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# ONE CRISIS AFTER ANOTHER: A DYNAMIC UNEMPLOYMENT PERSISTENCE ANALYSIS FOR THE GIPS COUNTRIES

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# ONE CRISIS AFTER ANOTHER: A DYNAMIC UNEMPLOYMENT PERSISTENCE ANALYSIS FOR THE GIPS COUNTRIES

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**Abstract**

This paper investigates the hypothesis of unemployment hysteresis for GIPS countries (Greece Ireland, Portugal, and Spain) over the period 1998(4)-2019(4). While most of the existing empirical studies assume constant order of integration for unemployment over the sample period, we consider the possibility that, like many macroeconomic variables, unemployment might display changes in persistence, which might result in potential switches between the natural rate and hysteresis hypotheses. In this respect, we adopt a multiple persistence change methodology. Our empirical results suggest that the structural natural rate (hysteresis) hypothesis is supported for Ireland (Portugal) over the entire sample without any change in persistence of the unemployment rate. For the cases of Greece and Spain, on the other hand, our results propose that unemployment is characterized by multiple changes in persistence with the observed dates for persistence changes coinciding with the Great Recession, the European Sovereign debt crisis, and the deepening of economic and labor market reforms launched to retrain the impact of the crises in those countries.

**Keywords:** Unemployment; Persistence; Hysteresis; Structural changes; GIPS countries
**JEL classification numbers**: C12, C22, E24, G01

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## 1. Introduction

Unemployment, with its steadily increasing pattern, has been on the front burner of the agenda in the world economy since the first oil shock of the early 1970s and has led many researchers to reconsider the natural rate hypothesis proposed by Phelps (1967, 1968). The natural rate hypothesis characterizes the unemployment rate as a process fluctuating around a natural or equilibrium rate that is associated with a fully equilibrated labor market. Hence, with this hypothesis, unemployment is expected to follow a stationary mean-reverting pattern with shocks only having temporary effects. However, experiences in the 1980s have cast doubt on the empirical validity of the natural rate hypothesis, especially in European countries. Being a puzzle that the natural rate hypothesis was not able to explain, European unemployment rates have experienced substantial increases during the 1970s and have shown no tendency to revert to their pre-shock levels. This gave rise to three alternative hypotheses, structuralist, persistence, and hysteresis hypotheses. Being a restricted version of the natural rate hypothesis, the structuralist hypothesis by Phelps (1994) claims that some occasional shocks arising from factors such as technology, institutions, or even real macroeconomic variables like inflation or interest rates might lead to permanent changes in the level of the equilibrium unemployment rate over time, though most of the shocks to the unemployment rate are temporary. Accordingly, the unemployment rate could follow a stationary path that is subject to occasional but permanent structural changes.

The hysteresis hypothesis as revealed by Blanchard and Summers (1986) characterizes the unemployment rate as a non-stationary process with the effects of shocks to the unemployment rate being permanent due to a number rationales including insider-outsider theory, long-term unemployment, and decline of physical capital stock during high unemployment periods. In the insider-outsider model, Blanchard and Summers (1986) suggest that only current employees (insiders) are involved in wage bargaining and they have all the bargaining power while the unemployed become outsiders in the labor market. With this setting, insiders set wages probably above the market-clearing price, while outsiders have no power to reduce the wages and remain unemployed. Another rationale that might lead to temporary shocks to unemployment to have permanent effects is the long-term unemployment, which might breed human capital depreciation and irrational behavior of unemployed people. As stressed by Phelps (1972) and Pissarides (1992), the skills of unemployed people might depreciate over time, and in a dynamic market structure, those unemployed people may experience difficulties to adjust their skills with the requirements of available jobs. This

argument becomes more compatible with longer durations of unemployment since longer unemployment spells might give a bad signal to employers regarding the employability of unemployed people. Irrational behavior of unemployed people, including diminishing search efforts especially in the presence of labor market institutions like unemployment benefits, is another problem that could arise from the long duration of unemployment. Physical capital depletion is documented as another argument that supports the hysteresis hypothesis. Concerning this explanation, a temporary rise of unemployment is transformed into a permanent surge as it undermines the evolution of capital associated with lower output and profit by boosting unemployment further due to shrinking capital stock.

Finally, the persistence hypothesis, which is also referred in the literature as partial hysteresis, suggests that the unemployment rate is a mean-reverting process with a slow speed of adjustment towards the long-run equilibrium level. Some of the popular explanations put forward to explain such a slow adjustment include real wage rigidity and union behaviors. To explain union behavior, Blanchard (2006) has extended the insider-outsider model of Blanchard and Summers (1986) by accounting for the fact that unions would be aware of the probability that insiders may become outsiders at some point in wage setting process and firms use the high level of unemployment as a trump card in the bargaining table to prevent hysteresis from being prevalent even if it may drive a great degree of persistence. Therefore, it is remarked that the high level of unemployment might create downward pressure on the persistence mechanism despite the limitation of the impact, which might lead not full but high persistence of unemployment.

An assessment that is compatible with the dynamic properties of unemployment is important due to unemployment's social consequences and its effects on institutions, market structures, and expectation formations, and hence on the overall functioning of the economy. Accordingly, they are important for policymakers as well. That is, if unemployment follows a stationary mean-reverting process being consistent with the natural rate hypothesis or its structuralist version, then the shocks to the unemployment rate would dampen automatically over a short period of time and the unemployment rate would converge to its equilibrium level without any policy intervention. Dealing with high or full persistence (hysteresis) of unemployment, on the other hand, requires both demand-side policies and structural reforms designed to affect the supply-side dynamics. Many empirical studies have tested these opponent hypotheses to reveal the dynamics of unemployment. Overall, in the literature, while the hysteresis hypothesis is formulated as a unit root process, and its rejection provides empirical

support for the natural rate or the structuralist hypotheses depending on whether unemployment dynamics are characterized by a stationary process with or without occasional mean shifts.

In this context, earlier studies, including Alogoskoufis and Manning (1988), Brunello (1990), Elmeskov and MacFarlan (1993), Jaeger and Parkinson (1994) and Røed (1996) have focused on testing the hysteresis hypothesis against the natural rate hypothesis through conventional unit root tests such as the augmented Dickey-Fuller (ADF) test and provided, in general, substantial evidences in favor of hysteresis hypothesis in various European and OECD countries. There are two problems with the studies relying on the standard unit root testing procedures. The first one is the well-known low power of the tests in the presence of structural breaks, nonlinear dynamics, and near unit root. Secondly, these studies consider only testing two extreme viewpoints without accounting for the potential validity of the structuralist hypothesis. That is, based on this setting, failing to reject the null hypothesis of hysteresis would signal purely nonstationarity of unemployment. However, it is quite probable that the failure could arise from the nonlinear path dependence of unemployment or its stationary structure with a number of occasional but permanent mean shifts, both of which point to the validity of the structuralist hypothesis rather than the hysteresis theory.

In response, some of the recent papers accounted for the possibility that unemployment could follow a stationary process with gradual or smooth mean shifts (e.g. Arestis and Mariscal, 1999; Papell et al., 2000; Ewing and Wunnava, 2001; Camarero et al., 2005; Lee and Chang, 2008; Chang, 2011; García-Cintado et al., 2015). Overall, despite a lack of consensus, these studies have provided empirical evidence in favor of the structuralist hypothesis over the hysteresis theory in various European and OECD countries. The incapability of the hysteresis framework to capture potential business cycle asymmetry of unemployment arising from gradual declines during expansions but steep increases during recessions has further lead to the development of another strand of the literature. In this strand, focusing on the business cycle asymmetries, the studies including Bianchi and Zoega (1998), Coakley et al. (2001), Skalin and Teräsvirta (2002), and Akdoğan (2017) have explored the nonlinearities in unemployment rates of a number of European and OECD countries and described them as stationary nonlinear processes[†].

[†] There are also series of studies focusing on the cross-sectional information and analyzing the order of integration of unemployment rates of blocs of countries or regions of a specific country through panel unit root tests (e.g. Song and Wu (1998), Smyth (2003), León-Ledesma (2002), León-Ledesma and McAdam (2004)).

Another group of studies into unemployment has analyzed the rate of unemployment in a fractional viewpoint (e.g. Tschernig and Zimmermann, 1992; Gil-Alana and Henry, 2003; Caporale and Gil-Alana, 2008, 2009; Cuestas et al., 2011). In this context, instead of using the classical I(0)/ I(1) dichotomy, unemployment is considered to be I($d$), where the fractional parameter $d$, which can take any real value, is used to understand the characteristics of unemployment rates. More specifically, while $0 < d < 0.5$ (with structural breaks) is associated with the natural rate (structuralist) hypothesis, $0 \leq d < 0.5$ and $d \geq 1$ are interpreted as persistence and hysteresis hypotheses, respectively. While this group of studies has associated the degree of persistence of unemployment with its degree of integration, Mitchell (1993), Papell et al. (2000), and Lee and Chang (2008), among others, have utilized the half-lives as a measure for persistence.

Although the fractional integration studies addressed the dichotomy in terms of the order of integration, all of the above studies have the conventional assumption of constant order of integration of unemployment over the entire sample period, which also implies unchanging characteristics of unemployment persistence. Recently, this assumption has turned into being contentious with empirical evidences suggesting that many macroeconomic variables, including output, budget deficit, commodity prices, inflation, and unemployment rates, display changes in persistence, varying stationary and nonstationary regimes (e.g. Kim, 2000; Busetti and Taylor, 2004; Fosten and Ghoshray, 2011; Ghoshray and Stamatogiannis, 2015; Belaire-Franch, 2019; Canarella et al., 2019). With these findings, it appears that it could be quite probable to observe subsamples over which unemployment is characterized by the natural rate and hysteresis hypotheses, while the analysis over the whole sample suggesting an I(1) structure. Hence, a more appropriate way to assess the dynamic properties of unemployment rather than testing for I(1) or I(0) dynamics throughout the data could be permitting for regime shifts between I(0) and I(1) structures.

In that sense, recent studies, Fosten and Ghoshray (2011), Ghoshray and Stamatogiannis (2015), and Canarella et al. (2019), have analyzed unemployment dynamics by allowing for switches between natural rate and hysteresis hypothesis. Among these studies, Fosten and Ghoshray (2011) have utilized the methodology proposed by Leybourne et al. (2007) to detect multiple changes in unemployment persistence for a number of OECD countries. By using annual unemployment rates, they observed multiple changes in persistence for the UK, the USA, Canada, and Denmark. The procedure of Leybourne et al. (2007) tests the null hypothesis of nonstationarity throughout the sample against the alternative hypothesis that the time series is subject to endogenous structural changes in the persistence coefficient and alternates between

I(0) and I(1) regimes through doubly recursive sequences of ADF-type statistics applied to various data subsamples. In this procedure, once the most prominent I(0) regime in the sample is identified, one should continue with the reapplication of the test to all subsamples to search for further I(0) regimes. In that respect, one important limitation of the test of Leybourne et al. (2007) is that during the reapplication of the test, observed break(s) might produce sub-samples that are too small to be tested for further breaks in persistence. In a recent study, using the same null and alternative hypotheses as in Leybourne et al. (2007), Kejriwal et al. (2013) has proposed a superior alternative procedure that is based the sup-Wald principle and they showed that their testing procedure performs better than that of Leybourne et al. (2007) in finite samples. Accordingly, Ghoshray and Stamatogiannis (2015) and Canarella et al. (2019) have employed the testing procedure of Kejriwal et al. (2013) to test for multiple persistence changes in unemployment rates of the UK and the USA. The empirical findings of Ghoshray and Stamatogiannis (2015) revealed a switch from the natural rate to the hysteresis hypothesis after the early 1920s (1930) for the UK (USA). Canarella et al. (2019) have investigated changes in unemployment persistence for 20 American states and observed that the Great Recession led to a change in unemployment persistence in most of the states.

In this paper, we intend to investigate the hypothesis of unemployment hysteresis for Greece, Ireland, Portugal, and Spain, collectively the GIPS countries, over the period 1998(4)-2019(4). Being severely affected by the Great Recession and the European Sovereign debt crisis that followed, these countries provide a good platform to investigate hysteresis in unemployment with unemployment rates struggling to return to their pre-crisis levels despite the fact that more than ten years have elapsed since the onset of the Great Recession. Methodologically, considering the possibility that the hysteresis and the natural rate hypotheses might be mutually exclusive over the entire sample period, we allow for switches between these two extreme viewpoints and adopt the multiple persistence change test of Kejriwal et al. (2013), as in Ghoshray and Stamatogiannis (2015) and Canarella et al. (2019). Roughly, with the application of the test, we find that the hysteresis (natural rate) hypothesis is confirmed for unemployment in Portugal (Ireland) with observed structural changes affecting only the mean level of the unemployment rate while keeping its persistence unchanged. For the cases of Greece and Spain, on the other hand, it appears that the observed structural changes alternate the persistence of unemployment and produce sub-periods confirming hysteresis and natural rate hypotheses. Furthermore, the estimated break dates for the persistence of Greek and Spanish unemployment rates appear to correspond to the Great Recession, the 2010 European

sovereign debt crisis, and the deepening of economic and labor market reforms launched to retrain the impact of the crises.

The rest of the paper is structured as follows. While the next section outlines the econometric methodology we adopt, the data and the empirical results are presented in Section 3, and finally, Section 4 concludes the study.

## 2. Methodology

In this section, we start with the description of the multiple persistence change test of Kejriwal et al. (2013) that is based on the sup-Wald tests. Then, we proceed with the discussion of the hybrid testing procedure that is required to rule out the cases where the process is stable I(0) or it is subject to I(0) preserving changes and to ensure that rejection of the sup-Wald tests indicates that the process under consideration involves switches between I(0) and I(1) regimes.

Kejriwal et al. (2013) consider the following time series process $y_t$ that is exposed to multiple *m* breaks and contains *m+1* regimes:

$$y_t = c_i + \alpha_i y_{t-1} + u_{it} \tag{1}$$

for $t \in [T_{i-1}+1,\ T_i]$, $i = 1,....,m+1$ with $T_0 = 0$ and $T_{m+1} = T$, where $T$ is the sample size and $u_{it}$ are stationary disturbances. Developing a statistic to test the null hypothesis that $y_t$ is I(1) against the alternative that it alternates between I(0) and I(1) regimes requires some knowledge regarding the integration order of the initial regime. Since the initial regime or the direction of change is unknown, Kejriwal et al. (2013) has developed two models depending on whether the initial regime is stationary or not. In Model 1a, the process switches between I(1) and I(0) regimes with a unit root in the first regime (i.e. $c_i = 0,\ \alpha_i = 1$ in odd regimes and $|\alpha_i| < 1$ in even regimes). In Model 1b, similar switches are observed with the only difference that the initial regime is stationary (i.e. $c_i = 0,\ \alpha_i = 1$ in even regimes and $|\alpha_i| < 1$ in odd regimes). Once the models are constructed the null hypothesis that $y_t$ is I(1) throughout the sample is tested by the restriction $c_i = 0,\ \alpha_i = 1$ for all *i*.

To test this null hypothesis, the equation (1) is extended to accommodate higher autoregressive orders and it is re-defined for a fixed number of regime changes $m = k$ as:

$$\Delta y_t = c_i + (\alpha_i - 1) y_{t-1} + \sum_{j=1}^{l_T} \Delta y_{t-j} + v_t \quad (2)$$

where the autoregressive order $l_T$ increases with the sample size.[‡] Then, the Wald test is defined for Model 1a as:

$$F_{1a}(\lambda, k) = (T - k - l_T)(SSR_0 - SSR_{k,1a}) / (kSSR_{k,1a}) \text{ if } k \text{ is even}$$

$$F_{1a}(\lambda, k) = (T - k - 1 - l_T)(SSR_0 - SSR_{k,1a}) / ((k+1)SSR_{k,1a}) \text{ if } k \text{ is odd}$$

and for Model 1b as:

$$F_{1b}(\lambda, k) = (T - k - 2 - l_T)(SSR_0 - SSR_{k,1b}) / ((k+2)SSR_{k,1b}) \text{ if } k \text{ is even}$$

$$F_{1b}(\lambda, k) = (T - k - 1 - l_T)(SSR_0 - SSR_{k,1b}) / ((k+1)SSR_{k,1b}) \text{ if } k \text{ is odd}$$

In these test statistics, $\lambda = (\lambda_1, .....\lambda_k)$ is the vector of break fractions with $\lambda_i = T_i / T$, $SSR_0$ is the sum of squared residuals observed under the null of $c_i = 0$, $\alpha_i = 1$ for all *i*, $SSR_{k,1a}$ and $SSR_{k,1b}$ denote the sum of squared residuals obtained from ordinary least squares (OLS) estimation of equation (2) under the restrictions imposed by Model 1a and Model 1b, respectively.

This setup involves three unknown points that are to be determined: break dates, characterization of the initial regime, and the number of breaks. To specify the break dates, Kejriwal et al. (2013) define the sup-Wald tests for Model 1a and Model 1b as:

$$\sup F_{1a}(\lambda, k) = \sup_{\lambda \in \Lambda_\varepsilon^k} F_{1a}(\lambda, k)$$

$$\sup F_{1b}(\lambda, k) = \sup_{\lambda \in \Lambda_\varepsilon^k} F_{1b}(\lambda, k)$$

where $\Lambda_\varepsilon^k = \{\lambda : |\lambda_{i+1} - \lambda_i| \geq \varepsilon, \lambda_1 \geq \varepsilon, \lambda_k \leq 1 - \varepsilon\}$ for some arbitrary small number $\varepsilon$. Next, to accommodate the problem that the integration order of the first regime is unknown, $\sup F_{1a}(\lambda, k)$ and $\sup F_{1b}(\lambda, k)$ are combined to produce the second sup-Wald test given by:

$$W_1(k) = \max\left[\sup F_{1a}(\lambda, k), \sup F_{1b}(\lambda, k)\right]$$

Finally, to integrate the issue of the/an unknown number of breaks into the testing procedure, the ultimate sup-Wald test is defined as:

[‡] In this setting, Kejriwal et al. (2013) do not allow for changes in short-run dynamics and variance of disturbances in order to direct the test against potential changes in persistence of the process and ensure the highest power possible. Moreover, allowing for such changes under the null hypothesis of $c_i = 0$, $\alpha_i = 1$ would result in limiting distribution of the test statistic to depend on unknown parameters and break dates, which would complicate the asymptotic inference.

$$W_{\max_1} = \max_{1 \le m \le A} W_1(m) \tag{3}$$

where $A$ indicates the maximum number of breaks set a priori.

To derive all sup-Wald tests discussed above, one needs to minimize the sum of squared residuals under the alternative hypothesis while imposing the relevant within- and cross-regime restrictions imposed by the model. To this end, Kejriwal et al. (2013) utilize the dynamic programming algorithm proposed by Perron and Qu (2006). Finally, given the nonstandard nature of the limit distributions, which differ regarding whether the alternative hypothesis assigns unit root or stationarity to the initial regime, the critical values are tabulated through Monte Carlo simulations by setting the maximum number of breaks at $A = 5$ and the level of trimming at $\varepsilon = 0.15$.

An important aspect of the inference based on these sup-Wald tests is that rejection of the null hypothesis of nonstationarity of $y_t$ throughout the sample might not always point to the existence of switches between I(1) and I(0) regimes but might suggest that the process is stable I(0) or it is I(0) with persistence changes which preserve I(0) structure of the process without changing its integration order. To clarify this issue Kejriwal et al. (2013) suggest to employ a hybrid testing procedure that requires the joint application of the $W_{\max_1}$ test with the structural change test of Bai and Perron (1998) ($BP(m)$) and the Ng and Perron (2001) unit root tests. In that respect, following the rejection of the null of nonstationarity of $y_t$ throughout the sample by $W_{\max_1}$, to distinguish between stable I(0) and at least one switch between I(1) and I(0) regimes $BP(m)$ is applied to test for structural changes in the intercept term and the autoregressive parameter in (2) while keeping the short-run dynamics fixed. If both $W_{\max_1}$ and $BP(m)$ reject, one can eliminate the possibility of having a stable I(0) process. In order to distinguish between a process with I(0) preserving changes and the one with I(1)/I(0) switches, Kejriwal et al. (2013) suggest to apply the Ng and Perron (2001) unit root tests with the idea that if the process includes at least one I(1) segment, those unit root tests will fail to reject the null hypothesis. Hence, the decision rule, labeled the $J_m$ test, is to reject the null of nonstationarity of $y_t$ throughout the sample against the alternative that the process is subject to switches between I(1) and I(0) regimes if both $W_{\max_1}$ and $BP(m)$ reject while the Ng and Perron (2001) unit root tests fail to reject.

## 3. Data and Empirical Results

We employ monthly seasonally adjusted unemployment rates of the GIPS countries covering the period 1998(4)-2019(4) which is the widest interval available and covers both the Great Recession and the European Sovereign Debt crisis periods. All data is extracted from Federal Reserve data (FRED).

Results of the persistence change test of Kejriwal et al. (2013) are displayed in Table 1. According to the results, we can reject $W_{\max_1}$ and $BP$ tests but fail to reject the Ng and Perron (2001) unit root tests for the countries Greece and Spain, which points to the existence of persistence changes and switches between hysteresis and natural unemployment rate hypotheses for those countries. In the case of Ireland, the rejection of $W_{\max_1}$ test together with rejections of $BP$ and the Ng and Perron (2001) tests indicates empirical validity of the (structural) natural rate hypothesis throughout the sample with structural changes altering the mean level of the unemployment rate without affecting its degree of persistence. For Ireland, as illustrated in Figure 1, we observe two structural changes in 2008(5) and 2012(2), which possibly coincide with the Great Recession and the beginning of the recovery from the European debt crisis. In their analyses, Ghoshray and Stamatogiannis (2015) and Canarella et al. (2019) do not employ the hybrid testing procedure but use only the $W_{\max_1}$ test to provide inferences regarding persistence changes in unemployment rates of the UK and the USA. However, as it becomes apparent in the case of Ireland, inferences based on the $W_{\max_1}$ test alone might result in misleading inferences so that without application of the hybrid testing procedure, one might conclude that unemployment alternates between I(0) and I(1) regimes due to the rejection of $W_{\max_1}$ test though its actual form is I(0) with persistence changes preserving its I(0) structure. For Portugal, on the other hand, rejection of the $BP$ test only, suggests that the unemployment rate follows a nonstationary path over the entire sample with structural changes preserving its I(1) nature. As seen in Figure 1, the observed structural change in 2013(2) possibly corresponds to the date when the recovery period began with an obvious downward trend in unemployment following the European Sovereign debt crisis which had triggered unemployment in Portugal.

**Table 1: Results of the Multiple Persistence Change Test of Kejriwal et al. (2013)**

| | $W_{\max_1}$ | $BP$ | $MZ_{\alpha}^{GLS}$ | $MZ_{t}^{GLS}$ | $MSB^{GLS}$ | $MP_{T}^{GLS}$ | $J_m$ |
|---|---|---|---|---|---|---|---|
| *Greece* | 50.33[a] | 18.91[a] | -2.67 | -1.10 | 0.41 | 8.98 | CP |
| *Ireland* | 15.61[a] | 25.52[a] | -10.76[a] | -2.29[a] | 0.21[a] | 2.42[a] | NCP (I(0)) |
| *Portugal* | 7.52 | 37.20[a] | -1.14 | -0.76 | 0.66 | 21.47 | NCP (I(1)) |
| *Spain* | 10.69[b] | 22.47[a] | -4.23 | -1.44 | 0.34 | 5.82 | CP |
| *Critical Values* | | | | | | | |
| 5% | 10.9 | 11.7 | -8.1 | -1.98 | 0.233 | 3.17 | |
| 10% | 9.86 | 10.16 | -5.7 | -1.62 | 0.275 | 4.45 | |

Notes: $W_{\max_1}$ indicates the sup-Wald statistic of the persistence change test of the Kejriwal et al. (2013), $BP$ is the structural change test of Bai and Perron (1998), $MZ_{\alpha}^{GLS}$, $MZ_{t}^{GLS}$, $MSB^{GLS}$ and $MP_{T}^{GLS}$ are Ng and Perron (2001) unit root test statistics and $J_m$ refers to the decision rule observed through the application of the hybrid testing procedure that involves the joint application of the $W_{\max_1}$ with $BP$ and the Ng and Perron (2001) unit root tests. In all tests, the lag order is chosen using the Bayesian Information Criterion (BIC) with the maximum autoregressive set to be $12\left(T/100\right)^{1/4}$, where T is the sample size. $W_{\max_1}$ is calculated by setting the trimming at 15 percent and the maximum number of breaks at 5. $BP$ test statistic is calculated by keeping the short-term dynamics unchanged, as discussed in the text. [a] and [b] denote rejection of the null hypothesis at 5 percent and 10 percent significance levels, respectively. CP indicates the existence of persistence changes and switches between I(1) and I(0) regimes, while NCP indicates no change in persistence.

The details of the persistence changes observed for the cases of Greece and Spain are summarized in Table 2 and illustrated further in Figure 1. In the case of Greece, with three structural changes in persistence, two stationary regimes are detected and the series is characterized as an I(1)-I(0)-I(1)-I(0) switching process. The period from 1998(4) to 2007(6) which includes the process of the European Monetary Union from 2001 onwards is characterized by the hysteresis hypothesis. The first persistence change is observed in 2007(6) and the unemployment is identified by the natural rate hypothesis in the early years of the Great Recession, which may suggest that the initial effects of the world recession were on a temporary basis for the Greek labor market. This could be supported by the ongoing downward trend of unemployment in Greece until the second quarter of 2008 and a marginal increase in unemployment in the last quarter of 2008, as observed in Figure 1. However, it appears that the evolution of the Great Recession into the European debt crisis started in Greece where the sovereign debt burden became unsustainable led the unemployment rate to switch to an I(1) regime in 2011(4), and reached its peak in the last quarter of 2013. From 2010 onwards, the Greek economy went through a substantial rescue package with the joint efforts of the European Union and the International Monetary Fund. Serious reforms were adopted to strengthen its fiscal position and to enhance the flexibility and productivity in the labor market which was suffering from the high incidence of unemployment[4]. Labor market reforms consisted mainly of institutional changes relating to wage bargaining procedures, including decreasing the minimum wage, suspension of automatic wage increases in collective agreements and reduction in the overtime premium and salaries paid. As emphasized by OECD (2016), among all reforms implemented with the onset of the debt crisis, labor market reforms, are the most powerful ones. Being in line with the proposal of OECD (2016), our results indicate that successful adaption of the labor market reforms led the dynamics of the unemployment rate to switch from I(1) to I(0) in 2014(5) and provided empirical support for the natural rate hypothesis over the period 2014(6)-2019(4).

[4] See Bakas and Papapetrou (2014) and OECD (2016) for further discussion of the reforms in Greece.

**Table 2: Persistence Changes Results**

| | *k* | *Period* | *Integration Order* |
|---|---|---|---|
| *Greece* | 3 | 1998(4)-2007(6) | I(1) |
| | | 2007(7)-2011(3) | I(0) |
| | | 2011(4)-2014(5) | I(1) |
| | | 2014(6)-2019(4) | I(0) |
| *Spain* | 3 | 1998(4)-2004(12) | I(1) |
| | | 2005(1)-2007(11) | I(0) |
| | | 2007(12)-2012(3) | I(1) |
| | | 2012(4)-2019(4) | I(0) |

Notes: *k* indicates the observed number of persistence changes.

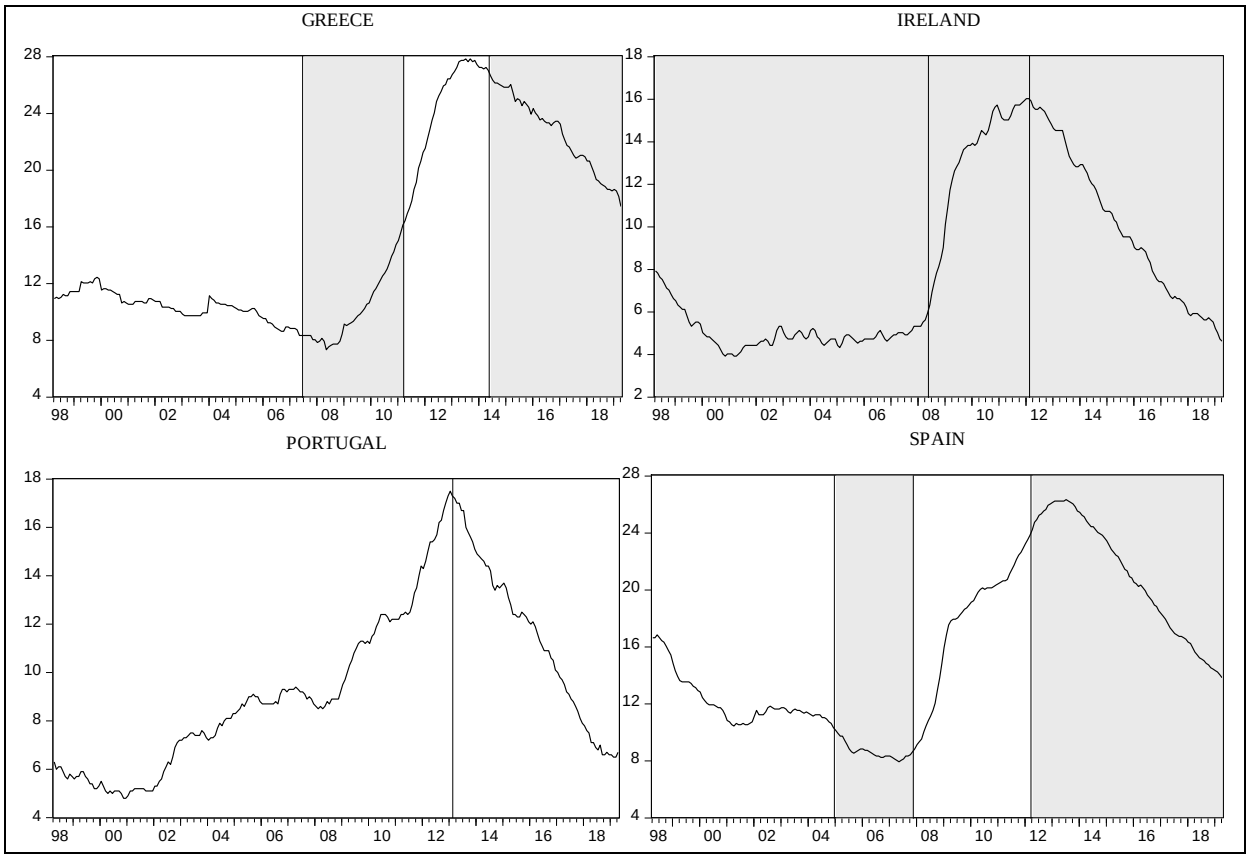


**Figure 1: Unemployment Rates of GIPS Countries**

Notes: The vertical lines represent estimated structural breaks and the shaded areas denote observed I(0) regimes.

Similar to the case of Greece, the unemployment rate in Spain seems to be identified by an I(1)-I(0)-I(1)-I(0) switching process. The period from 1998(4) to 2004(12), which includes the formation of the European Monetary Union in 2001 and the labor market reforms in 2001,

2002 and 2004, which aimed to enhance the functioning of the labor market by fighting the prevalence of temporary employment and encouraging part-time hiring and conversion of temporary contracts into permanent ones, appears to be characterized by the hysteresis hypothesis[5]. Our results reveal that subsequent to these reforms which were coupled with the favorable cyclical impacts that emerged after joining the European monetary union, the first persistence change is observed in 2004(11), and the Spanish unemployment rate switches to an I(0) process. While Spanish unemployment is identified by the natural rate hypothesis over the period of 2005(1)-2007(11), the second persistence change is observed with the outbreak of the Great Recession in 2007(11), and the unemployment rate switches back to I(1). It emerges from Figure 1 that, unlike the case of Greece, the increasing trend in Spanish unemployment started simultaneously with the outbreak of the global economic crisis in the second quarter of 2007 and the hardest stage of the crisis in terms job destruction coincided with the first quarter of 2009 with a sharp upward movement. The rising trend of Spanish unemployment appears to be undergirded further by the impacts of the European debt crisis. Following the crisis, many reforms were implemented by the Spanish government to retrain the impact of the crisis and to drive the economy into a more sound and stable pattern. Among those reforms, one of the major ones was the labor market reform launched after the 2010 reforms in February 2012 to generate a labor market that is more dynamic but less segmented. As discussed in detail by OECD (2014), this reform modified several aspects of the Spanish labor market regulation, including collective bargaining rules and collective and individual redundancy procedures and costs. It appears from our findings that the 2012 labor market reform in Spain is a significant step in the right direction with the final persistence change observed in 2012(3) resulting in a switch from I(1) to I(0). Furthermore, the finding that the switch of the Spanish unemployment to an I(0) regime observed in 2012 (3), almost two years before that of the Greek unemployment, implies that the relatively strong fiscal condition of the Spanish economy expedited the pace of recovery unlike the Greek economy suffering from the excess amount of public debt during the sovereign debt crisis.

[5] See Ramirez and Rodriguez (2014) for further details of the labor market reforms in Spain.

## 4. Conclusion

This study has scrutinized the hypothesis of unemployment hysteresis for GIPS countries over the period 1998(4)-2019(4), which coincides with the Great Recession, 2010 European Sovereign debt crisis, and the deepening of economic and labor market reforms launched to retrain the impact of the crises. There is an enormous empirical literature on testing the hysteresis theory, which characterizes the unemployment rate as a non-stationary I(1) process, against the natural rate hypothesis, which requires unemployment to be governed by a stationary mean-reverting I(0) process with shocks only having temporary effects, through the use of increasingly advanced testing procedures. However, most of the existing empirical studies assume constant order of integration of the unemployment rate over the entire sample period without allowing for any switches between the hysteresis and natural rate hypotheses.

Our study moves away from this dichotomy and considers the possibility that the natural rate and hysteresis hypotheses might be mutually exclusive over the entire sample period. As such, we employ the multiple persistence change test of Kejriwal et al. (2013), which tests the null hypothesis of nonstationarity throughout the sample against the alternative hypothesis that the time series is subject to endogenous structural changes in the persistence coefficient and alternates between I(0) and I(1) regimes.

It appears from our results that while the natural rate hypothesis is supported for Ireland throughout the sample with structural changes altering the mean level of the unemployment rate by keeping its degree of persistence unchanged, the hysteresis hypothesis is supported for Portugal with no evidence of interior stationary regime. For Greece and Spain, on the other hand, our empirical results yield interesting findings regarding the alternation between hysteresis and natural rate hypotheses over the entire period. More specifically, for Greece we observe two different periods conforming the natural rate hypothesis: one starting around the Great Recession and ending just before the deepening of the European debt crisis and the other one starting just after the adoption of labor market reforms implemented with the onset of the debt crisis to enhance the flexibility and productivity in the Greek labor market. For Spain, similar to the case of Greece, two stationary regimes are detected. The first stationary regime is observed over the period of 2005(1)-2007(11), which is attributable to successful adoptions of the subsequent labor market reforms in Spain. During the Great Recession and the European debt crisis, hysteresis takes over with increasing unemployment rates. Afterwards, following the labor market reform launched in 2012 to retrain the impact of the debt crisis and making the

labor market more dynamic and less segmented, Spanish unemployment seems to be identified by the natural rate hypothesis again.

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