DIW Berlin

German Institute
for Economic Research

Discussion Papers

572

Christian Dreger
Hans-Eggert Reimers

Hysteresis and Persistence in the Course of Unemployment: The EU and US Experience

Berlin, April 2006

Opinions expressed in this paper are those of the author and do not necessarily reflect views of the Institute.

IMPRESSUM

DIW Berlin
German Institute for Economic Research
Königin-Luise-Str. 5
14195 Berlin
Tel. +49 (30) 897 89-0
Fax +49 (30) 897 89-200
www.diw.de

ISSN print edition 1433-0210
ISSN electronic edition 1619-4535

Hysteresis and persistence in the course of unemployment: the EU and US experience

Christian Dreger and Hans-Eggert Reimers[1]

Abstract: We investigate hysteresis and persistence behaviour in the course of unemployment in EU countries and US states by means of first and second generation panel unit root tests. While the former tests assume independent cross sections, the latter control for dependencies. The first generation tests indicate, that unemployment is persistent, but nevertheless stationary. Second generation tests reveal mixed results, but the evidence for stationarity is much stronger for the US. Hysteresis in EU unemployment is attributed to the idiosyncratic, but not to the common component. In contrast, idiosyncratic components are stationary in the US. If hysteresis behaviour is also relevant here, it is more likely to arise in the common component. These findings might reflect a lower degree of migration of the unemployed in the EU from starving into prosperous regions, possibly because of language barriers or national labour market regulations.

JEL code: C22, C23, E24

Keywords: Unemployment persistence, hysteresis, panel unit roots

[1] Dreger (corresponding author): German Institute for Economic Research (DIW Berlin), Königin-Luise-Str. 5, D-14195 Berlin, cdreger@diw.de, Phone: +49-30-89789529. Reimers: Hochschule Wismar, Postfach 1210, D-23952 Wismar, h.reimers@wi.hs-wismar.de, Phone: +49-3841 753601 The computations in this paper are based on the Matlab code provided by Christophe Hurlin, University of Orleans, France.

1 Introduction

Apart from some progress especially during the second half of the 1990s, the labour market performance in the EU has been rather weak. While unemployment rates in Germany and France fell below one half of those in the US in the aftermath of the first oil crisis in 1973/74, the rates have exceeded this level approximately by a factor of 1.5 in 2004. A substantial part of the unemployed are long-term unemployed, that is, the duration of their unemployment spells is longer than 1 year. In this segment, the differences to the US are even larger (see Llaudes, 2005). According to the OECD employment outlook, over 40 percent of the unemployed in the EU are long term unemployed, compared to only 12 percent in the US. Hence, severe barriers to enter the EU labour market seem to exist, once a job is lost.

Two basic approaches explaining the the link between business cycle developments and the response of unemployment can be distinguished. In models allowing for some degree of wage and price stickiness, fluctuations in the GDP growth rate generate corresponding changes in the unemployment rate. In the first approach, unemployment will return to a constant equilibrium value consistent with flexible wages and prices in the long run (see Barro, 1986). This level is identified by the natural rate of unemployment and depends on the structural conditions of the economy. Although the deviations from equilibrium can persist over substantial intervals of time, unemployment will finally exhibit mean-reverting behaviour.

In the second approach, changes in GDP growth cause permanent shifts in unemployment. This view refers to the hysteresis phenomenon and implies the existence of a unit root in the unemployment rate, see the seminal paper of Blanchard and Summers

(1986). Hysteresis can be justified, inter alia, by the insider-outsider hypothesis, see Layard, Nickell and Jackman (1991): wage bargaining is dominated by insiders, i.e. union members or workers employed. The long term unemployed are outsiders and cannot exert much pressure on wage bargaining. Hence, negotiated wages are prevented from falling. The behaviour of the unemployment rate is a central question for economic policy. If hysteresis prevails, policy measures can affect the unemployment rate even in the long run.

Several authors have investigated the presence of hysteresis in the course of unemployment in the industrial economies, see Blanchard and Summers (1986), Mitchell (1993) and Franz (2005), among others. Most studies cannot reject the null of a unit root for the EU countries. For the US, mixed results are obtained. Often ADF and PP type unit root tests are applied, which are designed for the analysis of univariate time series. But it has been widely acknowledged that standard unit root tests can have low power against stationary alternatives, see Campbell and Perron (1991) for the simulation evidence. Panel unit root tests offer a promising alternative. Since the time series dimension is enhanced by the cross section, the results rely on a broader information set. Thus gains in power are expected, and more reliable evidence can be obtained (see Levin, Lin and Chu, 2002).

Several authors have investigated persistence and hysteresis in unemployment by first generation panel unit root tests. Song and Wu (1997) applied the Levin, Lin and Chu (2002), hereafter LLC test for a panel of 48 US states. By looking at 51 US states and 12 EU countries, León-Ledesma (2002) has detected a higher degree of persistence in the EU than in the US. He applied the Im, Peseran, and Shin (2003), hereafter IPS test.

León-Ledesma and McAdam (2003) and Smyth (2003) have carried out similar studies for the Eastern European countries and Australian territories, respectively.

A serious drawback of the first generation tests is that they are built on the crucial assumption that the observations are generated independently across the panel members. If dependencies are relevant, size and power distortions might occur, see O'Connell (1998) and Lyhagen (2000). The true size of the tests can be far above the nominal level even if the correlation is moderate and the cross section dimension is large. Size distortions are also important if the panel members are tied together by cross section cointegrating relationships, see Banerjee, Marcellino and Osbat (2004, 2005). Hence, the LLC and IPS test tend to overreject the unit root if there are common sources of nonstationarities. Thus the results are highly questionable if dependencies are neglected.

In the unemployment analysis, dependencies are likely, as countries are subject to similar shocks. If the contemporaneous correlation can be restricted to arise from common time effects, it can be removed when cross sectional demeaned data instead of the original series are used, see Hsiao (1986). But the correlation pattern can rarely be removed by this approach. For example, the shock impact might differ across the panel members, and migration flows from high into low unemployment regions can generate spillovers. In the second generation panel unit root tests, cross sectional dependencies are taken into account. Hence, these methods provide a superior way to study the long run behaviour of unemployment.

The contribution of this paper to the literature is twofold. First, the new panel tests are applied to examine persistence and hysteresis effects in the course of EU and US unemployment, and compare the results with those obtained by older tests. The results indicate that the evolution of unemployment can be suitably described by persistent, but stationary behaviour. Second, the new tests indicate mixed evidence, as some tests reject the null of a unit root, while others fail. However, the evidence in favour of stationarity is stronger for the US. If hysteresis is present in the EU unemployment rate, it can be attributed not to the common, but to the idiosyncratic component. Thus hysteresis might be traced to individual national developments. In contrast, idiosyncratic components turn out to be largely stationary in the US. If hysteresis behaviour is also relevant here, it is more likely in the common component. In this sense the new tests can reveal important insights into the sources of nonstationarities, i.e. whether random walks are mainly attributed either to common or idiosyncratic developments. To the best of our knowledge, no other paper has analysed these issues for the labour market so far.

The rest of the paper is organised as follows. Section 2 gives a short review of the first generation panel unit root tests. Afterwards, the second generation tests are presented in some more detail, where special attention is drawn to dynamic panels with common factors (section 3). Data issues and results are presented in section 4. Finally, section 5 concludes.

2 First generation panel unit root tests

Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003), among others, have suggested tests of the null of a unit root in cross sectionally independent panels. See Banerjee (1999) for a review of these procedures, which generalize the ADF principle. Heterogeneity of panel members is allowed to some extent, and is shown in individual deterministic components (constants and linear time trends) and individual short run dynamics to achieve serially uncorrelated errors. However, the tests differ in the alternative considered, that is, on the way of pooling information. In the LLC approach, a homogeneous first order autoregressive parameter is assumed. The within-type statistic is based on the t-value of its estimator in a pooled regression. The between-type IPS test is a standardized average of individual ADF statistics. If the null of a unit root is rejected, the series are stationary for at least one individual. Hence, the IPS test extends heterogeneity across the panel members even to the long run behaviour of the series considered. The test statistics in all cases

$$(1) \qquad Z_t = \frac{Z_t^* - \mu}{\sigma}$$

are asymptotically distributed as standard normal with a left-hand side rejection area. Standardization factors μ and σ are obtained by simulation and depend on deterministic components included in the testing procedures. If unit roots are analysed by time series data, limiting distributions are given by complicated functionals of Wiener processes. In contrast, the distributions of panel statistics are Gaussian and can be justified by central limit arguments. The independency assumption is crucial in this exercise. Provided that the dependencies are caused by common time effects, the asymptotics remain still valid, if cross-sectional means are subtracted from the data.

3 Second generation panel unit root tests

The second generation panel unit root tests relax the independency assumption. For the analysis of cross sectional dependent data, various strategies have been proposed in the literature (see Hurlin, 2004 and Jang and Shin, 2005 for recent surveys). In the tests applied in this paper dependencies are explained by dynamic factor models, where the cross sectional correlation pattern is caused by components which are common to all panel members, but might have different loadings across the individuals.

Three approaches have been proposed in the literature. Firstly, Pesaran (2003) has suggested a single factor approach. The common component is assumed to be stationary and embedded in the error process of the model. The test is built on a cross sectional extension of the ADF test (CADF). The standard ADF regression is augmented with cross sectional averages of lagged levels and differences of the series of interest. In the model

$$(2) \qquad \Delta Y_{it} = a_{1i} + \alpha_{2i} Y_{i,\,t-1} + \alpha_{3i} \overline{Y}_{t-1} + \alpha_{4i} \Delta \overline{Y}_{t-1} + u_{it}$$

$$\overline{Y}_t = n^{-1} \sum\nolimits_{i=1}^{n} Y_{it}\,, \ \Delta \overline{Y}_t = n^{-1} \sum\nolimits_{i=1}^{n} \Delta Y_{it}$$

the cross sectional average is treated as a proxy for a single factor, which accounts for the common component. For the null of a unit root the t-ratio of the first order autoregressive parameter is considered. The panel unit root test is a cross sectionally extension of the IPS test (CIPS), where t-ratios are pooled across the individuals. The limiting distribution of the CIPS procedure is non-standard and critical values have been tabulated by Pesaran (2003).

Secondly, Moon and Perron (2004), hereafter MP have proposed panel tests for the null of a unit root utilizing idiosyncratic data. Multiple common factors are allowed but as in Pesaran (2003), they are restricted to be stationary. The number of factors present in the residuals of a pooled regression is determined using the Bai and Ng (2002) information criteria. Then, the series are de-factored by a projection of the original data onto a space orthogonal to the factor loadings. Hence, the de-factored data do not exhibit cross sectional dependencies. The test statistics are based on a modified pooled OLS estimator for the first order autoregressive parameter

$$(3) \qquad \hat{\delta}_{\text{mod}} = \frac{tr(Y_{-1}QY') - NT\theta}{tr(Y_{-1}QY_{-1}')}$$

where Y is the original (TxN) data organised in columns per individual, Y_{-1} holds the one period lags, $Q=I-\Lambda(\Lambda'\Lambda)^{-1}\Lambda'$ is the projection matrix, and Λ denotes the matrix of factor loadings to be estimated in advance by principal component methods. The modification $NT\theta$ corrects for autocorrelation in the de-factored residuals, uQ. Specifically, θ is obtained as cross section average of the long run autocovariances of the residuals. Based on this estimator, t-type panel unit root tests are proposed,

$$(4) \qquad MP_1 = \frac{T\sqrt{N}(\hat{\delta}_{\text{mod}} - 1)}{\sqrt{2\gamma^4 / \omega^4}}$$

$$(5) \qquad MP_2 = T\sqrt{N}(\hat{\delta}_{\text{mod}} - 1)\sqrt{\frac{1}{NT^2} tr(Y_{-1}QY_{-1}')\frac{\omega^2}{\gamma^4}}$$

where ω^2 is the cross sectional average of the long run variances of the residuals and γ^4 denotes the cross sectional average of ω^4. Both statistics have a limiting standard normal distribution under the null, and diverge under the stationary alternative.

Thirdly, the most general method is the PANIC approach (Panel Analysis of Nonstationarity in Idiosyncratic and Common components) suggested by Bai and Ng (2004). They offer a complete procedure to examine the order of integration in the common and idiosyncratic component. Compared to the previous approaches, the common component is not restricted to the error term, but enters the systematic part of the model. Additionally, both common and idiosyncratic components are allowed to exhibit nonstationary behaviour. In this sense, the PANIC approach can be exploited to investigate the possible sources of nonstationarity. In particular, the variable of interest Y_{it} is expressed as the sum of a deterministic component, a common component expressed by a dynamic factor structure, and an idiosyncratic component, which accounts for the error term. For the i-th panel member and time t, the decomposition

$$(6) \qquad Y_{it} = \alpha_i + \lambda_i ' F_t + u_{it}$$

is applied, where α_i is a fixed effect, eventually including a linear time trend, F_t is the rx1 vector of common factors, λ_i is a rx1 vector of factor loadings and u_{it} is the idiosyncratic component. The parameter r denotes the number of factors, and is estimated by the information criteria discussed in Bai and Ng (2002). The series Y_{it} includes unit roots if one or more of the common factors are nonstationary, or the idiosyncratic error is nonstationary, or both.

Instead of testing for the presence of a unit root directly in the variable of interest, Bai and Ng (2004) propose to investigate the common and idiosyncratic components separately. Principal components are employed to estimate the common factors. But, as the components might be integrated, a suitable transformation is required in advance. Bai and Ng (2004) perform the principal component analysis by means of the differenced data, which have to be stationary. Once the components have been estimated, they are cumulated again to match the integration properties of the original data.

The nonstationarity of the idiosyncratic component can be analysed by means of standard ADF tests. But they will have low power, as in the time series case. Therefore, panel unit root tests are prefered. In fact, first generation tests are more efficient here, as the de-factored data are uncorrelated across the panel members. For the null of nonstationary idiosyncratic errors, Bai and Ng (2004) have proposed Fisher type tests as suggested by Choi (2002), among others. The statistic

$$(7) \qquad Z_C = \frac{-2\sum_{i=1}^{N} \log \pi_i - 2N}{\sqrt{4N}}$$

is based on the p-values π_i of ADF regressions carried out separately for the N panel members and asymptotically distributed as standard normal with a right hand side rejection area.

The appropriate strategy for the common component depends on the number of factors of the series considered. If there is only a single factor, a standard ADF regression with a constant can be applied,

$$(8) \qquad \Delta F_t = \alpha + \phi_0 F_{t-1} + \sum_{i=1}^{p} \phi_i \Delta F_{t-i} + v_t$$

and inference is based on the Dickey Fuller distribution. For the case of multiple common factors, Bai and Ng (2004) have proposed an iterative procedure based on a vector autoregressive model, comparable to the Johansen trace test to determine the cointegration rank. The limiting distributions of the test statistics are non-standard and have been tabulated by Bai and Ng (2004). Jang and Shin (2005) conclude from their small sample analysis that the PANIC approach has a better test performance than the Moon and Perron procedure or the procedure suggested by Pesaran.

4 Data and empirical results

Nonstationarities in the unemployment rate are explored using quarterly seasonally adjusted series for 51 US states and 14 EU member countries having an EU membership of more than 10 years. Greece has been excluded, as the unemployment rate is only available on an annual base. The sample period runs from 1982.1 to 2004.4. Overall there are 4692 observations in the US and 1288 observations in the EU panel. US data are reported by the Bureau of Labor Statistics, while Eurostat is the source for the EU series.

In table 1, the unit root evidence of the first generation panel unit root tests is presented. The optimal lag length for the LLC and IPS tests is selected using the general-to-simple approach stressed by Campbell and Perron (1991). The consistent estimator of the long-run residual variance needed for the LLC test is obtained using the Bartlett kernel and the automatic bandwidth parameter as proposed by Newey and West (1994). The tests are specified with a constant, but no time trend.

-Table 1 about here-

According to the first generation tests, unemployment appears to be stationary in both panels, as the LLC and IPS tests soundly reject the null of a unit root at least at 5% significance level. While unemployment might be persistent, it is a mean-reverting process, and its long run level reflects the structural conditions in the economy. These results are in line with the findings of Song and Wu (1997) and Léon-Ledesma (2002), at least for the US. For the EU, Léon-Ledesma (2002) detected nonstationarity, as the IPS test fail to reject the null hypothesis. However, this evidence can be biased towards stationarity, if cross section correlation is substantial. For the level (first difference) of unemployment rates, the average contemporaneous correlation coefficient is 0.65 (0.43) in the US and 0.22 (0.28) in the EU panel, respectively. It is worth noting that not all countries were members of the EU in the 1980s. Despite international common shocks like oil price movements the institutional evolution of labour markets in the EU countries was very different (see Blanchard 2005). Moreover, the lower degree of cross country correlation in the EU might reflect less cross country migration of the unemployed from less to more prospereous regions, possibly because of language barriers or the availability of more generous unemployment benefits.

-Table 2 about here-

Table 2 shows the results of second generation panel unit root tests. The number of factors needed for the MP tests and the PANIC approach has been estimated by the BIC3 criterion, see Bai and Ng (2002). If the cross section and time series dimensions of the panel are roughly of the same magnitude, this criterion is has to be favoured over the alternatives. However, the evidence turns out to be robust to this choice. As for the first generation tests, lags in ADF style regressions have been determined by data driven criteria, and the MP tests have been carried out with a Bartlett kernel, and the automatic bandwidth parameter as proposed by Newey and West (1994) is applied. All tests are specified with a constant, but no time trend.

Only the MP tests confirm the former evidence based on first generation tests. The CIPS test indicates the presence of a unit root in the evolution of EU and US unemployment. More elaborated insights can be gained from the PANIC approach, where a single factor is optimal in both cases. Nonstationarities are especially relevant in the EU panel. While the common component is stationary, the idiosyncratic errors contain random walks. Hence hysteresis might be primarily traced to individual national developments. This is in line with results of Llaudes (2005), where institutional variables of national labour markets affect the coefficients of modified Phillips curves. In the US, nonstationarity is soundly rejected for the idiosyncratic component. Instead the common component appears to have a unit root at the 0.05 level. At a slightly higher level of significance (0.065), the unit root is rejected. Therefore, nonstationarities might be less important in the US. In this sense, the PANIC approach confirms the evidence from studies of Blanchard and Summers (1986) and of León-Ledesma (2002).

5 Conclusions

The paper has investigated hysteresis and persistent effects in the course of the unemployment rate in EU14 countries and 51 US states. Both first and second generation panel unit root tests are applied, where the latter control for cross section dependencies across the panel members. According to the first generation tests the development of unemployment can be suitably described by persistent, but stationary behaviour. However, this evidence is biased towards stationarity, as cross section correlation appears to be substantial. Insofar, policy conclusions might be misleading. Thus, second generation tests are superior.

Tests relying on dynamic factor methods show mixed evidence. If nonstationarities are present in unemployment behaviour, they could be attributed not to the common, but rather to the idiosyncratic component in the EU panel. Therefore, hysteresis might be traced to individual national developments. This is in line with the different labour market performance in EU member states. On the one hand, there are countries like Ireland, the Netherlands and Denmark which actually have low rates compared to their maximum and on the other hand, countries like Germany, France and Italy lived with relatively high rates in this century (see Blanchard 2005). These findings might reflect a lower degree of migration of the unemployed in the EU from less into more prospereous regions, possibly because of language barriers.

Moreover, the EU labour market is dominated by huge amount of national regulations and weak influence of the EU commission. Institutional variables like employment protection, the relevance of unions in the wage bargaining process, active labour market polices or tax-transfer systems differ across the EU member states and indicate policy fields for national reforms. In contrast, idiosyncratic components turn out to be stationary in the US. If hysteresis behaviour is also relevant here, it is more likely due to the common component.

References

Bai, J., Ng, S. (2002): Determining the number of factors in approximate factor models, Econometrica 70, 191-221.

Bai, J. Ng, S. (2004): A PANIC attack on unit roots and cointegration, Econometrica 72, 1127-1177.

Banerjee, A. (1999): Panel data unit roots and cointegration: An overview; Oxford Bulletin of Economics and Statistics 61, 607-629.

Banerjee, A., Marcellino, M., Osbat, C. (2004): Some cautious on the use of panel methods for integrated series in macro-economic data, Econometrics Journal 7, 322-340.

Banerjee, A., Marcellino, M., Osbat, C. (2005): Testing for PPP: Should we use Panel Methods?, Empirical Economics 30, 77-91.

Barro, R. (1986): The persistance of unemployment, American Economic Review, Papers and Proceedings, 32-37.

Blanchard, O. (2005): European unemployment: The evolution of facts and ideas, NBER Working paper series, No. 11750.

Blanchard, O., Summers, J. (1986): Hysteresis and the European unemployment problem, NBER Macroeconomic annual, Cambridge 15-90.

Campbell, J.Y., Mankiw, N.G. (1991): The response of consumption to income, European Economic Review 35, 723-767.

Choi, I. (2001): Unit root tests for panel data, Journal of International Money and Finance 20, 249-272.

Franz, W. (2005): Will the (German) NAIRU please stand up? German Economic Review 6, 131-153.

Hurlin, C. (2004): Nelson and Plosser revisited: A re-examination using OECD panel data, University of Orléans, France.

Im, K.S., Pesaran, M.H., Shin, Y. (2003): Testing for unit roots in heterogeneous panels; Journal of Econometrics 115, 53-74.

Jang, M. J., Shin, D.W. (2005): Comparison of panel unit root tests under cross sectional dependence, Economics Letters 89, 12-17.

León-Ledesma, M.A. (2002): Unemployment hysteresis in the US states and the EU: A panel approach, Bulletin of Economic Research 54, 95-103.

León-Ledesma, M.A., McAdam, P. (2003): Unemployment, hysteresis and transition, European Central Bank Working paper 234.

Levin, A., Lin, C.-F., Chu, C.-S. (2002): Unit root tests in panel data: Asymptotic and finite sample properties, Journal of Econometrics 108, 1-24.

Llaudes, R. (2005): The Phillips curve and long-term unemployment, European Central Bank Working Paper Series No. 441, Frankfurt am Main.

Lyhagen, J. (2000): Why not use standard panel unit root tests for testing PPP, Working Paper Series in Economics and Finance 413, Stockholm School of Economics.

Mitchell, W. F. (1993): Testing for unit roots and persistence in OECD unemployment rates, Applied Economics 25, 1489-1501.

Moon, H.R. Perron, B. (2004): Testing for a unit root in panels with dynamic factors, Journal of Econometrics 122, 81-126.

Newey, W., West, K.D. (1994): Automatic lag selection for covariance matrix estimation, Review of Economic Studies 61, 631–653.

O'Connell, P.G.J. (1998): The Overevaluation of Purchasing Power Parity, Journal of International Economics, 44, S. 1-19.

Song, F.M., Wu, Y. (1997): Hysteresis in unemployment. Evidence from 48 US states, Economic Inquiry 35, 235-243.

Smyth, R. (2003): Unemployment hysteresis in Australian states and territories: Evidence from panel data unit root tests, Australian Economic Review 36, 181-192.

Table 1: First generation panel unit root tests

	EU	US
LLC	-7.330*	-17.444*
IPS	-2.027*	-2.555*

Sample period 1983.1 to 2004.4. EU: 14 countries (old EU members without Greece), US: 51 US states. LLC=Levin, Lin and Chu (2002) test, IPS=Im, Pesaran and Shin (2003) test. A '*' indicates a rejection of the null hypothesis of nonstationarity at least on the 0.05 level of significance.

Table 2: Second generation panel unit root tests

	EU	US
CIPS	-1.160	-1.954
MP1	-5.357*	-25.933*
MP2	-3.153*	-10.871*
PANIC		
NF	1	1
CC	-3.423*	-2.805
IC	-0.724	2.143*

Sample period 1983.1 to 2004.4. EU: 14 countries (old EU members without Greece), US: 51 US states. CIPS=Pesaran (2003) test, MP1, MP2=Moon and Perron (2004) $t(a)$ and $t(b)$ tests, respectively, PANIC= Bai and Ng (2004) test, NF=number of common factors CC=common component, IC=idiosyncratic component, examined by a Fisher type test. A '*' indicates a rejection of the null hypothesis of nonstationarity at least on the 0.05 level of significance.