criterion (BIC) and the modified Schwarz Information criterion (LWZ) of Liu et al. (1997). The second procedure is based on sequential computation of structural breaks with the application of *pseudo* F-type test statistics. Bai and Perron (2001) compare the procedures and conclude that second one outperforms the first one. Thus, if there are trending regressors, then the number of structural breaks should be estimated using BIC and LWZ Information criteria. On the other hand when the model doesn't include trending regressors, the number of structural breaks should be estimated using sequential procedure.

EMPIRICAL RESULTS

Table 1 presents the panel data test statistics, for the unit root and stationary tests that do not allow for the presence of cross-section dependency (i.e., first generation panel unit root tests). The results shown in Table 1 clearly indicate that the LLC, IPS, PP, ADF tests reject the null of non-stationary unemployment rate for all 16 countries the model with constant. Hadri (2000) test also supports this result.

If we take into account the model with trend, we obtain that unit root in rate of unemployment is rejected for 16 countries by means of IPS and ADF-Fisher Chi-square tests.

After obtained this result, it has to be investigated whether rate of unemployment has cross-section dependency. Thus, we test Breusch and Pagan (1980)'s cross-section LM testing. Since number of cross-section observation is smaller than number of time series observation in our model, it is taken into account CDLM1 test of Pesaran (2004). According to Table 2, probability value of CDLM1 test converges to zero. Since probability value is smaller than significance level (0.05), we reject to presence of cross-sectional independence. Thus, we must rely on second generation unit root tests instead of first generation unit root tests. First generation tests depend crucially upon the independence assumption across individuals, and hence not applicable since cross sectional correlation is present. So, we must consider results of Table 3.

Table 3 presents panel data test statistics, for the unit root and stationary tests that do allow for the presence of dependency across panel members. As is seen from Table 3, results of CADF for unemployment show that the null of a unit root in each country's unemployment series can be rejected at the 5% level in the model with trend and constant, except for UK in all countries. At the same time, when we analyzed from CIPS stat, still we could reject to the null of a unit root in all countries at the 5% level.

Carrion-i-Silvestre et al. (2005) and Carrion-i-Silvestre (2005), all of whom conclude that the unit root hypothesis can be strongly rejected once the level and/or slope shifts are taken into account. In light of these considerations, in this paper, we apply the test of Carrion-i-Silvestre et al. (2005). The empirical analysis first specifies a maximum of m_{max} = 5 structural breaks, which appears to be reasonable given the number of time observations (T = 21) in our study. Table 4 shows our results. We find that the null of stationary is not rejected in any of the cases. As can be seen from Table 5, Portugal and Spain exhibit four breaks, Italy and Luxemburg have one break, and the remaining countries have around two and three breaks. Finland is the only country with none breaks. Table Panel B presents results of panel unit root test based on structural break. The presence of stationary cannot be rejected by either the homogeneous or the heterogeneous long-run version of test in the model with constant if we use the bootstrap critical values, as shown in Panel C. If we consider model with trend, then we fail to accept the presence of unit root in rate of unemployment at 1% significance level. Taken together, our results suggest that the panel data set of unemployment rate is stationary when we introduce structural break into the model.

Table 1 Result of First Generation Unit Root Tests

(Table 1) First Generation Tests	Without Trend		With Trend	
	Test stat.	Prob.	Test stat.	Prob.
Levin, Lin & Chu t stat.	-1.11	0.13	0.609	0.27
Im, Pesaran and Shin W stat.	-1.2	0.11	-3.62	0.0001
ADF – Fisher Chi-square stat.	44.21	0.07	64.94	0.0005
PP – Fisher Chi-square stat.	30.54	0.54	18.2	0.9759
Hadri Z-stat.	4.33	0	5.64	0
Hadri Het. Cons Z stat.	5.56	0	4.17	0

Number of lag for LLC, IPS, ADF- Fisher and PP-Fisher test statistics was selected by Schwarz criterion and for Hadri test was selected by Newey and West (1994) criterion.

Table 2 Results of Cross-Section Dependence Tests in Panel

Table 2	Without Trend		With Trend	
	T stat.	Prob.	T stat.	Prob.
CDLM2	2.94	0.0016	3.89	4
CDLM1	166	0.004	180.35	0.0003
CDLM	0.37	0.36	0.81	0.21

Table 3 Results of CADF for Unemployment

Table 3	Without Trend(Only constant)			With Trend		
Country	P Lag	CADF Test stat.	CV (5%)	P Lag	CADF Test stat.	CV (5%)
Austria	1	-	-3.42	1	-	-4
Belgium	4	-2.258	-3.42	4	-	-4
Denmark	1	-	-3.42	1	-	-4
Germany	1	-	-3.42	1	-1.186	-4
Greece	1	-	-3.42	1	-	-4
Spain	1	-0.261	-3.42	4	-	-4
France	2	-1.577	-3.42	2	-	-4
Ireland	5	43.27	-3.42	1	-0.701	-4
Italy	2	-	-3.42	2	-1.952	-4
Luxemburg	5	-	-3.42	2	-	-4
Netherlands	2	-1.227	-3.42	2	-	-4
Portugal	2	-2.125	-3.42	2	-	-4
Finland	1	-1.364	-3.42	1	-	-4
Sweden	1	-1.388	-3.42	1	-	-4
United Kingdom	1	-0.944	-3.42	1	-	-4
Turkey	1	-2.055	-3.42	1	-	-4
CIPS stat		-1.746	-2.21		-	-2.73

Critical values are obtained from Tables in article of Pesaran (2003)

Table 4a Panel Stationary Test with Structural Breaks For Rate of Unemployment:

Panel A. Country-by-Country Test

Table 4a	Without Trend			With Trend		
Country	Breaks #	KPSS Test	CV	Breaks #	KPSS Test	CV (95%)
1. Austria	2	0.12	1.17	1	0.059	1.32
2. Belgium	3	0.5	0.69	2	0.2	1.103
3. Denmark	3	0.08	0.65	3	0.07	0.88
4. Germany	3	0.04	1.91	5	0.47	0.24
5. Greece	3	0.22	0.6	1	0.07	1.35
6. Spain	4	0.23	1.74	3	1.06	0.097
7. France	2	0.08	1.51	2	0.06	0.5
8. Ireland	3	0.12	1.25	3	0.9	0.137
9. Italy	1	0.12	1.29	3	0.049	1.341
10. Luxembourg	1	0.31	1.3	2	0.06	0.39
11. Netherland	2	0.26	1.19	3	0.66	0.41
12. Portugal	4	0.3	0.4	3	1.62	1.05
13. Finland	0	0.11	1.86	2	0.16	0.15
14. Sweden	2	0.05	1.64	4	1.21	0.103
15. U.K	2	0.042	1.1	4	0.06	0.38
16. Turkey	2	0.35	1.25	1	0.15	1.05

Table 4b Panel Stationary Test with Structural Breaks For Rate of Unemployment:

Panel B. Panel Stationary Test Based On Structural Break (The test of Carrion-i Silvestre et al., 2005)

(Table 4b) Constant	Time Trend	Test stat.	P Val.	Test stat.	P Val.
LM (λ)	Hom.	2.87	0.002	44.89	0
LM (λ)	Het.	8.23	0	141.93	0

Table 4c Panel Stationary Test with Structural Breaks For Rate of Unemployment:

Panel C. Bootstrap Distribution (%)

Table 4c	Boots CV (Constant)		Boots CV (Time Trend)	
Level	Hom	Het	Hom	Het
0.01	-0.74	5.47	6.41	31.38
0.025	-0.33	6.75	7.03	36.08
0.05	0.11	7.86	7.72	39.38
0.1	0.76	9.46	8.91	45.19
0.9	24.47	31.11	36.72	107.17
0.95	32.82	36.3	43.97	120.56
0.975	43.64	42.56	71.87	135.75
0.99	54.85	50.12	86.88	162.56

The finite sample critical values are computed by means of Monte Carlo simulations using 10,000 replications. LM (λ)(hom) and LM(λ) (het) denote the Carrion-i-Silvestre et al. (2005) KPSS test assuming homogeneity and heterogeneity, respectively, in the estimation of the long-run variance.

CONCLUSION

In this empirical study, we employ the Carrion-i Silvestre et al.'s (2005) panel stationary test with structural breaks to assess validity of hysteresis in unemployment rates for 16 countries using annual data for the period 1985-2005.

We contribute to this empirical literature in several respects. First, we apply jointly panel unit root and stationary tests. Second, we use three versions of these tests: the first one, imposing cross-section independence, the second one allows for dependency and the third one allows for structural breaks.

Carrion-i Silvestre et al.'s (2005) panel stationary test indicates that a unit root in rate of unemployment is rejected for 16 countries we study here. This finding has been interpreted as support for the absence of hysteresis hypothesis in countries analyzed. As a result, temporary shocks have temporary effects on unemployment instead of permanent effect. Structural factors can affect the natural rate of unemployment and, therefore, unemployment would be stationary around a process that is subject to structural breaks. So, there still exists a unique natural rate of unemployment to which the economy eventually will converge.

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