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**UNEMPLOYMENT PERSISTENCE IN THE
EU15**

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Unemployment persistence in the EU15

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Abstract:

The financial crisis of 2008 quickly spread from the USA to the world's major economies and might have impacted on the persistence of unemployment. This might happen because the crisis ushered in recession to every country affected and, in the aftermath, most countries have pursued austerity measures to reduce their growing levels of debt. This paper analyses the dynamics of unemployment in the EU 15 and the USA to assess whether these dynamics have changed over our sample period.

J.E.L. Classification: C32, E20

Key words: Unit roots, structural breaks, debt stock, EU.

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1 Introduction

In recent years, European unemployment has been high and persistent compared with the USA (see Srinivasan and Mitra, 2013, for a recent analysis for France and Germany). However, the financial crisis which began in 2008 might have changed the dynamics of unemployment. One reason for this is the underlying effect of a contraction in aggregate demand caused by the crisis itself. The effect of other exogenous events, such as austerity measures, might also impact on unemployment.

In this note, rather than strictly testing for the hysteresis vs the Non-Accelerating Inflation Rate of Unemployment (NAIRU) hypothesis of Friedman (1986) and Phelps, which would imply testing whether unemployment rates are $I(1)$ or $I(0)$, we test for changes in the persistence of shocks in the USA and the EU-15.

Cuestas et al. (2011), analyse the behaviour of selected European unemployment rates taking into account structural breaks and non-linearities in the autoregressive parameters in unemployment rates. This paper goes further, and analyses possible changes in the autoregressive parameter of unemployment rates as a proxy of speed of mean reversion.¹

Unemployment rates in Europe have increased markedly since the beginning of the 2008 crisis, but the duration and effects are country specific. This justifies assessing whether unemployment rates in the present period are fed by past unemployment rates - the classic Dickey-Fuller (Dickey and Fuller, 1979) equation. For this purpose, we make use of Bai and Perron (2003)'s approach, which allows us to test for parameter changes in any regression and identify endogenously structural breaks. We also apply the Leybourne et al. (2007) test which identifies changes in persistence from $I(1)$ to $I(0)$ and vice versa. This then serves a double objective; (1) we can identify changes in persistence and the direction of those changes; and (2) we can assess the effect of certain events such as the financial crisis and/or austerity measures, on the behaviour of unemployment rates.

The remainder of the paper is organised as follows. Section 2 summarises the econometric methods and report our main findings and, section 3 presents our concluding remarks.

2 Empirical analysis

In this paper we use seasonally adjusted quarterly unemployment rates for the EU-15 countries, and the United States. The data run 1987:1-2013:4 for Belgium, Denmark, Ireland, France, Italy (ending in 2013:3), Luxembourg, Netherlands, Portugal, Sweden, UK (ending in 2013:3) and the USA. For Austria data run 1994:1-2013:3, Finland 1988:1-2013:4, Germany 1991:1-2013:4, Greece 1998:2-2013:3, and Spain 1986:2-2013:4. (Data from *Eurostat*.)

As a preliminary, the Figure below displays time varying estimates for the autoregressive parameters for Greece, Ireland, Italy and Spain. We use a Kalman filter to obtain these and the figure implies that the speed of adjustment in unemployment rates (u_t) might be

¹ See Cuestas and Mourelle (2011) for an application of nonlinear modelling on the real exchange rate.

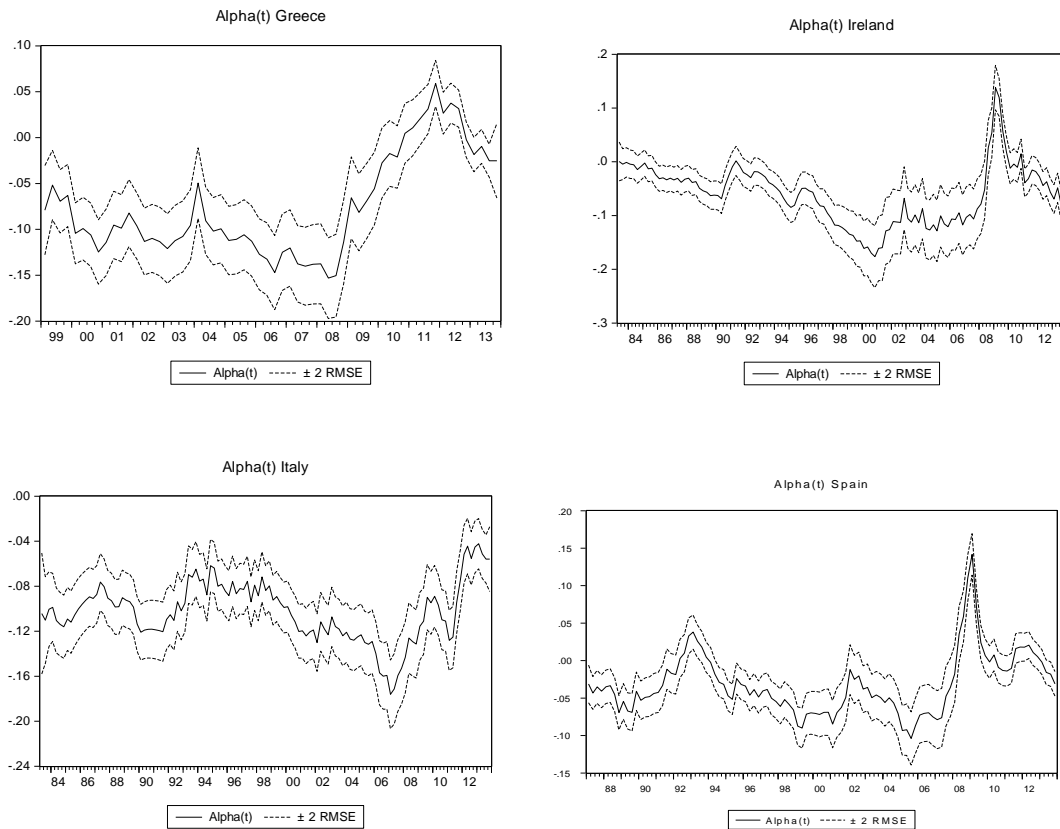
inversely related to the autoregressive parameter. The system consists of the following equations:

$$\Delta u_t = \gamma + \alpha_t u_t + \varepsilon_t \quad (1)$$

$$\alpha_t = \alpha_{t-1} + \xi_t \quad (2)$$

Equation (1) is the measurement equation, and equation (2) is the transition equation which explains the time-varying behaviour of the autoregressive parameter in (1). From the Figure, we see that the speed of adjustment clearly drops in 2008 as the autoregressive parameter estimates reach positive (explosive) figures. For the sake of brevity we only include the figures for four of the countries analysed.

Figure: Kalman filter for alpha: Greece, Ireland, Italy and Spain



Unemployment rates have been commonly tested for their order of integration. However, few papers have analysed changes in the persistence of shocks to unemployment rates, in particular after 2008. This is important in the wake of the crisis because the behaviour of unemployment might have changed. Investigating this is therefore of crucial policy importance.

To investigate changes in the persistence of shocks we use two tests which can determine the existence of structural breaks in persistence endogenously: Bai and Perron (2003) and Leybourne et al. (2007).

Bai and Perron (2003) propose estimating of the following relationship:

$$Y = X\beta + \bar{Z}\delta + E \quad (3)$$

where X and Y are vectors of variables, E is a vector containing the error term and $\delta = (\delta'_1, \delta'_2, \dots, \delta'_{m+1})'$ and \bar{Z} is the matrix which diagonally breaks the full set of observations Z at (T_1, \dots, T_m) , indicating break points. The Bai and Perron (2003) method facilitates estimating endogenously breaks by minimising the sum of the squared residuals in (3), as well as the values of the parameters before and after the break. For our case of changes in unemployment hysteresis, we estimate the following relationship for the unemployment rate:

$$\Delta u_t = \gamma_1 I(t < T_b) + \gamma_2 I(t \geq T_b) + \alpha_1 I(t < T_b) u_{t-1} + \alpha_2 I(t \geq T_b) u_{t-1} + \sum_{i=1}^p \beta_i \Delta u_{t-i} + \varepsilon_t \quad (4)$$

Hence we assess changes in the autoregressive parameter by observing the estimated values of α_1 and α_2 . Note that the drift is also allowed to shift from γ_1 to γ_2 , following the structuralist perspective of the NAIRU which assumes changes in the equilibrium rate of unemployment due to changes in the underlying fundamentals.

The Table displays the results of our empirical analysis. Column 1 shows the autoregressive parameter estimated for the whole period - equivalent to the augmented Dickey-Fuller (Dickey and Fuller, 1979) test. Assuming a critical value of -2.9 at the 5% level, the unit root hypothesis is rejected for Belgium, Denmark, Finland and France. This implies that unemployment rates in these countries are consistent with the NAIRU hypothesis reverting back to equilibrium after a shock. However, our interest lies in changes in the persistence of shocks for endogenously determined breaks. We select the breaks from a maximum of two using the information criteria suggested by Bai and Perron (2003). In most cases, we cannot reject the hypothesis of at least one change in persistence and again in most cases, at least one of the breaks is post 2008. In some cases, such as Austria, Belgium, Denmark, Ireland, Netherlands, Portugal and the UK, we observe a reduction in the persistence of shocks after the breaks. However, for other countries it is unclear whether hysteresis declines or not. In Finland, things deteriorate after 1993. In France there is an improvement in 2007:3-2008:3, but persistence increases thereafter. Germany is interesting because after 2008:3 the persistence of shocks is reduced significantly, but after 2009:1 persistence increases. A similar result is found in Luxembourg. Greece has significantly reduced hysteresis which is encouraging for policy makers. The estimated parameter for Spain becomes positive after 2007:2, implying an explosive behaviour in unemployment dynamics there. For the USA we find that persistence increases after 2007:4 with the onset of the financial crisis, and only improves after 2009:1.

Table: Bai and Perron (2003) and Leybourne et al. (2007) results

Country	$\hat{\alpha}$	Tb	$\hat{\alpha}_1$	$\hat{\alpha}_2$	$\hat{\alpha}_3$	I(0) start_end	M
Austria	-0.156 (-2.86)	2006:1	-0.085 (-1.44)	-0.424 (-4.35)	-	2007:3-2011:4	-4.287**
Belgium	-0.055** (-3.13)	2001:3	-0.034 (-1.83)	-0.306 (-4.95)	-	-	-3.601
Denmark	-0.047** (-3.07)	1993:2 2008:2	-0.013 (-0.47)	-0.074 (-3.54)	-0.176 (-4.73)	-	-3.312
Finland	-0.019** (-3.92)	1990:3 1993:2	-0.147 (-1.46)	-0.008 (-0.69)	-0.022 (-4.08)	1988:1-1994:3	-5.04**
France	-0.049** (-3.013)	2007:3 2008:3	-0.040 (-2.43)	-0.924 (-3.84)	-0.171 (-3.61)	1984:3-1994:4	-3.99*
Germany	-0.015 (-1.55)	2008:2 2009:1	-0.038 (-3.11)	-1.279 (-4.60)	-0.047 (-1.764)	1996:1-2000:4	-5.08**
Greece	-0.052 (-2.15)	2008:3 2011:3	-0.007 (-0.14)	0.120 (2.57)	-0.213 (-4.94)	-	-3.69
Ireland	-0.012 (-1.99)	1993:2 2008:2	-0.074 (-1.83)	-0.025 (-2.70)	-0.152 (-6.18)	-	-3.36
Italy	-0.026 (-1.69)	2009:2 2011:2	-0.027 (-1.89)	-0.751 (-3.10)	-0.231 (-4.16)	-	-2.69
Luxembourg	-0.004 (-0.41)	2002:2 2011:4	-0.075 (-2.50)	-0.135 (-4.07)	-0.080 (-0.725)	-	-3.55
Netherlands	-0.022 (-2.84)	1995:1 2012:3	-0.026 (-1.69)	-0.047 (-4.10)	-0.347 (-4.52)	1998.4-2009:1	-3.92*
Portugal	-0.010 (-0.88)	2008:4 2011:3	-0.037 (-2.20)	-0.217 (-3.03)	-0.378 (-5.60)	-	-3.29
Spain	-0.015 (-2.09)	2007:2 2009:1	-0.008 (-0.99)	0.177 (2.91)	0.005 (0.26)	-	-3.53
Sweden	-0.018 (-1.97)	1992:4 1998:2	0.021 (0.57)	-0.350 (-6.02)	-0.095 (-3.20)	-	-3.07
UK	-0.015 (-2.10)	2008:1 2009:4	-0.011 (-1.72)	-0.257 (-4.28)	-0.646 (-3.26)	-	-3.32
USA	-0.033 (-2.59)	2007:4 2009:1	-0.034 (-2.01)	0.364 (3.42)	-0.079 (-1.52)	1995:2-2001:4	-3.89*

Note: The symbols * and ** mean rejection of the null of unit root in part of the sample at the 10% and 5% significance levels, respectively. Critical values for the M-statistics can be found in Leybourne et al. (2007), table 1 page 13. The test has been run with a drift only in the auxiliary regression, consistent with the NAIRU hypothesis. The lag length has been chosen by means of the Bayesian Information Criterion from a maximum of 4 lags.

Notwithstanding these results, the critical values for the t-ratios of the estimated parameters in this framework may be invalid because the residuals may not be stationary. To deal with this, we use Leybourne et al. (2007) who propose a methodology which allows us to identify changes in persistence from I(1) to I(0) and vice versa. Their

approach is based on the Dickey-Fuller test and a detrending method developed by Elliot et al. (1996).

Column 7 of our table presents the periods where the M-test proposed by Leybourne et al. (2007) rejects the null of a unit root, and column 8 presents the test statistic. In only a few cases (Austria, Finland, France, Germany, Netherlands and the USA) is there evidence of a change in persistence from $I(1)$ to $I(0)$. Interestingly the results for Austria are consistent with the estimated parameter in column 5 and with the break dates. For Finland and France, the periods of stationarity coincide with the first years of the ‘Great Moderation’ where the economies of Europe were relatively stagnant. For Germany the stationarity period runs from 1996 to 2000 which is just before the final ‘boom’ before the crisis – a result not dissimilar to the USA. Finally, the period of stationarity for the Netherlands implies that the crisis impacted on unemployment later than in other countries.

3 Conclusions

We have examined the dynamics of unemployment in the EU15 and the USA to assess whether the financial crisis has changed these dynamics.

Our main finding is that some countries (Austria, Belgium, Denmark, Ireland, Netherlands, Portugal and the UK) experience a reduction in persistence once structural breaks are allowed for. For Finland the opposite happens from 1993 onwards. In general for France, Germany and Luxembourg, persistence increases after the financial crisis spreads to Europe. For Spain, the situation deteriorates significantly after the second quarter of 2007, and despite the application of strong austerity measures in this country, the unemployment rate shows persistence.² For the USA, hysteresis increases throughout 2008 and only begins to fall in 2009. The strongest reduction in hysteresis is experienced by Greece which must give policy makers there some comfort.

² See also Cuestas et al. (2014).

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