Analysis of Youth Unemployment Hysteresis in Hıgh-Income OECD Countries: Evidence from Panel Unit Root Test With Structural Breaks

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Abstract
This paper examines youth unemployment in high-income OECD countries over the 1996-2014 period, using panel unit root tests that allow for structural breaks. We consider two group of countries: first, a sample of 16 high-income OECD countries whose youth unemployment rate is above the OECD average (14.06 %), and second, a group of 14 high-income OECD countries with youth unemployment rates below the OECD average. Using a panel unit root test based on structural break introduced by Carrion-i Silvestre et al. (2005), we investigate whether or not youth unemployment rates are stationary. The results confirm the stationarity of youth unemployment. We then find evidence supportive of the absence of hysteresis in our sample, except in some countries. The persistence is particulary high in the US, Canada, Japan and some EU countries such as Belgium, Norway and Denmark. These results thus suggest that cyclical fluctuations have temporary effects on youth unemployment instead of permanent effects. However, structural factors may affect the natural rate of youth unemployment, as the latter appears stationary around a process that is subject to structural breaks.

Keywords: Youth Unemployment, Hysteresis, Cross-Section Dependence, Panel KPSS
JEL Classification: C12, C23, E12, E24.

1. Introduction

Youth unemployment is increasingly becoming a key matter of concern in political and academic debate since the unfolding of the Great Recession in 2008, including in OECD countries. Unemployment rate in OECD-Europe increased from 1.7% in the early 1960 to 11% in the mid-1990 (Blanchard and Wolfers, 2000). This pattern was compounded by the 2008 financial crisis, with the number of young people out of work in the OECD area being about one-third higher than in 2007. Despite the sluggish economic recovery in these countries, unemployment remains extremely high. The youth share of the working-age population is much lower in high-income than in low-income countries, but youth unemployment rate remains well above its pre-crisis (Lam, 2014).

Youth unemployment in many European countries has developed into a dangerous threat. In 2012, OECD countries had a youth unemployment rate of 16.3%. According to OECD's statistics at the end of the first quater of 2013, in nine OECD countries, including Portugal, and Italy, youth unemployment rate exceeded 25% and in 2014 reached 53.2% in Spain, 52.4% in Greece, 42.7% in Italy and 34.8% in Portugal. Despite multiple efforts from the governments, youth unemployment rate remains high, thus bringing it at the forefront of the policy debate[1].

Two main hypotheses can help understand this high and persistent unemployment rate. First, the so-called natural unemployment rate or NAIRU, pioneered by Phelps (1967, 1968) and Friedman (1968), stimulates that unemployment rate is a dynamic process that evolves consistently with the inflation rate. Indeed, after shocks, unemployment rate tends to revert to its equilibrium level over the long run, should unemployment rate follow a stationary process. For a long time, this natural unemployment rate theory has been the dominating theory explaining unemployment rate. At the same time, especially in Europe during the 1970's and 1980's, the so-called natural unemployment rate failed to explain the high and persistent unemployment rates. As the NAIRU theory failed to capture the important aspect of this reality, Blanchard and Summers (1986, 1987) brought forward the notion of hysteresis. According to hysteresis hypothesis, given labour-market rigidities, shocks have permanent effects on unemployment rate, such that the unemployment rate can be characterized as an integrated process. In other words, the term hysteresis is used to describe a situation in which transitory shocks have permanent effects, that is, unemployment rate is a unit root process (León-Ledesma and McAdam, 2004). The Structuralist school made an important contribution to the literature on natural rate hypothesis. Phelps (1994) indicates that, the natural unemployment rate is an endogenous variable, which can be affected by the market like any other economic variable that gives rise to movements of the natural rate because of changes either in real macroeconomic variables or in the institutional framework. The Structuralist school assumes the existence of structural breaks in the steady-state path of a stochastic variance stationary process.

[1]Youth Employment Initiative (YEI) for example for European Union Countries.

Many empirical studies attempted to shed light on this debate between the two above-mentioned hypotheses. However, the issue of youth unemployment hysteresis has received limited attention, these studies concluded into mixed results, depending on the sample and methodology adopted. Song and Wu (1999), noting the low specification of the previous models, proposed one in which panel data and cross-section are used. This latter model is more powerful, rejecting the hysteresis hypothesis in 15 OECD countries. Allowing two endogenous break points in unemployment rate of 26 OECD countries, Arestis and Mariscal (1999) rejected the hypothesis of full hysteresis. Lee and Chang (2008) examined the hysteresis hypothesis in 14 major OECD countries, and found that the unit root null hypothesis of hysteresis is strongly rejected. With the same method, León-Ledesma and McAdam (2004) tested the hysteresis hypothesis in Central and Eastern European Countries (CEECs), and found results confirming the two precedent studies. Unlike León-Ledesma and McAdam (2004)'s findings, Gozgor (2013) tested the hysteresis effects in unemployment rate for CEECs using panel unit root test with cross-sectional dependence that confirms the hysteresis hypothesis.

However, some studies in which structural break have been allowed led to mixed results or confirmed the hysteresis hypothesis. For example, Romero-Avila et al (2009), using panel data from the US and European Union (EU) countries, in which multiple structural breaks have been allowed, CBL panel unit root test confirms the structuralist view for US and unit root hysteresis hypothesis for EU countries. Liu et *al.* (2012) examined the hysteresis hypothesis in Australian regions and by using the Carrion-i-Silvestre et al. (2005a) methodology, which allows for multiple structural breaks and cross-sectional dependence, found out that temporary shocks have permanent effects on unemployment rate. Carrion-i-Silvestre et al. (2005a, 2006) tests the hysteresis hypothesis on Transition Countries for the 1992-2003 period and 19 OECD countries for the 1956–2001 period respectively. The methodology considers endogenous break point in unemployment rate series, and the results are the same in the two cases, confirming the natural unemployment rate hypothesis for majority of the countries. Gomes and da Silva (2009) investigated the hysteresis hypothesis vs NAIRU hypothesis in Brazilian regions, using a unit root test with break point method, and found evidence supportive of the hysteresis hypothesis for five regions.

Some evidence tested for hysteresis effects in unemployment rate. In this unit root test, structural breaks were not taken into account and the findings supported excessive persistence in unemployment. Philip and Mariscal (1999) called these models 'misspecified' models. Knut (1996) used Augmented Dickey Fuller (ADF) t-statistic test, and assumed the absence of structural breaks. Their result on 16 OECD countries supports the hysteresis hypothesis. This evidence confirms Mitchell (1993) result on OECD countries. In addition to the difference in assumption as to whether structural break is considered or not, further difference can be noted on samples specificities. For example, Chang and Su (2014) specified their sample by taking educational attainment categories in Taiwan; the test of unit root null hypothesis of hysteresis against natural rate of unemployment without structural breaks confirmed hysteresis effects in unemployment. As a study investigating on youth unemployment in 15 European countries, Caporale and Gil-Alana (2014) used fractional cointegration method, and confirmed the hysteresis effects in youth unemployement rates in all European countries considered. Choudhry et al. (2012) examined 70 countries around the world, and found with fixed panel estimation that financial crisis effects on youth unemployment are greater than the effect on overall unemployement. In addition, these crises affect youth unemployment during five years, with the most adverse effects in the second and third year after the financial crisis. Verick (2009) concluded in "Big 5" countries (Finland, japan, Norway, Spain and Sweeden) and the episodes in Mexico and Turkey youth unemployment rate affected by financial crises and have persistence on youth unemployment despite economic growth after crisis.

This study makes an important contribution to the literature by analyzing youth unemployment hysteresis in 30 high-income OECD countries using a panel-based unit root tests. With this aim, we apply a new panel stationarity test incorporating multiple structural changes endogenously determined as proposed by Carrion-i-Silvestre et al. (2005a). This test provides important power gains compared to time series equivalent tests.

The remainder of this paper is organized as follows. Section 2 briefly describes the econometric methodology used in the paper, Section 3 reports and discusses the findings of this study. Section 4 presents the conclusion.

2. Empirical Methodology: Carrion-I Silvestre et al.'s (2005) Panel Stationary Test With Structural Breaks

The Panel KPSS (PANKPSS) test of Carrion-i Silvestre et al. (2005a, hereafter CBL) is a generalisation of Hadri's (2000) panel stationarity test by considering multiple structural breaks. The CBL panel procedure takes into consideration the series averages and breaks in trends. Panel in this case for each cross-sectional unit at different times and different numbers structural breaks are allowed. To perform our hypothesis testing we consider the following data generating process (DGP) under the null hypothesis of stationarity in variance as:

$$y_{it} = \propto_i + \sum_{k=1}^{m_i} \theta_{i,k} DU_{i,k,t} + \beta_i t + \sum_{k=1}^{m_i} \gamma_{i,k} DT^*_{i,k,t} + \varepsilon_{ij} \tag{1}$$

where y_{it} denotes the series of youth unemployment rate and ε_{ij} is error term. The dummy variables, $DU_{i,k,t}$ and $DT^*_{i,k,t}$ are defined as$DU_{i,k,t} = 1$ for $t > T^b_{ik}$ and zero orherwise, and $DT^*_{ikt} = t - T^b_{ik}$ for $t > T^b_{ik}$ and zero otherwise, where T^b_{ik} denotes the kth date of the break for ith individual and $k = (1, \ldots, m), m_t \geq 1$. Note that equation (1) is also general enough to allow for unit-specific intercepts and time trends in addition to unit-specific mean and slope shifts.

The null hypothesis of this test implies youth unemployment rate stationarity for all high income OECD countries versus the non-stationarity alternative for some countries. The test statistics were computed as the average of univariete KPSS (Kwiatkowski et al., 1992; Yang et al., 2012) tests as formulated in Hadri (2000). The general expression forthe test statistic is

$$LM(\boldsymbol{\lambda}) = \boldsymbol{N^{-1}} \sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} \left(\boldsymbol{\widehat{\omega}_i^{-2} T^{-2}} \sum_{\boldsymbol{t=1}}^{\boldsymbol{T}} \boldsymbol{\widehat{S}_{i,t}^2} \right) \quad (2)$$

where $\hat{S}_{i,t} = \sum_{j=1}^{t} \hat{\varepsilon}_{i,j}$ denotes the partial sum process that is obtained using the estimated OLS residuals from Equation 1, with $\widehat{\omega}_i^2$ being a consistent estimate of the long-run variance of $\varepsilon_{i,t}$.$\boldsymbol{\lambda}$ denotes the dependence of the test on the dates of the break. For each individual i it is defined as:

$$\lambda_i = \left(\lambda_{i,1} \,_{\ldots,} \lambda_{i,m_i}\right)' = \left(\frac{T_{b,1}^i}{T}, \ldots, \frac{T_{bm_i}^i}{T}\right)' \; (3)$$

which indicates the relative positions of the dates of the breaks on the all time period, T. To obtain the location and the number of breaks, Carrion-iSilvestre et al. (2005) recommend using the Bai and Perron (1998 and 2001) procedure, which computes the global minimisation of the sum of squared residuals (SSR). The SSR($T_{b,1}^i, \ldots, T_{b,m_i}^i$) is computed from Equation 1 as follows:

$$\left(\hat{T}_{b,1,}^i \ldots, \hat{T}_{b,m_i}^i\right) = \arg min_{T_{b,1}^i, \ldots, T_{b,m_i}^i} SSR(T_{b,1}^i, \ldots, T_{b,m_i}^i) \quad (4)$$

Having obtained the dates for all possible $m_i \leq m^{max}, i = \{1, \ldots, N\}$, we select the optimal number of breaks for each $i(m_i)$. On the procedure used to estimate the structural breaks, Carrion-i Silvestre et al. (2005), following the work of Bai and Perron (2001), suggest that one should use the Bayesian information criterion when the model under the null hypothesis of panel stationarity includes trending regressors. However, if the model does not include trending regressors then they recommend estimating the breaks by using the modified Schwarz information criterion of Liu *et al.* (1997).

The limiting distribution of $\eta_i(\lambda_i) = \widehat{w}_i^2 T^{-2} \sum_{t=1}^{T} S_{t=1}^2$ is used to construct the asymptotic distribution of Equation 2. Therefore, by defining $\overline{\xi = } N^{-1} \sum_{i=1}^{N} \xi_i$ and $\varsigma^{-2} N^{-1} \sum_{i=1}^{N} \varsigma_i^2$. where ξ_i and ς^{-2} are the individual mean and variance of $\eta_i(\lambda_i)$, respectively, the test statistic fort he null hypothesis of a stationary panel with mltiple breaks is:

$$Z(\boldsymbol{\lambda}) = \frac{\sqrt{\boldsymbol{N}(\boldsymbol{LM}(\boldsymbol{\lambda}) - \overline{\boldsymbol{\xi}})}}{\overline{\boldsymbol{\varsigma}}} \xrightarrow{\boldsymbol{d}} \boldsymbol{N})\boldsymbol{0}, \boldsymbol{1}) \quad (5)$$

Carrion-i Silvestre *et al.* (2005a:163) show that the limit distribution of Z($\boldsymbol{\lambda}$) is standard normal; thus, no new set of critical values needs to be computed.

3. Data and Empirical Results

3.1. Data

In this paper we test the null hypothesis of unit root in the youth unemployment over the period 1996-2014 for high income 30 OECD countries. The countries consist of Austria, Australia, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Irland, Italy, Japan, Korea, Luxembourg, Netherland, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweeden, Switzerland, United Kingdom, United States, Chile, Israel. In this study, 16 high-income OECD countries have been selected as subject matter whose youth unemployment rate is above the OECD average (14.06 %). Additionally, we have prefered 14 high-income OECD countries, the youth unemployment rates are below the OECD average. This variable defined as the number of unemployed in the 15-24 years age group expressed as a percentage of the youth labour force. The series are annual and have been obtained from OECD database. All data was converted into natural logarithmic form before the empirical analysis.

As it is seen from Figure 1 in Annex that the youth unemployment rates differ from time-to-time in these high-income OECD countries. Thus, it is feasible to doubtful that different country may follow different time path in achieving the equilibriumnatural rate of youth unemployment. Until 2008, except Poland, Slovakia and Greece, youth unemployment rate with stationary trend fluctuated between 7-20% band and after 2008, due to international crisis effects youth unemployment rateprimarily in Greece, Spain, Italy and Portugaland all EU countriesshown increasing trend.

3.2. Empirical Results

3.2.1. Univariate Unit Root Tests

This study uses Carrion-i Silvestre et al. (2005a, 2005b) test (PANKPSS) in measuring presence of structural break. But before in order to make a compare we have applied a variety of panel stationarity and unit root tests. To start with, this paper employs conventional univariate unit root testing methods, without structural breaks. The comparison between these two sets of results helps to identify the extent to which misspecification is due to ignoring structural breaks. The conventional univariate unit root tests that we employ are the ADF (Dickey & Fuller, 1979), the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) stationarity test (Kwiatkowski et al., 1992). ADF test examine the null hypothesis of a unit root (nonstationarity) while the KPSS test examines the null hypothesis of no unit root (stationarity). The results are reported in Table 1. Following, we apply tests assuming cross-section independence: Levin-Lin-Chu(2002) (hereafter LLC), Hadri (2000) stationarity test, the Im, Peseran and Shin (2003) (hereafter IPS) unit root tests and Maddala and Wu (1999) unit root test (henceforth, MW test). We report the optimal lag length in square brackets.

We now analyse the results from the ADF test with intercept, which is reported in column 1 of Table 1. Our main findings from the ADF test are that we are able to reject the unit root null hypothesis only for Finland at the %10 level; Belgium, Canada, Greece, Korea and Slovak Rep. at the %5 level and Czech Rep. at the %1 level. For the remaining 23 countries in our sample, we could not reject the unit root null hypothesis at the 10% level or beter. The results from the ADF test with intercept and trend, which is reported in column 2 of Table 1. We are able to reject the null hypothesis of nonstatioanarity for 8 countries in our sample: for Belgium, Island, Greece and Sweeden at the %10; Czech Rep. and USAat the %5; and Portugal and Korea at the %1 level.

We consider the results from the KPSS test, which is reported in column 3 and 4 of Table 1 for the case with and without a trend in the model. Unlike the ADF, the KPSS test treats the null hypothesis as stationarity. We are able to reject the null hypothesis with intercept as stationarity only for Australia, Denmark, Finland, Norway, Hungary, UK and USA at the 10% level, and Luxembourg, Portugal and Switzerland at the 5% level. Otherwise, we are able to reject the null hypothesis with intercept and trend of stationarity only for Canada, Denmark, Germany, Greece, Hungary, Japan, Netherland, New Zeland and Portugal at the 10% level, and Austria, Finland, Finland, France, Irland, Italy, Spain, Chile, UK and Israel at the %5 level.

Taken together, the results from the two univariete tests suggest that there is strong evidence in favour of youth unemployment being a nonstationary series for most of the high-income OECD countries. Perron (1989) claimed that the conventional ADF test has low power to reject the unit root null hypothesis when the true data generating process is stationary about a broken linear trend. Therefore we must approach with caution the results we have achieved. Panel unit root tests with time and cross-sectional dimension characteristics give more reliable results than individual time series. For this reason, before accepting hysteresis hypothesis we need to look to panel unit root test results.

Table 1. KPSS and ADF unit root tests without a break (logunp)

Country	**ADF Test**						**KPSS Test**			
	Intercept			Intercept and trend			Intercept		Intercept and trend	
	t-stat	p-value	l_i	t-stat	p-value	l_i	t-stat	l_i	t-stat	l_i
Austria	-1.8295	(0.3553)	0	-0.8120	(0.9450)	0	0.3141	3	0.1732**	2
Australia	-1.0992	(0.6922)	0	-1.9112	(0.6073)	0	0.4411*	3	0.0992	2
Belgium	-3.4054**	(0.0256)	1	-3.6213*	(0.0583)	1	0.1842	2	0.1088	3
Canada	-3.0997**	(0.0458)	1	-2.8600	(0.1976)	1	0.1658	2	0.1332*	2
Czech Rep.	-4.0737***	(0.0069)	1	-3.7919**	(0.0434)	1	0.2744	2	0.1160	1
Denmark	-1.5190	(0.5014)	0	-1.7292	(0.6901)	2	0.3799*	3	0.1439 *	2
Finland	-2.8059 *	(0.0771)	0	-2.5350	(0.3096)	0	0.3784 *	2	0.1563**	1
France	-1.9734	(0.2946)	0	-1.6804	(0.7176)	0	0.1867	2	0.1634**	2
Germany	-1.6145	(0.4540)	1	-1.5351	(0.7753)	1	0.1331	3	0.1284 *	3
Greece	-3.5439 **	(0.0196)	1	-3.5577*	(0.0649)	1	0.2662	3	0.1428 *	3
Hungary	-0.8836	(0.7693)	0	-2.1943	(0.4626)	1	0.4285 *	3	0.1190 *	2
Island	-1.1879	(0.6556)	0	-3.4490*	(0.0780)	1	0.4048*	3	0.0931	1
Irland	-1.2616	(0.6217)	1	-2.7249	(0.2397)	1	0.3459*	3	0.1651**	2
Italy	-1.0305	(0.7171)	1	0.4267	(0.9978)	0	0.1588	3	0.1533**	3
Japan	-1.2954	(0.6080)	0	-1.5277	(0.7806)	0	0.1783	2	0.1389*	2
Korea	-3.6779**	(0.0144)	0	-5.0971***	(0.0055)	3	0.1030	3	0.0959	3
Luxembourg	-0.5354	(0.8623)	0	-2.5600	(0.2995)	0	0.4906**	3	0.0891	2
Netherland	-1.8894	(0.3288)	1	-2.4756	(0.3337)	1	0.2026	2	0.11238*	2
New Zealand	-1.8617	(0.3407)	1	-2.1198	(0.4995)	1	0.1981	3	0.1229*	3
Norway	-1.8657	(0.3394)	0	-3.2312	(0.1114)	1	0.4171*	2	0.0699	1
Poland	-2.2567	(0.1955)	1	-3.0000	(0.1602)	1	0.1833	3	0.1026	2
Portugal	-1.5667	(0.4770)	1	-3.5343***	(0.0020)	1	0.4754**	3	0.1347*	2
Slovak Rep.	-3.2795**	(0.0326)	1	-3.1743	(0.1221)	1	0.0865	2	0.0859	2
Spain	-1.6649	(0.4300)	1	-2.1932	(0.4632)	1	0.2382	3	0.1545**	3
Sweeden	-1.7779	(0.3776)	1	-3.5724*	(0.0677)	3	0.3259	3	0.1099	2
Switzerland	-2.1193	(0.2399)	0	-2.7806	(0.2228)	2	0.5071**	3	0.0938	2
UK	-2.4956	(0.1357)	3	-2.2164	(0.4534)	0	0.4013*	3	0.1514**	2
US	-2.5106	(0.1303)	1	-3.7115**	(0.0499)	1	0.4000*	3	0.0831	2
Chile	-2.0444	(0.2670)	0	-2.0245	(0.5499)	0	0.1503	2	0.1470**	2
Israel	-0.5135	(0.8670)	0	-2.0867	(0.5182)	0	0.3369	3	0.1816**	2

*Notes:*Lag length $l_i$was chosen due to the minimum of the modified Schwarz information criterion.It should be note that the null hypothesis of ADF test is unit roots, while the null hypothesis of KPSS test is stationary.The finite sample critical values for the ADF test with constant are -2.660551, -3.040391 and -3.857386 at the 10,5 and 1% levels, respectively, and are extracted from MacKinnon (1996). ADF statistics for unit root tests with a constant and trend are -3.286909, -0.690814 and -4.571559 at the 10,5 and 1% levels, respectively. For the KPSS test with a model without and with a trend, critical values are 0.739 (1%), 0.463 (5%), 0.347 (10%) and 0.216 (%1), 0.146(5%), 0.119(10%), respectively.*(**)*** Denote statistical significance at the 10, 5 and 1% levels, respectively.

3.2.2. Panel Unit Root Tests and Cross-Sectional Dependence

As conventional unit root tests show low power with a short time interval of data, we test for the hysteresis hypothesis by applying different panel unit root tests to the logarithmic transformation of the youth unemployment rate. Panel unit root tests are analyzed in two ways according to the independent and dependent from each cross-section handling units. First-generation tests called the panel unit root methods of testing, were developed under the assumption of croos-sectional units independence. For example, Im Pesaran and Shin (hereafter IPS) (2000), Maddala and Wu (hereafter MW) (1999), Levin, Lin and Chu (hereafter LLC) (2002), Hadri (hereafter HAD) (2000) and Choi (2001). Hadri null hypothesis, panel series are jointly stationary, however other tests null hyspothesis states for panel series unit root. In all the tests the common assumption is the cross-sectional independence. Further, cross-sectional independence LM test developed by Breusch and Pagan (1980) and Pesaran (2004) should be used to test this common hypothesis. İf timedimension represented by T is more than cross-sectional units represented by N (T>N) CDLM1 is used,CDLM2 when T and N are the same and CDLM when N>T. Here N=30 and T=19 CDLM test is the suitable one to use. Therefore, the null of cross-sectional independence is examined applying the Peseran's (2004) CD test in Table 2. The null hypothesis of zero cross-sectional correlation among the OECD countries is strongly no rejected at the 1% level of significance. At 10% only for constant model null hypothesis can be rejected. In this case, first-generation of unit root tests should be applied.

Table 2: Cross Sectional Dependent Tests

	Constant		Constant and Trend	
	Statistic	**Prob.**	**Statistic**	**Prob.**
CD (Peseran 2004)	-1.303*	0.096	-1.235*	0.108

Note:The null hypothesis of CD test is of presence of no cross sectional dependence in panel.
*implies no rejection of the null hypothesis at %5. Number of lag are taken as a1.

The results from the independent panel unit root tests are illustrated in Table 3. We perform five tests based on the cross-sectional independence hypothesis (LLC, IPS, MW, Breitung and HAD). Results from tests developed LLC (2002); IPS (2001) with MW (1999)have been classed according intercept; intercept and trend models. Table 3 shows that the LLC, IPS and MW tests are non-stationary at a %99 confidence level i.e. the reject of null hypothesis of unit root. Under the null hyspotesis, Hadri panel unit root test rejected stationarity in youth unemployment rate at 1%. According to Breitung panel unit root test findings gave support to non-stationarity in youth unemployment. Except these two tests, Hadri and Breitung, the other panel unit root tests findings showed stationarity in youth unemployment.

Table 3. First Generation Panel Unit Root Test Results (logunp)(Level)

	Intercept	Intercept and Trend

	Test statistic	Prob.	Test statistics	Prob.
Null:Unit Root				
LLC	-3.25209***	0.0006	-3.33992***	0.0004
Breitung	-	-	-0.51514	0.3032
IPS	-2.88306***	0.0020	-2.82332***	0.0024
MW	92.8635***	0.0042	96.9377***	0.0018
Null:Stationarity				
HAD_{HOM}	6.79132***	0.0000	8.67160***	0.0000
HAD_{HET}	4.59745***	0.0000	7.77942***	0.0000

Notes:*** indicates rejection of the null hypothesis at 1% significance level.
Levin, Lin, and Chu (LLC), Breitung, and Hadri tests all employ the assumption that there is a common unit root process so that ρ_i is identical ($\rho_i foralli$) across cross sections. It should be note that the joint null hypotheses of LLC, Breitung,IPS, and MW are unit roots, while the null hypothesis of Hadri's test is stationary.

Existing results from first-generation panel unit root tests without structural breaks have to be taken with precaution. Because tests with structural breaks gave extreme support to the null hypothesis Perron (1989). İn this case unit root tests for series produced by stationarty process may give incorrectly conclusions. Forthis reason cross-sectional dependence and independence KPSS panel unit root test with structural breaks developed by Carrion-i-Silvestre et al (2005a, 2005b) used in this paper gives more reliable conclusions. Table 4 gives the findingds from this test with strutural breaks dates.

3.2.3. Carrion-I Silvestre et al.'s (2005) Panel Stationary Test With Structural Breaks

As a next step we proceed, by employing Carrion-I Silvestre et al.'s (2005a, 2005b) panel stationary test with structural breaks. The panel A of Table 4 gives the results for individual KPSS panel unit root test of youth unemployment with intercept model. For each OECD country, except for Denmark findings at 5 % level can not be rejected stationarity hypothesis, however at 10% level stationarity hyspothesis can be rejected only for Belgium, Japan and Norway. Panel B of Table 4 gives the results for common stationarity test and asymptotic critical values.

Table 4. Individual and panel KPSS test statistics sample 1996-2014 (T=19) (Constant)

Panel a: The dates of structural breaks and the results of individual KPSS tests										
Countries	KPSS	m	Tb,1	Tb,2	Tb,3	Tb,4	Tb,5	Critical values (%)		
								90	95	99
AUS	0.065	1	2002					1.057	1.623	3.794
AUT	0.044	1	2003					1.075	1.690	3.410
BEL	1.144*	0						0.992	1.450	2.874
CAN	0.262	2	1999	2008				1.099	1.688	3.258
CZE	0.615	1	1997					0.859	1.417	3.002
DNK	1.735**	1	2008					1.088	1.654	4.056
FIN	0.185	1	1998					0.803	1.268	2.844
FRA	0.054	2	1999	2008				1.053	1.632	4.174
DEU	0.158	2	2002	2009				1.386	2.074	4.812
GRC	0.226	1	2010					1.043	1.536	3.676
HUN	0.074	2	2004	2008				1.280	1.815	3.764
ISL	0.295	1	2008					1.135	1.707	4.390
IRL	0.186	2	1998	2008				1.017	1.507	3.520
ITA	0.051	2	2000	2011				0.857	1.323	3.088
JPN	1.641*	2	1998	2005				1.149	1.801	3.672

KOR	0.559	2	1997	1999				0.682	1.134	2.580
LUX	0.378	1	2002					0.983	1.684	3.958
NLD	0.184	0						0.976	1.481	2.989
NZL	0.046	2	2002	2008				1.539	2.450	6.280
NOR	1.264*	1	2005					1.180	1.791	3.922
POL	0.067	2	1999	2005				1.129	1.737	3.377
PRT	0.119	2	2002	2010				1.297	1.934	3.872
SVK	0.168	0						0.791	1.308	2.977
ESP	0.122	2	1999	2008				1.119	1.718	3.399
SWE	0.345	2	1998	2004				1.155	1.792	3.808
CHE	0.495	1	2002					1.019	1.624	3.653
GBR	0.055	1	2008					1.160	1.747	4.185
USA	0.284	1	2008					1.087	1.672	3.796
CHL	0.174	2	1998	2010				0.950	1.424	3.194
ISR	0.089	1	2007					1.153	1.791	3.897

Panel b: Panel stationarity test (assuming cross-sectional independence)

Model	Test statistics	Probability value ***
LM (λ) (hom)	5.063	0.000
LM (λ)(het)	18.693	0.000

Panel c: Bootstrap distribution (allowing for cross-sectional dependence)

Model	90	95	99
LM(λ)(hom)	12.777	14.838	20.907
LM(λ) (het)	44.677	51.471	71.504

Notes: *** denotes asymptotic probability values. * and ** indicates significance at the 10% and 5% levels. m and Tbdenote the number and dates of breaks, respectively. maxm is set at two. The finite sample critical values are computed by means of Monte Carlo simulations using 5000 replications. LM (λ) (hom) and LM(λ) (het) denote the Carrion-i-Silvestre et al. (2005a) KPSS test assuming homogeneity and heterogeneity, respectively, in the estimation of the long-run variance.

Before to reject cross-sectional independence hyspothesis, LM panel statistics should be compared to bootstrap[2] critical values in Panel C. At 5% level from the test in panel B is less than critical value, so for common stionarity tests constant variance as well as heterocedascity can be rejected.

Results from individual panel unit root and common unit root tests are in contradiction. Even if for one, common panel unit root tests rejected null hypothesis for the panel formed series; test conclusion may be biased (Güloğlu and İspir 2011). Results from individual panel KPSS tests are more reliable than common panel unit root test results. For 25 high-income OECD countries except 5 countries findings for individual KPSS panel unit root test are rejected hysteresis effects in youth unemployment rates. Except the 5 countries, natural rate hyspothesis can be accepted for high-income OECD countries. Findings gave support to hysteresis effects in youth unemployment rates for Belguim (20.44%), Danmark (9.86%), Japan (8.31%) and Norway (9.75). For those countries, except Belguim, their youth unemployemet rates are under the OECD average youth unemployment rate.

Table 5 reports the results from the panel KPSS tests with two breaks (with intercept and trend) for the youth unemployment rate. We conclude that the null hypthesis of stationarity can be rejected for Belgium, Canada and Denmark at the 10% level and for Norway and the USA at the 5% level. These results suggest that while for 25 out of 5 countries the youth unemployment rate is nonstationary despite allowing for multiple structural breaks.

[2] Bootsrap kritik değerleri karşılaştırma amacıyla verilmiştir.

Table 5. Individual and panel KPSS test statistics sample 1996-2014 (T=19) (Constant and Trend)

Panel a: The dates of structural breaks and the results of individual KPSS tests										
Countries	KPSS	m	Tb,1	Tb,2	Tb,3	Tb,4	Tb,5	Critical values (%)		
								90	95	99
AUS	0.425	2	2000	2008				2.510	4.015	9.544
AUT	0.068	2	1999	2003				1.387	2.351	6.079
BEL	1.076*	0						0.771	1.288	2.806
CAN	1.778*	1	2008					1.269	2.066	4.756
CZE	0.603	2	1998	2006				1.735	2.560	5.512
DNK	1.207	1	2008					1.325	1.983	4.076
FIN	0.037	1	2008					1.302	2.032	5.058
FRA	0.147	1	1999					0.744	1.161	2.706
DEU	0.242	2	2000	2005				2.146	3.272	7.583
GRC	0.178	2	2008	2012				1.448	2.279	5.117
HUN	0.328	2	2001	2012				1.381	2.118	4.908
ISL	1.506	2	2001	2008				3.779	5.625	12.643
IRL	0.053	2	1999	2008				1.863	2.993	6.805
ITA	0.874	1	2006					1.497	2.211	4.417
JPN	0.852	2	2001	2008				4.039	5.831	13.038
KOR	0.055	2	1997	2002				1.297	2.032	5.093
LUX	0.121	1	2002					1.307	2.013	4.600
NLD	0.070	2	2000	2005				2.151	3.665	8.683
NZL	0.050	1	2008					1.279	1.967	4.617
NOR	2.658*	2	1998	2005				1.858	2.752	5.323
POL	1.410	2	2003	2008				3.377	5.009	9.937
PRT	0.302	1	1999					0.771	1.220	2.547
SVK	2.658	2	2001	2008				3.599	5.427	12.524
ESP	0.068	1	2007					1.479	2.184	5.122
SWE	0.133	2	2000	2004				1.781	2.752	6.682
CHE	0.492	1	2002					1.337	2.094	5.053
GBR	0.122	2	2002	2012				1.724	2.581	5.295
USA	2.659**	1	2008					1.222	1.922	3.908
CHL	0.138	1	1998					0.647	1.045	2.722
ISR	0.137	1	2003					1.622	2.292	4.690

Panel b: Panel stationarity test (assuming cross-sectional independence)		
Model	Test statistics	Probability value ***
LM (λ) (hom)	35.453	0.000
LM (λ)(het)	197.241	0.000

Panel c: Bootstrap distribution (allowing for cross-sectional dependence)			
Model	90	95	99
LM(λ)(hom)	52.641	60.829	82.260
LM(λ) (het)	328.487	386.660	517.317

Notes: *** denotes asymptotic probability values. * and ** indicates significance at the 10% and 5% levels. m and Tbdenote the number and dates of breaks, respectively. maxm is set at two. The finite sample critical values are computed by means of Monte Carlo simulations using 5000 replications. LM (λ) (hom) and LM(λ) (het) denote the Carrion-i-Silvestre et al. (2005a) KPSS test assuming homogeneity and heterogeneity, respectively, in the estimation of the long-run variance.

4. Conclusion

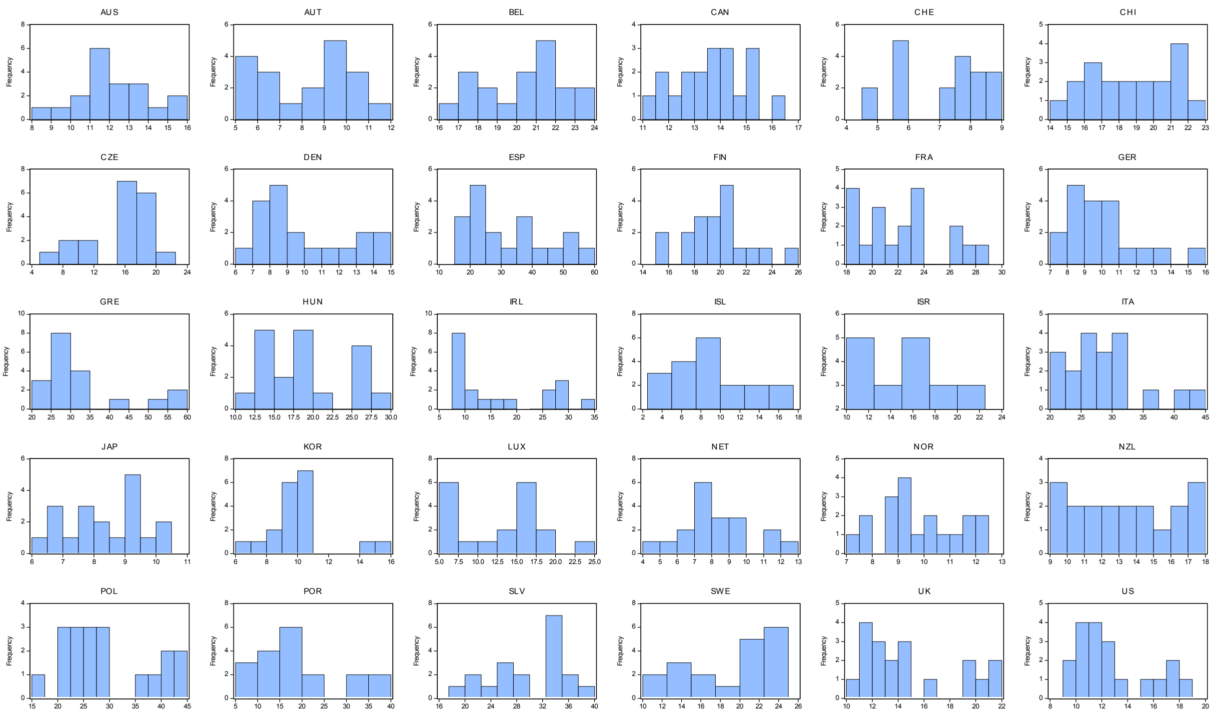
In this empirical study, we investigated the Carrion-i Silvestre et al. (2005) panel stationary test with structural breaks to assess validity of hysteresis in youth unemployment rates for high-income 30 OECD countries using annual data for the period 1996-2014. We contribute to the empirical literature in severeal respects. We apply individuals and jointly panel unit root and stationary tests. Second, we use cross-section dependence tests and third one we allowed structural breaks.The conventional individual unit root test (ADF and KPSS tests) failed to reject the unit root for most of the high-income OECD countries. Similary, the panel unit root tests (e.g. Hadri, 2000 and Breitung) indicated that the hysteresis hypothesis ın youth unemployment can not be rejected.

Carrion-i Silvestre et al.'s (2005) panel stationary test indicates that a unit root in rate of youth unemployment is rejected for 26 countries. This finding has been interpreted as support forthe absence of hysteresis hypothesis in most of OECD countries analyzed. As a conclusion, temporary shocks have temporary effects on youth unemployment instead of permament effects. Structural factors can affect the natural rate of youth unemployment and, therefore, youth unemployment would be stationary around a process that is subject to structural breaks. So, there still exists a unique natural rate of youth unemployment to which the economy eventually will converge. The evidence suggests that persistence is particulary high in USA, Canada, Japan and some EU countries such as Belgium, Norway and Denmark.

Our findings have an important implication for policy makers and economic modellers. In modelling youth unemployment rates, it is important to account for structural breaks in testing for unit roots.

ANNEX:

Figure 1 Plots of youth unemployment rates (percentage) for high-income thirty OECD countries



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