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Hysteresis in Regional Unemployment Rates in Turkey

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Abstract

It is important for policy-makers to understand the nature of unemployment, particularly in the regional level. As a developing country, Turkey suffers from severe unemployment, as well as major regional discrepancies, even in the periods of high-level economic growth. In this study, we analyze a possible hysteresis effect in regional unemployment rates in Turkey from 2004 to 2011. We apply heterogeneous or homogenous Panel-based Unit Root (PUR) tests that they can be arranged in groups by cross-section independence or cross-section dependence. Results of the PUR tests show that there is no mean-reversion in regional unemployment rates and natural-rate of unemployment hypothesis is strongly rejected. Thus, empirical results provide significant support for the existence of the hysteresis hypothesis in regional unemployment rates in Turkey.

Keywords: hysteresis, regional unemployment, panel unit root tests, natural rate of unemployment, cross-section dependence, Turkish economy

1. Introduction

There are persistent unemployment rates in many developed countries and emerging economies during the last decades. This sight about unemployment rates is cited as evidence in favor of the hysteresis hypothesis.

Generally, unemployment dynamics can be explained by two opposite theoretical views; namely, the Non-accelerating Inflation Rate of Unemployment (NAIRU) hypothesis and the hysteresis hypothesis. (Note 1).

In this context, the 'Classical view' describes the unemployment fluctuations as cyclical deviations from the 'natural-rate' or the NAIRU. However, 'Keynesian view' defines the unemployment rate as a 'hysteretic process' and it suggests that temporary shocks on unemployment rate will have permanent effects. On this account, first view indicates that unemployment rates should follow a stationary or a mean-reverting process, and the second one denotes that unemployment rates should follow a non-stationary or a unit root process.

Friedman (1968) and Phelps (1968) firstly proposed the NAIRU hypothesis and they suggested that unemployment rate is a stationary process or a mean-reversion. However, many researchers were skeptical about the NAIRU hypothesis as unemployment rates showed that high-level and persistent characteristics in the 1970's and in the early 1980's. So, there was a 'puzzle' that the NAIRU hypothesis was not able to explain.

The solution seeking to address the 'puzzle' resulted in the 'hysteresis' hypothesis. The hysteresis hypothesis suggests that cyclical fluctuations in the labor market can significantly and permanently affect the unemployment rate, and this can lead to the 'long-term persistence'. Thus, unemployment rates should follow a unit root process. On the basis of this view, if unemployment rates are a unit root process, the shocks affecting the series will have permanent effects. In other words, shocks will shift the 'unemployment equilibrium' from one level to another. Blanchard and Summers (1986) were the first to examine the hysteresis hypothesis, and they argued that a raise on the unemployment rate in a sufficient length of time was bound to affect the natural-rate of unemployment, due to the 'bargaining power' of insiders. In this case, the policy-point of this view can be summarized as the policy action is certainly necessary to turn back 'first equilibrium level' of the unemployment rate. On the other hand, if unemployment rates are a mean-reverting process, the effect of the shocks will be transitory. As a result, the necessity for a policy action is subordinate, since the unemployment rate will 'naturally' return to its first equilibrium level.

However, it is important for policy-makers to understand the nature of unemployment, particularly in the regional level. At this point, it can be said that less number of papers have focused on regional unemployment rates. Song and Wu (1997, 1998) used the LLC PUR test by Levin et al. (2002), from the 1960's to 1992Q2 in 48 states of the United States (US). The LLC PUR test concluded that the hysteresis hypothesis is rejected.

Leon-Ledesma (2002) used the data from 1985Q1 to 1990Q4 in 51 US states and he concluded that the rejection of the hysteresis hypothesis by Im et al. (2003)'s the IPS PUR test. On the contrary, Smyth (2003) both used the LLC and the IPS PUR tests from the 1983Q2 to 2002Q1 in states of Australia and he concluded that the hysteresis hypothesis was valid. Chang et al. (2007) used the LLC, the IPS and Taylor and Sarno (1998)'s PUR tests from 1993M7 to 2001M9 in 21 regions of Taiwan, and they concluded that the hysteresis hypothesis was rejected by all PUR tests. Gomes and Da Silva (2009) applied the unit root test by Lee and Strazicich (2003) from 1981M1 to 2002M12 in 6 major Brazilian metropolitan-areas and the result of unit root tests showed that the hysteresis hypothesis was only rejected in one region. Lanzafame (2012) recently concluded that the hysteresis hypothesis was only valid in 1 of 20 regions in Italy.

The main objective of this paper is to test the possible presence of hysteresis in the regional unemployment rates in Turkey. As a developing country, Turkey suffers from severe unemployment, as well as major regional discrepancies, even in the periods of high-level economic growth. We suggest that investigating the validation of the hysteresis hypothesis in regional unemployment is not only critical for researchers, but also for the policy-makers. To our best knowledge, no work has systematically so far addressed the presence of hysteresis effect in the regions of Turkey. The only available empirical evidence describes the wide regional unemployment disparities in Turkey from 1980 to 2000 by using the nonparametric statistical techniques (Filiztekin, 2009).

Furthermore, there is also no empirical result that obtained from the PUR tests. We apply heterogeneous or homogenous PUR tests that they can be arranged in groups by cross-section dependence or independence. We also know that the classical unit root tests are characterized by some power problems in the literature. So, this paper contributes to the related literature on the evaluation for mean-reversion or unit root properties of the regional unemployment rates in Turkey by using 'more powerful' PUR tests.

In the following section, the methodology, data used in this study, the empirical findings have been defined and elaborated. The final section is the conclusion.

2. Data and Methodology

In this section, we use unemployment rates of 26 regions in Turkey for the period from 2004 to 2011. We select this period because regional unemployment rates in Turkey only available in this period. The frequency of data is yearly. Unemployment rates of the regions are defined by the 'regional-level', namely, Nomenclature of Territorial Units for Statistics (NUTS) II. We obtain the data from Turkish Statistical Institute (TSI). (Note 2).

The classical unit root tests, such as Dickey and Fuller (1979) are subject to some criticism that is occurred from the low-power of these tests in small samples, in order to define a unit root process. Consequently, PUR tests have begun to be widely used in the literature. In this study, we employ PUR tests that they can be arranged in groups by cross-section dependence or independence and heterogeneous or homogenous unit roots such that proposed by Maddala and Wu (1999), Breitung (2000), Hadri (2000), Choi (2001), Levin et al. (2002), Im et al. (2003), Carrion-i-Silvestre et al. (2005) and Im et al*.* (2005).

However, we firstly consider whether it is worth to rely on the results from these PUR tests. Particularly, homogenous PUR tests report the evidence regarding the bias and relative low-power of these tests is now pretty strong, so the evidence that homogenous PUR tests provide may not be relied upon.

On the other hand, the impact of cross-sectional dependence is likely to be significant in regional unemployment rates. So, we consider performing a formal test of cross-section dependence, such as that proposed by Pesaran (2004). If the outcome supports the presence of cross-section dependence, 'first-generation PUR tests' (which assume cross-section independence) could be dropped in favor of 'second-generation PUR tests'. There are now a number of 'second-generation PUR tests' available in the literature, but given the small dimension of the panel used in this study, the relatively simple test proposed by Pesaran (2007) would probably a good choice.

Pesaran (2004) proposed the test statistic (CD) that it is an alternative of LM statistic by Breusch and Pagan (1980), and it is defined for balanced panels as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right) \tag{1}$$

He showed that under the null hypothesis of no cross-sectional dependence, $CD \xrightarrow{d} N(0,1)$ for $N \to \infty$ and T is sufficiently large. This test also offers a robust procedure in the small samples and the presence of structural-breaks. The CD test statistic may also be used when T and N are large.

We now apply the CD test procedure into the regional unemployment rates and we report findings as follows:

Table 1. Results of Pesaran (2004) CD test for regional unemployment in Turkey

Pesaran (2004) CD-stat	0.162 (0.1134)
Average absolute value of the off-diagonal elements	0.119

Notes: CD test by Pesaran (2004) is defined under the null hypothesis that cross-sectional independence of regional unemployment rates in Turkey. The p-value is in parentheses.

As we can see from Table 1, the CD test by Pesaran (2004) nearly rejects the alternative hypothesis of no cross-sectional dependence. Thus, it can be said that our findings from first generation PUR tests may be called as 'robust'.

We now consider a following AR (1) process for panel data to define first generation PUR tests (Quantitative micro software 2009, 395-401):

$$\mathrm{y}_{\mathrm{it}} = \rho_{\mathrm{i}} \mathrm{y}_{\mathrm{it-1}} + \mathrm{X}_{\mathrm{it}} \delta_{\mathrm{i}} + \varepsilon_{\mathrm{it}} \tag{2}$$

Where $i = 1, 2, ...N$ cross-section units or series that they are observed over periods $t = 1, 2, ...T_i$ In this simple equation, X_{it} represent the exogenous variables in the model, including any fixed effects or individual trends, ρ_{i} are the autoregressive coefficients, and $\varepsilon_{\mathrm{it}}$ (the errors) are assumed to be mutually independent idiosyncratic disturbance. If $\left|\rho_{\mathrm{i}}\right| < 1$, y_{i} said to be weakly (trend) stationary. On the other hand, if $\left|\rho_{\mathrm{i}}\right| = 1$ then y_i contains a unit root.

There are two natural assumptions that one can make about the ρ_{i}. First, one can assume that the persistence parameters are common across cross-sections, so that $\rho_{\mathrm{i}} = \rho$ for all i. Breitung (2000), Hadri (2000) and Levin et al. (2002) tests employ this assumption. Alternatively, one can allow ρ_{i} varying freely across cross-sections. Im et al. (2003), and Fisher-ADF and Fisher-PP tests define by Maddala and Wu (1999) and Choi (2001) are in this form.

Breitung (2000), Levin et al. (2002) and Hadri (2000) all assume that there is a common unit root process, so that ρ_i is identical across cross-sections. The first two tests employ the null hypothesis of a unit root, while Hadri (2000) test uses the null of no unit root. Breitung (2000) and Levin et al. (2002) both consider the following basic ADF specification:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j-1}^{p_i} \beta_{ij} \Delta y_{it-j} + X'_{it} \delta + \varepsilon_{it} \tag{3}$$

Where they assume a common $\alpha = \rho - 1$ but allow the lag order for the difference terms, ρ_i to vary across cross-sections. The null and alternative hypotheses for the tests may be written as H_0: $\alpha = 0$ H_1: $\alpha < 0$ so, under the null hypothesis, there is units root while under the alternative, there is no unit root.

Im et al. (2003), the Fisher-ADF and Fisher-PP tests all allow for individual unit root processes, so that may ρ_i vary across cross-sections. The tests are all characterized by the combining of individual unit root tests to derive a panel-specific result. Im et al. (2003) begin by specifying a separate ADF regression for each cross section:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j-1}^{p_i} \beta_{ij} \Delta y_{it-j} + X'_{it} \delta + \varepsilon_{it} \tag{4}$$

H_0: $\alpha = 0$ for all i while the alternative hypothesis is given by

$$H_1 \begin{cases} \alpha_i = 0 \, for \ldots i = 1, 2, N_1 \\ \alpha_i < 0 \, for \ldots i = N + 1, N + 2, ...N \end{cases}$$

(Where they may be reordered as necessary) which i may be interpreted as a non-zero fraction of the individual processes is stationary.

An alternative approach to PUR tests uses Fisher's results to derive tests that combine the p-values from individual unit root tests. This idea has firstly been proposed by Maddala and Wu (1999) and by Choi (2001).

On the other hand, Carrion-i-Silvestre et al. (2005) define the Data Generating Process (DGP) under the null hypothesis of stationary in the variance. Their approach includes (1) Individual effects that are in fact individual structural-break effects (or shifts in the mean is caused by the structural-break) (2) Temporal effects (3) Temporal structural-break effects when there are shifts in the individual structural time trend.

Carrion-i-Silvestre et al. (2005) suggest that a structural-break specification that it is general enough to allow for unit-specific intercepts and time trends in addition to unit-specific mean and slope shifts. This test is based on the null hypothesis of a stationary PUR test by Hadri (2000). As we have already mentioned, Hadri (2000) designs a test statistic that it is simply the average of the univariate stationary test by Kwiatkowski et al. (1992)'s KPSS. Carrion-i-Silvestre et al. (2005) compute the panel stationary test as the average of univariate KPSS tests. This test is computed as follows:

$$LM(\hat{\lambda}) = N^{-1}\sum_{i=1}^{N}\psi_i^{-2}T^{-2}\sum_{t=1}^{T}\hat{S}_{i,t}^{2} \quad (5)$$

$\hat{\psi}_i^{-2}T^{-2}\sum_{t=1}^{T}\hat{S}_{i,t}^{2}$ is the univariate KPSS test for individual i and $\hat{S}_{i,t}=\sum_{j=1}^{t}\hat{\varepsilon}_{i,j}$ represents the partial sum process that it is obtained by using the estimated OLS residuals of DGP.

$\hat{\psi}_i^2$ is the consistent estimate of the long-run variance of residual $\varepsilon_{i,j}$.

Furthermore, Im et al. (2005) propose a standardized Panel-LM unit root test statistic, following the univariate LM test by Lee and Strazicich (2003). Under the null hypothesis that an existence of structural break, $E(L_T)$ denotes expected value of LM_i^T. Their test is computed as follows:

$$\psi_{LM} = \frac{\sqrt{N}\left[LM_{barNT} - E(L_T)\right]}{\sqrt{V(L_T)}} \quad (6)$$

Im et al. (2005) provide the numerical values for $E(L_T)$ and $E(L_T)$. The asymptotic distribution of this test is standard normal. This test procedure is not affected by the structural break(s).

3. Empirical Findings

In this section, we firstly apply PUR tests, which are proposed by Maddala and Wu (1999), Breitung (2000), Hadri (2000), Choi (2001), Levin et al. (2002) and Im et al. (2003) into the regional unemployment rates in Turkey. These PUR tests are used on the level of variable. Trend is also accompanied in the empirical analysis, because in the recent studies, a time trend is included in the PUR tests (Gozgor, 2011). We therefore employ the PUR tests including constant and trend and results can be seen in Table 2 as follows:

Table 2. Results of PUR tests for regional unemployment in Turkey

Cross Section Independence	Cross Section Independence
Homogenous Unit Roots	Constant and Trend
Hadri (2000) Homogenous Z-stat	5.710* (0.0000)
Hadri (2000) Heterogeneous Z-stat	4.304* (0.0000)
Levin et al. (2002) t-stat	-0.454 (0.3246)
Breitung (2000) t-stat	2.225 (0.9870)
Heterogeneous Unit Root	Constant and Trend
Im et al. (2003) W-stat	1.163 (0.8778)
Cross Section Dependence	Cross Section Dependence
Heterogeneous Unit Root	Constant and Trend
Maddala and Wu (1999) ADF-Fisher Chi Square	28.787 (0.9963)
Choi (2001) ADF-Choi Z-stat	2.308 (0.9914)
Maddala and Wu (1999) PP-Fisher Chi Square	32.901 (0.9822)
Choi (2001) PP-Choi Z-stat	2.071 (0.9808)

Notes: PUR tests are defined under the null hypothesis that non-stationary of regional unemployment rates in Turkey, except that Hadri (2000) is defined as stationary. All PUR tests are defined by quadratic-spectral kernel and Andrews (1991)'s bandwidth selection. Heterogeneous test by Hadri (2000) assumes that the heteroskedasticity is consistent in PUR test. The optimal number of lag is chosen by Akaike Information

Criterion (AIC). Probabilities for Fisher tests are computed by using an asymptotic chi-square distribution. All other tests assume asymptotic normality. The p-values are in parentheses and * denotes the rejection of the null hypothesis at 1% significance.

We also apply PUR tests by Carrion-i-Silvestre et al. (2005) and Im et al. (2005) into regional unemployment rates in Turkey. These results can be seen in Table 3.

Table 3. Results of structural break PUR tests for regional unemployment in Turkey

Carrion-i-Silvestre et al. (2005)	Test Statistics	10% CV	5% CV	1% CV	Break Date
Homogenous Long-run Variance	5.746*	2.134	2.934	4.750	2009
Heterogeneous Long-run Variance	5.699*	2.067	2.804	4.520	2009
Im et al. (2005)	Test Statistics	10% CV	5% CV	1% CV	Break Date
Univariate Panel-LM test statistic	-0.282	-2.326	-1.645	-1.282	2009

Notes: CV: Critical Value. Carrion-i-Silvestre et al. (2005) PUR test are defined under the null hypothesis that stationary of regional unemployment rates in Turkey. CV in Carrion-i-Silvestre et al. (2005) test is computed by the bootstrap distribution by using 10.000 replications. As it is suggested by Camarero et al. (2006), bootstrap distribution in Carrion-i-Silvestre et al. (2005) test allows for the cross-sectional dependence. The number of break point(s) is estimated by the Modified Schwarz Information Criterion (LWZ) by Liu et al. (1997). LWZ is allowed for maximum two structural breaks. The global minimization procedure of the sum-of-squared residuals by Bai and Perron (1998) is used to determine the break location(s) for each unit. Im et al. (2005) PUR test is defined under the null hypothesis that non-stationary of regional unemployment rates in Turkey. Im et al. (2005) PUR test allows for the fixed time effects and the regression includes an intercept and a time trend. Structural-break denotes a shift in the level or in the intercept. The optimal number of lag is chosen by the AIC in Im et al. (2005) test. * denotes the rejection of the null hypothesis at 1% significance.

As we can see from Table 2 and Table 3, results from all PUR tests clearly show that existence of hysteresis effect in regional unemployment rates in Turkey. Furthermore, given the short time dimension of the panel, one can suggest that using of PUR tests allowing for structural breaks is not a good idea. Actually, these tests usually search for breaks in a subset of the available observations, (e.g. by truncating the first and last 10% of the observations), and this is done to avoid a situation in which the detected structural-break reduces the pre-break or post-break period to a small number of observations. Unfortunately, in this study, data for regional unemployment rates in Turkey is strictly limited from 2004 to 2011.

4. Conclusion

This study firstly investigates whether regional unemployment rates in Turkey are determined by the hysteresis hypothesis or the NAIRU hypothesis. In this paper, we employ the panel unit root tests by Maddala and Wu (1999), Breitung (2000), Hadri (2000), Choi (2001), Levin et al. (2002), Im et al. (2003), Carrion-i-Silvestre et al. (2005) and Im et al. (2005). All of these PUR tests show that the validation of the hysteresis hypothesis for the regional unemployment rates in Turkey. In other words, empirical findings from the all eight PUR tests indicate that the hysteresis hypothesis for regional unemployment rates in Turkey cannot be rejected.

The main policy implication induced from this study is that a fiscal or a monetary stabilization policy will have permanent effects upon regional unemployment rates in Turkey. The important implication of our findings comes from the fact that temporary shocks into the regional unemployment rates will have permanent effects. Thus, the demand-side policies will be substantially effective in reducing the regional unemployment rates in the long-run. Furthermore, it can be said that our findings are well-fitted with the unemployment background of Turkey.

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Notes

Note 1. See Romer (2006, 437-489) for alternative theoretical models.

Note 2. See statistical features of regional unemployment rates in Turkey in Appendix A.

Appendix A

Statistical features of regional unemployment rates in Turkey

Year	National Average	Minimum	Maximum	Standard Deviation
2004	10.8	1.8	19.2	4.3
2005	10.6	3.3	18.8	4.0
2006	10.2	5.0	16.9	3.5
2007	10.3	4.2	19.9	3.8
2008	11.0	5.6	17.4	3.5
2009	14.0	6.0	22.0	4.1
2010	11.9	6.1	17.0	3.0
2011	9.8	4.7	14.7	2.8