Department of
Economics and Finance

Working Paper No. 13-29

Economics and Finance Working Paper Series

Guglielmo Maria Caporale, Luis Gil-Alana,
and Yuliya Lovcha

Testing Unemployment Theories: A Multivariate Long Memory Approach

December 2013

http://www.brunel.ac.uk/economics

TESTING UNEMPLOYMENT THEORIES:
A MULTIVARIATE LONG

1. Introduction

This paper investigates the empirical relevance of different unemployment theories in three major economies, namely the UK, the US and Japan, by estimating the degree of dependence in the unemployment series. For this purpose, it applies long memory methods and in particular, fractional in

2. Unemployment theories

There are two main theoretical approaches to understanding the behaviour of the

1993, Bianchi and Zoega, 1998, and Papell et al, 2000) have tended instead to support structuralist theories.

Panel approaches have subsequently been used to deal with the well-known problem of the low power of standard unit root tests (see, e.g., Song and Wu (1998) and Leon-Ledesma (2002)), generally finding that hysteresis models work better in Europe, and NAIRU models in the US. Panel analyses allowing for breaks as well (see Murray and Papell (2000) and Strazicich, Tieslau and Lee (2009)) are more supportive of structuralist theories.

Another recent strand of the literature estimates fractionally integrated (ARFIMA) models to test for long memory in the unemployment rate (see, for instance, Tschernig and Zimmermann, 1992; Crato and Rothman, 1996; Gil-Alana, 2001, 2002; etc.). By allowing for fractional orders of integration, such a modelling approach is suitable for both stationary processes (NAIRU models), and highly persistent/nonstationary ones (hysteresis hypothesis), and by incorporating structural TZiher bra fr(r)-3.4((a)4. in inedem)8.4(p8)]TJ7.055 06D-.0408 T

and $\Gamma(x)$ represents the Gamma function. Thus, the impulse responses are also clearly affected by the magnitude of d, and the higher the value of d is, the higher the responses will be.

Given the parameterisation in (1), seve

proposed by Boes et al. (1989). The discussion of the multivariate version of the procedure can be found in Hosoya (1996).

4. Data and empirical results

The data source is the St. Louis Federal Reserve Bank database. We use the following three series:

1. Harmonized Unemployment Rate: All Persons for United Kingdom, quarterly, seasonally adjusted, 1971-01-01 to 2011-10-01, series ID: GBRURHARMQDSMEI

2. Harmonized Unemployment Rate: All Persons for the United States, quarterly, seasonally adjusted, 1971-01-01 to 2011-10-01, series ID: USAURHARMQDSMEI

3. Harmonized Unemployment Rate: All Persons for Japan, monthly, seasonally adjusted, 1971-01-01 to 2011-10-01, series ID: JPNURHARMMDSMEI, transformed to quarterly by taken average of months inside a quarter.

[Insert Figure 1 about here]

Prior to the estimation we take logs of the series, and for the multivariate approach we standardise them by substracting the mean.

where σ^2 is the variance of the error term, and m is the number of parameters required to describe the short run dynamics of the series. Its main advantage is that it mimics the behaviour of ARMA (AutoRegressive Moving Average) structures with a small number of parameters. Moreover, it works extremely well in the context of the LM tests of Robinson (1994) (Gil-Alana, 2004).

Given the above model, we consider the three standard cases examined in the literature, i.e., the case of no regressors, i.e. $\zeta = \eta = 0$ in (6), an intercept (ζ unknown and $\eta = 0$) and an intercept with a linear time trend (ζ and η unknown in (6)). The t-values (not reported) indicate that a time trend is not required, an intercept being sufficient to describe the deterministic part of the process in all cases.

[Insert Table 1 about here]

We report the estimates of d along with the 95% confidence band of the non-rejection values of d using Robinson' s (1994) parametric approach. Starting with the case of white noise disturbances. It can be seen that the three estimates of d are above 1 and the unit root null hypothesis is rejected in favour of higher degrees of integration for the UK and Japan but not for the US. However, when using the semiparametric method

$y \quad u$

$y \quad u \quad , \quad t \quad 1, 2, ...$

$) \quad y \quad u$

and the “hysteresis” view for the UK and Japan, with a higher degree of persistence in the unemployment rate in the UK than in Japan.[1]

5. Conclusions

This study revisits the issue of the degree of dependence in the unemployment series with the aim of discriminating between alternative unemployment theories. Specifically, it carries out both a univariate and multivariate analysis of the long memory properties of the unemployment series in the UK, the US and Japan. The latter type of framework has the advantage of allowing for possible cross-country correlations overlooked in previous empirical studies. The results are indeed very different depending on whether a univariate or multivariate approach is taken, showing the importance of modelling cross-country correlations to draw valid inference.

The main findings can be summarised as follows. When taking a univariate approach, the unit root null cannot be rejected in case of the UK and Japanese unemployment series, and some degree of mean reversion ($d < 1$) is found in the case of the US unemployment rate. When applying multivariate methods instead, higher orders of integration are still found for the UK and Japanese series, but the NAIRU hypothesis cannot be rejected in the case of the US.

[1] This ranking of persistence is consistent with the univariate results: the UK displays the highest degree of dependence, followed by Japan and the US.

Lobato, I. and C. Velasco (2007), Efficient Wald tests for fractional unit roots, Econometrica 75, 575-589.

Lopez, H., E. Ortega and A. Ubide, 1996. Explaining the dynamics of Spanish unemployment, *Working Paper in Economics, no.96/14, European University Institute*.

Mitchell, W.F., 1993, “Testing for unit roots

Song, F.M. and Y. Wu, 1998, “Hysteresis in unemployment? Evidence from OECD countries”, *Quarterly Review of Economics and Finance*, 38, 181-192.

Robinson, P.M. 1994. Efficient tests of nonstationary hypotheses. Journal of the American Statistical Association 89, 1420-1437.

Robinson, P.M., 1995, Gaussian semi-parametric estimation of long range dependence, Annals of Statistics 23, 1630-1661.

Strazicich, M.C., M. Tieslau and J. Lee, 2001, Hysteresis in unemployment? Evidence from panel unit root tests with heterogeneous structural change, Bulletin of Economic Research 61, 4, 325-334.

Tschernig, R. and K.F. Zimmermann, 1992. Illusive persistence in German unemployment, *Recherches Economiques du Lovaine*, 58, 441-453.

Wilkinson, G., 1997. A micro approach to the issue of hysteresis in unemployment; evidence from the 1988-1990 labour market activity survey”, *Bank of Canada, Working Papers 97-12*.

Figure 1. Harmonized Unemployment Rate: UK, US, Japan, %

Table 1: Estimates of d (and 95% confidence intervals) from the univariate approach

	Parametric Robinson (1994)	Semiparametric Robinson (1995)	Nonparametric Bloomfield (1973)
UNITED KINGDOM	1.457 (1.354, 1.588)	0.954 (0.771, 1.228)	1.081 (0.667, 1.433)
JAPAN	1.126 (1.019, 1.266)	0.894 (0.771, 1.228)	0.862 (0.534, 1.346)
UNITED STATES	1.052 (0.944, 1.299)	0.780 (0.771, 1.228)	0.683 (0.298, 0.993)

Table 2: Estimated coefficients in the multivariate model

			UNITED KINGDOM			JAPAN			UNITED STATES		
Estimates of d			d_{UK} = 0.615 (0.171)			d_{JAP} = 0.568 (0.307)			d_{US} = 0.086 (0.221)		
F_1			F_2			F_3			F_4		
0.836 (0.168)	0.311 (0.068)	-0.123 (0.050)	0.206 (0.135)	-0.251 (0.132)	-0.048 (0.066)	-0.033 (0.168)	-0.092 (0.126)	0.068 (0.064)	-0.282 (0.088)	0.109 (0.071)	0.020 (0.052)
-0.177 (0.110)	1.608 (0.232)	-0.125 (0.065)	0.139 (0.148)	-0.605 (0.279)	0.114 (0.082)	0.170 (0.146)	-0.020 (0.157)	-0.081 (0.068)	-0.168 (0.108)	0.004 (0.094)	-0.061 (0.085)
0.056 (0.141)	0.021 (0.112)	0.352 (0.300)	0.065 (0.193)	0.117 (0.200)	0.205 (0.095)	0.090 (0.190)	-0.143 (0.213)	0.284 (0.089)	-0.248 (0.152)	0.010 (0.139)	-0.083 (0.095)
Variance – Covariance matrix of the estimated residuals: $V(\varepsilon_t) = \Lambda \Lambda^T$											
Λ			ω_{11} = 0.553 (0.031)								
			ω_{21} = 0.257 (0.053)			ω_{22} = 0.649 (0.036)					
			ω_{31} = 0.260 (0.071)			ω_{32} = 0.157 (0.068)			Ω_{33} = 0.857 (0.048)		