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Have European Unemployment Rates Converged?

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Abstract

Using different unit root statistics and the approach of Tomljanovich and Vogelsang (2002), we test for the existence of stochastic and $\beta-$convergence in the unemployment rates of a set of thirteen European countries. Using quarterly data for the period 1984:1-2005:4, we observe that there has taken place a convergence process in the majority of European unemployment rates. This process has become more intense since 1993.

Keywords: Unemployment Rate, European Union, Stochastic Convergence and β-convergence.

JEL Classification: C22, C52, E24, J60.

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1 Introduction

Throughout the last twenty years, a macroeconomic convergence process has taken place inside European countries, motivated mainly by the objective of reaching a single common currency. However, there exists certain consent around the statement that this convergence has not taken place in the different labour markets in terms of the labour force composition, productivity, wages, etc. Furthermore, in accordance with Saint-Paul (2004) and Blanchard (2006), since the mid-eighties, European countries have followed a diverging unemployment pattern.

Hence, United Kingdom has not suffered a persistent long-term unemployment, and countries like Denmark, Holland and Ireland have seen how their unemployment rates have diminished noticeably, being located even below the US unemployment rate. On the contrary, the four largest continental countries, France, Germany, Italy and Spain have settled in high average unemployment rates, although there are important differences among them[1]. Also, while Scandinavian countries escaped the increase of the unemployment in the seventies, they have experienced during the 1990s an unknown increase due to macroeconomic external shocks. Since then, unemployment rate has followed in general terms a descending trend although it has been slower in Finland. All these patterns can be observed in Table 1.

Nowadays, these disparities in the behavior of the unemployment rate are even more patent in such a way that Blanchard (2006) and Saint-Paul (2004) consider misleading the concept "European unemployment".

According with works like those of Blanchard (2006), Bean (1994), Layard et al. (1991), Nickell (1997, 2003), Nickell *et al.* (2005), Phelps (1994) and Saint-Paul (2004), initially, the origin of these differences were adverse shocks, such as the rise of the oil prices and the productivity fall, that produced an increase in the unemployment rates. However, after these shocks,

[1] In Spain, the unemployment rate has sharply fallen in the last years, but it continues being higher than in the rest of European countries. The unemployment rate in Germany has followed a rising process that starts up from some low previous rates to the process of reunification and that it shows important regional differences between the west and the east. The rates of Italy and France from principles of the years eighty have begun to rise but while the Italian rate shows regional elevated differences between the north area and south of the country, regional differences are not so ostensible in France.

discrepancies in the behavior of the unemployment among countries are caused by the differences in "labour market institutions". Nevertheless, in spite of the existence of appreciable differences in their European labour markets, in this work we analyze whether an approach or convergence in the unemployment rates of thirteen European countries can be observed or not.

Convergence is a key feature of the neo-classic growth framework. One can affirm that absolute convergence exists when the economies converge toward the same level of per capita output in a steady state. On the other hand, there is conditional β-convergence when the economies converge to different steady states[1].

In empirical terms, conditional β-convergence has been strongly supported across a broad group of developed and underdeveloped countries in the post World War II period[2]. In other cases, absolute β-convergence have been supported by regional studies; basically because most of the variables used in cross-country empirical studies to account for different steady states can reasonably be assumed to be constant across regions of the same countries. Such is the case of Barro and Sala-i-Martin (1995) and Carlino and Mills (1993) using US data sets. In these works, authors argue that empirical evidence suggests that the poorest regions present higher convergence rates compared to the richer countries, which in theoretical terms is the same conclusion as the neoclassical model of growth.

The number of works that study the convergence among the unemployment rates is reduced, especially when an international analysis is carried out, while the regional analysis inside a country is more extensive. Some examples are those of Armstrong and Taylor (2000), Avilés *et al.* (1995), Bayer and Juessen (2006), Blanchard and Katz (1992), Elhorst (2003), Llorente (2005), Martin (1997) or Pehkonen and Tervo (1998).

In this paper we adopt a time series focus following the work of Carlino and Mills (1993), which distinguishes between stochastic convergence and β-convergence. When there exits both types of convergence then we can say that a convergence process is taking place.

[1] For a more complete survey about other notions of convergence and growth models, see De La Fuente (1995, 1998).

[2] See Abramovitz (1988), Baumol (1986) and Barro (1991, 1997).

Applying these concepts and Tomljanovich and Vogelsang (2002) methodology to the European unemployment rates, our results show that there is a process of convergence among them, except in the case of Luxembourg, where we can only speak of deterministic convergence or conditional convergence, and the United Kingdom, where a process of divergence of its unemployment rate has taken place with regard to the European mean. Lastly, we point out that from 1993 this convergence (and divergence) process is accentuated in all the countries except for France and Italy, where it takes place in later dates, and Germany where it takes place starting from the reunification.

The rest of the work is organized as follows. Section 2 deals with data and methodology used. Section 3 presents empirical results and implications on stochastic and deterministic convergence. In section 4 the main conclusions are presented.

2 Data and Methodology

We analyze the convergence in the European unemployment rates of thirteen countries: Germany, Belgium, Denmark, Spain, Finland, France, Holland, Ireland, Italy, Luxembourg, Portugal, United Kingdom and Sweden, all them belonging to European Union, although Denmark, United Kingdom and Sweden are not included in the Euro area. We have used Standardized Unemployment Rates (SUR) from OECD with quarterly frequency for the period $1984Q1$ to $2005Q1$.

Convergence analysis requires variables expressed in relative terms with regard to a reference variable. Relative unemployment rates can be calculated as the difference in levels among unemployment rate of each country ($uc_{i,t}$) and the reference variable that will be the arithmetic mean of the thirteen countries of the sample ($um_{13,t}$). So, relative unemployment rate ($u_{i,t}$) for the country i can be calculated as: $u_{i,t} = uc_{i,t} - um_{13,t}$.

Following Carlino and Mills (1993), there will exist convergence if stochastic convergence and β-convergence are verified. The former type means that shocks only have a temporary effect. Using regional US data, they find no evidence of stochastic convergence without including a break in the trend of the series. Doing that, they show that three of eight US regions display stochastic convergence, indicating that at least part of the US is converging. The latter type means that poorer provinces are on average catching up to the national average. Finally, they add that the bulk of the US convergence took place before World War II.

In a related research, Loewy and Papell (1996) have extended these findings by testing for a unit root allowing for an unknown break date. They find evidence in support of stochastic convergence in seven out of eight US regions, but they ignore the β-convergence tests needed to make complete statements on US regional convergence.

Recently, Tomljanovich and Vogelsang (2002) contribute to this debate expanding the findings of Carlino and Mills (1993) and Loewy and Papell (1996). Their approach consists of using the new econometric tools suggested by Vogelsang (1997, 1998) and Bunzel (1998), which allow the researcher to estimate and perform inference on the parameters related to the trend function of the series. The most important fact of these econometric tools is that these statistics are robust to the presence of a unit root in the noise function of the time series.

This paper presents further empirical evidence about the existence of β-convergence in European countries. The estimates of the intercept and the slope of the trend function from unemployment time series suggest the existence of deterministic convergence, using unknown and known break dates.

Let $y_t = u_{i,t}$, which denotes the difference of the rate of unemployment of a country with regard to the average rate of the group. In a time series framework, β-convergence requires that regions with initial values above the average rate should grow slower than the rest of countries while regions below that average rate should grow faster than the rest of countries. This is equivalent to require that in the regions where y_t is initially positive, the growth rate of y_t should be negative and the converse also has to be true.

According to the requirements mentioned above, β-convergence can be analyzed estimating the parameters of the deterministic trend function of

y_t. Hence, suppose that y_t is modelled as:

$$y_t = \mu + \beta t + \epsilon_t \tag{1}$$

where u_t is a mean zero random process that is serially correlated, β represents the average growth of y_t over time and μ represents the initial level of y_t. Therefore, in the context of β-convergence, if $\mu > 0$ then $\beta < 0$ and if $\mu < 0$ then $\beta > 0$. Hence, the evidence on β-convergence can be obtained from estimates of the trend function of y_t.

However, the inference on estimates of μ and β is not straightforward because u_t is serially correlated and may be an integrated process of order one, denoted as I(1). For example, in their study, Carlino and Mills (1993) modelled u_t as an AR(2) process. Unfortunately, as argued by Tomljanovich and Vogelsang (2002), there are some pitfalls to writing y_t in this form. One inconvenience is the fact that parameters associated to the trend function in the autoregressive representation of y_t are nonlinear functions of μ, β and the structure of the correlation. On other hand, using an AR(2) representation may not be a good approximation of the true structure of the correlation in u_t. Furthermore, when u_t is an I(0) or an I(1) process, it will have different implications about the interpretation of the trend parameters in the autoregressive representation of y_t. More precisely, if u_t is an I(0) process, then inference about β can be obtained from the estimate of the slope. But if u_t is an I(1) process, this coefficient is zero and the inference has to be found from the estimate of the intercept in the autoregressive representation of y_t.

We will follow the approach proposed by Tomljanovich and Vogelsang (2002) which involves direct estimates of μ and β based on simple regressions. Their approach is based on a class of statistics proposed by Vogelsang (1997, 1998) and Bunzel (1998), which are robust to the case where u_t is either an I(0) or I(1) process. In what follows similar notation as in Tomljanovich and Vogelsang (2002) is used. The method consists of estimating two OLS regressions. The first regression is given by:

$$y_t = \mu_1 DU_{1t} + \beta_1 DT_{1t} + \mu_2 DU_{2t} + \beta_2 DT_{2t} + \epsilon_t, \tag{2}$$

where $DU_{1t} = 1$ if $t \leq T_B$ or 0 otherwise, $DU_{2t} = 1$ if $t > T_B$ or 0 otherwise, $DT_{1t} = t$ if $t \leq T_B$ or 0 otherwise and $DT_{2t} = t - T_B$ if $t > T_B$ or 0 otherwise. In this case, T_B is the date of a shift in the parameters of the trend function of y_t. This point is considered as unknown but it can be estimated from the data. Estimates where $\mu_1 > 0$ or $\mu_2 < 0$ indicate whether relative per-capita income is above or below average at times 1 and T_B, respectively. The parameters β_1 and β_2 are growth rates before and after the break, respectively.

The second regression, named the z_t regression, is given by:

$$z_t = \mu_1 DT_{1t} + \beta_1 SDT_{1t} + \mu_2 DT_{2t} + \beta_2 SDT_{2t} + S_t \tag{3}$$

where $z_t = \sum_{j=1}^{t} y_j$, $SDT_{it} = \sum_{j=1}^{t} DT_{ij}$, $S_t = \sum_{j=1}^{t} u_j$, for $i = 1, 2$ and DT_{it} was defined before. Hence, this regression is obtained calculating partial sums of y_t.

In terms of notation, let t_y and t_z denote the t-statistics for testing the null hypothesis that the individual parameters in the y_t and z_t regressions are zero. For the y_t regression, the appropriate modified t-statistic is simply $T^{-1/2}t_y$, where T is the sample size. On another side, for the z_t regression, the appropriate modified t-statistic is defined as $t - PS_T = T^{-1/2}t_z \exp(-bJ_T)$, where b is a constant (to be calculated) and J_T is multiplied by the Wald statistic for testing in the following OLS regression:

$$y_t = \mu_1 DU_{1t} + \beta_1 DT_{1t} + \mu_2 DU_{2t} + \beta_2 DT_{2t} + \sum_{i=2}^{9} c_i t^i + \epsilon_t \tag{4}$$

Note that the J_T-statistic is the unit root statistic proposed by Park and Choi (1988) and Park (1990) and it can be computed as:

$$\frac{RSS_Y - RSS_J}{RSS_J} \tag{5}$$

where RSS_Y is the residual sum of squares from regression (2), and RSS_J is the residual sum of squares from regression (4). Given a significance level for the test, the constant b can be chosen so that the critical values of the $t-PS_T$ statistics are the same whether u_t is I(0) or I(1). In consequence, the J_T modification results in t-statistics from the z_t regression that are robust to I(1) errors. Note that if $b = 0$, the distribution of $t - PS_T$ is different when u_t is I(0) compared to when u_t is I(1) given that in this situation the J_T modification has no effect. Hence, the use of $b = 0$ is recommended if the errors are known to be I(0) and we are certain that the I(0) asymptotic distribution is more accurate.

As Tomljanovich and Vogelsang (2002) mention, the J_T modification is not needed in the y_t regression since $T^{-1/2}t_y$ statistics have well-defined asymptotic distribution when u_t is I(1) and when u_t is I(0), the statistic $T^{-1/2}t_y$ converges to zero. Therefore, $T^{-1/2}t_y$ is a conservative test when the errors are I(0).

Asymptotic distributions for $T^{-1/2}t_y$ the and $t - PS_T$ statistics are non-standard and depend on the break date used in the regressions. In particular, the critical values depend on whether the break date is assumed to be known or unknown. In the last case, the break date has to be estimated from the data to avoid criticism of data mining (see Christiano, 1992). Selection method affects also the limiting distribution. Here, the same method used in Tomljanovich and Vogelsang (2002) is followed, which consists of taking a trimming from the sample, which is $(0.1T, 0.90T)$, with T as the sample size. By doing that, break dates near the start and end points of the sample are not considered. Then, for each regression, T^{-1} multiplied by the Wald statistic is calculated in order to test the joint hypothesis that $\mu_1 = \mu_2$ and $\beta_1 = \beta_2$. In other words, the null hypothesis is that there is no break in the trend function of the time series y_t. Critical values are taken from Vogelsang (1997) and they are reported at the end of each table.

3 Empirical Results

Firstly, we have used a set of unit root tests to verify the existence of stochastic convergence. In accordance with the results of the Augmented Dickey-

Fuller (Dickey and Fuller, 1979; Said and Dickey, 1984) and Phillips-Perron (Phillips and Perron, 1988) tests, the relative unemployment rates of Belgium, Denmark, Finland, France, Ireland, Italy, United Kingdom and Sweden reject the null hypothesis of a unit root. On the other hand, relative rates of Belgium, Denmark, France, Italy, Portugal and United Kingdom do not reject the null hypothesis of stationarity of Kwiatkowski-Phillips-Schmidt-Shin (1992). In summary, nine of the thirteen countries reject the existence of a unit root in their relative unemployment rates while the rest (Germany, Luxembourg, Holland and Spain) could not be considered stationary and, therefore, there will not be stochastic convergence. Nevertheless, DeJong et al. (1992) show that this kind of tests has some problems of power. For this reason, we proceed to use the Ng and Perron (2001) tests on the non-stationary series, although none of them are able to reject the null hypothesis of a unit root.

However, it is well known[3] that the failure of unit root (and stationarity) tests can be caused by an erroneous specification of the deterministic trend. The presence of structural changes in the time series can cause a spurious non-rejection of the null hypothesis. As consequence, it is necessary to keep in mind the inclusion of, at least, one break inside the unit root tests. We have applied three types of unit root tests with one structural change: Zivot and Andrews (1992), Perron and Rodríguez (2003), and Lee and Strazicich (2004) tests on the non-stationary relative unemployment rates (Germany, Luxembourg, Holland and Spain). Two of them, Holland and Spain, reject the null hypothesis of a unit root and it can be considered that there is stochastic convergence.

Finally, we proceed to apply the unit root tests with two structural changes of Lumsdaine and Papell (1997) and Lee and Strazicich (2003) on Germany and Luxembourg. Although Germany rejects the null, in the case of Luxembourg we cannot verify the existence of stochastic convergence which can be interpreted as shocks, suffered by the relative unemployment rate of this country, have permanent effects and perpetuate the differences between the unemployment rate of Luxembourg and the mean of the thirteen

[3] See Perron (1989), Campbell and Perron (1990) or Montañés and Reyes (1998)

analyzed countries.

What can explain the different behaviour of the relative unemployment rate of Luxembourg and the rest of the European countries? Although there are many reasons, following Palacio and Álvarez (2004), we pointed out the hiring structure of this country, which is radically different to the rest of European countries. While Holland, Sweden, Spain, Germany, the United Kingdom or Denmark have chosen more flexible hiring forms (partial or temporary contracts), in Luxembourg both types are little used, which can justify differences in its long term unemployment rate.

Secondly, to continue with the analysis of the β-convergence we calculate the tests statistics of Vogelsang (1997, 1998) described previously[4]. If we can establish β-convergence for any of the twelve countries that satisfy stochastic convergence, then we have established convergence.

In the regressions discussed in the previous section, the key to this question lies in the point estimates of the intercepts and slopes. The β-convergence tests check if parameters μ_i and β_i $(i = 1, 2)$ are significantly different from zero and negatively related. Hence, β-convergence implies that if $\mu_1 > 0$ then $\beta_2 < 0$ and that if $\mu_1 < 0$ then $\beta_2 > 0$. This negative relationship is vital to the analysis because convergence indicates that, initially, countries with higher levels of unemployment (with a positive intercept) grow at a slower rate (or decrease faster) than regions with a lower unemployment rate, which can be understood as a "catching-up" process in levels.

Nevertheless, before going on, following DeJuan and Tomljanovich (2005) it is necessary to point out two boundaries of this methodology. In the first place, this methodology does not possess any forecast power on the trend that the relative unemployment rate will follow. Furthermore, due to the lineal specification of the trend, any value statistically significant of β_i $(i = 1, 2)$ implies divergence in some moment in the future for any region or country initially above or below the reference value, for what the analysis is limited to the sample period where adjusting a lineal trend to data is reasonable. In second place, contrary to studies of cross-section convergence, there is not

[4]Estimations were performed using the Gauss code supplied by Tim Vogelsang.

any parameter that allows us to estimate the convergence speed.

Table 2 shows the estimated break point for each country[5]. In accordance with the first model type, it is clear that most of break points are detected around 1991 (Holland and Portugal) and 1993 (Belgium, Denmark, Finland, Ireland, Luxembourg, Spain, Sweden and United Kingdom), while in the remaining countries (Germany, France and Italy) break dates are completely different. It is highly interesting that the most important continental economies show rupture points far away from the rest of countries. This can be interpreted as a fact that these labour markets are more affected by their own national shocks[6].

Tables 2, 3.1, 3.2 and 4 include the results obtained using the $t - PS_T$ without J_T correction, the $t - PS_T$ with J_T correction and the $T^{-1/2}t_y$, respectively. In each table, results are calculated considering an unknown and known break date in the regressions.

It is well know that statistics calculated with unknown break point have lower power. This means that using a known break date may increase the power in a such way that stronger evidence in favour of convergence, if there exists, may be obtained. In this sense, and following other papers like those of Carlino and Mills (1993), Tomljanovich and Vogelsang (2002), DeJuan and Tomljanovich (2005) and Rodríguez (2006), we perform the same set

[5] The selected break points in Tables 2 to 4, are different than those dates selected by the unit root statistics which used the method infimum to select the break point. As it is well known, the break date selected by this method is not a consistent estimator of the true value. For further details, see Vogelsang and Perron (1998).

[6] The estimated structural change date in Germany takes place at the reunification moment. Although in a first moment it turns up into a decline of the relative unemployment rate, further on we find an increase of that rate. Likewise, Bertola and Garibaldi (2006) pointed out that 1998 is the beginning of a quite remarkable unemployment decline in Italy, which may be partly linked with the slow institutional reform process that started in the second half of the 1990s. Finally, from the beginning of 1997, unemployment falls in France sharply as a result of the combination of high employment and relative modest output growth. Different studies consider that the French unemployment decrease is caused by some structural changes in his labour market. Decressin et al. (2001) suggest that job-rich growth in France may have been caused in part by changes in the basic parameters of the wage setting mechanism resulting in a rightward shift in a labour supply like relationship between real wages and employment. However, Crépon and Desplatz (2001) focus on the positive labour demand effects of the cuts in firm's social security contributions enacted by the French government beginning in 1993.

of results fixing the break date at $1993Q1$[7]. Therefore, each Table includes the results of the model with one unknown and a known break.

Table 2 also presents estimates of μ and β before and after the break date from regression z_t without J_T correction. According to Vogelsang and Tomljanovic (2002) and DeJuan and Tomljanovic (2005), J_T correction should not be necessary for all countries (that follow a stationary process) except Luxembourg. Nevertheless, it is also true that the results obtained in Table 2 need to be considered with caution[8], because they are obtained assuming I(0) disturbances in the residuals, but even considering stationary errors, a high persistence in the residuals can "inflate" spuriously $t - PS_T$ statistics.

Contrary to Table 2, the results of Tables 3.1, 3.2 and 4 have been corrected for the possibility that a unit root is present in the errors of the process. Table 3 contains the same coefficients than Table 2, but J_T correction has been used. In this case, $t-PS_T$ statistics are smaller and, therefore, they are more conservative. Table 4 presents the results using y_t regression and it also provides statistic values robust to the presence of unit roots.

There are important differences between the unknown break date model and the fixed point of rupture model ($1993Q1$) in some countries which make necessary a differentiated analysis of both models. According to unknown break model in Table 2, estimates of μ_1 are statistically different from zero for most of the countries considered, except Italy, Holland and Portugal, which implies that in $1984Q1$ the unemployment rate in the other countries was significantly different from the thirteen countries average. In particular, the estimate of μ_1 is positive for the group of countries formed by Belgium, France, Ireland, Spain and United Kingdom, which means that their unemployment rates are higher than the average rate. On the contrary,

[7] We have chosen this break date for several reasons. In first place, as can be seen in Table 2, the break point of the majority of countries is around 1993. In second place, this date represents the moment in which the European Single Market goes into effect and the free circulation of goods, services and people is allowed among countries belonging to the EU. In third place, fluctuation bands of the European Monetary System (EMS) were enlarged at August of that year. In fourth place, the Maastricht Treaty was signed in November the 1^{st} (although Finland and Sweden didn't belong to the EU until 1995), and finally, 1993 can be considered the beginning of the end of the economic recession.

[8] See Vogelsang and Tomljanovic (2002), DeJuan and Tomljanovic (2005) and Rodríguez (2006).

it is negative in the cases of Denmark, Germany, Luxembourg and Sweden, which means that their unemployment rates are lower than the average rate. These results coincide totally with Tables 3-1, 3-2 and 4 estimations and a visual analysis of Figure 1.

Estimates of β_1 in Table 2, 3-1 and 3-2 are statistically significant in six countries. Belgium, Spain, Portugal and the United Kingdom present a downward trend, while calculated trend in Denmark and Luxembourg is positive. Coefficients μ_1 and β_1 are inversely related in Belgium, Denmark, Germany, Luxembourg, Portugal, Spain, Sweden and United Kingdom which can be interpreted as a β-convergence process in the European unemployment rates before the break date. On the contrary in France, Ireland and Finland the evidence shows a process of divergence[9]. Lastly, we cannot extract conclusions for Italy and Holland[10].

According to the coefficients μ_2 and β_2 and the combination of the results of Tables 2 to 4, we see that these coefficients are negatively related for all countries except the United Kingdom and Sweden, which indicates that in the post-break period took place a convergence process in the majority of European unemployment rates. However, in Sweden, according to the value of their coefficients and their graphic representation (Figure 1), it seems that during the post-break period this convergence had already taken place which can be considered like an equilibrium situation.

Hence, United Kingdom is the only country with an unemployment rate that spreads to diverge during the sample period. In our opinion, this can be the result of two factors: firstly, UK is a non-continental country, and secondly, it doesn't belong to the Euro area.

[9] In the case of Finland and Ireland the evidence is weaker. Attending to $t - PS_T$ statistics without and with J_T correction a process of divergence takes place; however, $T^{-1/2}t_y$ statistics suggests a convergence process. This discrepancy, in our opinion, is the result of the erratic behaviour of relative rates. Nevertheless, its graphic representation shows an increase in the national unemployment rates overcoming the European mean.

[10] According to the magnitudes of the coefficients and the graphic representation of Holland, we can affirm that during this period its relative unemployment rate was in an equilibrium situation. In the case of Italy, it is more difficult to achieve a similar conclusion because the magnitude of β_1 is much bigger. However, seeing the very superior magnitude of β_2, and that the fluctuations of the Italian unemployment rate around the European average rate although they are quite wide, we can think that during this period the Italian relative unemployment rate stayed in a certain equilibrium.

Table 5 presents a summary of all the results of Tables 2 to 4. In this Table, a (large) C denotes that the estimates are consistent with β-convergence, that is, $\mu > 0$ and $\beta < 0$, or, $\mu < 0$ and $\beta > 0$. In this case we consider that both estimates are statistically significant at least at the 10.0% level. A (lower case) c denotes point estimates consistent with β-convergence but only with one coefficient statistically significant at least at the 10.0% level. The D and (lower case) d denote estimates consistent with divergence, where D signifies that both coefficients are statistically significant and d signifies that only one coefficient is statistically significant at least at 10.0% level. An E denotes point estimates that are small in magnitude and not statistically different from zero. Such point estimates suggest that β-convergence has already occurred. It is exactly the same notation as used in Tomljanovich and Vogelsang (2002). Note however, that the criteria used to identify a coefficient as "small" in magnitude is not clear. Observing the results found in Tomljanovich and Vogelsang (2002), it seems that they are assuming that a coefficient is small in magnitude if it is not larger than around $|0.120|$. In the works of DeJuan and Tomljanovic (2005) and Rodríguez (2006), these authors consider as a small magnitude a coefficient not larger than $|0.200|$. In our case, we believe that a small value of the coefficient can be lower than $|1.200|$. This magnitude can seem quite high, but in relative terms, compared with the rest of estimate coefficients it is not. Finally, a (lower case) u means that no conclusion is possible to be advanced about the province using all information in Tables 2 to 4. This situation is characterized when coefficients are not significant but they are not small in magnitude to be considered as an equilibrium situation (E).

According to the results of the second model (known break point), we have found a similar behavior, although there exists some differences. In pre-break period, Germany and Holland, contrary to the previous model, diverge. During the post-break period, the main differences we have found are that the relative unemployment rate of France presents a strong evidence of divergence in Table 2, and in the case of Italy it is not possible to reach a conclusion.

Therefore, we see that in general terms the main results are still valid with the fixing break date at $1993Q1$, although we find some changes in the more important continental economies. Hence, Germany passes from a divergence pre-break process to a convergence post-break process, which can be interpreted as a fact that the German reunification of 1990 is not the cause (at least not immediate) of the unemployment rate increase in Germany. The effects of the reunification pushed up German growth to high levels in 1990 and 1991. Once the spending impulse of the reunification had petered out in mid 1992, Germany also went into a delayed recession[11].

Changes in the relative unemployment rate of France and Italy in the second model are due, in our opinion, to the unemployment worsening in these countries in 1993, which has not been possible to compensate with the convergence process that began at the end of 1996 and 1998 respectively. The negative behavior of these three countries contrasts with England, the other great European economy, that from 1993 and on has suffered a reduction of its relative unemployment rate.

4 Conclusions

This study presents further empirical evidence about the notion of β-convergence for thirteen European countries using quarterly unemployment rate data covering the period 1984:1-2005:4. Using a time series methodology with statistics recently proposed by Vogelsang (1997, 1998) and Bunzel (1998), which are robust to the presence of I(0) or I(1) disturbances, we can affirm that, in spite of the existent differences among the different countries of the sample, there exists deterministic convergence between unemployment rates in Europe during the sample period analyzed.

Hence, Belgium, Denmark, Germany, Luxembourg, Holland, Portugal and Sweden; countries that have traditionally had lower rates than the European average, from 1993 have suffered an increase of its relative rate, overcoming the European mean in the case of Belgium and especially of Germany. We can also say that Spain, Ireland or Finland, starting in 1993

[11] The decline in German GDP was strong during 1992 and 1993. In addition to this, according with the German Federal Ministry of Finance, in the nineties a sweeping recovery measured by the output gap (the difference between Potential Output and GDP), which was mostly negative until the end of 1999, was very late in arriving, which provoked a lower decreased of the unemployment rate in Germany with respect the European mean.

from larger unemployment rates than the European average have experienced a process of convergence, reducing their relative unemployment rate getting an even lower unemployment rate than the European mean as the Irish case.

In addition to this, United Kingdom is the unique country in which a divergence process has taken place from 1993. We have attributed this behavior to the extra-continental character of this country and his negative to belong to the Euro. Likewise, the relative unemployment rate of Luxembourg does not verify a stochastic convergence process, something that we have attributed to the structure of its labour market, although during the sample period analyzed a catching-up process (conditional convergence) has taken place.

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Table 1. Annual Unemployment Rates (%)

	1985		1990		1995		2000		2004	
Belgium	10.14	(10)	6.55	(7)	9.69	(8)	6.88	(9)	8.37	(9)
Denmark	6.61	(4)	7.17	(9)	6.76	(3)	4.34	(5)	5.50	(5)
Finland	6.05	(3)	3.16	(3)	15.22	(12)	9.75	(11)	8.91	(10)
France	9.66	(9)	8.52	(10)	11.07	(9)	9.09	(10)	9.59	(12)
Germany	7.17	(5)	4.77	(4)	8.01	(5)	7.17	(8)	9.53	(11)
Ireland	16.81	(12)	13.44	(13)	12.28	(11)	4.25	(4)	4.51	(1)
Italy	8.1	(7)	8.87	(11)	11.16	(10)	10.12	(12)	8.02	(8)
Luxembourg	2.88	(2)	1.65	(1)	2.86	(1)	2.32	(1)	5.10	(4)
Holland	7.87	(6)	5.85	(6)	6.56	(2)	2.86	(2)	4.55	(2)
Portugal	9.14	(8)	4.77	(5)	7.26	(4)	4.01	(3)	6.66	(7)
Spain	17.78	(13)	12.98	(12)	18.43	(13)	11.08	(13)	10.60	(13)
Sweden	2.87	(1)	1.73	(2)	8.82	(7)	5.62	(7)	6.32	(6)
United Kingdom	11.22	(11)	6.88	(8)	8.47	(6)	5.35	(6)	4.67	(3)
European Mean	8.95		6.64		9.74		6.37		7.10	

Table 2. Empirical results using the z_t regression and $t-PS_T$ statistics without J_T correction; Regression: $z_t = \mu_1 DT_{1t} + \beta_1 SDT_{1t} + \mu_2 DT_{2t} + \beta_2 SDT_{2t} + S_t$

Country	Known Break Date, $T_B = 1993Q1$				Unknown Break Date				
	$\hat{\mu}_1$	$\hat{\beta}_1$	$\hat{\mu}_2$	$\hat{\beta}_2$	$\hat{\mu}_1$	$\hat{\beta}_1$	$\hat{\mu}_2$	$\hat{\beta}_2$	$\hat{T}_B$
	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	
Belgium	2.346**	-9.912**	-0.658*	5.065**	2.321**	-9.615**	-0.170	3.936**	1994Q1
	(4.674)	(-3.201)	(-1.098)	(2.026)	(6.813)	(-5.003)	(-0.325)	(1.646)	
Denmark	-3.590**	13.013**	-3.358**	3.943	-3.437**	11.649**	-3.730**	5.587*	1993Q3
	(-3.171)	(1.863)	(-2.486)	(0.699)	(-3.765)	(2.165)	(-3.021)	(1.035)	
Finland	-4.232**	10.636**	7.122**	-13.430**	-2.782**	-2.252	6.584**	-9.929**	1993Q3
	(-2.392)	(0.974)	(3.374)	(-1.524)	(-3.504)	(-0.405)	(9.606)	(-3.863)	
France	0.680	3.361*	1.482**	3.696*	0.942**	1.679	2.882**	-1.525	1996Q4
	(1.009)	(0.808)	(1.843)	(1.101)	(2.693)	(1.045)	(2.715)	(-0.230)	
Germany	-1.701**	-1.681	-2.437**	11.697**	-2.037**	1.543	-3.359**	11.354**	1990Q4
	(-4.082)	(-0.654)	(-4.902)	(5.635)	(-4.024)	(0.387)	(-10.142)	(9.894)	
Ireland	7.576**	0.705	3.991**	-17.645**	7.652**	0.044	3.637**	-17.018**	1993Q2
	(7.871)	(0.119)	(3.475)	(-3.680)	(8.592)	(0.008)	(3.214)	(-3.521)	
Italy	-0.413	6.571	0.834	6.130	0.197	2.611	4.541*	-12.967	1998Q1
	(-0.249)	(0.641)	(0.421)	(0.741)	(0.256)	(0.801)	(1.394)	(-0.536)	
10.0% critical value	±0.854	±0.683	±1.030	±0.908	±1.570	±1.330	±1.140	±0.936	
5.0% critical value	±1.120	±0.883	±1.350	±1.200	±2.190	±1.760	±1.500	±1.270	

** and * denote significance at the 5% and 10% level using a one-tailed test. Values in parentheses are the $t-PS_T$ statistics using $b=0$. The last two rows report the 10% and 5% asymptotic I(0) critical values.

Table 2 (continued). Empirical results using the z_t regression and $t - PS_T$ statistics without J_T correction; Regression:

$$z_t = \mu_1 DT_{1t} + \beta_1 SDT_{1t} + \mu_2 DT_{2t} + \beta_2 SDT_{2t} + S_t$$

Country	Known Break Date, $T_B = 1993Q1$				Unknown Break Date				
	$\hat{\mu}_1$	$\hat{\beta}_1$	$\hat{\mu}_2$	$\hat{\beta}_2$	$\hat{\mu}_1$	$\hat{\beta}_1$	$\hat{\mu}_2$	$\hat{\beta}_2$	$\hat{T}_B$
	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	
Luxembourg	-6.111**	1.896**	-8.280**	13.049**	-6.264**	3.238**	-8.326**	12.366**	1992Q3
	(-19.901)	(1.001)	(-22.596)	(8.531)	(-23.434)	(1.871)	(-29.647)	(11.024)	
Holland	-0.191	-4.323**	-4.156**	1.718	-0.583	-0.770	-3.807**	0.439	1991Q4
	(-0.346)	(-1.268)	(-6.300)	(0.624)	(-1.101)	(-0.208)	(-8.323)	(0.256)	
Portugal	0.815**	-12.761**	-3.722**	5.919**	0.702	-11.829**	-4.058**	6.061**	1991Q4
	(1.618)	(-4.106)	(-6.191)	(2.359)	(1.175)	(-2.825)	(-7.862)	(3.131)	
Spain	9.146**	-9.205**	9.931**	-15.291**	9.146**	-9.205**	9.931**	-15.291**	1993Q1
	(15.289)	(-2.494)	(13.911)	(-5.130)	(15.289)	(-2.494)	(13.911)	(-5.130)	
Sweden	-6.626**	6.674**	0.364	-3.497*	-6.516**	5.718	0.228	-2.937	1992Q4
	(-9.204)	(1.503)	(0.423)	(-0.975)	(-8.868)	(1.232)	(0.277)	(-0.874)	
United Kingdom	2.299**	-4.973**	-1.114*	-1.357	2.334**	-5.352*	-1.441**	-0.257	1993Q4
	(3.187)	(-1.117)	(-1.294)	(-0.378)	(4.199)	(-1.670)	(-1.802)	(-0.072)	
10.0% critical value	±0.854	±0.683	±1.030	±0.908	±1.570	±1.330	±1.140	±0.936	
5.0% critical value	±1.120	±0.883	±1.350	±1.200	±2.190	±1.760	±1.500	±1.270	

** and * denote significance at the 5% and 10% level using a one-tailed test. Values in parentheses are the $t - PS_T$ statistics using $b = 0$. The last two rows report the 10% and 5% asymptotic I(0) critical values.

Table 3. Empirical results using the z_t regression and $t - PS_T$ statistics with J_T correction; Regression: $z_t = \mu_1 DT_{1t} + \beta_1 SDT_{1t} + \mu_2 DT_{2t} + \beta_2 SDT_{2t} + S_t$

	Known Break Date, $T_B = 1993Q1$				Unknown Break Date				
	$\hat{\mu}_1$	$\hat{\beta}_1$	$\hat{\mu}_2$	$\hat{\beta}_2$	$\hat{\mu}_1$	$\hat{\beta}_1$	$\hat{\mu}_2$	$\hat{\beta}_2$	$\hat{T}_B$
	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	
	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	
Belgium	2.346**	-9.912**	-0.658	5.065	2.321**	-9.615**	-0.170	3.936*	1994Q1
	(3.112)	(-0.924)	(-0.215)	(0.616)	(6.143)	(-3.646)	(-0.215)	(1.216)	
	(3.307)	(-1.332)	(-0.330)	(0.860)	(6.239)	(-4.002)	(-0.240)	(1.323)	
Denmark	-3.590**	13.013*	-3.358*	3.943	-3.437**	11.649*	-3.730**	5.587	1993Q3
	(-2.408)	(0.804)	(-0.826)	(0.312)	(-3.392)	(1.575)	(-1.991)	(0.763)	
	(-2.509)	(1.030)	(-1.101)	(0.392)	(-3.446)	(1.730)	(-2.220)	(0.831)	
Finland	-4.232*	10.636	7.122	-13.430	-2.782**	-2.252	6.584**	-9.929**	1993Q3
	(-0.844)	(0.040)	(0.052)	(-0.072)	(-3.353)	(-0.354)	(8.059)	(-3.398)	
	(-0.986)	(0.103)	(0.155)	(-0.170)	(-3.375)	(-0.369)	(8.437)	(-3.522)	
France	0.680	3.361	1.482	3.696	0.942*	1.679	2.882	-1.525	1996Q4
	(0.219)	(0.008)	(0.004)	(0.013)	(1.859)	(0.337)	(0.617)	(-0.078)	
	(0.275)	(0.030)	(0.020)	(0.044)	(1.965)	(0.471)	(0.908)	(-0.106)	
Germany	-1.701**	-1.681	-2.437**	11.697**	-2.037**	1.543	-3.359**	11.354**	1990Q4
	(-3.398)	(-0.373)	(-2.352)	(3.294)	(-3.742)	(0.311)	(-7.588)	(8.003)	
	(-3.492)	(-0.440)	(-2.849)	(3.829)	(-3.783)	(0.331)	(-8.185)	(8.493)	
Ireland	7.576*	0.705	3.991	-17.645	7.652*	0.044	3.637	-17.018	1993Q2
	(1.011)	(0.000)	(0.001)	(-0.009)	(1.197)	(0.000)	(0.001)	(-0.011)	
	(1.374)	(0.001)	(0.008)	(-0.049)	(1.607)	(0.000)	(0.009)	(-0.055)	
Italy	-0.413	6.571	0.834	6.130	0.197	2.611	4.541	-12.967	1998Q1
	(-0.007)	(0.000)	(0.000)	(0.000)	(0.223)	(0.526)	(0.802)	(-0.358)	
	(-0.012)	(0.000)	(0.000)	(0.000)	(0.228)	(0.595)	(0.927)	(-0.401)	
10.0% critical value	±0.854	±0.683	±1.030	±0.908	±1.570	±1.330	±1.140	±0.936	
5.0% critical value	±1.120	±0.883	±1.350	±1.200	±2.190	±1.760	±1.500	±1.270	

Table 3 (continued). Empirical results using the z_t regression and $t-PS_T$ statistics with J_T correction; Regression $z_t = \mu_1 DT_{1t} + \beta_1 SDT_{1t} + \mu_2 DT_{2t} + \beta_2 SDT_{2t} + S_t$

	Known Break Date, $T_B = 1993Q1$				Unknown Break Date				
	$\hat{\mu}_1$	$\hat{\beta}_1$	$\hat{\mu}_2$	$\hat{\beta}_2$	$\hat{\mu}_1$	$\hat{\beta}_1$	$\hat{\mu}_2$	$\hat{\beta}_2$	$\hat{T}_B$
	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	(5% t-stat)	
	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	(10% t-stat)	
Luxembourg	-6.111**	1.896*	-8.280**	13.049**	-6.264**	3.238*	-8.326**	12.366**	1992Q3
	(-18.182)	(0.759)	(-15.739)	(6.549)	(-22.344)	(1.618)	(-24.503)	(9.590)	
	(-18.429)	(0.824)	(-17.297)	(7.053)	(-22.504)	(1.689)	(-25.753)	(9.972)	
Holland	-0.191	-4.323	-4.156*	1.718	-0.583	-0.770	-3.807*	0.439	1991Q4
	(-0.213)	(-0.288)	(-0.903)	(0.151)	(-0.689)	(-0.050)	(-1.274)	(0.065)	
	(-0.229)	(-0.446)	(-1.499)	(0.225)	(-0.739)	(-0.076)	(-2.079)	(0.095)	
Portugal	0.815**	-12.761**	-3.722**	5.919**	0.702	-11.829**	-4.058**	6.061**	1991Q4
	(1.368)	(-2.462)	(-3.167)	(1.445)	(1.091)	(-2.257)	(-5.856)	(2.525)	
	(1.403)	(-2.862)	(-3.772)	(1.658)	(1.103)	(-2.411)	(-6.324)	(2.682)	
Spain	9.146**	-9.205**	9.931**	-15.291**	9.146**	-9.205**	9.931**	-15.291**	1993Q1
	(14.389)	(-2.072)	(10.911)	(-4.296)	(14.389)	(-2.072)	(10.911)	(-4.296)	
	(14.520)	(-2.188)	(11.625)	(-4.515)	(14.520)	(-2.188)	(11.625)	(-4.515)	
Sweden	-6.626**	6.674	0.364	-3.497	-6.516**	5.718	0.228	-2.937	1992Q4
	(-5.795)	(0.366)	(0.066)	(-0.252)	(-6.067)	(0.386)	(0.061)	(-0.288)	
	(-6.210)	(0.555)	(0.108)	(-0.368)	(-6.421)	(0.544)	(0.090)	(-0.393)	
United Kingdom	2.299**	-4.973*	-1.114	-1.357	2.334**	-5.352*	-1.441*	-0.257	1993Q4
	(2.851)	(-0.795)	(-0.828)	(-0.272)	(3.980)	(-1.418)	(-1.454)	(-0.061)	
	(2.899)	(-0.879)	(-0.930)	(-0.299)	(4.012)	(-1.488)	(-1.538)	(-0.064)	
10.0% critical value	±0.854	±0.683	±1.030	±0.908	±1.570	±1.330	±1.140	±0.936	
5.0% critical value	±1.120	±0.883	±1.350	±1.200	±2.190	±1.760	±1.500	±1.270	

** and * denote significance at hte 5% and 10% level using a one-tailed test. Values in parentheses are the$t-PS_T$ statistics with the first appropriate for a 10% test and the second appropriate for a 5% test. The last two rows report the 10% and 5% asymptotic critical values. The $b's$ used to compute the statistics can be found in Vogelsang (1997).

Table 4. Empirical results using the y_t regression and $T^{-1/2}t_y$; Regression:
$y_t = \mu_1 DU_{1t} + \beta_1 DT_{1t} + \mu_2 DU_{2t} + \beta_2 DT_{2t} + \epsilon_t$

	Known Break Date, $T_B = 1993Q1$				Unknown Break Date				
	$\hat{\mu}_1$ (t-stat)	$\hat{\beta}_1$ (t-stat)	$\hat{\mu}_2$ (t-stat)	$\hat{\beta}_2$ (t-stat)	$\hat{\mu}_1$ (t-stat)	$\hat{\beta}_1$ (t-stat)	$\hat{\mu}_2$ (t-stat)	$\hat{\beta}_2$ (t-stat)	$\hat{T}_B$
Belgium	2.312**	-9.606**	-0.684	4.905	2.269**	-9.300**	-0.205	3.936	1994Q1
	(1.787)	(-1.618)	(-0.605)	(1.221)	(2.016)	(-1.992)	(-0.189)	(0.937)	
Denmark	-3.202**	10.301*	-2.931	2.683	-3.084**	9.412	-3.330	4.153	1993Q3
	(-1.050)	(0.736)	(-1.100)	(0.283)	(-1.126)	(0.789)	(-1.325)	(0.446)	
Finland	-4.766**	14.581*	6.376	-10.564	-3.348**	2.770	5.869	-7.725	1993Q3
	(-1.107)	(0.738)	(1.694)	(-0.790)	(-0.969)	(0.152)	(2.207)	(-0.901)	
France	0.662*	3.558	1.559	2.937	0.914**	1.727	2.917*	-1.546	1996Q4
	(0.485)	(0.568)	(1.308)	(0.693)	(0.983)	(0.566)	(2.478)	(-0.256)	
Germany	-1.723**	-1.460	-2.410*	11.303**	-1.969**	0.911	-3.229**	10.809**	1990Q4
	(-1.442)	(-0.266)	(-2.309)	(3.047)	(-1.591)	(0.122)	(-3.773)	(4.212)	
Ireland	7.806**	-1.457	4.203*	-17.191**	7.884**	-2.058	3.879	-16.709**	1993Q2
	(3.170)	(-0.129)	(1.953)	(-2.248)	(3.286)	(-0.192)	(1.805)	(-2.144)	
Italy	-0.348	6.256	1.338	2.759	0.013	3.324	4.392	-12.529	1998Q1
	(-0.100)	(0.392)	(0.441)	(0.256)	(0.006)	(0.509)	(1.394)	(-0.660)	
10.0% critical value	±0.389	±0.676	±1.820	±1.560	±0.671	±1.470	±2.370	±1.480	
5.0% critical value	±0.504	±0.887	±2.390	±2.040	±0.875	±2.000	±3.000	±2.010	

** and * denote significance at the 5% and 10% level using a one-tailed test. Values in parentheses are the $T^{-1/2}t_y$statistics. The last two rows report the 10% and 5% asymptotic critical values.

Table 4 (continued). Empirical results using the y_t regression and $T^{-1/2}t_y$; Regression: $y_t = \mu_1 DU_{1t} + \beta_1 DT_{1t} + \mu_2 DU_{2t} + \beta_2 DT_{2t} + \epsilon_t$

	Known Break Date, $T_B = 1993Q1$				Unknown Break Date				
	$\hat{\mu}_1$ (t-stat)	$\hat{\beta}_1$ (t-stat)	$\hat{\mu}_2$ (t-stat)	$\hat{\beta}_2$ (t-stat)	$\hat{\mu}_1$ (t-stat)	$\hat{\beta}_1$ (t-stat)	$\hat{\mu}_2$ (t-stat)	$\hat{\beta}_2$ (t-stat)	$\hat{T}_B$
Luxembourg	-5.905**	0.387	-8.021**	12.207**	-6.072**	1.721	-8.101**	11.726**	1992Q3
	(-4.831)	(0.069)	(-7.509)	(3.216)	(-5.285)	(0.309)	(-8.482)	(3.597)	
Holland	0.083	-6.389*	-3.989**	1.733	-0.354	-2.733	-3.781**	0.926	1991Q4
	(0.049)	(-0.811)	(-2.658)	(0.325)	(-0.227)	(-0.331)	(-3.144)	(0.239)	
Portugal	0.841**	-12.961**	-3.884**	6.950	0.633	-11.216	-4.292**	7.109*	1991Q4
	(0.540)	(-1.814)	(-2.854)	(1.437)	(0.393)	(-1.315)	(-3.458)	(1.778)	
Spain	8.939**	-7.847*	9.630**	-13.961**	8.939**	-7.847	9.630**	-13.961**	1993Q1
	(4.608)	(-0.882)	(5.681)	(-2.318)	(4.608)	(-0.882)	(5.681)	(-2.318)	
Sweden	-6.927**	9.239**	-0.236	-1.578	-6.825**	8.436	-0.350	-1.190	1992Q4
	(-3.383)	(0.983)	(-0.132)	(-0.248)	(-3.324)	(0.872)	(-0.200)	(-0.195)	
United Kingdom	2.227**	-4.604	-0.952	-2.184	2.309**	-5.215	-1.262	-1.370	1993Q4
	(1.189)	(-0.536)	(-0.582)	(-0.375)	(1.329)	(-0.706)	(-0.772)	(-0.222)	
10.0% critical value	±0.389	±0.676	±1.820	±1.560	±0.671	±1.470	±2.370	±1.480	
5.0% critical value	±0.504	±0.887	±2.390	±2.040	±0.875	±2.000	±3.000	±2.010	

** and * denote significance at the 5% and 10% level using a one-tailed test. Values in parentheses are the $T^{-1/2}t_y$statistics. The last two rows report the 10% and 5% asymptotic critical values.

Table 5. Summary of Empirical Results

	$t-PS_T$: I(0) Errors Assumed				$t-PS_T$: Robust to I(1) Errors				$T^{-1/2}\ t_y$: Robust to I(1) Errors			
	$\hat{T}_B$= 1993Q1		$\hat{T}_B$ Unknown		$\hat{T}_B$= 1993Q1		$\hat{T}_B$ Unknown		$\hat{T}_B$= 1993Q1		$\hat{T}_B$ Unknown	
	Pre-Break	Post-Break	Pre-Break	Post-Break	Pre-Break	Post-Break	Pre-Break	Post-Break	Pre-Break	Post-Break	Pre-Break	Post-Break
Belgium	C	C	C	c	C	u	C	c	C	u	C	u
Denmark	C	c	C	C	C	c	C	c	C	u	c	u
Finland	C	C	d	C	c	u	d	C	C	u	c	u
France	d	D	d	c	u	u	d	u	d	u	d	c
Germany	d	C	c	C	d	C	c	C	d	C	c	C
Ireland	d	C	d	C	d	u	d	u	c	C	c	c
Italy	u	u	u	c	u	u	u	u	u	u	u	u
Luxembourg	C	C	C	C	C	C	C	C	c	C	c	C
Holland	d	c	E	c	u	c	E	c	c	c	u	c
Portugal	C	C	c	C	C	C	c	C	C	c	u	C
Spain	C	C	C	C	C	C	C	C	C	C	c	C
Sweden	C	C	c	u	c	u	c	u	C	E	c	u
United Kingdom	C	d	C	d	C	u	C	d	c	u	c	u

C and D denote point estimates consistent with β-convergence (divergence) that are statistically significant at least at the 10% level; c and d denote point estimates consistent with β-convergence (divergence) with only one estimate statistically significant at least at the 10% level; E denotes point estimates very small in magnitude and statistically insignificant which suggest that β-convergence has occurred; u means that no conclusion is possible to be advanced using all information because coefficients are not significant but they are not small enough in magnitude to be considered as an equilibrium situation (E).

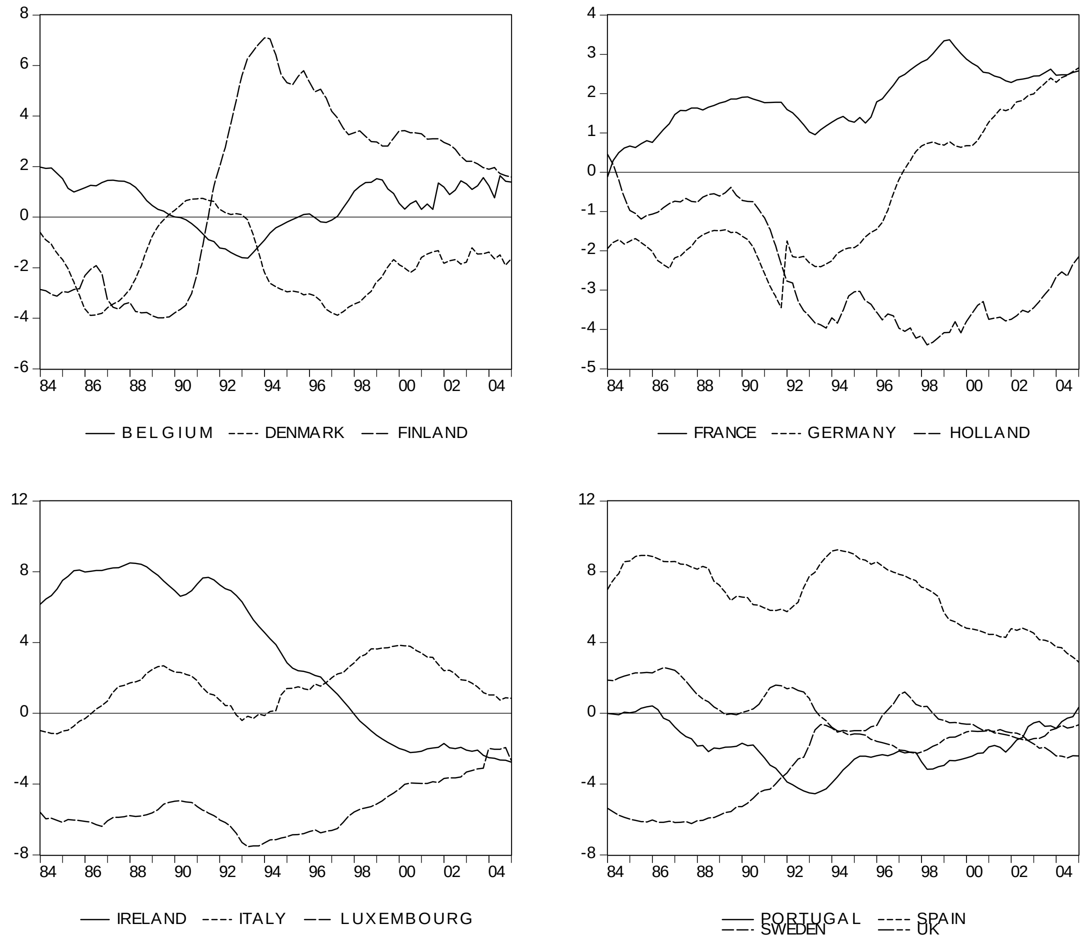

Figure 1. Relative Unemployment Rates (Differences with respect to the average)