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Hysteresis vs. natural rate of unemployment: One, the other, or both?

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Abstract

This paper re-examines the empirical validity of the hysteresis hypothesis in unemployment rates in terms of education level in 17 OECD countries. To this end for unbalanced panel, we employ Pesaran's Cross Sectional Dependence (CD) and Cross-Sectionally Augmented ADF (CADF) tests. Our empirical findings provide that the evidence is favorable to the non-stationary of the unemployment rates by primary and secondary education attainment in total unemployment, and therefore the existence of hysteresis while there is no evidence of hysteresis for unemployment rates by tertiary education.

I. Introduction

There has been an intense and lively academic and political debate on the unemployment in world economies during the last 25 years, notably for European economies. It can be distinguished two major hypotheses on the time series properties of unemployment: the natural rate hypothesis (NRH) and the hysteresis hypothesis (HH). NRH characterizes unemployment dynamics as a mean reverting process, which means that the unemployment rate tends to revert to its equilibrium in the long run. On the other hand, HH states that cyclical fluctuations have permanent effects on the level of unemployment therefore; the level of unemployment can be characterized as a non-stationary process.

Despite a blooming literature on testing HH and NRH (e.g., Blanchard and Summers, 1986; Mitchell, 1993; Song and Wu, 1998; Leon-Ledesma, 2002; Chang et al., 2005) by the time series and panel data unit-root methodology, there are still some methodological debates associated with empirical literature.

First of all, the dynamics of the aggregate unemployment rate need not reflect that of joblessness is neglected in many studies (Gustavsson and Osterholm, 2006). Due to discouraged-worker and added-workers effects particularly in less skill workers, new empirical works have started to turn their attention to examining variations in the labor

force participation rate and employment rate[1] (e.g., Gustavsson and Osterholm, 2007; Madsen et al., 2008). One other issue that has been addressed in time-series analyses of HH is whether there has been a structural break in the unemployment series. The several studies illustrate that structural breaks could provide an explanation for hysteresis or persistence in the equilibrium rate of unemployment (e.g., Papell et al. 2000; Summers, 2003; Lee and Chang, 2008). Last methodological problem is the cross-sectional dependencies are not taken into account in panel data analysis of HH (e.g., Camarero et al., 2006; Berger and Everaert, 2008). This problem is stated expressly by Christopoulos and Ledesma (2007). They applied a battery of second-generation panel unit root tests that allow for cross-sectional correlation. Although the data set was the same used in Ledesma (2002), contrary to ledesma findings, the hypothesis of unemployment hysteresis in the EU is rejected. The study shows that, contrary to previous empirical literature, hysteresis does not characterise EU unemployment

In this paper, we re-examine the informational value of unemployment rates in studies of hysteresis from disaggregated perspectives. In particular, it is applied second generation panel data unit root methodology to investigate the differences between on unemployment among workers categorized by their level of educational attainment for 17 OECD countries. This approach allows us to abstract away from changes in the composition of the unemployed labor force by focusing on particular educational groups and accounting at the same time for the presence of cross sectional dependence.

The paper is organized as follows: In Section II presents the data used. The econometric techniques and the empirical results are discussed in Section III. The final section concludes the paper.

II. Data

This study employs unemployment indicators in which are the percentage distribution of a country's total unemployed according to level of educational attainment. Data for both indicators were collected from International Labour Organization-ILO (2007) and World Bank's World Development Indicators (WDI) online database. The major classifications used in the databases are unemployment with primary education (UPE), unemployment with secondary education (USE) and unemployment with tertiary

[1] Labor force skill level and expansion of the educational system may effect employability of workers and then cyclicality of both employment and unemployment rates (Murphy and Topel, 1997; Keane and Prasad, 1993; Hoynes, 1999; Gustavsson and Osterholm, 2007; Camarero et al., 2008).

education (UTE). Sample is an unbalanced panel data that comprises of 17 OECD countries with a time length that varies between 12 to 27 years. For details about data, please see the Appendix.

III. Methodology and Analysis

A traditional testing procedure in which to empirically examine HH is to apply unit root tests on the unemployment rate. Because hysteresis is consistent with non-stationary unemployment rates, unit root tests provide a convenient methodological framework. Starting with Levin and Lin (1992), much work has also been done on testing for unit roots in panels, including papers by Maddala and Wu (1999), Choi (2001), Im et al., (2003) and others. Besides, as shown in two simulation studies by Banerjee et al. (2004a, 2004b) if panel members are cross-correlated, all these tests experience strong size distortions and restricted power. For this reason, panel unit root tests relaxing the assumption of cross sectional independence have recently been proposed in the literature by Choi (2002), Bai and Ng (2003), Moon and Perron (2003), Pesaran (2003), Phillips and Sul (2003) and Peseran (2005).

To check if our sample is characterized by cross-section dependence, the Pesaran's cross sectional dependence test is applied.

Pesaran (2004) presents a simple cross-sectional dependence test (CD) that can be applicable to both balance and unbalanced panels. The test is based on the average of pair-wise correlation coefficients ($\hat{\sigma}_{ij}$) of the residuals obtained from the individual augmented Dickey-Fuller (ADF) regression. The CD statistics for an unbalanced panel is computed as:

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

Table 1 contains CD statistics that obtain residuals from ADF estimations with intercept and linear trend regression. The hypothesis of zero cross section correlation is rejected for all series at the 1%-level of significance.

Table 1. Pesaran's cross sectional dependence test

Test results	UPE	USE	UTE
CD statistic	17.171	22.647	38.377
p-value	(0.000)	(0.000)	(0.000)

Notes: The CD statistic is asymptotically normally distributed. The p-values refer to a two-sided test.

The rejection of the non-cross-sectional dependence null hypothesis implies that it should be taken this dependence into account when we test the unit root null hypothesis. To this end it can be adopted second generation panel unit root tests that rejects the cross-sectional independence include Phillips and Sul (2003) and Pesaran (2005), Bai and Ng (2004), Moon and Perron (2004). In this paper, we consider that the test defined in Pesaran (2005) can be helpful for small panels[2].

Pesaran (2005) proposes the following ADF regression with the cross section averages of lagged levels and first differences of the data:

$$\Delta y_{it} = c_{i0} + c_i t + \beta_i y_{i,t-1} + \sum_{j=1}^{p} \gamma_{ij} \Delta y_{i,t-j} + \varphi_i \bar{y}_{t-1} + \sum_{j=0}^{p} \eta_{ij} \Delta \bar{y}_{t-j} + u_{it} \qquad (2)$$

where $\bar{y}_t = \sum_{i=1}^{N} y_{it} / N$. The t-ratio of β_i is used as the test statistic for a unit root and it is called the cross-sectionally augmented ADF (CADF) statistic. Its critical values have been generated by Monte Carlo and are tabulated in Pesaran (2005). The results reported are the $Z(N,T)$ version in which is normally distributed under the null hypothesis of the unit root defined as:

$$Z(N,T) = \frac{1}{\sqrt{N}} \sum_{1}^{N} \phi^{-1}(P_{iT}) \qquad (3)$$

where P_{iT} is the p-value corresponding to the unit root test of the i^{th} individual cross section unit.

Table 2 shows the CADF statistics for UPE, USE and UTE series within our samples. The null hypothesis of a unit root cannot be rejected for the UPE and USE series with

[2] Because Peseran's method does not require the direct estimation of idiosyncratic components from the data it can be beneficial for small panels where estimation of factors is difficult (Moon and Peron, 2007).

all lag specifications. But we are able to reject the null hypothesis of a unit root in for UTE series with 0 and 1 lag specifications.

Table 2. Pesaran's CADF test

p	UPE	USE	UTE
0	-0.161	-1.283	-2.696*
	(0.436)	(0.100)	(0.004)
1	0.880	0.992	-1.545**
	(0.810)	(0.839)	(0.061)
2	3.856	2.717	1.836
	(1.000)	(0.997)	(0.967)

Notes: p is average lags. p-values in brackets. * and ** indicates significant at the 1% and %10 level respectively.

Our results from CADF statistics are consistent with the HH for UPE and USE series. However, the empirical evidence not to favor the HH for UTE series for our sample. These results indicate that shocks have permanent effects on the unemployment with lower levels of educational attainment while the unemployment with higher level of educational attainment tends to revert to its equilibrium in the long run after a shock.

IV. Conclusion

We have applied CADF unit root tests to the unemployment rates by educational attainment in total unemployment for 17 OECD countries during the period 1980–2007 with unbalanced panel data. After controlling for educational attainment we find significant differences between unemployment rates. More specifically we can conclude that the evidence is favorable to the nonstationary of the unemployment rates by primary and secondary education attainment in total unemployment, and therefore the existence of hysteresis, in these parts of unemployed labor force.

But we also find that, there is no evidence of hysteresis for unemployment rates by tertiary education in total unemployment. These results show that the aggregate unemployment rate should be superior to tests for hysteresis. The results also point to the importance of considering some degree of heterogeneity with educational differences in labour markets.

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Appendix

Country	Age	Data availability
Australia	15+	1989-2007
Austria	15+	1985-2007
Belgium	15+	1994-2007
Canada	15+	1980-2007
Denmark	15-66	1994-2007
Finland	15-77	1995-2007
Germany	15+	1996-2007
Italy	15+	1993-2007
Japan	15+	1987-2007
Netherlands	15-64	1995-2007
New Zealand	15+	1990-2007
Norway	16-74	1996-2007
Spain	16+	1980-2007
Sweden	16-64	1987-2007
Switzerland	15+	1991-2007
United Kingdom	15-64	1987-2007
United States	25+	1994-2007