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MEASURING UNEMPLOYMENT PERSISTENCE BY AGE AND GENDER

Amaia ALTUZARRA¹

Abstract

This paper examines the dynamics of the unemployment rates across gender and age in Spain during the period 19761q1-2013q4. A battery of unit root tests with and without structural breaks is applied to test the hypothesis of hysteresis and fractional integration techniques are used to study the persistence of the unemployment rates. Empirical evidence suggests that there are structural breaks and high level of persistence in all the series, especially in those of young and women. Consequently, differences in the dynamics of the unemployment rates between men and women as well as between young and adults should be taken into account in the design of the public policy in order to correct the effects of cyclical shocks.

Keywords: unemployment, unit root, fractional integration, gender unemployment, youth unemployment, structural breaks

JEL Classification: J64, C22

I. Introduction

The dynamics of unemployment rate has been widely studied in the theoretical and empirical literature. The high unemployment rate of many European countries and its persistence at high levels for long periods has attracted the attention of researchers and policy-makers. High unemployment level and its persistence is a matter of major concern in many of the newer EU member states as well as in the poorest old EU countries. Spain is one of the EU countries that has suffered more severely from this problem, especially since the outbreak of the recent financial crisis, becoming one of the most critical policy challenges facing the Spanish government.

The main weaknesses that distinguish the Spanish labour market are related to the high structural unemployment, the high temporary employment and the low incidence of internal flexibility measures, which have limited the adjustment mechanisms to firing workers (Hidalgo, 2012). To this should be added the existence of significant differences among specific groups of workers. The unemployment rate is not evenly distributed

¹ Department of Applied Economics, University of the Basque Country. Facultad de CC. Económicas y Empresariales. Av. Lehendakari Agirre, 8348015 Bilbao, e-mail: amaia.altuzarra@ehu.eus.

either among people of different gender or among different age groups. Young people and women concentrate the highest unemployment rates. The recent financial crisis has also aggravated the unemployment gaps between men and women, as well as between young people and adults, revealing the precarious position and the vulnerability of women and young workers. Young people were the first excluded from the labour market directly after the beginning of the financial crisis as a large number of them held fixed-term contracts. Many women also lost their jobs, although in a lesser proportion than men, since the collapse of the housing market that accompanied the international financial crisis led to the destruction of jobs, above all, in the building industry.

The severity of the economic and social consequences of such high unemployment rates and the uneven distribution among different groups of population has led the Spanish government to implement two different reforms of the labour market, along with a package of economic measures since the beginning of the financial crisis.

There are several reasons that have been put forward to explain the differences in unemployment rates between men and women. A different behaviour between genders in relation to job search or an uneven distribution of employment among industries between men and women may be some explanations (Queneau and Sen, 2008). Bikacova (2012) considers the different behaviour between men and woman with respect to family responsibilities as a possible cause of the divergence in unemployment rates. For example, ruptures in professional careers motivated by family reasons tend to be more extended among women than among men. Professional breaks have negative consequences for human capital accumulation and productivity and increase the probability of being unemployed.

Differences in the rate of unemployment among young and adult people may be due to low human capital accumulation and lack of experience of young people. It has also been argued that the existing mismatch between the skills of young people that have finished their education and those required in the labour market could account for such differences (Quintini *et al.*, 2007).

Although gender and age differences are factors that aggravate the problems related to unemployment from a political point of view, the truth is that the study of dynamics of unemployment rates by gender and by age has received only marginal attention from researchers and policy-makers. The motivation of this paper, therefore, is to shed some light upon the unemployment rates patterns for women and men and for different groups of age, with special attention given to what happened with the outburst of the crisis.

There are two major lines of research to study the unemployment rates' dynamics and its relationship with the business cycle. The first line is known as hypothesis of the natural rate of unemployment (Phelps, 1967; Friedman, 1968; Layard *et al.*, 1991). It states that unemployment dynamics is a process that reverts to its mean over time. Therefore, the shocks affecting the unemployment rate have only temporary effects and, on long term, it is expected that unemployment rate will revert to its natural rate.

The second line of research is the hypothesis of hysteresis (Blanchard and Summers, 1986). It argues that the cyclical fluctuations have permanent effects on the unemployment rate due to the existence of certain rigidities in the labour market. Labour-market rigidities are primary due to the pressures exerted by insiders. These workers, with stable and permanent contracts and high exit costs, control the terms of

collective bargaining. On the contrary, outsider workers, with fixed-term contracts and low exit costs, are unable to influence collective bargaining and have difficulty in gaining experience and human capital. The loss of human capital of outsiders may explain the persistence of unemployment (Bakas and Papapetrou, 2012).

The implications for economic policy derived from the previous theoretical approaches are dissimilar. If the hypothesis of hysteresis is correct, the intervention by governments with corrective measures to reduce the unemployment rate would be necessary. It would not be expected that the effects of, for example, an economic crisis on unemployment will disappear on their own over a short period of time. If, however, the hypothesis of the natural rate of unemployment is met, a reversion to the natural rate of unemployment will occur without the need for active government intervention.

These two hypotheses have been empirically tested by applying a range of unit root tests on the time series of unemployment rate. A stationary process $I(0)$ is considered to be consistent with the hypothesis of the natural rate of unemployment. Conversely, the presence of a unit root $I(1)$ in the series is interpreted as supporting the hypothesis of hysteresis. At this point, it is worth noticing the exiting difference between the concepts of hysteresis and persistence. Persistence is a process that refers to a time series that displays a tendency to revert to its mean, although this process occurs very slowly. However, hysteresis must be understood as a process in which there is no reversion to the long run equilibrium. Camarero *et al.* (2006) state that "persistence implies a slow speed of adjustment towards the long-run equilibrium level. Therefore, it is a special case of the hypothesis of natural rate of unemployment, as the series show mean reversion after all. In fact, very frequently, persistence might be hiding changes in the level of the rate nature" (p. 16).

The results obtained in empirical research for the case of Spain are mixed and depend on the period considered and, especially, on the methodology applied. Mitchell (1993) studied 15 OECD countries over the period 1960q1-1991q3 using the Perron (1989) unit root test with and without breaks and his results are consistent with the hypothesis of hysteresis for the Spanish case. A similar conclusion is obtained by Arestis and Mariscal (2000), who study 22 OECD countries over the period 1960q1-1997q2 using the Perron (1997) unit root test. Roed (2002) studied 10 countries in the OECD during the years 1960-1965 using ADF and KPSS unit root tests and concludes also in favour of hysteresis for Spain. Feve *et al.* (2003) studied 21 OECD countries over the period 1966q1-1999q1 with the generalization of the ADF test and obtained the same result. Chou and Zhang (2010) analyze the case of G-20 countries during the period 1980-2008 using the Seemingly Unrelated Regressions ADF test (SUR) and find results which are consistent with the hypothesis of hysteresis for the Spanish case. García del Barrio and Gil-Alana (2009) using panel techniques for the Spanish regions during the period 1976q3 to 2004q4 find support for the persistence hypothesis. Romero-Avila and Usabiaga (2011) test the hypothesis of hysteresis in the Spanish regions using unit root tests which allow for structural breaks and find support for the hysteresis. Gil-Alana (2001) using fractional integration for selected OECD countries during the years 1960-1998 finds also persistence for Spain.

Other studies, however, have obtained results consistent with the hypothesis of natural rate of unemployment for the Spanish case. Lee (2010) using the Ucar-Omay test for

29 OECD countries during the period 1978-2008 find support for the natural rate of unemployment. Similar conclusions are drawn in Camarero and Tamarit (2004) applying the SUR test for 19 OECD countries, in Leon-Ledesma and McAdam (2004) using univariate and panel unit root with and without breaks for the 27 EU countries for the period 2001m5-1991m, and in Papell *et al.* (2000) using the Zivot and Andrews test for 16 OECD countries over the period 1955-1997.

There are few studies that, either at an international or domestic level, address the dynamics of unemployment from the perspective of gender and/or age. At an international level, for example, Queneau and Sen (2010) study the unemployment rates by gender in eight OECD countries during the years 1965-2002 (Spain not included). Queneau and Sen (2009, 2012) analyze the U.S. unemployment by gender. Bicakova (2012) looks into the dynamics of unemployment for men and women for the more recent EU member states. Belloc and Tilli (2012) study the unemployment by gender in Italian regions during the period 1992q4-2009q3, and Pereiro *et al.* (2012) analyze the relationship between unemployment and the business cycle in the UK and the US including gender differences.

Empirical evidence which includes the case of Spain is found to the best of our knowledge in just a few research works. Queneau and Sen (2008) study the gender dimension for selected OECD countries; Bakas and Papapetrou (2013) apply panel techniques to a sample of 15 countries of the European Union, and Koutentakis (2010) analyzes a sample of European economies (Belgium, France, Greece, Italy, Portugal and Spain). All these studies found significant differences in unemployment rate between men and women for Spain.

Even scarcer is the empirical evidence available on the differences in unemployment rate by age. Caporale and Gil-Alana (2012) analyze the dynamics of youth unemployment for a set of OECD countries (which includes Spain) and find significant persistence in the youth unemployment rate in the case of Spain.

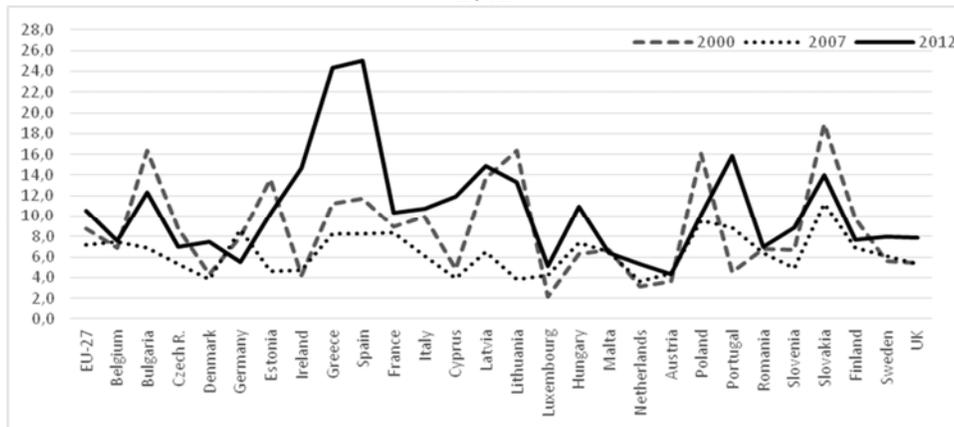
The aim of this paper is, therefore, twofold. Firstly, it intends to provide empirical evidence on the validity of the hysteresis hypothesis in Spain by gender and age by applying different unit root tests. Secondly, it pursues to examine the degree of persistence of unemployment rate using fractional integration techniques. With these aims, the paper is organized in the following manner: Section 2 shows some trends in the unemployment rate in Spain, Section 3 describes the data and the methodology, Section 4 discusses the empirical results and Section 5 presents the main conclusions.

II. Tendency and Persistence of Unemployment Rate by Gender and Age

One of the toughest challenges faced by policy-makers in Spain is the high and persistent unemployment rate that has characterized the country for long periods. This economic and social blight is particularly worrying since the outbreak of the financial crisis. In addition, as noted in the previous section, the unemployment rate is not evenly distributed across gender and age: young people and women are the groups that tend to have the highest unemployment rates.

In the year 2000, during the economic expansion, unemployment rate in Spain was 11.7%, the highest in the nucleus of countries that comprises the EU-15, and one of the highest among the EU-27. Only Estonia (13.6%), Latvia (13.7%), Poland (16.1%), Lithuania (16.4%), Bulgaria (16.4%) and Slovakia (18.9%) recorded higher unemployment rates than Spain (Figure 1). In 2007, just before the burst of the financial crisis, Spain registered the lowest unemployment rate since the eighties (8.3%). From that year on, the unemployment rate started to grow at a fast rate, reaching 25% in 2012, the highest unemployment rate in the EU-27 and of the last decades (Figure 2).

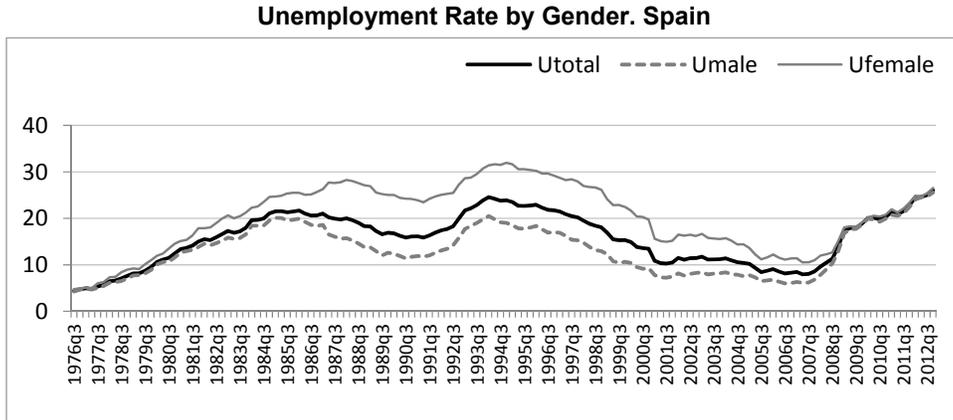
Figure 1
Total Unemployment Rate in the European Union Countries. 2000, 2007 and 2012



Source: Eurostat (data not seasonally adjusted).

Unemployment rate has spread differently between men and women. Figure 2 shows the evolution of total unemployment rate and the male and female unemployment rates during the period 1976-2012. The unemployment rate for women exceeds significantly that of men throughout the whole period until the onset of the crisis. Since the year 2007, a convergence of unemployment rates occurred, due to a process of strong job destruction which affected men more than women, in relative terms. For the first time, in 2000 the Strategy of Lisbon brought the active labour market policies to the fore and set an objective to reach at least an employment rate for women of 60% in 2010. The efforts made to meet this aim and the fact that women were less affected by the economic cycle has contributed to slightly reduce the gap in unemployment rates between men and women.

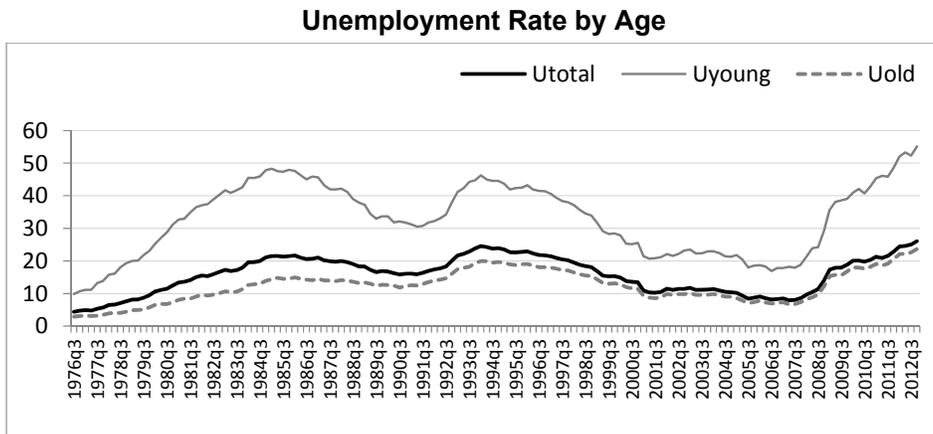
Figure 2



Source: Spanish National Statistics Institute (INE).

Also, youth unemployment rate (below 25 years old) has almost doubled as compared to the unemployment rate for people over 25 years old throughout the period. Figure 3 shows the total unemployment rate of those under 25 years old and those over 25 years old. In 2000, for example, the unemployment rate for people between 16 and 25 years old was 26.0% (9 points above the overall rate of unemployment). In 2007, the rate of youth unemployment fell to 18.2% (9.9 points above the overall rate), while in 2012 the rate of unemployment rose sharply to 48.6%; that is, almost one of two young people below 25 years old were unemployed, although they wanted to work. The high level and persistence of youth unemployment is the result, among other factors, of the weak employability of early school drop outs and the high presence of temporary contracts among young workers (Wöfl and Mora-Sanguinetti, 2011).

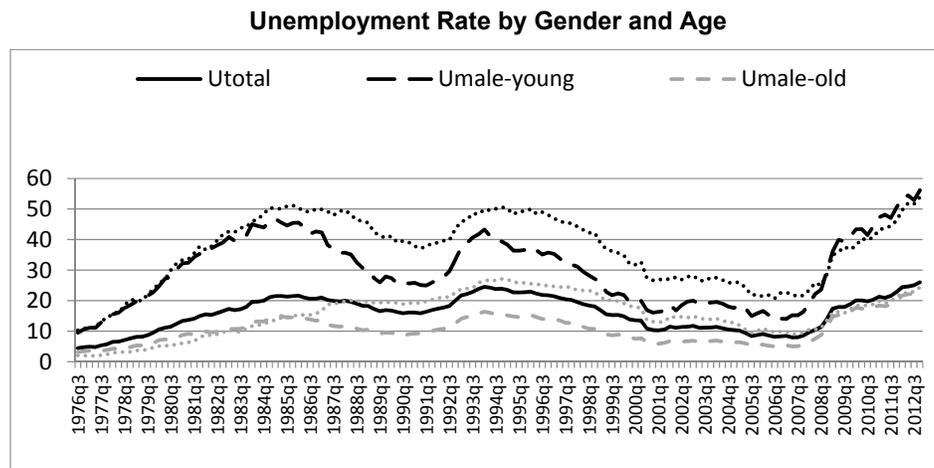
Figure3



Source: Spanish National Statistics Institute (INE).

Gender and youth unemployment rate gaps mean that women below 25 years old are the group of people who suffer the most the scourge of unemployment. Figure 4 shows the total unemployment rate and the unemployment rates for men below 25 years old, men over 25 years old, women below 25 years old and women over 25 years old. One should notice that until the beginning of the crisis the unemployment rate for women below 25 years old recorded the highest values. These data show the strong vulnerability to which especially young people and women are exposed in Spain.

Figure 4



Source: Spanish National Statistics Institute (INE).

III. Data and Methodology

III.1. Data

The data used in the empirical analysis come from the Economically Active Population Survey (EAPS) elaborated by the National Statistics Institute of Spain². We have used quarterly data for the unemployment rate disaggregated by gender and age for the

²The Economically Active Population Survey (EAPS) is a continuous quarterly survey that targets households, and its main objective is to obtain data on the labour force (which is subcategorized by employed and unemployed), and on the people outside the labour market. It is conducted quarterly by the INE. It is based on results from telephone interviews carried out on people of working age. The initial sample consists of 65,000 families who are interviewed on their employment status every quarter; from that number around 60,000 families answer the interview, which amounts to 180,000 to 200,000 people between 16 and 74 years. The census takes into account the people without employment or self-employment in the week prior to the interview; those looking for work in the previous four weeks, those who are available to work in the next two weeks or who will be incorporated in a work in the next three months. Unemployed is the person who is enrolled at the employment office in the four weeks previous to the interview and excludes those who just go to the unemployment office to renew the request or attend training courses.

Spanish case during the period 1976: q1-2012: q4. The variables used and their description is as follows:

- Total unemployment rate: percentage of people (U_{total})
- Male unemployment rate (U_{male})
- Female unemployment rate (U_{female})
- Unemployment rate for people below 25 years (U_{youth})
- Unemployment rate for those over 25 years (U_{adult})
- Unemployment rate for men below 25 years ($U_{youth-male}$)
- Unemployment rate for men over 25 years ($U_{adult-male}$)
- Unemployment rate for women below 25 years ($U_{youth-female}$)
- Unemployment rate for women over 25 years ($U_{adult-female}$)

Table 1 provides descriptive statistics for the unemployment rate series over the period 1976q1-2012q4. These figures suggest the existence of a heterogeneous distribution of unemployment by gender and age. Unemployment rate for women (20.26%) is seven points higher than that of men (13.30%). Unemployment rate for people below 25 years old (33.00%) is more than double the unemployment rate of those over that age (12.40%). The highest unemployment rate appears associated with women younger than 25 years old (36.61%).

Table 1

Summary Statistics: Unemployment RATES

Variable	Obs	Mean	Std. Dev.	Min	Max
U_{total}	146	15.86	5.54	4.41	26.02
U_{male}	146	13.30	5.22	4.26	25.58
U_{female}	146	20.26	7.17	4.78	31.96
U_{adult}	146	12.40	4.86	2.93	23.71
U_{young}	146	33.00	10.99	9.87	55.13
$U_{youth-male}$	146	30.08	11.33	9.51	56.23
$U_{youth-female}$	146	36.61	11.33	10.32	53.89
$U_{adult-male}$	146	10.55	4.48	3.21	23.19
$U_{adult-female}$	146	15.51	6.91	1.92	27.12

Source: INE and own elaboration.

III.2. Methodology

III.2.1. Standard Unit Root Tests

To test our hypotheses, we applied different techniques. The first step in our empirical work is to test for unit roots using methods that do not account for structural change. We begin with a univariate examination of the individual series to test stationarity of the series by using the standard unit root tests, of which the most popular is the Dickey–Fuller Generalised Least Squares (DFGLS) approach of Elliott, Rothenberg and Stock (1996). This method is preferred by many econometricians to the first–generation tests

of Dickey and Fuller (Dickey and Fuller, 1979). Inferences drawn from the DFGLS test are likely to be more robust than those based on the first-generation ones (Baum, 2001). The null hypothesis is that of non-stationarity in levels. The null hypothesis of a unit root is rejected when the value of the t-statistic is greater than the appropriate critical value.

The second step consists of running the KPSS test (Kwiatkowski, Phillips, Schmidt and Shin, 1992) whose null hypothesis is that of stationarity. The DFGLS and KPSS tests can be used complementarily to see if the results of both are consistent, so that we can accept or reject the hypothesis of existence of unique root with more certainty. The combined result of both tests is often used to examine the possibility that a time series is fractionally integrated.

The KPSS τ test includes an intercept and linear time trend, while the KPSS η test does not. The null hypothesis of a stationarity is rejected if the value of the t-statistic is greater than the appropriate critical value. We can assume that a stationary series has significant DFGLS and KPSS non significant. A series has a unit root when it has no significant DFGLS and significant KPSS.

III.2.2. Unit Root Test Allowing for Structural Breaks

Since the contribution of Perron (1989), it has become well-known that in the presence of a structural break the standard unit root tests are biased towards the non-rejection of the null of a unit root, due to misspecification of the deterministic trend. From the theoretical point of view, there may be many potential sources of structural breaks. Events such as crises, changes in real interest rates, or labour reform measures and other major policy changes may lead to a break. Zivot and Andrews (1992), among others, developed a unit root test which allows for one endogenous break. Later, Lumsdaine and Papell (1997) extended the Zivot and Andrews (1992) model allowing for two structural breaks. In the same line, Perron and Vogelsang (1992) and Perron (1997) developed one test that allows for two different types of endogenous breaks: the Additive Outlier (AO) and Innovative Outlier (IO) models. The AO model allows for a sudden change in mean (crash model), while the IO model allows for more gradual changes (Glynn *et al.*, 2007). Clemente, Montañés and Reyes (1998) extended the idea of Perron and Vogelsang (1992) and, besides considering both the AO model and the IO model, allowed for two structural breaks

Therefore, in order to test the unit root hypothesis taking into account the possibility of structural breaks in the data, we perform the Zivot and Andrews (1992) test and the test proposed by Clemente, Montañés and Reyes (1998). The Zivot and Andrews (ZA) test has a null hypothesis of unit root and allows for an endogenously determined breakpoint. In this test, we examined for a single structural break in the intercept and in the trend. Through the Clemente, Montañés and Reyes test, we proceed considering two alternative events within our time series: the Additive Outlier model that captures a sudden change in the series and the Innovative Outlier model that allows a gradual shift in the mean of the series.

III.2.3. Testing Persistence

We used fractional integration techniques to capture the potential persistence of unemployment rates. Fractional integration is a widely used tool to model long memory. Granger and Ding (1996) consider that a series has long memory when the autocorrelation structure gradually decreases. This autocorrelation structure indicates that the process depends heavily on the past values of the series.

Autoregressive Fractionally Integrated Moving Average Models (ARFIMA) have three parameters, p , d , and q . Parameter p is the number of lags involved in the autoregressive part of the series. The parameter q is the moving average lags. Finally, d is the long memory parameter, which may take any value (not just 0 or 1, as in the ARIMA models).

An ARFIMA (p,d,q) process can be expressed as:

$$\Phi(L) (1-L)^d Y_t = \Theta(L) \varepsilon_t, \varepsilon_t \sim (0, \sigma^2)$$

where: d is the long memory parameter (or parameter of fractional integration) and expresses the number of differences to be taken in the series Y_t to become stationary; $\Phi(L)$ and $\Theta(L)$ are autoregressive and moving average polynomials whose roots are outside the unit circle.

If $d=0$ the series is stationary with finite variance. If $0 < d < 0.5$ the series is stationary with finite variance and long memory. If $0.5 \leq d < 1$ the series is not stationary with infinite variance and permanent memory, but is mean reverting. Finally, if $d \geq 1$ the series do not revert to the mean. Thus, for $0 < d < 1$, the process has a long memory and reverts back to the mean.

There are different methods to estimate the parameter d . In this work, parameter d is computed by applying a modified form of the Geweke Porter-Hudak (1983) estimation of the long memory parameter proposed by Phillips (1999a, 1999b).

The fractional integration test suggested by Geweke and Porter-Hudak (GPH) is based on the following OLS estimation:

$$\ln(I(\omega_j)) = \beta_0 + \beta_1 \ln(4 \sin^2(\omega_j/2)) + \delta_t, \quad j=1, \dots, n$$

with $\beta_1 = -d$, where $I(\omega_j)$ is the periodogram of a series in the frequency ω_j , $\omega_j = 2\pi j / T$ ($j = 1, \dots, T-1$).

The ordinal number of low frequency (n) used in this test is $n = T^\alpha$, where T is the number of observations. This GPH test allows the estimation of d without knowing p and q in ARFIMA (p, d, q). Furthermore, this method is robust to short-term dependence, as well as variance shifts and conditional heteroskedastic effects (Booth and Tse, 1995).

However, according to Baum and Wiggins (2009) "distinguishing unit-root behaviour from fractional integration using this method may be problematic, given that the GPH estimator is inconsistent against $d > 1$ alternatives. This weakness of the GPH estimator is solved by Phillips' Modified Log Periodogram Regression estimator, in which the dependent variable is modified to reflect the distribution of d under the null hypothesis that $d=1$. The estimator gives rise to a test statistic for $d = 1$ which is a standard normal variate under the null". Accordingly, the procedure proposed by Phillips to correct the

weakness of the Geweke and Porter-Hudak method consist of removing deterministic trends from the series before applying the estimator.

IV. Empirical Results³

The results for the DFGLS test and the KPSS test with ($\eta\tau$) and without trend ($\eta\mu$) are presented in Table 2. The maximum number of lags in the DFGLS and KPSS tests has been determined according with the Schwert criterion. For each series, we report the t-statistic and the level of significance.

The DFGLS unit root statistics for all unemployment rate series are insignificant in trend and in levels. The with-trend KPSS test statistics for all unemployment rate series are significant at the level of 1%. Both tests results are, therefore, consistent with the hysteresis hypotheses. Shocks to these unemployment rates will have a long-term effect.

Table 2

Unit Root Test: DFGLS and KPSS

	DFGLS $\eta\mu$	DFGLS $\eta\tau$.	KPSS $\eta\mu$	KPSS $\eta\tau$.	
U_{total}	-0.208	-2.121	.345	.356	***
U_{male}	-0.230	-1.439	.236	.259	***
U_{female}	-0.504	-1.515	.521 **	.533	***
U_{adult}	-0.214	-1.824	.654 **	.355	***
U_{youth}	-0.749	-2.108	.273	.290	***
$U_{youth-male}$	-0.881	-2.114	.229	.247	***
$U_{youth-female}$	-0.422	-1.656	.376 *	.399	***
$U_{adult-male}$	0.084	-1.419	.359 *	.249	***
$U_{adult-female}$	-0.186	-1.516	.931 ***	.579	***

Note: ***, ** and * denote significance at the 1%, 5% and 10% level.

The without-trend KPSS test statistics, however, are significant at the level of 1% only in the case of adult-female employment rate. We cannot reject the null hypotheses of stationarity for the rest of the cases at that level of significance. Therefore, the DF-GLS test results in conjunction with the without-trend KPSS test results is also conclusive in favour of the hysteresis hypothesis at the level of significance of 1% for the adult female unemployment rate. For the rest of the rates, the diagnosis, however, is contradictory at that level of significance. This contradictory outcome suggests that it may be useful to consider (as we will do later on) fractional integration techniques to estimate the order of integration.

The results for the Zivot and Andrews unit root test with one endogenous structural break are reported in Table 3. The unit-root statistics for all the unemployment rate series are insignificant and, therefore, consistent with the hysteresis hypothesis. That is, shocks to these unemployment rates will have a persistent effect. All the unemployment time series present one abrupt change over the period 1976-2012. When we take into account the break in the intercept, we find that for all unemployment

³ All tests have been run with STATA 12.0.

rates the structural breaks occurs during the years 1996-1998 (except for the youth-male unemployment rate for which the structural break takes place in 2007). According to Romero-Avila and Usabiaga (2008), those breaks may be “associated with the cyclical upturn of the second half of the 1990s, which coincides with the marked decline in interest rates and the apparent effects of the reforms implemented with the aim of increasing labour market flexibility (1992, 1993, 1994 and 1997)” (p. 91).

It can be noticed that the structural breaks come a year and a half earlier in the case of unemployment rate for men than for women and two and a half years earlier in the case of adult men than for adult women. Also, this break comes nearly two years earlier in the case of unemployment rate for young workers than for adult workers. The sectoral characteristics of the Spanish production structure (with a high percentage of employment in tourism and construction sectors) as well as the excessive use of temporary contracts, especially among young workers, explain, at least partially, the existence of different rhythms in the processes of job creation and destruction. Jobs in the construction sector, mostly held by men, are more affected by the fluctuation of the economic cycle, which explains why men are the first to feel the consequences, in terms of unemployment rate, of the economic upturns and downturns. The high temporary employment rates, another feature of the Spanish labour market, are mainly concentrated amongst young workers, which in turn also explain why the economic shocks increase and decrease the unemployment rates of young workers earlier than among adults. This is especially crucial considering the low presence of internal flexibility measures, which leads companies to use dismissal as the dominant adjustment mechanism.

Table 3

Zivot and Andrews Test with Break in Intercept and in Trend

	Zandrews Intercept t-statistic	T _B	Zandrews Trend t-statistic	T _B
<i>U</i> _{total}	-3.083	1996q2	-2.953	2007q2
<i>U</i> _{male}	-2.791	1996q2	-3.343	2006q3
<i>U</i> _{female}	-3.666	1997q4	-2.419	2007q2
<i>U</i> _{adult}	-2.829	1998q1	-2.501	2007q2
<i>U</i> _{youth}	-2.823	1996q2	-3.462	2006q4
<i>U</i> _{youth-male}	-3.127	2007q2	-3.609	2006q3
<i>U</i> _{youth-female}	-3.083	1996q2	-3.232	2007q2
<i>U</i> _{adult-male}	-2.403	1996q2	-3.123	2006q4
<i>U</i> _{adult-female}	-3.611	1998q4	-1.809	1984q1

Note: ***, ** and * denote significance at the 1%, 5% and 10% level, minimum t-statistics.

Tables 4 and 5 present the results for the Clemente-Montañes-Reyes (1998) unit root test. For each series, we present the test statistics and the level of significance for the “additive outlier” model (AO) and for the “innovation outlier” model (IO), respectively. For convenience, we have considered each model with two breaks. Both the additive outlier and the innovative outlier models show that unit roots are presents even when two of structural breaks are considered, and therefore argue in favour of the hysteresis hypothesis.

However, when the break in the trend is considered, structural breaks occurs during the years 2006-2007 for all unemployment rates (except for the adult-female unemployment rate, for which structural break occurs in 1984, coinciding with the beginning of the massive incorporation of women into the labour market). The break in 2007 relates to the burst of the housing bubble and the rising in unemployment due to the slowdown experienced by the construction industry. The breaking point is noticed slightly earlier in the male unemployment rate than in the female one and in the youth unemployment rate earlier than in the adult one.

When taking into account the two structural breaks in the “additive outlier” model, that is, when the specification allows a sudden change in the series (Table 4), we note that for the majority of the series (U_{total} , U_{male} , U_{adult} , U_{youth} , $U_{youth-male}$, $U_{adult-male}$), the first break occurs during the period 1999-2001. This period coincides with a decline in these unemployment rates, as the negative sing of du_1 shows. The second break takes place during the period 2009-2010. The sign of d_2 is positive as a result of an increase in unemployment rates due to the effects of the recent crisis. The strong decline in unemployment rates with the first break was the result of two factors. The first was the favourable economic dynamics started in 1997, with growth rates of 3.4% of GDP, which significantly increased the capacity to generate employment in the Spanish economy. The second was the results of employment reforms that boosted job creation, as explained above. In contrast, the increase in unemployment rates in 2009-2010 was the result of the economic crisis, which reveals the structural weaknesses of the Spanish labour market to deal with the economic shocks.

Some female unemployment rates (U_{female} and $U_{adult-female}$), however, follow a different behaviour. The first break occurs during the 1980s and the second one in the early 2000s. The signs of the breaks are opposite to the previous ones. In the early 1980s in Spain, over two million people lost their jobs and women started entering the labour force. When job losses occur, the female labour force tends to abandon the search for employment resulting in a decline in their unemployment rates. On the contrary, in an expansionary period, women are encouraged to participate in the labour market; however, if it does not generate sufficient employment, unemployment rates rise, as it happened for female workers in 2000s.

Table 4

Clemente-Montañes-Reyes Unit Root Tests (Additive Model with Two Breaks)

	k	T_B	Test statistic	d_1^*	T-statistics	d_2^*	T-statistics
U_{total}	7	2001q2, 2009q3	-2.580	-5.9079	(-6.374) ***	11.1622	(7.386) ***
U_{male}	7	1999q4, 2009q3	-2.477	-5.4738	(-7.444) ***	13.0200	(10.530) ***
U_{female}	3	1983q2, 2001q2	-2.944	13.9373	(14.848) ***	-9.52780	(-11.977) ***
U_{adult}	6	2001q4, 2010q2	-1.788	-2.3193	(-2.749) ***	10.3474	(6.751) ***
U_{youth}	1	2000q3, 2009q3	-3.025	-12.5147	(-7.378) ***	23.9259	(8.508) ***

	k	T _B	Test statistic	d ₁ *	T-statistics	d ₂ *	T-statistics
<i>U</i> _{youth-male}	8	1999q4, 2009q3	-2.816	-12.0998	(-7.602) ***	28.2674	(10.562) ***
<i>U</i> _{youth-female}	3	1999q1, 2009q1	2.929	-12.7068	(-6.942) ***	16.6601	(5.703) ***
<i>U</i> _{adult-male}	2	1999q4, 2009q2	-2.511	-3.7093	(-6.112) ***	12.0410	(12.199) ***
<i>U</i> _{adult-female}	7	1987q4, 2002q1	-3.040	12.5359	(14.100) ***	-6.7260	(-7.423) ***

Notes: *, **, and *** denote significance at the 1%, 5% and 10% levels, respectively. Term k is the optimal number of lagged first-differenced terms included in the unit root test to correct for serial correlation. T_B denotes the estimated break points. The 5% critical values test with two breaks -5.490. The coefficients (d_i) are reported. T-statistics for d_i are given in parentheses. Term d is the coefficient of dummy variables under the unit root null.

In the “innovative outlier” model, that is, when the specification allows a gradual change in the series (Table 5), the first break occurs for all unemployment series during the recovery of the cycle of the late 1990s. The second break happens during the period 2007-2008, coinciding with the outburst of the crisis. Again, adult female unemployment rates show a different pattern. The first break happens in 1997 and the second one in 2002. In this specification breaks, as expected, are noted a few years earlier than in the “additive outlier”.

Table 5

Clemente-Montañes-Reyes Unit Root Tests (Innovative Model with Two Breaks)

	K	T _B	Test statistic	d ₁ *	T-statistics	d ₂ *	T-statistics f
<i>U</i> _{total}	6	1997q3, 2008q2	-3.709	-0.4543	(-3.334) ***	0.8936	(3.928) ***
<i>U</i> _{male}	12	1997q3, 2008q1	-4.823	-0.4946	(-3.456) ***	0.9563	(3.958) ***
<i>U</i> _{female}	6	1998q3, 2008q2	-3.882	-0.7728	(-3.920) ***	1.0785	(3.984) ***
<i>U</i> _{adult}	6	1998q3, 2008q2	-3.318	-0.3262	(-2.868) ***	0.8939	(4.104) ***
<i>U</i> _{youth}	8	1997q3, 2008q2	-4.200	-0.8628	(-2.913) ***	1.7026	(3.547) ***
<i>U</i> _{youth-male}	12	1996q3, 2008q2	-4.417	-0.9926	(-3.061) ***	1.9564	(3.532) ***
<i>U</i> _{youth-female}	8	1998q3, 2008q2	-4.040	-1.0803	(-2.884) ***	1.8319	(3.436) ***
<i>U</i> _{adult-male}	12	1997q3, 2008q1	-4.680	-0.3555	(-3.083) ***	0.9701	(4.199) ***
<i>U</i> _{adult-female}	7	1983q2, 1998q2	-2.678	0.4536	(1.795) *	-0.1910	(-1.366)

Notes: *, **, and *** denote significance at the 1%, 5% and 10% levels, respectively. Term k is the optimal number of lagged first-differenced terms included in the unit root test to correct for serial correlation. TB denotes the estimated break points. The 5% critical values test with two breaks -5.490. The coefficients (d_i) are reported. T -statistics for d_i are given in parentheses. Term d is the coefficient of dummy variables under the unit root null.

In summary, all the results argue in favour of the hysteresis hypothesis in the Spanish labour market, as they all suggest the presence of a unit root in all the unemployment series regardless of the unit root technique used or the number of breaks in the time-series considered.

However, as previously noted, the combined results of DFGLS and KPSS tests opened the possibility that our time series were fractionally integrated. If this is the case, it would mean that instead of hysteresis, we could have high persistence in the unemployment rates time series. The results of the fractional integration analysis according to the method proposed by Phillips, as a correction of the Geweke and Porter-Hudak method, are presented in Table 6. The estimation of the long memory parameter (d) has been performed for the bandwidth $m = g(T) = T^\alpha$, with $\alpha = 0.50, 0.60, 0.70$ and 0.80 . Simulations suggest that α should be 0.5 or higher (Geweke and Porter-Hudak, 1983).

However, the work of Cheung and Lai (1993) notes that a large number of α will contaminate the estimation of d , while very few will produce imprecise estimates of d . The latest results of Hurvich *et al.* (1998) and other authors have found that $0.6 < \alpha < 0.8$ are the most suitable values to be used. Table 6 presents the d estimates, standard errors and two p -values of the test statistics for the null hypothesis $d=0$ and $d=1$. Table also shows one conclusion for the case of $\alpha = 0.60$. All comments on the results will be based on this power.

We find that the estimated parameters are quite robust to the choice of the number of frequencies for all the unemployment rates. Differences in the size of the d parameter allow us to draw some conclusions about the persistence degree of the unemployment series.

The parameter d presents values higher than 0.5 in all time series, which means that all unemployment rates (except the adult-women unemployment rate), are non-stationary with infinite variance, but mean-reverting. Or, to put it in another way, we find evidence of a high persistence in all unemployment rates time series, except for the case of the adult-women, where we find clear evidence in favour of the hysteresis hypothesis.

The values of the parameter d range from 0.7779 for the adult men unemployment rate to 1.0077 for the adult women unemployment rate. The reversion to the mean after a shock caused by an event such as the current economic crisis will occur earlier in the male unemployment rate (.8709) than in the female one (.9795); and also the reversion to the mean will happen earlier in the youth unemployment rate (.8420) than in the adults' one (.8765).

The adult male unemployment rate exhibits the fastest reversion to the mean (.7779). The adult women unemployment rate, by contrast, has the highest value (1.0077). As the value is very close to the unity, it is a non-stationary series with infinite variance without reversion to the mean.

Table 6

Fractional Integration. Results

Power	$\alpha=0.50$			$\alpha=0.60$			$\alpha=0.70$			$\alpha=0.80$			Conclusion
	D	P> z z(H0:d=1 against H1:d<1)	P> t t(H0:d=0 against H1:d>0)	d	P> z z(H0:d=1 against H1:d<1)	P> t t(H0:d=0 against H1:d>0)	d	P> z z(H0:d=1 against H1:d<1)	P> t t(H0:d=0 against H1:d>0)	d	P> z z(H0:d=1 against H1:d<1)	P> t t(H0:d=0 against H1:d>0)	
U_{total} s.e.	.8829 .1874	0.001	0.001	.9099 .1107	0.000	0.000	.9657 .0634	0.000	0.000	.9882 .0585	0.000	0.000	Mean-reverting
U_{male} s.e.	.8219 .2207	0.004	0.001	.8709 .1290	0.000	0.000	.9394 .0738	0.000	0.000	.9591 .0525	0.000	0.000	Mean-reverting
U_{female} s.e.	.9987 .1799	0.000	0.000	.9795 .1105	0.000	0.000	1.0090 .0638	0.000	0.000	1.0240 .0638	0.000	0.000	Mean-reverting
U_{adult} s.e.	.8372 .1675	0.001	0.001	.8765 .0998	0.000	0.000	.9492 .0590	0.000	0.000	.9636 .0503	0.000	0.000	Mean-reverting
U_{youth} s.e.	.7590 .2135	0.005	0.003	.8420 .1270	0.000	0.000	.9122 .0728	0.000	0.000	.9536 .0568	0.000	0.000	Mean-reverting
$U_{youth-male}$ s.e.	.7758 .2393	0.009	0.003	.8597 .1412	0.000	0.000	.9295 .0810	0.000	0.000	.9451 .0583	0.000	0.000	Mean-reverting
$U_{youth-female}$ s.e.	.7707 .2085	0.004	0.003	.8332 .1263	0.000	0.000	.8971 .0739	0.000	0.000	.9628 .0621	0.000	0.000	Mean-reverting
$U_{adult-male}$ s.e.	.6856 .2195	0.011	0.008	.7779 .1296	0.000	0.000	.8823 .0756	0.000	0.000	.9199 .0537	0.000	0.000	Mean-reverting
$U_{adult-female}$ s.e.	1.0363 .1385	0.000	0.000	1.0077 .0917	0.000	0.000	1.0351 .0555	0.000	0.000	1.0183 .0505	0.000	0.000	Hysteresis

Spain has felt a great shock from the recent global economic crisis, and this shock has impacted adversely on the country's labour market. The high persistence of unemployment rates (and the underlying weaknesses of the labour market that lead to that) makes it necessary to implement policy measures aimed at increasing the speed of mean-reverting of all unemployment rates. These public intervention policies should also address more specifically youth and women unemployment rates, as these groups of workers endure even higher persistence and unemployment rates than the other groups of workers.

The high unemployment rates are not new in Spain and there have been several attempts to correct this failure of the labour market since the Statute of Workers (first major Spanish labour law) was enacted in 1980. The first labour market reforms (1984, 1992, 1993 and 1994) were aimed at promoting external labour flexibility through the generalization of temporary contracts. The primary objective of these reforms was to reduce the high rate of employment that characterized the Spanish economy at that time. The following reforms (1997, 2001 and 2006) sought to reduce the level of temporality, which was considered excessive and potentially detrimental to the Spanish competitiveness. This aim, however, was not met, and the high temporality has remained, along with the high structural unemployment and the low internal flexibility, a dominant feature of the Spanish labour market.

With the 2008 crisis, the main issue facing the Spanish government is to deal with the massive job losses that accompanied the economic decline and the urgent need to create new jobs. Since the onset of the financial crisis, the Spanish government has approved a package of measures to stimulate the economy¹ and positively affect the labour market and has undergone two new labour market reforms². These labour reforms (2010 and 2012) are intended to encourage companies to create stable employment, especially among young people, improve the training and employability of workers and increase external flexibility. More precisely, the measures contained in the reforms are focused on three issues. The first is to reduce the duality in the Spanish labour market by expanding the conditions under which the dismissal of permanent workers for objective reasons could be justified, reducing the severance pay of permanent contracts in certain circumstances or making the use of temporary contracts more restrictive. The second is to improve the adaptability of firms to market shocks by reforming the collective bargaining system and by favouring some practices of internal flexibility, such as reductions in working time. The third is to improve the employability of the young and the unskilled people by reforming vocational education and giving these workers work related skills (Wölf and Mora-Sanguinetti, 2011). It is too early to make a full assessment of the impact of the reforms, though recent data suggest that

¹ *Royal Decree-Law 9/2008 of 28 November, creating a State Fund of local investment and a special State fund for the revitalization of the economy and employment and approved extra funds to meet their financing, and Royal Decree-Law 13/2009 of 26 October establishing the State fund for employment and local sustainability.*

² *Law 35/2010 of 17 September with Urgent Measures for Reforming the Labor Market based on the Royal Decree-Law 10/2010 of 16 June with Urgent Measures for Reforming and the Labor Market, and Law 3/2012 of 6 July for Reforming the Labor Market based on the Royal Decree-Law 10/2010 of 16 June with Urgent Measures for Reforming and the Labor Market.*

the effects on employment are still limited. In this respect, in 2013 the OECD published a report which was commissioned by the Spanish government in order to provide an initial evaluation of the Spanish labour market reform. The OECD considers that the reform is “a significant step in the right direction” (p. 44). However, at the same time the OECD acknowledges the difficulty in evaluating the reform considering the short period that has elapsed and the need to further monitor the results.

V. Conclusions

This paper examines the behaviour of unemployment series across both age and gender in Spain during the period 1976q1-2012q4. It intends to provide empirical evidence on the validity of the hysteresis hypothesis and to test the degree of persistence of unemployment rates using fractional integration techniques. The results when using unit root test (with and without breaks) argue in favour of the hysteresis hypothesis. Empirical evidence suggests that there are structural breaks during the period under study. Breaks occur almost at the same time for all series. When considering the presence of two breaks, the first tends to occur in the second half of the '90s, between the years 1998-2001. This period is characterized by a reduction in the unemployment rate as a result of the implementation of policy measures, such as reducing interest rates and labour reforms aimed at increasing numerical flexibility. The second break occurs in the middle of the 2000s, between the years 2007-2009. These years coincide with the beginning of the financial crisis and the rising unemployment caused by the sharp slowdown in the construction sector. Broadly speaking, structural breaks appear earlier for men than for women and for young workers than for adult ones.

The results when using the fractional integration method show a high level of persistence in all series of unemployment, particularly in the female unemployment rate, in which a process of hysteresis is observed.

Given the degree of persistence of the unemployment series we may conclude that there is room for the policy intervention to affect the unemployment in Spain. In addition, our results suggest that the design of the public policy should take into account the differences in the dynamics of unemployment rates of men and women, as well as of young and adult workers. In this respect, since the onset of the economic crisis in 2008 the Spanish government has approved two reforms of the labour market, along with a set of policy measure to stimulate the economy. Although it is too early to make an evaluation of the effects of the reforms, it seems that the impact on employment is being modest for all groups of workers considered.

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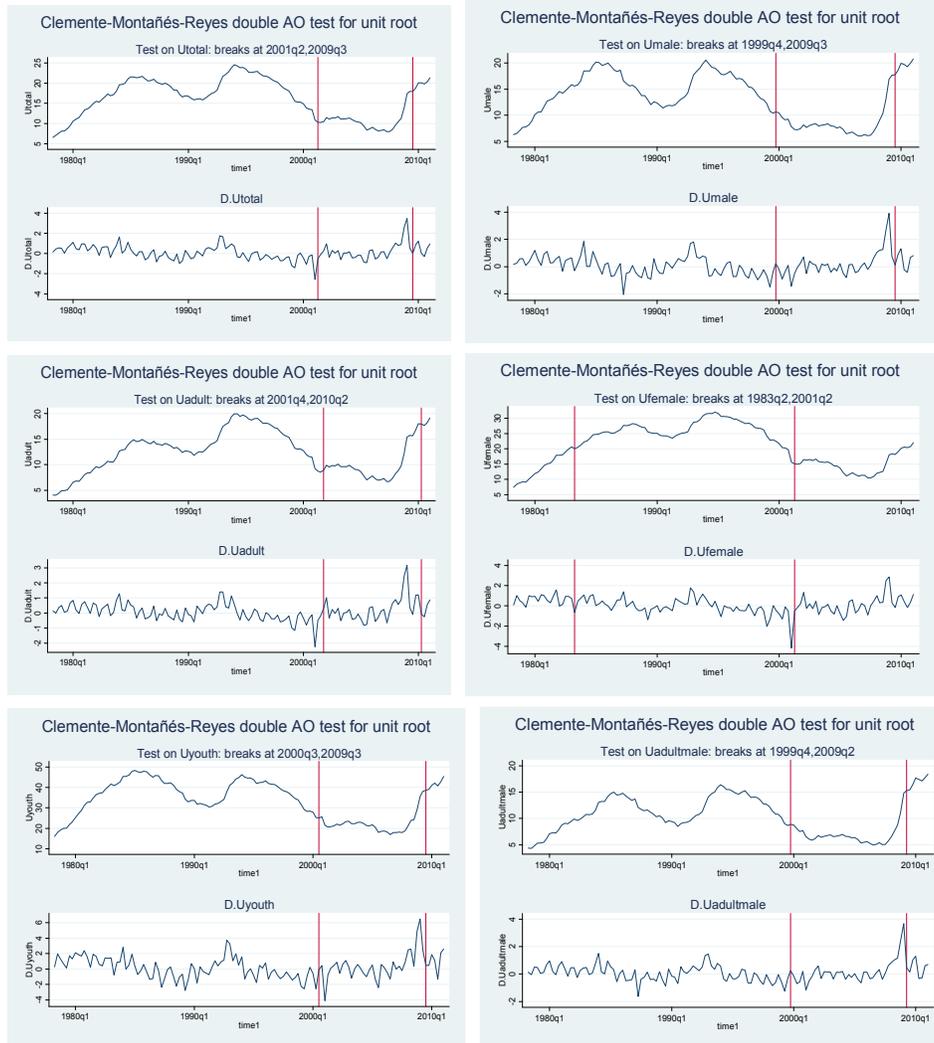
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Appendix

Figure A1

Clemente-Montañés-Reyes Tests: Additive Outlier with Two Breaks



Clemente-Montañés-Reyes Tests: Additive Outlier with Two Breaks (cont.)

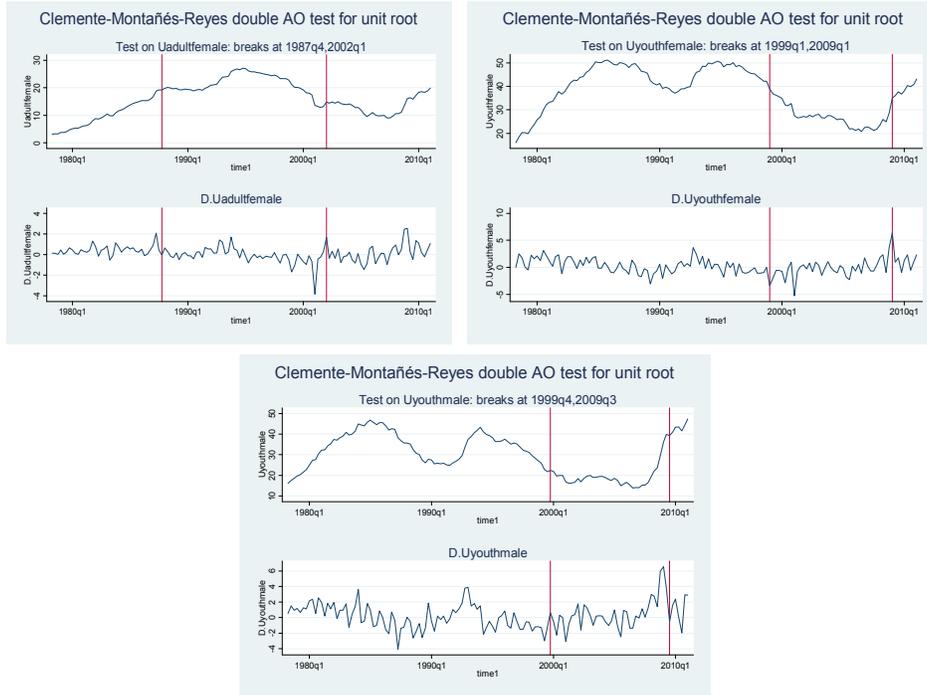
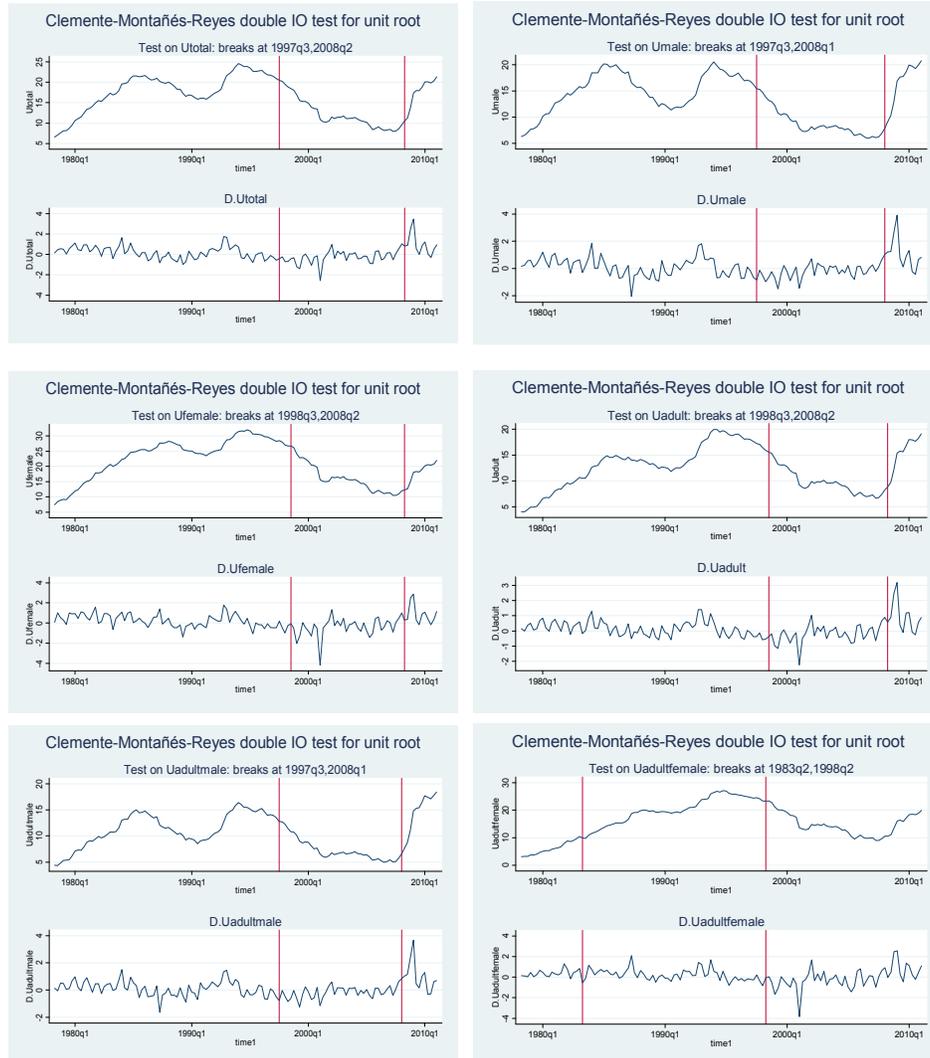


Figure A2

Clemente-Montañés-Reyes Tests: Innovative Outlier with Two Breaks



Clemente-Montañés-Reyes Tests: Innovative Outlier with Two Breaks (cont.)

