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UNEMPLOYMENT HYSTERESIS IN THE US AND THE EU:

A PANEL DATA APPROACH

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Abstract

This paper applies the panel unit root test proposed by Im, Pesaran and Shin (1997) to test for unemployment hysteresis in the US states and the EU countries against the alternative of a natural rate. The results show that hysteresis for the EU and the natural rate for the US states are the most plausible hypotheses.

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UNEMPLOYMENT HYSTERESIS IN THE US AND THE EU: A PANEL DATA APPROACH

1. Introduction

The literature on the relation between unemployment and the business cycle distinguishes between two main hypotheses. The first states that output fluctuations will generate cyclical movements in the unemployment rate, but that, in the long run, it will tend to revert to its equilibrium value. This hypothesis, associated with the existence of a *natural rate* of unemployment (or NAIRU), characterises unemployment dynamics as a mean reversion process. The second hypothesis, unemployment *hysteresis*, proposes that cyclical fluctuations will have permanent effects on the level of unemployment due to labour market rigidities. Thus, under this hypothesis – pioneered by Blanchard and Summers (1986) – the level of unemployment is characterised as a non-stationary or unit root process. The existence of hysteresis should not be confused with *persistence*. Persistence implies that, although the speed of adjustment towards the equilibrium level is slow, unemployment shows mean reversion. Thus, persistence is a special case of the natural rate hypothesis in which unemployment is a near-unit root process. Under hysteresis, macroeconomic policy would have permanent effects on unemployment. If persistence were the prevailing case it would have long lasting but not permanent effects.

Several works have attempted to test the presence of hysteresis in unemployment for developed countries (for example, Blanchard and Summers, 1986, Mitchell, 1993 and Brunello, 1990). In general, the studies cannot reject the null of a unit root for most of the European countries but the results for the US are mixed. The usual procedure is to apply the Augmented Dickey-Fuller (ADF) or Phillips-Perron (PP) tests to the unemployment series. However, the low power of these tests against the stationary alternative, when the process is near-integrated, is a well-known problem. Song and Wu (1997) apply the Levin and Lin

(1992) panel unit root test (LL) to the US states in order to gain power by exploiting cross-sectional information. However, as pointed out by Im *et al.* (1997) and Maddala and Wu (1999), the LL test is of little economic applicability because it assumes that all cross-sections converge to the equilibrium at the same speed of adjustment under the alternative of stationarity.

The contribution of this paper is to test for unit roots in unemployment in a panel context using the test procedure proposed by Im *et al.* (1997) (IPS). This procedure allows for a higher degree of heterogeneity in the cross-section dynamics and is shown to have higher power than the LL test. Thus, the IPS test is a more appropriate procedure to discern whether hysteresis or persistence is the process underlying the dynamics of unemployment in the US states and the EU. In section 2 we present the model and testing procedure. Section 3 analyses the results and section 4 concludes.

2. Model and testing procedure

We present a simple insider-outsider model of the labour market to derive our empirical analysis based on Blanchard and Summers (1986). According to this theory, hysteresis may arise as a consequence of the division between insider workers (currently employed) and outsiders (unemployed). Insiders are unionised or simply have all the bargaining power. 'Outsiders are disenfranchized and wages are set with a view to insuring the jobs of insiders. Shocks which lead to reduced employment change the number of insiders and thereby the subsequent equilibrium wage rate, giving rise to hysteresis' (Blanchard and Summers, 1986).

Let y_t be aggregate demand, m_t money supply and p_t the price level.[1] Demand

[1] All the lower case variables are expressed in logarithms.

depends on real money balances:

$$y_t = c(m_t - p_t) \tag{1}$$

Production is constant returns to scale and only uses labour, n_t. Since $y_t = n_t$, then profit maximisation leads to $p_t = w_t$, where w_t is the nominal wage. Insiders expect employment to be a function of the past period employment so that $n_t^E = \phi n_{t-1}$, with $0 < \phi \leq 1$. In equilibrium, aggregate supply equals demand and we have,

$$n_t = c(m_t - w_t)\,. \tag{2}$$

Taking expected values and subtracting from (2) we get:

$$n_t - n_t^E = c(m_t - m_t^E) - c(w_t - w_t^E). \tag{3}$$

Since wages are set by the union in advance, $w_t = w_t^E$, and the union's expectations are such that $n_t^E = \phi n_{t-1}$, we can write:

$$n_t = \phi n_{t-1} + c(m_t - m_t^E)\,. \tag{4}$$

The term in parentheses, the unexpected shocks to money supply, can be considered to be random or unexplainable and hence we obtain $n_t = \phi n_{t-1} + \varepsilon_t$, where ε_t is an i.i.d. error term. From this, we can see that employment – and unemployment if labour supply is stationary – follows a random walk with shocks affecting on a permanent basis, if and only if $\phi = 1$.[2] Otherwise the model would predict persistence.

[2] That is, the insiders' objective is to maximise wages keeping the size of the union constant.

Let $u_{i,t}$ be the unemployment rate of country $i = 1, 2, ..., N$ at time $t = 1, 2, ..., T$. Then the dynamics of unemployment can be tested with the following ADF(p_i) regression without a trend:

$$\Delta u_{i,t} = \alpha_i + \rho_i u_{i,t-1} + \sum_{j=1}^{p_i} \gamma_{ij} \Delta u_{i,t-j} + \xi_{i,t}. \quad (5)$$

The IPS panel unit root test is based on the null of non-stationarity ($\rho_i = 0 \ \forall i$) against the alternative of no unit root ($\rho_i < 0 \ \forall i$). The test $\rho_i = 0$ is equivalent to testing $\phi = 1$ in (4) for every cross-section unit. Note that the IPS test does not assume that all cross-sectional units converge towards the equilibrium value at the same speed under the alternative, i.e. $\rho_1 = \rho_2 = ... = \rho_N < 0$, and thus is a less restrictive test than the LL test.

The IPS test is based on the standardised *t*-bar statistic as follows:

$$\Gamma_t = \frac{\sqrt{N}[\bar{t}_{NT} - N^{-1}\sum_{1}^{N} E\{t_{iT}(p_i) \mid \rho_i = 0\}]}{\sqrt{N^{-1}\sum_{1}^{N} Var\{t_{iT}(p_i) \mid \rho_i = 0\}}} \sim N(0,1) \quad (6)$$

where $\bar{t}_{NT}$ is the average of the *N* cross-section ADF(p_i) *t*-statistics, $E\{t_{iT}(p_i) \mid \rho_i = 0\}$ and $Var\{t_{iT}(p_i) \mid \rho_i = 0\}$ are the mean and variance respectively of the average ADF(p_i) statistics under the null, tabulated by Im *et al.* (1997, Table 2) for different *T* and lag orders p_i of the ADF tests. Im *et al.* also show that, under the null of a unit root, Γ_t is distributed as $N(0,1)$.

When there is cross-sectional dependence in the disturbances, the IPS test is no longer applicable. Im *et al.* (1997) have proposed that in this case, the data can be adjusted by subtracting the cross-sectional averages and then applying the Γ_t test to the transformed data. Both unadjusted and adjusted data are utilised in the results that follow.

3. Results

We apply the IPS test to the unemployment rate of 51 US states and 12 EU[3] countries for the period 1985-1999 with quarterly data ($T = 60$). Data were obtained from the Bureau of Labour Statistics and the standardised unemployment series of the OECD.

The results of the individual ADF tests on the US states and the EU countries are presented in Tables 1 and 2 respectively. The lag order was chosen to maximise the Akaike Information Criterion.[4] Previous tests using the Dickey and Fuller (1981) Φ_3 and $t_{\tilde{\beta}}$ tests show that for the great majority of the series we cannot reject the hypothesis of no trend in the individual ADF tests. This is an expected result since there is no *a priori* reason to expect a trend in the unemployment rate. Column 1 shows the results with the original (unadjusted) data while column 2 reports the results for the data adjusted for cross-sectional correlation. The individual tests show that for the unadjusted data we cannot reject the null of a unit root in 48 out of 51 states and in all EU countries except Portugal at the 5% confidence level (bold numbers indicate rejection of the null). However, the correlation matrix of the error terms from the individual ADF regressions shows a high degree of cross-country correlation (non-diagonal matrix). For this reason, we expect the results from the adjusted data to be more reliable. The tests carried out with adjusted data show that we cannot reject the null of a unit root in 44 of the 51 US states and in all EU countries except Norway.

Since the advantage of the panel tests is that they provide higher power relative to the individual ADF tests, it would not be meaningful to apply the test to all the series but only to those in which we cannot reject the null. This view is reinforced by the fact that the IPS test shows a high probability of rejection of the null of non-stationarity when there is a single

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[3] Complete series of quarterly data for Luxembourg, Greece and Denmark were not available.
[4] Results using the general-to-specific criterion were remarkably similar.

stationary process in the panel.[5] Table 3 shows the results of applying the IPS test to the unadjusted and adjusted data for those states and countries for which we cannot reject the null at the individual level. When compared with the one-tailed critical values of the $N(0,1)$ distribution, the results for the unadjusted data reveal that we cannot reject the null of a unit root in the US states or the EU countries. However, the adjusted data show that we do reject the null of non-stationarity for the US states but not for the EU countries at the 5% confidence level. Given the high degree of cross-sectional correlation, the results from the adjusted data are the more reliable ones.

4. Conclusions

In this paper we have applied the panel unit root test proposed by Im *et al.* (1997) to test for the existence of hysteresis in the unemployment rates of 51 US states and 12 EU countries for the period 1985Q1 to 1999Q4. The results confirm the original findings of Blanchard and Summers (1986) who find a higher degree of persistence in the EU unemployment series than in that of the USA. This is still the case even after the period of the two oil shocks that affected adversely the advanced economies and may be a result of the higher degree of labour mobility in the US states. An important policy implication is that stabilisation policy can have permanent effects on the unemployment rates of the EU countries and long lasting effects on the USA.

[5] Results applying the test to all the series, however, reach the same conclusions.

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Table 1: ADF tests: 51 US states

	Unadjusted data		**Adjusted data**	
State Name	ADF lag	*t*-ratio	ADF lag	*t*-ratio
Alabama	3	-0.635	4	-1.464
Alaska	2	-1.589	2	**-3.506**
Arizona	4	-0.080	4	**-3.190**
Arkansas	4	-0.443	2	-1.660
California	1	-1.645	2	-1.431
Colorado	3	-0.606	2	-1.726
Connecticut	1	-1.561	1	-2.139
Delaware	1	-1.848	1	-1.784
District of Columbia	1	-2.311	2	-1.251
Florida	1	-1.005	1	-2.309
Georgia	3	-0.522	1	**-3.827**
Hawaii	2	-1.232	3	-0.016
Idaho	2	-2.818	1	-2.312
Illinois	1	-1.277	4	-1.454
Indiana	1	-0.643	4	-0.784
Iowa	2	-0.905	0	-2.150
Kansas	4	-0.446	1	**-3.877**
Kentucky	1	-1.148	1	-1.778
Louisiana	3	-1.148	1	-1.789
Maine	3	-1.678	3	-1.825
Maryland	1	-1.502	1	-2.300
Massachusetts	1	-1.522	2	-2.222
Michigan	1	-0.115	0	-0.420
Minnesota	4	0.692	4	-0.491
Mississippi	1	-1.399	1	-1.684
Missouri	4	1.617	1	-2.586
Montana	4	-1.494	4	-0.961
Nebraska	1	**-2.974**	1	-1.742
Nevada	1	-1.565	1	**-3.870**
New Hampshire	3	-1.777	3	-1.998
New Jersey	1	-1.365	1	-1.156
New Mexico	3	-1.887	3	-1.261
New York	2	-2.066	2	-1.373
North Carolina	3	-2.737	4	-1.619
North Dakota	2	-2.074	2	-2.543
Ohio	1	-1.312	0	-2.423
Oklahoma	4	-0.715	4	-1.306
Oregon	2	**-3.980**	2	**-3.080**
Pennsylvania	1	-1.623	1	-2.292
Rhode Island	0	-1.758	0	-2.307
South Carolina	1	-1.705	1	-2.409
South Dakota	1	**-2.986**	1	**-3.631**
Tennessee	4	-1.534	1	-2.108
Texas	1	-1.906	4	-1.977
Utah	1	-1.436	1	-2.313
Vermont	4	-0.632	1	-2.689
Virginia	4	-2.464	2	-2.031
Washington	1	-1.100	1	-2.245
West Virginia	4	-0.804	4	-2.119
Wisconsin	1	-0.907	1	-1.858
Wyoming	1	-1.687	1	-2.722

Table 2: ADF tests: 12 EU countries

	Unadjusted data		**Adjusted data**	
Country Name	ADF lag	*t*-ratio	ADF lag	*t*-ratio
Belgium	4	-2.865	4	-1.755
Finland	1	-1.785	1	-1.356
France	1	-2.159	1	-0.541
Germany	2	-1.458	2	-0.732
Ireland	1	0.196	1	0.760
Italy	0	-1.679	3	-1.845
Netherlands	0	1.681	0	0.763
Norway	3	-2.875	3	**-3.191**
Portugal	4	**-2.915**	3	-2.641
Spain	2	-2.700	2	-2.270
Sweden	3	-1.777	3	-1.338
United Kingdom	1	-2.077	1	-1.526

Table 3: IPS ADF panel test

	Unadjusted data	**Adjusted data**
US states	1.867	**-2.230**
EU countries	-0.333	0.902

Notes:

1. For the US states Unadjusted and Adjusted data, the IPS test is carried out with 48 and 44 states respectively.
2. For the EU countries, 11 countries are considered for IPS test.
3. 5% level one-tailed critical value of $N(0,1)$ is -1.64.