Department of
Economics and Finance

UNEMPLOYMENT IN AFRICA:
A FRACTIONAL INTEGRATION APPROACH

Guglielmo Maria Caporale
Brunel University London, CESifo and DIW Berlin

Luis A. Gil-Alana*
University of Navarra

January 2017

Abstract

This paper estimates long-

1. Introduction

There are two main ways of thinking about unemployment in the existing literature. The natural rate theory (see Friedman, 1968, and Phelps, 1967) implies that it should fluctuate around a stationary equilibrium level, known as the natural rate or NAIRU,

1994) this can shift over time as a result of infrequent shocks due to changes in economic fundamentals; once these shifts are taken into account mean-reversion appears to characterise unemployment. This type of models have been found generally to be appropriate for the US experience. By contrast, hysteresis models (see Blanchard and Summers, 1986, 1987, and Barro, 1988) appear to fit better the European countries, where unemployment exhibits a high degree of persistence, and its dynamic behaviour can be captured by long memory models with a (near) unit root.

The empirical literature testing unemployment theories initially replied on standard unit root tests (such as Dickey and Fuller, ADF, 1979, or Phillips-Perron, PP, 1988), and subsequently used panel approaches to deal with the well-known problem of the low power of standard unit root tests (see, e.g., Leon-Ledesma, 2002), or fractionally integrated (ARFIMA) models to test for long memory in unemployment (see, for instance, Gil-Alana, 2001, 2002). Caporale and Gil-Alana (2007, 2008) also allowed for breaks in a fractional integration framework, and Caporale et al. (2016) took into account the possible correlation between the unemployment series. The advantage of a fractional integration framework compared to the classical I(0)/I(1) dichotomy is that since the fractional parameter can take any real value no arbitrary restrictions are imposed on the stochastic behaviour of the series and therefore the model allows for a much richer dynamic structure that might suit the unemployment series particularly well.

where y_t represents the total number of unemployed in each ${}_1$ ${}_2$ are unknown coefficients on the intercept and a linear time trend respectively, and x_t is assumed to be I(d) where d can be any real value. We report the estimates of d for the ${}_1$ ${}_2$ are assumed to be equal to 0 in integration is found to be equal to or higher than 1 in all cases. Evidence of unit roots is found in the cases of Botswana, Ghana, Malawi, Mauritius, Senegal and South Africa; for the remaining countries the orders of integration are significantly higher than 1.

4. Conclusions

This paper estimates long-memory models to analyse the stochastic behaviour of unemployment in eleven African countries (Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, Tanzania and Zambia) from the 1960s until 2010, being the first academic study to do so. The empirical results provide very strong evidence of lack of mean reversion in all series under examination. This suggests that hysteresis models are the most relevant for the African experience, which is not a very surprising result if one considers the low degree of economic (financial development) of most of the countries in the sample as well as the existence of various types of rigidities in their labour markets. Therefore in such countries shocks hitting the unemployment series will have permanent effects, and policy makers should take appropriate action to reverse the effects of negative shocks.

References

-37.

Blanchard, O.J. and L.H.

Economic Review, 31, 288-295.

Bloomfield, P., 1973, An exponential model in the spectrum of a scalar time series. Biometrika, 60, 217-226.

Caporale, GM. and Gil-Alana, LA., (2007), Non-linearities and fractional integration in the US unemployment rate, Oxford Bulletin of Economics and Statistics 69 (4) : 521-544.

Caporale, GM. and Gil-Alana, LA., (2008), Modelling the US, UK and Japanese unemployment rates: fractional integration and structural breaks, Computational Statistics and Data Analysis 52 (11) : 4998- 5013.

Caporale, G.M., Gil- hypothesis revisited:

Letters.Dahlhaus, R. (1989) Efficient parameter estimation for self-similar process. *Annals of Statistics*, 17, 1749-1766.De Vries, G.J., M.P. Timmer, and K. de Vries

VGDC research memorandum 136.

Dickey, D., Fuller, W. (1979). Distribution of the estimators for autoregressive time series with unit root. Journal of the American Statistical Association, 74, 427-431.

Review, 58, 1-17.

Gil-Alana, L.A., 2001, The persistence of unemployment in the USA and Europe in terms of Fractionally ARIMA Models, Applied Economics, 33 (10), 1263-1269.

Gil-Alana, L.A., 2002, "Modelling

Phelps, E.S., 1994, Structural Slumps: The Modern Equilibrium Theory of Unemployment, Interest, and Assets, Cambridge, MA, Harvard University Press.

Phillips, P.C.B., Perron, P., (1988). Testing for a unit root in time series regression.Biometrica, 75, 335-346.

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

Robinson, P.M., (1995). Gaussian semiparametric estimation of long range dependence.Annals of Statistics 23, 1630-1661.

Table 1: Estimates of d. Parametric methods (Dahlhaus, 1989; Robinson, 1994)

i) No autocorrelation			
	No det. terms	A constant	A linear time trend
BOTSWANA	0.89 (0.72, 1.23)	**1.48 (1.18, 1.88)**	1.50 (1.23, 1.89)
ETHIOPIA	1.03 (0.87, 1.26)	1.43 (1.32, 1.62)	**1.52 (1.41, 1.66)**
GHANA	1.08 (0.89, 1.33)	1.28 (1.09, 1.55)	**1.31 (1.14, 1.54)**
KENYA	0.86 (0.54, 1.19)	**1.57 (1.40, 1.81)**	1.55 (1.38, 1.70)
MALAWI	0.98 (0.76, 1.26)	1.34 (1.11, 1.62)	**1.34 (1.13, 1.61)**
MAURITIUS	0.96 (0.66, 1.30)	1.16 (0.91, 1.47)	**1.14 (0.95, 1.42)**
NIGERIA	1.07 (0.92, 1.29)	1.40 (1.23, 1.67)	**1.40 (1.23, 1.67)**
SENEGAL	0.97 (0.76, 1.28)	1.76 (1.50, 2.10)	**1.69 (1.42, 2.04)**
SOUTH AFRICA	0.83 (0.65, 1.08)	1.08 (0.97, 1.27)	**1.09 (0.93, 1.30)**
TANZANIA	1.00 (0.84, 1.26)	1.47 (1.32, 1.75)	**1.60 (1.48, 1.81)**
ZAMBIA	0.97 (0.79, 1.23)	1.38 (1.19, 1.68)	**1.44 (1.26, 1.69)**
i) Autocorrelated (Bloomfield)			
	No det. terms	A constant	A linear time trend
BOTSWANA	0.67 (0.56, 1.06)	0.99 (0.83, 1.48)	**0.93 (0.44, 1.49)**
ETHIOPIA	0.96 (0.73, 1.38)	1.45 (1.18, 1.83)	**1.52 (1.27, 1.79)**
GHANA	0.86 (0.56, 1.39)	1.20 (0.74, 2.01)	**1.20 (0.53, 1.96)**
KENYA	0.47 (0.39, 1.23)	**1.52 (1.19, 1.94)**	1.47 (1.18, 1.91)
MALAWI	0.75 (0.45, 1.47)	0.90 (0.57, 1.86)	**0.93 (0.10, 1.83)**
MAURITIUS	0.45 (0.36, 1.33)	1.18 (0.79, 1.87)	**1.11 (0.69, 1.86)**
NIGERIA	1.11 (0.78, 1.52)	1.10 (0.33, 1.53)	**1.09 (0.57, 1.51)**
SENEGAL	0.75 (0.53, 1.39)	0.93 (0.47, 1.98)	**0.93 (0.02, 1.81)**
SOUTH AFRICA	0.69 (0.46, 1.13)	**1.23 (0.98, 2.31)**	1.34 (0.95, 2.36)
TANZANIA	0.89 (0.67, 1.31)		