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Secular stagnation and core-periphery uneven development in post-crisis eurozone

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Abstract

In this paper, we analyse secular stagnation in the eurozone. We adopt a core-periphery perspective, and analyse whether the 2007-2008 financial crisis triggered off diverging dynamics in the growth potential of core and peripheral eurozone countries. We find that secular stagnation affects the whole eurozone, but is a much more serious concern in peripheral countries. Among the components of potential output, the NAIRU shows a worrisome diverging evolution since 2008. It has remained broadly constant in the core whilst doubling in the periphery. We find that the pronounced increase in the NAIRU in the periphery is strongly related to demand-side factors such as investment demand and fiscal consolidation rather than rigid labour market institutions. The negative effect that fiscal contractions may have on the NAIRU is a novel theoretical contribution of this paper. In line with these findings, we argue that reforms in the eurozone should focus on the creation of macroeconomic institutions ensuring convergence in financial and macroeconomic conditions among member countries rather than on the generalised deregulation of labour markets.

Keywords: Secular stagnation, uneven development, core-periphery, eurozone

JEL Code: C23, E12, O11, O52

1. Introduction

The outbreak of the 2007-2008 financial crisis and, even more importantly, its transformation into a sovereign debt crisis in the eurozone, dramatically twisted the assessment of the euro experiment. In November 2007, Tumpel-Gugerell, a previous member of the ECB executive board, claimed that the introduction of the euro had brought “monetary stability, with low inflation and convergence of long-term interest rates towards the low levels”, these facts being “the best support for sustainable economic growth and employment”. In the same vein, a EU Commission report celebrating the 10-year anniversary of the introduction of the euro in 2008 prized the euro as a “resounding success” and stressed that “EMU secured macroeconomic stability” to its member States. Just two years later, the eruption of financial turbulences surrounding public debt in most of the countries in the “periphery” of the eurozone, and the risk of a disintegration of the eurozone itself, radically changed the mind of policy-makers and economists alike. According to several experts (Eichengreen, 2014; De Grauwe and Ji, 2015), the euro currency and the institutional features of the EMU passed from being a “resounding success” to being leading factors of the eurozone distress.

The above events triggered two interconnected evolutions in the economic literature. On the one hand, since 2007 and 2008, the economic discipline has rediscovered the concept of “secular stagnation” (Summers, 2014a, 2015; Eggertsson and Mehrotra, 2014; Gordon, 2014, 2015), which

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was originally coined by Alvin Hansen in the context of the Great Depression in the US in the 1930s (Hansen, 1934, 1939). Moreover, even though the concept of secular stagnation has been applied to most post-crisis developed economies worldwide, the idea of a secular decline has been frequently associated with the meagre economic performance of the euro area in the last 10 years, which has been significantly more dismal than elsewhere (De Grauwe, 2016; Bagnai and Rieber, 2019).

In this paper, we tackle the issue of post-crisis secular stagnation in the eurozone based on a core-periphery approach. First, we empirically analyse whether the 2007-2008 financial shock has triggered secular stagnation in both the core and the periphery of the euro area. In line with several recent contributions on secular stagnation (Jimeno *et al.*, 2014; Gordon, 2015; Storm, 2017; Crafts, 2017), we focus on the dynamics of *potential* GDP as a main indicator of secular stagnation itself. Different from them, however, we follow Storm (2017) by departing from a “pure” supply-side explanation of potential GDP. We rather analyse how the evolution of potential GDP may have been affected by the 2007-2008 crisis and abrupt demand shocks in the core and periphery of the eurozone. Second, we focus on the components of potential GDP that have changed the most in the wake of the crisis and that may represent relevant sources of deepening core-periphery divergence. Of these components of potential GDP, we particularly focus on the NAIRU, investigating the role demand-side forces and supply-side institutional factors play in explaining the widening gap in the NAIRU between the core and peripheral eurozone countries after 2008. In this regard, we also try to explain how the dynamics of the NAIRU in the eurozone has been influenced by fiscal austerity. We do so by introducing in our econometric model a specific fiscal policy variable among the set of demand-side explanatory factors. At the best of our knowledge, this is the first paper exploring this relation, which represents a relevant departure with respect to previous similar contributions (Stockhammer and Klär, 2011; Hemberger *et al.*, 2017).

The adoption of a core-periphery perspective in the analysis of post-crisis secular stagnation in the eurozone represents a novel theoretical contribution of this paper. Indeed, the existence of a deep heterogeneity in the development process among eurozone countries was already recognized by a variety of previous works. Estrada *et al.* (2013) and Barkbu *et al.* (2016), for instance, stress the lack (or slowdown) of *real* economic convergence among eurozone countries even before the outbreak of the 2007-2008 crisis. Landesmann (2015) and Celi *et al.* (2018) note that when pre-crisis convergence in per-capita GDP was recorded (in Greece and Spain, for instance), such processes were accompanied by *structural* (external) imbalances making core-periphery catching-up unsustainable and likely to fail in the long run. Despite this evidence, previous works about secular stagnation and/or unemployment in Europe or the eurozone ignored the possibility that the above two phenomena might be somehow related to an unfolding process of uneven development between the core and the periphery of the euro area. At the same time, Celi *et al.* (2018) use the structuralist core-periphery theory in order to explain the *causes* of the eurozone crisis, and perhaps why it became more severe in some peripheral eurozone countries. In this paper, we take a step further, as we try to analyse the *diverging long-run development* triggered by a common symmetric shock, i.e. the 2007-2008 worldwide financial crisis, in the core and the periphery of the eurozone given their structural differences.

Four different findings are worth mentioning at both an empirical and a theoretical level. First, whilst post-crisis secular stagnation seems to appear as a concrete reality in the whole eurozone, it is much more acute in the periphery. Since 2008, pre-crisis (timid) core-periphery convergence has turned into deep structural divergence. Second, capital accumulation and the level of the NAIRU are the components of potential GDP that have been most remarkably affected by the recessionary forces triggered by the worldwide financial crisis, and which diverged the most

afterwards. Since 2008, the NAIRU in the core of the eurozone has slightly declined, even though this change is not statistically significant. The NAIRU in the periphery of the eurozone, however, has increased substantially. Third, demand-side factors seem to play a far more relevant (and clear) role in determining the NAIRU than “supply-side” factors related to labour market institutions. We find that the NAIRU is negatively influenced by investment demand (i.e., increases in the latter tend to reduce the former), a result confirming what has already been put forward by Stockhammer (2004) and Stockhammer and Klär (2011). Moving on from these contributions, we also obtain the novel finding of a significant positive correlation between the NAIRU and fiscal cuts in the public budget. In the eurozone, tough fiscal consolidations have significantly drained aggregate demand and increased the NAIRU. Fourth, with the exception of active labour market policies, institutional factors affecting the functioning of the labour market (i.e., the provision of unemployment benefits, employment protection, and trade union density) do not play a consistent, clear or relevant role.

The above findings have important policy implications. Indeed, the persistent emphasis of EU institutions on labour market deregulation as the main way to reduce the NAIRU looks misplaced. It seems far more urgent to reform EU macro policies by introducing those institutions (a EU centralised fiscal budget and the issuance of common euro-bonds) that may avoid asymmetric reactions to common shocks and ensure convergent macro conditions throughout the whole eurozone.

The paper is organised as follows. Section 2 reviews the concept of secular stagnation and how it might be theoretically connected to and empirically analysed by looking at the dynamics of potential GDP and of its components. Section 3 addresses the structural effects of the 2007-2008 crisis in the core and the periphery of the eurozone. Section 4 points out the respective roles of demand- and supply-side factors in the determination of the NAIRU. Section 5 concludes and drives some policy implications that stem from the above findings.

2. Secular stagnation and the dynamics of potential GDP

The concept of secular stagnation has neither a well-established definition nor a clear method of how to measure it. Similarly, a consensus does not exist about its causes and solutions. In his presidential address in 1938, the US economist Alvin Hansen originally defined the “essence of secular stagnation [as] sick recoveries which die in their infancy and depressions which feed on themselves and leave a hard and seemingly immovable core of unemployment” (Hansen, 1939, p.4). He had first introduced the concept five years earlier however, saying “the secular stagnation of business [is] incident to the accumulation of a surplus of funds unable to find an adequate outlet in profitable investment” (Hansen, 1934, p.19).

Hansen’s reference to saving-investment matching as the possible missing economic adjustment leading to secular stagnation may have misdirected most of the recent mainstream contributions on secular stagnation from its original meaning, causes and solutions. On the one hand, these works take the Wicksellian theory of interest rate-driven adjustments to full employment (by equalising available loanable funds to full-employment investment) as the proper theoretical framework in order to address the problem of secular stagnation (see Eichengreen, 2015; Blanchard *et al.*, 2015; Claeys, 2016; Eggertsson *et al.*, 2017). On the other hand, mainstream empirical analyses concentrate their attention on estimating the existence of a *negative* natural interest rate as proof of secular stagnation (see Hamilton *et al.*, 2016; Belke and

Klose, 2017). A critique of these approaches is out of the scope of this paper.¹ What it is relevant for our purposes is that Hansen himself considered interest rate-led adjustments and the Wicksellian theory to be largely irrelevant in order to explain secular stagnation (Hansen, 1939, p.5). According to Hansen, the roots of secular stagnation lie in a structural lack of profitable investment opportunities and, hence, of an adequate investment *demand* as caused by structural forces such as the slowdown in population growth, a narrowing scope for innovation, the closing of the Western US frontier and a lower exploitation of natural resources.

The concept of potential GDP did not yet exist when Hansen first talked about secular stagnation (Gordon, 2014). Nonetheless, the long-run structural perspective characterising Hansen's view has led several economists to naturally connect secular stagnation to the growth potential of an economy.² According to Teulings and Baldwin (2014), three different (but rather close) approaches have recently emerged after Larry Summers rediscovered secular stagnation in his 2013 IMF address in honour of Stanley Fischer. The first one, consistent with Gordon (2014), links secular stagnation to the decline in the *growth rate* of potential GDP. The second one focuses on a one-off reduction in the *level* of potential GDP regardless of a possible slowdown in its trend growth. In both views, a slowdown in potential GDP is mainly explained by supply-side forces such as a negative exogenous shift in the dynamics of productivity or excessive labour market rigidities (causing persistent post-crisis increases in the NAIRU). A third Summers-like approach "measures" secular stagnation according to the *gap* between actual and potential GDP.

In this paper, we analyse post-2008 secular stagnation in the eurozone, and the possibility such a phenomenon might have taken different orders of magnitude in the core and the periphery, by looking at the dynamics of potential output rather than the output gap. We do so for two reasons. First, using the output gap as measure of secular stagnation is highly questionable. As Summers (2014b) himself admits, a squeeze in the output gap may actually come from a reduction in potential output itself rather than in a rebound in actual output towards its pre-crisis potential trend. Indeed, this is what has effectively happened in Japan in the 1990s and, more recently, in the US and EU alike. As a consequence, the output gap may well disappear, despite the economy remaining depressed with widespread unemployment. And, as we will highlight later on, a leading reason why potential output stagnated or even declined in the post-crisis eurozone periphery is precisely because of an increase in the NAIRU. Second, we follow Storm (2017) and we depart from the standard mainstream-type supply-side explanation of potential GDP. Consistent with the post-Keynesian theory, some of the components of potential GDP, and hence potential GDP as a whole, are strongly influenced by demand factors and macroeconomic shocks. One example of how this may play out is through productivity dynamics, which may be positively stimulated by a buoyant aggregate demand via Kaldor-Verdoorn effects (Storm, 2017).³ But more importantly for our analysis, this is also the case for the NAIRU. Indeed, there is now a solid empirical evidence in favour of an *endogenous* NAIRU, which shows considerable degrees of hysteresis and path-dependency with respect to actual unemployment (Ball, 2009; Storm and Naastepad, 2015), and which is strongly influenced by demand-related factors (Stockhammer, 2004; Ball, 2009;

¹ See Taylor (2017) for a critical analysis of the application of the loanable fund theory to secular stagnation.

² An alternative "structural" interpretation of stagnation has been elaborated by some heterodox and Marxian economists, who foresaw a permanent decline in the rate of capital accumulation of developed countries due to the intrinsic dynamics and contradictions of capitalist economies, i.e., the increase in oligopolistic concentration, a rise in the profit margins and an increase in excess capacity.

³ This perspective seems to be consistent with Hansen's own view, in particular when he stressed, in the words of Backhouse and Boianovsky (2016), that sustained post-Second World War productivity dynamics "could have not happened without expansionary fiscal policy [and that] technological progress was probably stimulated by adequate aggregate demand, meaning that the actual and potential growth trends are not independent from one another" (Backhouse and Boianovsky, 2016, p.958).

Stockhammer and Klär, 2011). All in all, the analysis of an endogenous slowdown in potential GDP caused by endogenous (demand-related) changes in the NAIRU seems a very promising way to apply Hansen's original formulation of secular stagnation to the context of current core and peripheral eurozone countries.

Before moving to the empirical analysis of secular stagnation and uneven development in the core and the periphery of the eurozone, some more words must be said about potential GDP and the NAIRU. First, potential GDP has recently become the core issue of a fervid economic debate (Palumbo, 2015), perhaps due to the increasing relevance this concept has played for the implementation of macro policies in the last 20 years or so. Discussions have centred on the methodology used to estimate potential output, as well as on its reliance on the mainstream theory of inflation and unemployment. The definition of potential output most frequently adopted by international institutions and national economic bodies refers to the maximum quantity of output that can be produced at *stable* inflation rates. Potential output is usually estimated by applying a standard production function to filtered macro data on GDP, capital stock, labour force and Total Factor Productivity (TFP). Its computation also relies upon the estimation of the NAIRU. Cotis *et al.* (2004) and Fontana *et al.* (2019) criticise such estimation techniques because they may not correctly gauge the real production potential of an economy, and therefore tend to systematically underestimate the output gap and the deepness of output losses during recessions. These methodological critiques are well grounded. Nonetheless, a critical appraisal of the measurements of potential GDP is beyond the scope of this paper. Our aim in the present work, is to investigate the possibility that the 2007-2008 financial crisis may have triggered uneven development and diverging dynamics in the growth potential of the core and the periphery of the eurozone.⁴ For this purpose, we will continue to rely on estimations of potential GDP, and on data about its components, as provided by most international organizations.

Second, Heimberger *et al.*, (2017) note that the way most international economic institutions, the European Commission among others, define and compute the NAIRU (i.e., by applying some smoothing filters to data about actual unemployment) may be inconsistent with the concept of structural unemployment (i.e., the level of unemployment caused by institutional factors such as labour market rigidities). In this paper, we do not address this theoretical issue and take the expression NAIRU and structural unemployment as interchangeable. We rather focus on the discussion whether demand-side factors, on top of supply-side related institutional variables, may influence the long-run development of an economy, potential GDP growth and long-run trend (or structural) unemployment in particular.

3. The 2007-2008 financial shock and potential output dynamics in the core and the periphery of the eurozone

The fact that the last financial crisis may have reduced potential output and prolonged economic stagnation in the euro area is not new in the economic literature (Summers, 2014b). Nonetheless, only a few works have addressed this issue from an empirical point of view. Anderton *et al.*, (2014) perform a detailed empirical analysis of the main components of potential output in post-crisis

⁴ Fontana *et al.*, (2019) themselves recognise the possibility that "prolonged crisis in demand may well have produced [...] a downward displacement of the whole potential growth path" (Fontana *et al.*, 2019, p.5). The fact that demand shocks may affect the long-run development trajectory of an economy (Dutt, 2006; Dosi *et al.*, 2010; Dosi *et al.*, 2018), and the determination of an *endogenous* NAIRU (Stockhammer, 2008), is in turn a consolidated pillar of post-Keynesian and evolutionary economics, and is now increasingly accepted by mainstream authors as well (see Ball, 2014).

eurozone and detect an unprecedented decline in the speed of capital accumulation and a symmetric increase in structural unemployment. Anderton *et al.*, (2014), however, takes the euro area as a whole, and does not make any distinction between different sets of countries. Ollivaud and Turner (2014) conduct a similar analysis for OECD countries, eurozone Member States among them, reporting evidence of post 2008 changes in potential output for each economy.

What is missing in the above works is the idea that *different groups* of (euro area) countries may have displayed structurally different reactions to a common (worldwide) economic shock. In our view, this represents a significant shortcoming in light of the increasing evidence of a North-South divide in the EU (Landesmann, 2015), and of the increasingly difficult co-existence of different types of Europe (Simonazzi *et al.*, 2013; Botta, 2014; Fagerberg and Verspagen, 2015; Grabner *et al.*, 2017, 2019). In this paper, we want to fill this gap by analysing whether, in the wake of the 2007-2008 crisis, the above different types of Europe (or the eurozone in this context) have showed diverging behaviours in their growth potential, thus revealing and widening even longer historical structural differences that were previously hidden under the surface of perhaps unsustainable macro convergence.

Before acknowledging that the eurozone may be composed by “clusters” of heterogeneous countries, it is important to note that there is not a commonly accepted definition of what the core and the periphery are. Grabner *et al.* (2019) suggest that we should depart from such a traditional dichotomy by considering a third group of (relatively) small highly financialized economies (i.e., Netherlands, Luxemburg, Malta and Ireland). They also argue that France is a controversial case that shares some commonalities with both core and peripheral economies, and that, in contrast to the standard taxonomy, might be included in the periphery. In this paper, we adopt the standard categorization of core and peripheral euro area economies, with Portugal, Ireland, Italy, Greece and Spain in the periphery, and Austria, Belgium, Finland, France, Germany and the Netherlands in the core. Despite some similarities with peripheral countries, we include France in the core due to its considerably lower exposure to financial turbulences and reduction in potential growth (with respect to the periphery) similarly to what recorded in other Centre-North eurozone countries. We do not consider small economies such as Luxemburg, Malta and Cyprus, or Eastern economies that joined the eurozone during or after the outbreak of the last financial crisis.

Given such classification, we have collected data for potential GDP and its components from 1998 to 2017 for all the countries in the sample.⁵ The statistical information comes from AMECO and Eurostat datasets. Consistent with the above mentioned production function technique, we have then computed average annual growth rates for the following components of potential GDP: trend TFP growth; net capital formation and the growth rate of working age population. We have finally taken average levels of labour force participation and the NAIRU. After constructing the dataset, we have computed simple averages for the core and the periphery for the sub-periods from 1999 to 2008 and from 2009 to 2017. We have checked for the occurrence of any *structural break* from one period to the other, and between core and periphery economies, by performing a two sample t-test on computed averages for all the variables at stake. The results of this analysis are reported in Tables 1.a-1.f below.

From Table 1.a, pre-crisis potential growth in the periphery was slightly higher, although not statistically different, with respect to what was recorded in the core. The outbreak of the crisis gave rise to a considerable and statistically significant drop in potential growth in both sets of countries. If we take reduction in potential GDP growth as a sign of secular stagnation, post-2007/2008 both core and periphery of the eurozone seem to exhibit signs of secular decline. The

⁵ Data for Ireland run from 1999 to 2014 only due to a change in statistical methodology thereafter.

reduction in the periphery, however, has been much more pronounced (indeed around 2.5 times deeper) than the decline registered in the core of the euro area. Whilst potential growth in the core is still positive (albeit 1.1 percentage points lower than pre-crisis average), potential output dynamics has turned negative in the periphery. As a consequence, from 2009 to 2017, there is solid empirical evidence for core-periphery divergence in the evolution of potential output.

When it comes to the components of potential output, our results say that capital accumulation (see Table 1.b) and TFP growth (see Table 1.c) have been significantly (and negatively) affected by the financial crisis in both peripheral and core economies. Once again, reductions in the periphery have been as large as or deeper than what was observed in the core. Capital accumulation was significantly faster in the periphery than in the core from 1999 to 2008 - a positive sign of intra-eurozone convergence. In the wake of the financial crisis, however, things have reversed, with core countries now investing much more than what economic actors do in the periphery. As to TFP growth, the dynamics of productivity has been persistently higher in the core than in the periphery both before and after the financial shock. This may be taken as additional evidence of the “structural” core-periphery divide that peripheral economies have never managed to reduce, and that is at least in part due to their persisting productive specialization in relatively low-tech industries with reduced scope for innovation and productivity growth, compared to the medium-high tech sectors at the centre of core economies’ productive systems (Storm and Naastepad, 2015 and 2016; Celi *et al.*, 2018). What is however different, and certainly worrisome, with respect to pre-crisis dynamics is that post-2009 TFP average growth in the periphery of the eurozone has turned negative.

Table 1.d shows another interesting part of the story of euro area core-periphery divergence. Before the 2007-2008 financial shock, core and peripheral countries recorded similar rates of working age population growth. Indeed, this variable was slightly higher in the periphery but not statistically different with respect to what was observed in the core. On the contrary, post crisis trends are statistically different and show different signs between the core and the periphery. Whilst working age population has kept on growing in core economies (albeit at a lower rate), it has declined in the periphery. This outcome should not come as a surprise. Indeed, it is consistent with the increasing evidence of intra-euro area migration, with part of the labour force in the periphery moving towards core economies in search for better employment opportunities (Fries-Tersch *et al.*, 2016). Whilst, on the one hand, this fact may partially alleviate the problem of mass unemployment in certain peripheral countries (see Greece and Spain in particular), on the other hand it stands out as an additional factor of divergence when periphery-to-core migration, especially high-skill workers’ migration, gives rise to a brain drain from the former in favour of the latter.

[TABLES 1.A – 1.F HERE]

Last but not least, Table 1.f portrays the results of our two-sample t-test analysis related to structural unemployment. As Table 1.f clearly shows, structural unemployment rates have been persistently higher in the periphery than in the core regardless of whether we are looking at the period before or after the crisis. Before the outbreak of the 2007-2008 financial crisis, NAIRU rates were, on average, 3 percentage points higher in peripheral eurozone countries than in core economies, this difference being statistically significant. This fact notwithstanding, it is worth noting that such a gap has significantly widened in the post-crisis period. On the one hand, average NAIRU rates have slightly decreased in core economies, with no sign of a structural break being recorded. On the other hand, structural unemployment has remarkably increased in peripheral countries by around 3 percentage points. The statistically relevant dimension of this

change suggests that a perverse structural break in the level of structural unemployment has indeed occurred in the periphery following the financial and sovereign debt crisis.

Once accepted that changes in the level of the NAIRU may play a significant role in determining the level, if not the growth rate, of potential output (see Anderton *et al.*, 2014), it is important to clarify which factors lie behind structural unemployment itself. This is even the more so in the context of our analysis, since that opposite post-crisis variations in structural unemployment seem to increasingly divide the eurozone periphery from core economies. Such analysis is also relevant in order to properly inform European and Member States' (macro) policy-making and institutional reforms. So far, the rising gap in the level of the NAIRU between core and peripheral countries has led most European institutions to push for structural reforms (read deregulation of domestic labour markets) in the periphery in order to restore international competitiveness (via internal devaluation) and reduce structural unemployment at socially acceptable levels (ECB, 2015). This policy stance is due to the fact that European institutions still take labour market rigidity, perhaps interacting with the real-side economic effects of the financial shock (ECB Task force, 2012; Masuch *et al.*, 2018), as the main factors responsible for a persisting rise in structural unemployment and long-lasting decline in potential output. However, as we have already stressed, an increasing amount of work has recognised demand-related factors rather than supply-side labour market-related variables as the main determinants of the NAIRU. The current policy stance of European institutions is therefore both theoretically and empirically contentious. In the next section we will address this point by testing which factors have contributed most to the recent dynamics of structural unemployment in the core and in the periphery of the eurozone.

4. Secular stagnation and the NAIRU in core and peripheral eurozone countries

There are contesting theories about the determinants of the NAIRU. In this section, we test the contribution of these alternative theories in the core and the periphery of the eurozone. Our econometric analysis extends the previous empirical contributions by Stockhammer and Klär (2011), and Heimberger *et al.*, (2017). We estimate a model with three sets of explanatory variables. First, we consider institutional labour market-related variables. According to mainstream theory, these factors might have an effect on structural unemployment by increasing the rigidity of the labour market. Second, we consider a range of "macro shock" variables (Blanchard and Wolfers, 2000; Stockhammer and Klär, 2011) such as the long-run real interest rate, changes in terms of trade, and the TFP growth rate. The first macro shock variable may contribute to determine structural unemployment via demand-side mechanisms by affecting capital accumulation. Consistent with the theoretical approach of our work, it also stands out as a relevant monetary policy variable that may say how the ECB's monetary policy may unevenly display its effects between the core and in the periphery of the eurozone. Terms of trade and TFP shocks, instead, are usually interpreted as supply shocks that may have an effect on the NAIRU via wage bargaining and/or price setting rules. Finally, one "Keynesian" demand side component of our analysis is represented by investment demand as measured by the gross rate of capital formation. In contrast to the previous literature, we include also a fiscal policy variable in the set of demand side factors. After 2010, the implementation of tough fiscal austerity has been a distinguishing feature of policy-making in the eurozone, in particular in the periphery. Contractions in public budgets may have curtailed aggregate demand and given rise to double-dip recessions. Incorporating the possibility that demand side factors may be important determinants of the NAIRU, we test whether, in the post-crisis eurozone, fiscal retrenchment has led, together with the decline in capital accumulation, to increased structural unemployment, depressed

potential output and, eventually, secular stagnation. We take the cyclically adjusted primary balance as our measure of discretionary fiscal adjustments.

4.1 Data and estimation methodology

The data for institutional factors is based on the OECD dataset about labour market variables. In order to keep data source homogeneity as high as possible, we also use the OECD estimations for the NAIRU and TOTS shocks. Data for the long-term real interest rate, capital accumulation and TFP growth are in turn collected from AMECO. None of the abovementioned datasets provide data for cyclically adjusted primary balances (CAPB) over a sufficiently long time period. Hence, we calculate CAPB in the eurozone as structural government budget balance minus net interest payments, as a ratio to potential GDP, using data provided by the IMF.

In this paper, we extend the period of analysis in Heimberger *et al.*, (2017), which covered the period from 1985 to 2012. Our baseline regression model uses data for the period of 1985-2014. 2014 is the last year for which comprehensive information about labour market institutions are available. Due to the lack of data for CAPBs for the full sample, estimations including CAPB is based on an unbalanced dataset.

Panel data analysis frequently involves cross-sectional heteroskedasticity and autocorrelation issues. We run a battery of tests reported in Table A.1 in the Appendix. The Woolridge, Pearson and LR Maximum likelihood tests all confirm the presence of heteroskedasticity and autocorrelation. Therefore, we follow Orlandi (2012) and Heimberger *et al.* (2017) and adopt an Ordinary Least Square Panel Data Corrected Standard Error (OLS-PCSE) estimation method. According to Beck and Katz (1995), this is well suited when dealing with panel data where the time dimension is not much larger than the cross-section size.

Equation (1) below shows the full model we estimate to analyse the determinants of structural unemployment in the core and peripheral eurozone countries:

$$NAIRU_{it} = \alpha LMI_{it} + \beta MS_{it} + \gamma ACCU_{it} + \delta_1 CAPB_{it} + \delta_2 CAPB_{it} * d_{cris} + \theta_1 FE_i + \theta_2 FE_t + e_{it} \quad (1)$$

where LMI_{it} is a vector of labour market institutions for country i in time t including employment protection legislation (EPL), active labour market policies (ALMP), trade union density (UnD), and the unemployment benefit replacement rate (UBR)⁶. Table A.2 in the Appendix provides a detailed description of the variables and data sources. MS_{it} is the vector of macro shock variables, i.e., the level of the real long-term interest rate (LTI), the growth rate of total factor productivity (TFP), and the growth rate of terms of trade (TOTS). Finally, $ACCU_{it}$ and $CAPB_{it}$ represent the demand-side factors including capital accumulation and fiscal policy stance. The fiscal policy variable is interacted with the dummy variable d_{cris} , which is equal to 1 during 2008-2010, and zero otherwise to test if the effect of the public budget on structural unemployment differed during the financial crisis and its aftermath. In the immediate aftermath of the financial crisis, governments of most developed countries, eurozone member States among them, had to take *discretionary* fiscal policy measures to bail out financial institutions. These measures obviously affected the public budget by giving rise to deeper deficits, whilst they did not have a direct impact on the real economy or in

⁶ Previous empirical works also include the tax wedge in this set of institutional variables. Tax wedge data from the OECD only goes back to the year 2000. One option would be to compute a longer series by splicing this data with an older tax wedge series found in the Bassanini and Duval (2006) dataset, along the lines of Orlandi (2012). However, the Bassanini and Duval (2006) dataset does not have historical tax wedge data for Greece, a key peripheral country, and so we have left this institutional variable out of the analysis.

the evolution of (actual and structural) unemployment.⁷ The interaction dummy tests the significance of this “disturbance”. Following Stockhammer and Klär (2011), Orlandi (2012) and Heimberger *et al.* (2017), we include period-fixed effects (FE_t) and country-fixed effects (FE_i) in order to take into account time-specific as well as country-specific factors.

4.2 Estimation results

We estimate three different sets of specifications. The first set of estimations (I.A – I.C) includes labour market institutions only. Specification (I.A) refers to the full sample of eurozone countries. Specification (I.B), in turn, focuses on core economies, whilst Specification (I.C) looks at peripheral eurozone countries. Results from this first set of regressions are reported in Table 2. A second set of Specifications (II.A – II.C in Table 3) includes also the variables capturing macro-shock and capital accumulation. Once again, we run this regression for the full sample of countries (II.A), as well as for the core (II.B) and the periphery (II.C) separately. Finally, specification (III) includes the fiscal policy variable, which is only estimated for the full sample due to limited data availability. The results are shown in the last column of Table 3.

The results in Table 2 suggest that labour market institutions play some role in explaining the evolution of structural unemployment. In some cases, however, our findings contradict the expectations of the mainstream theory. Employment protection policies, for instance, have a statistically significant negative effect on the NAIRU for the full sample (I.A), i.e. the tougher the measures protecting employment are (i.e., the more rigid the labour market is), the lower the structural unemployment is. When the specification is estimated separately for the core and peripheral economies, the coefficient is still negative albeit statistically insignificant.⁸ The effects of the other institutional variables are more in line with the standard mainstream theory. Active labour market policies have a significant negative impact on structural unemployment in all three specifications in Table 2. Trade union density and the level of unemployment benefits appear to increase structural unemployment. However trade union density is statistically significant only in the full sample regression (I.A).⁹ Unemployment benefits is statistically significant in the full sample and in the “core economies” (I.B) only, but is insignificant in the periphery.

[TABLE 2 HERE]

The first three columns of Table 3 report the “expanded” specifications including capital accumulation and “macro shock” variables in the set of explanatory variables. The effects of some labour market institutions are not robust. Employment protection policies now have a positive

⁷ The public sector bail out of private institutions certainly helped not to precipitate the financial crisis in an even deeper recession of the real economy. Yet, those measures were not meant, by themselves, to stimulate aggregate demand and, therefore, to reduce unemployment. This is why a potentially “spurious” negative relation (a lower and even negative CAPB associated with increasing structural unemployment) could connect the evolution of the (cyclically-adjusted) primary balance to the NAIRU at the peak of the post-financial crisis recession. Of course, available data do not tell what would have happened in the absence of those interventions.

⁸ Indeed, mainstream theory does not offer a clear-cut empirical evidence of the effects that stricter labour protection measures might cause on structural unemployment (see Blanchard and Katz, 1997; Blanchard *et al.*, 2006).

⁹ Even in this case, mainstream theory offers a mixed view of the potential role of union density in explaining structural unemployment (see Blanchard *et al.*, 2006). If one takes labour union density as a proxy for workers’ coordination in the wage bargaining process with firms, a stronger union density might actually favour necessary wage adjustments avoiding increases in unemployment in the wake of negative economic shocks. On the contrary, if higher union density means stronger downward wage rigidity, this might be source of a permanent increase in the level of structural unemployment.

effect on structural unemployment, but this effect is statistically significant only in the “peripheral economies” (II.C). Trade union density has still a significantly positive effect in the full sample and “core economies” specifications (II.A and II.B), but is statistically insignificant in the periphery. Unemployment benefit (UnB) has a positive and statistically significant effect in the “core economies”, but *negative* and statistically significant effect in peripheral countries. The only labour market institution with a robust effect in all specifications and is consistent with mainstream economic theory is active labour market policies (AlmP).

Consistent with Stockhammer and Klär (2011) and Heimberger *et al.* (2017), capital accumulation always displays a negative and statistically significant effect on structural unemployment. Our results thus provide further evidence in line with the post-Keynesian theory about the role of capital accumulation as a key determinant of the NAIRU, whose evolution could be relevantly influenced by demand-side shocks.

Whilst TFP growth and TOTS variables are insignificant most of the time (and TFP growth with the wrong sign), the long-term real interest rate (LTI) has a positive and statistically significant effect for the full sample. The expected positive sign is consistent with economic theory: an increase in the long-term real interest rate may discourage capital accumulation and hence, reduce potential economic activity and increase structural unemployment. Interestingly, when we split the sample into the “core” and the “periphery”, the results change. On the one hand, LTI keeps on displaying a positive and significant effect in the eurozone periphery. On the other hand, however, the effect becomes negative and insignificant in the core countries. We interpret these results as a clear sign of the diverging macroeconomic and, in particular, financial and monetary policy environment that divided the periphery from core eurozone countries in the aftermath of the 2007-2008 crisis. Indeed, financial turmoil and the sovereign debt crisis (with the connected increase in interest rates and spread with respect to core economies) mainly concerned peripheral eurozone countries. In core economies, in turn, net capital inflows (partly related to the repatriation of capital previously invested in the periphery) led to reduced long-term interest rates that in some cases even became negative. Such core-periphery asymmetry in the post-crisis macro-financial climate has been likely relevant in deepening the economic downturn (and stagnation) in the periphery whilst providing some relief to the core.

[TABLE 3 HERE]

The last column in Table 3 reports the results from the full specification incorporating the fiscal policy stance. Employment protection policies again have a negative significant effect (and unexpected from the perspective of mainstream theory) on structural unemployment. Active labour market policies continue to have a negative effect. Also capital accumulation (ACCU) and the long-term real interest rate (LTI) show the expected signs, negative and positive respectively.

During the years outside the crisis period of 2007-2010 a restrictive fiscal policy stance has a significantly positive effect on structural unemployment. In other words, discretionary fiscal contractions (i.e., increases in the cyclically-adjusted fiscal primary balance) tend to raise the NAIRU. Once again, this stands out as additional evidence of the importance of demand-side variables for the determination of structural unemployment.

Interestingly, when we include CAPB in regression (III), the coefficient associated to capital accumulation remains negative and significant, but its absolute value decreases remarkably. There are two possible explanations for this fact. They are connected to the possible effects that fiscal policy choices may bear on structural unemployment as mediated by capital accumulation. First, discretionary fiscal measures may influence structural unemployment via a “direct” investment channel if related to public investment. Discretionary fiscal contractions, in particular, if they

curtail public investment, may reduce total investment and, hence, cause a rise in the NAIRU. Second, an “indirect” investment channel may also matter. In a recession, fiscal stimuli usually contribute to tame the reduction in economic activity and, therefore, to encourage entrepreneurs. Fiscal retrenchments, in turn, may exacerbate the recession and spread “pessimistic” expectations through entrepreneurs. Even more depressed entrepreneurs’ animal spirits may eventually lead business to downsize investment further and cause an escalation in structural unemployment. Thus, these effects of fiscal policy on structural unemployment might have been captured by the investment coefficient in the previous literature, which does not consider the effects of fiscal policy explicitly. The inclusion of CAPB in our third specification may help to disentangle these effects from those effects directly related to private business investment. The policy implication is that in the wake of a recession, it is important to create institutional and macroeconomic conditions that facilitate expansionary fiscal policies, in particular public investment to offset the effects of credit rationing in the financial markets.

4.3 Interaction between economic shocks and labour market institutions

Mainstream economic theory also incorporates hysteresis effects of actual unemployment on structural unemployment, in particular the *interaction* between economic shocks and rigid labour market institutions (Blanchard and Wolfers, 2000; Blanchard *et al.*, 2006). When a negative economic shock takes place actual unemployment tends to increase. Such an increase, in turn, may persist for a long period due to rigid labour market institutions impeding the quick return to pre-crisis unemployment level, hence raising structural unemployment.

In order to test this effect, we conduct an empirical analysis similar, in spirit, to that performed by Blanchard and Wolfers (2000). More specifically, we first take 5-year average values of *actual* unemployment rates¹⁰ for a sample of eurozone countries¹¹ before and after the financial shock. We then run a simple correlation analysis between the degree of rigidity in labour market institutions at the beginning of the crisis (i.e. 2008), and the absolute change between pre- and post-crisis unemployment.¹² According to Blanchard and Wolfers (2000), we would expect a stronger increase in (average) unemployment rates in those countries characterized by more rigid labour market institutions when the shock took place and started to affect the real economy. Pre-crisis unemployment averages are computed over the period 2003-2007, whilst post-crisis averages run from 2010 to 2014. We have performed this analysis for all the four labour market institution variables included in our regression model. The results are portrayed in Figures 1 to 4 below.

The results challenges mainstream expectations. For instance, the countries providing the unemployed with larger unemployment benefits seem to have experienced lower post-crisis

¹⁰ In this section of the paper, we use data about *actual* unemployment rates rather than about the NAIRU in order to stay as close as possible to the original line of reasoning and empirical analysis put forward by Blanchard and Wolfers (2000). For the same reason, we also take 5-year average values of unemployment as dependent variable in our correlation analysis.

¹¹ In order to have more observations and make our analysis more reliable, we extended the sample of eurozone countries to include small economies (Luxemburg) and “latecomers” eurozone member countries (Estonia, Slovenia and Slovakia) for which data about labour market institutions are available.

¹² The focus of the final section of our work is restricted to the effects that the 2007-2008 financial crisis might perhaps have caused on structural unemployment in eurozone countries by interacting with rigid labour market institutions. The time and spatial horizons of our analysis are much narrower, the number of observations available smaller, and, as a consequence, the statistical method we adopt simpler. The simple correlation analysis we present in this section of the paper must be intended as a “prime-facie” empirical evidence of the role the interaction between a (specific) economic shock and country-specific labour market institutions might have played in determining recent changes in unemployment records.

increases (or even small reduction) in average unemployment rates. This may reflect the positive demand effects of unemployment benefits, which may have offset the negative effects of the crisis. The same applies to the case of “trade union density”. Again this may reflect the role of unions in accepting wage concessions in return for preserving employment, which in turn stabilizes unemployment in a recession. More relevantly, our analysis tends to suggest that labour market institutions at the time of the crisis have very poor explanatory power, if any, of the pre/post crisis change in unemployment records. The R squares associated to the four correlations portrayed in Figures 1 to 4 are all very small. Hence, cross-country variance in labour market institutions in 2008 explains a negligible part of cross-country variance in pre/post crisis unemployment dynamics.

As a robustness check, we have repeated this analysis by taking into account countries’ deviations from cross-country average values (as in Blanchard and Wolfers (2000)). The results do not change. Whilst we now obtain a positive correlation between unemployment benefits and pre/post crisis changes in average unemployment (i.e. deviation from sample mean), the explanatory power of all four labour market institution variables remains minimal (or even decreases). After all, it seems that heterogeneity in labour market institutions across the eurozone countries cannot explain much of the diverse performance, in terms of unemployment records in the wake of the 2007-2008 financial shock.

[FIGURES 1 – 4 HERE]

5. Conclusions

In this paper, we address the problem of secular stagnation, and the connected evolution of structural unemployment, in the eurozone in the aftermath of the 2007-2008 financial and economic crisis. In contrast to previous contributions on this topic, we frame our analysis in the context of the structuralist core-periphery approach. We do so in order to analyse whether secular stagnation manifested itself with different degrees of intensity in the core and the periphery of the eurozone as a consequence of their structural asymmetries. The final goal of this paper is to investigate whether post-2008 secular stagnation may have given rise to or deepened uneven development among eurozone Member States, thus putting at risk the cohesion and survival of the eurozone itself.

We “measure” secular stagnation by looking at the dynamics of potential GDP before and after the outbreak of the financial crisis. Our structural break analysis reveals that secular stagnation, i.e. a statistically significant reduction in the growth rate of potential GDP, is a eurozone-wide problem. It affects both core and peripheral eurozone countries. The depth of the problem, however, differs remarkably in the two set of countries, and the emergence of diverging trends is clear. After 2008, the dynamics of potential GDP growth slowed down considerably in the eurozone as a whole, but dramatically more so in the case of peripheral countries, where the recession was prolonged. By the same token, the reduction in net capital accumulation has been much more pronounced in the periphery of the eurozone rather than the core, and it is now much lower in the former economies than in the latter (it was the opposite before the crisis). Perhaps more importantly, the crisis seems to have ignited migration flows and a sort of brain drain phenomenon from (economically) weaker peripheral economies to more solid core ones. Whilst structural unemployment does not seem to have been affected in the latter, it has risen dramatically in the former. Post-crisis NAIRU in the periphery is now two times that observed in core countries.

In the second part of this paper, we analyse whether changes in the NAIRU, and the increase in structural unemployment in the eurozone periphery in particular, is due to rigidities in labour market institutions or to other demand-side factors such as capital accumulation and/or fiscal policy stances. The inclusion of fiscal policy among the explanatory factors of the NAIRU is a novel contribution of this paper and a point of departure with respect to previous similar works, which have largely ignored the possible relation between fiscal austerity and the evolution of the NAIRU in the eurozone.

Our results say that labour market institutions may play a role in explaining the NAIRU. Nevertheless, their effects are sometimes at odds with what is suggested by mainstream economic theory (employment protection policies actually tend to reduce structural unemployment). Moreover, in some of our specifications, they seem to have different impacts on the NAIRU in core and peripheral economies. More generous unemployment benefits in peripheral economies (core economies) seem to reduce (increase) structural unemployment. On the other hand, capital accumulation is always significant in all our specifications and in all the subsets of eurozone countries. This is a clear demonstration that demand-side factors might be the major determinants of structural unemployment. This evidence is confirmed by our new finding that (with the exclusion of “exceptional” years at the peak of the crisis) fiscal policy stances also have a statistically significant effect on structural unemployment. Austerity measures, in particular, may increase structural unemployment directly, by cutting public investment, and indirectly, by depressing entrepreneurs’ animal spirits and private investment even further.

Last but not least, cross-country heterogeneity in labour market institutions in 2008 does not explain much, if anything, of cross-country post-crisis heterogeneous changes in unemployment records. Together with the previous point, this finding suggests that observed uneven development between core and peripheral eurozone economies is not a consequence of structural differences (i.e. different labour market institutions) among them. It is rather due to diverging macro and, above all, financial environments. In the periphery of the eurozone, the initial common and symmetric financial crisis evolved into a sovereign debt crisis. Financial turbulences mounted, interest rates increased (differently from what happened in the core), capital accumulation plummeted (more than in the core) and tough austerity measures were implemented. It is the emergence of such a fragile macro-financial environment in the periphery and relative stability in the core, that is the major cause of post-crisis core-periphery diverging dynamics in structural unemployment.

The above findings bring a number of important policy implications. Uneven development and widening structural gaps between core and peripheral eurozone countries put at serious risk the survival of the euro area itself. In this context, the emphasis of most European institutions on structural reforms aimed at making labour market institutions more flexible across all eurozone countries is largely misplaced. Reforms in the eurozone should better focus on ensuring that homogeneous macro-financial environments develop in eurozone countries, and that symmetric shocks do not eventually ignite asymmetric core-periphery dynamics. For this purpose, the completion of the eurozone with a banking union and the creation of a central fiscal authority (possibly avoiding a new asymmetric sovereign debt crisis to arise) are much more important reforms than a “one-size-fits-all” deregulation of eurozone Member States’ labour markets. In our view, such macro reforms, together with the implementation of industrial policies targeting the structural (productive) gaps at the basis of the core-periphery eurozone divide are the only credible responses to the worrisome uneven development and centrifugal forces described in this paper.

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Tables and Figures

Table 1.A. Potential GDP growth rate: pre-crisis (1999-2008) and post-crisis (2009-2017) structural break analysis and core-peripheral gap.

Potential GDP growth rate	Before-crisis (1999-2008) country sub-sample averages	After-crisis (2009-2017) country sub-sample averages	Pre- and post-crisis within sample difference
Core	2.151 (0.093)	0.996 (0.064)	-1.155*** (0.116)
Periphery	2.373 (0.205)	- 0.436 (0.179)	-2.809*** (0.275)
Pre- and post-crisis between samples difference	No -0.221 (0.203)	Yes 1.432*** (0.1656)	

Source: Authors' computation on the basis of data from AMECO dataset (2018)

Table 1.B. Net capital stock growth rate: pre-crisis (1999-2008) and post-crisis (2009-2017) structural break analysis and core-peripheral gap.

Net capital stock growth rate	Before-crisis (1999-2008) country sub-sample averages	After-crisis (2009-2017) country sub-sample averages	Pre- and post-crisis within sample difference
Core	1.934 (.065)	1.132 (.0487)	-.802*** (.083)
Periphery	3.104 (.183)	.0435 (.164)	-3.060*** (.248)
Pre- and post-crisis between samples difference	-1.169*** (.169)	1.088*** (.146)	

Source: Authors' computation on the basis of data from AMECO dataset (2018)

Table 1.C. Trend TFP growth rate: pre-crisis (1999-2008) and post-crisis (2009-2017) structural break analysis and core-peripheral gap.

Trend TFP growth rate	Before-crisis (1999-2008) country sub-sample averages	After-crisis (2009-2017) country sub-sample averages	Pre- and post-crisis within sample difference
Core	0.723 (.061)	.131 (.058)	-.592*** (.084)
Periphery	0.261 (.158)	-.309 (.189)	-.570* (.245)
Pre- and post-crisis between samples difference	0.462*** (0.149)	-.045* (.085)	

Source: Authors' computation on the basis of data from AMECO dataset (2018)

Table 1.D. Working age population growth rate: pre-crisis (1999-2008) and post-crisis (2009-2017) structural break analysis and core-peripheral gap.

Working age population growth rate	Before-crisis (1999-2008) country sub-sample averages	After-crisis (2009-2017) country sub-sample averages	Pre- and post-crisis within sample difference
Core	0.411 (.053)	.385 (.090)	-.026 (.104)
Periphery	0.586 (.136)	-.234 (.060)	-.821*** (.149)
Pre- and post-crisis between samples difference	-0.174 (0.129)	.619*** (.121)	

Source: Authors' computation on the basis of data from AMECO dataset (2018)

Table 1.E. Labour force participation rate: pre-crisis (1999-2008) and post-crisis (2009-2017) structural break analysis and core-peripheral gap.

Labour force participation rate	Before-crisis (1999-2008) country sub-sample averages	After-crisis (2009-2017) country sub-sample averages	Pre- and post-crisis within sample difference
Core	65.55	64.01 (.52)	-1.53** (.716)
Periphery	61.74	59.61 (.78)	-2.13* (1.10)
Pre- and post-crisis between samples difference	3.80*** (.860)	4.40*** (.90)	

Source: Authors' computation on the basis of data from AMECO dataset (2018)

Table 1.F. NAIRU: pre-crisis (1999-2008) and post-crisis (2009-2017) structural break analysis and core-peripheral gap.

NAIRU	Before-crisis (1999-2008) country sub-sample averages	After-crisis (2009-2017) country sub-sample averages	Pre- and post-crisis within sample difference
Core	7.18 (.268)	6.689 (.232)	-.492 (.358)
Periphery	10.22 (.407)	13.255 (.487)	.358*** (.631)
Pre- and post-crisis between samples difference	-3.045*** (.467)	-6.56 *** (.488)	

Source: Authors' computation on the basis of data from AMECO dataset (2018)

Table 2. OLS-PCES estimations (I.A – I.C) with labour market institution explanatory variables.

LMI	(I.A) Full sample	(I.B) Core	(I.C) Periphery
EmP	-1.242** (0.470)	-0.972 (0.638)	-0.148 (0.554)
AlmP	-0.173** (0.021)	-0.126*** (0.019)	-0.488*** (0.081)
UD	0.053** (0.019)	0.028 (0.025)	0.010 (0.027)
UnB	0.037** (0.011)	0.080*** (0.015)	-0.047 (0.025)
Cons	3.670* (1.699)	1.245 (1.387)	9.023*** (2.443)
N	314	174	140
R²	0.804	0.872	0.766

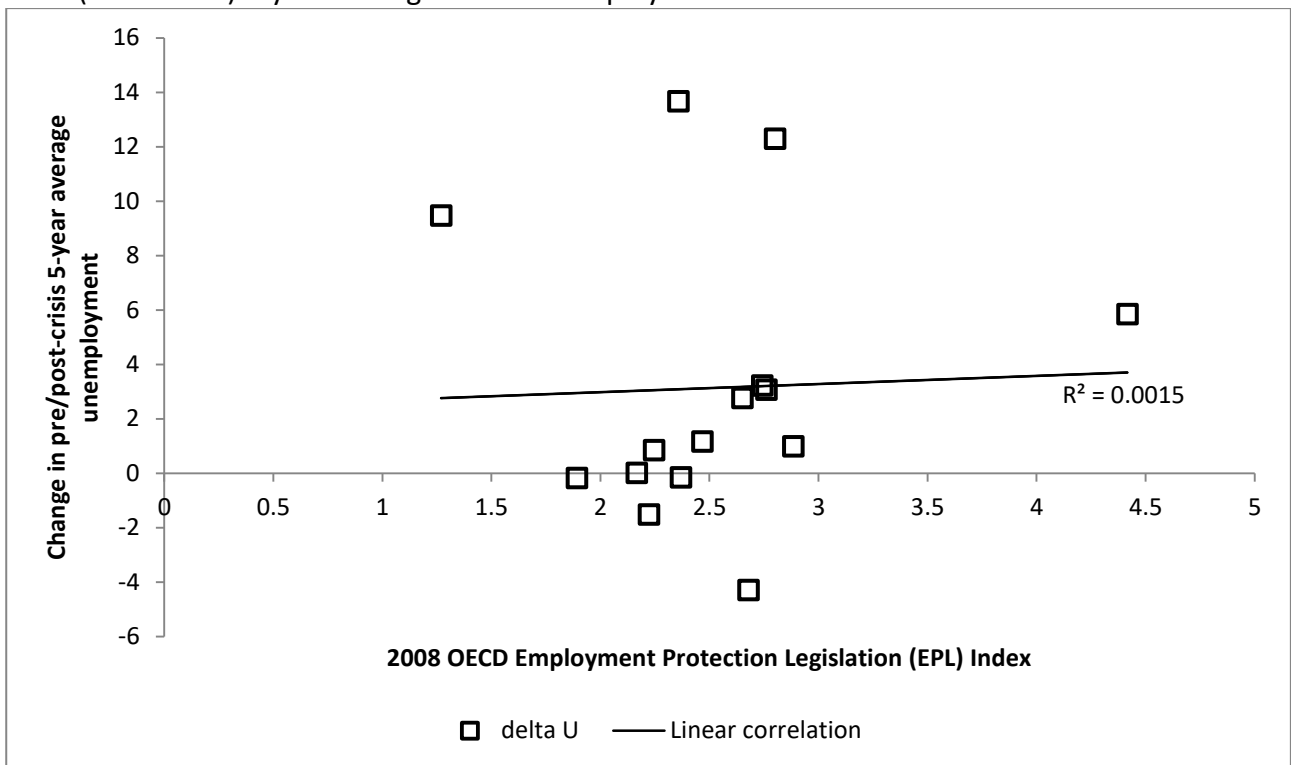
Notes: * p < 0.1; ** p < 0.05; *** p < 0.01. Standard errors in brackets.

Table 3. Augmented OLS-PCES estimations including macro shock (II.A – II.C) and fiscal policy variables (III).

	(II.A) Full sample	(II.B) Core	(II.C) Periphery	(III) Full Sample
EmP	0.051 (0.242)	0.155 (0.466)	1.907*** (0.576)	-1.389*** (0.435)
AlmP	-0.086*** (0.018)	-0.076*** (0.015)	-0.155* (0.074)	-0.083*** (0.014)
UD	0.031* (0.013)	0.054** (0.017)	-0.024 (0.029)	-0.012 (0.031)
UnB	0.006 (0.09)	0.065*** (0.012)	-0.122*** (0.023)	0.061*** (0.016)
ACCU	-0.906*** (0.087)	-1.311*** (0.151)	-1.182*** (0.166)	-0.545*** (0.110)
LTI	0.174** (0.058)	-0.134 (0.082)	0.218** (0.070)	0.110* (0.055)
TFP	12.603 (7.659)	17.665* (6.937)	6.632 (9.234)	13.451 (7.523)
TOTS	3.629 (3.975)	-6.227 (4.453)	-3.434 (5.704)	1.574 (4.841)
CAPB				0.068* (0.030)
CAPB*d_{cris}				-0.216** (0.079)
Cons	6.949*** (0.999)	6.783*** (1.354)	9.389*** (2.217)	7.714*** (1.466)
N	314	174	140	251
R²	0.881	0.940	0.855	0.877

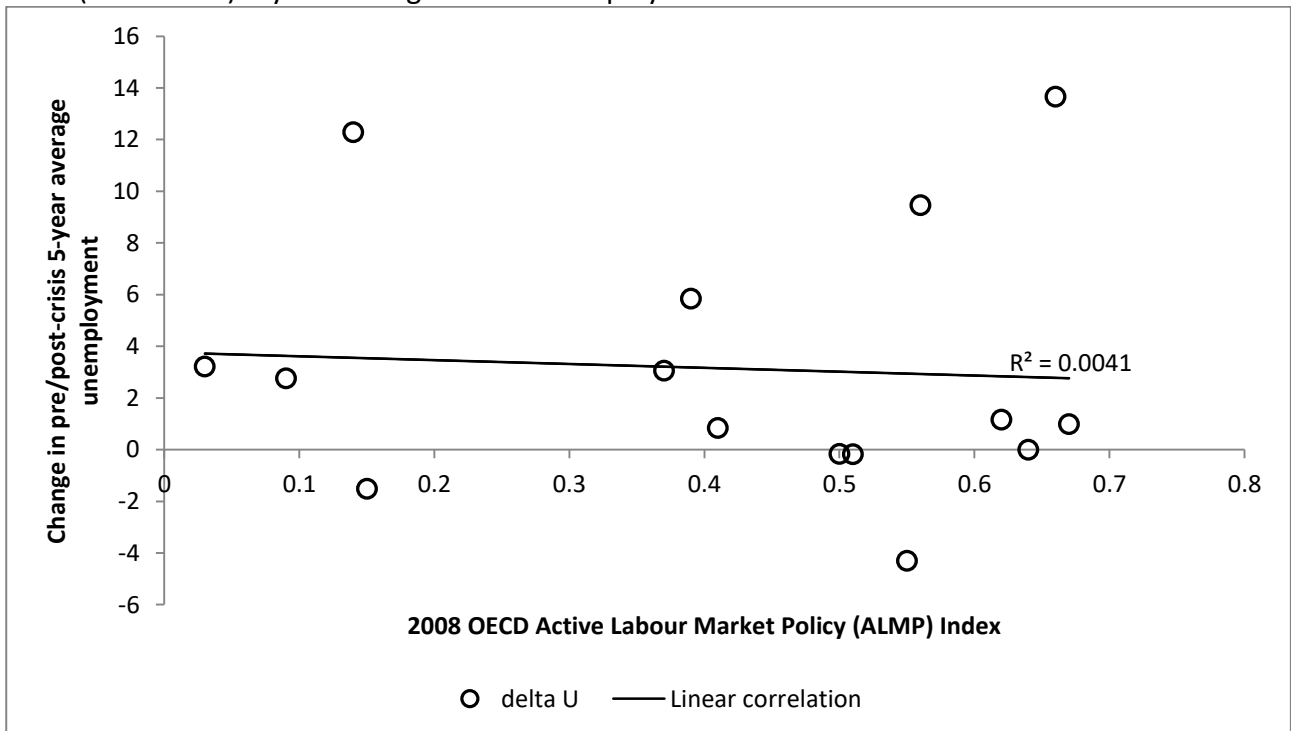
Notes: * p < 0.1; ** p < 0.05; *** p < 0.01. Standard errors in brackets. In regression (III), time series for cyclically-adjusted primary balances start from different years (see years in parentheses) in different countries: Austria (1991); Belgium (1985); Finland (1985); France (1985); Netherlands (1985); Ireland (1999), Greece (1988), Germany (1991), Portugal (1995), Italy (1998), Spain (2000).

Figure 1. Correlation between 2008 (OECD) EPL index and change in pre-crisis (2003-2007)/post-crisis (2010-2014) 5-year average actual unemployment.



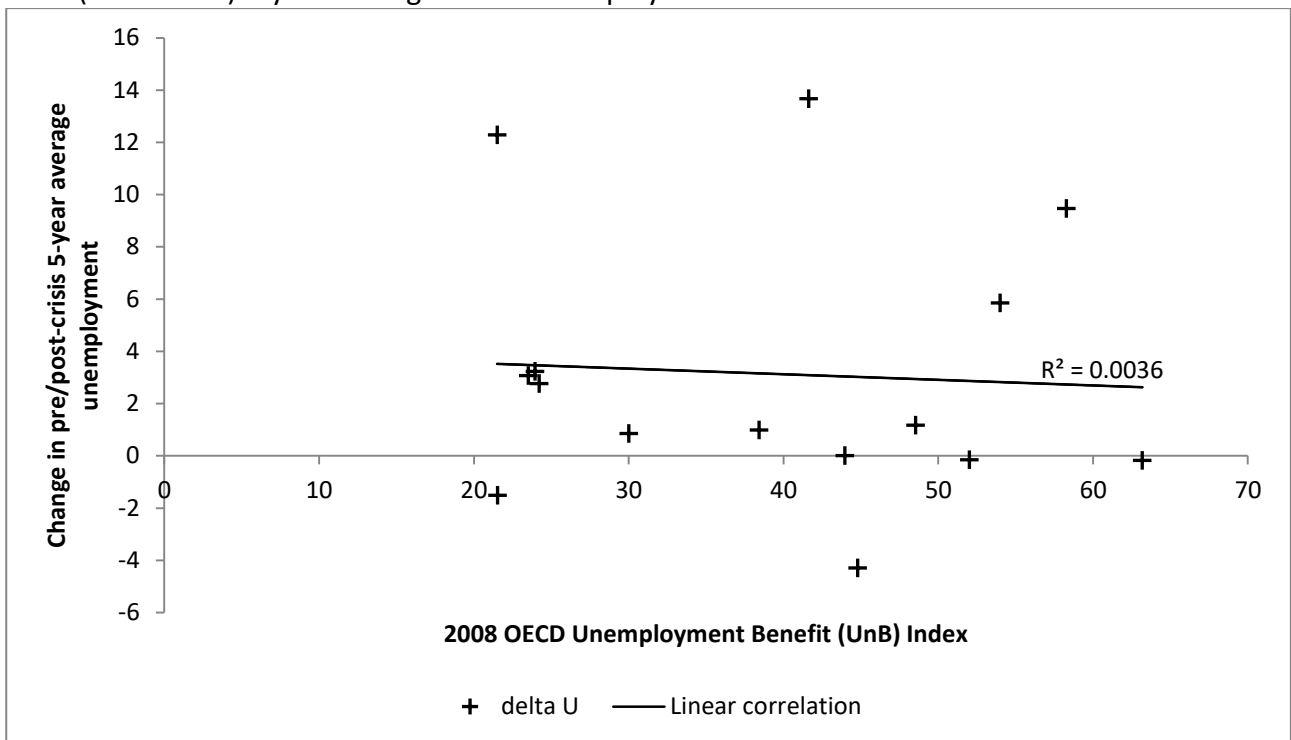
Source: Authors' computations on the basis of data from AMECO (for unemployment) and OECD (for labour market institutions) datasets (2018).

Figure 2. Correlation between 2008 (OECD) ALMP index and change in pre-crisis (2003-2007)/post-crisis (2010-2014) 5-year average actual unemployment.



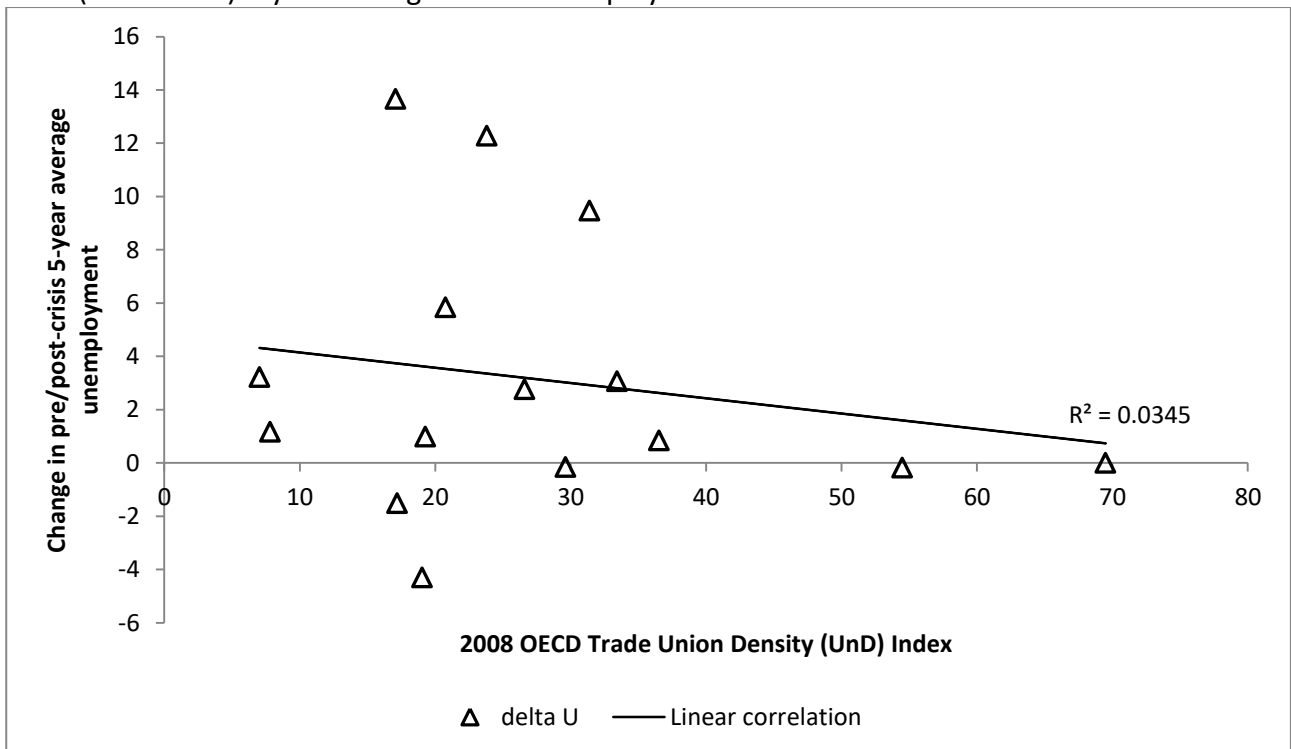
Source: Authors' computations on the basis of data from AMECO (for unemployment) and OECD (for labour market institutions) datasets (2018).

Figure 3. Correlation between 2008 (OECD) UnB index and change in pre-crisis (2003-2007)/post-crisis (2010-2014) 5-year average actual unemployment.



Source: Authors' computations on the basis of data from AMECO (for unemployment) and OECD (for labour market institutions) datasets (2018)

Figure 4. Correlation between 2008 (OECD) UnD index and change in pre-crisis (2003-2007)/post-crisis (2010-2014) 5-year average actual unemployment.



Source: Authors' computations on the basis of data from AMECO (for unemployment) and OECD (for labour market institutions) datasets (2018).

Appendix

Table A.1. List of econometric tests for autocorrelation, heteroskedasticity and panel data cross-sectional dependence.

	Test	Test Statistic and Hypothesis test	Conclusion
Autocorrelation	Woolridge test for serial correlation	H0: no first order correlation Prob > F = 0.0000	There is autocorrelation in panel data
Heteroskedasticity	LR Maximum likelihood test	H0: constant variance Prob > chi2 = 0.0000	There is heteroscedasticity in panel data
Cross-sectional Dependence	Pearson test	H0: cross sectional independence Pr = 0.0708	There is cross sectional dependence.

Table A.2. List of variables in the regression analysis: Definition, data source and time spell.

Variable	Definition	Source and time period
NAIRU	Non-accelerating inflation rate of unemployment	OECD, 1985 – 2014
Labour market institutions variables		
Employment Protection Legislation (EPL)	Strictness of employment protection, individual and collective dismissals (regular contracts)	OECD, 1985 – 2014
Active Labour Market Policy (ALMP)	Public expenditure and participant stocks in LMP (in % of nominal GDP), divided by the unemployment rate	OECD, 1985 – 2014
Unemployment benefits (UBR)	Net unemployment benefit replacement rate spliced with gross unemployment benefit replacement rate.	OECD, 1985 – 2014
Trade Union Density (UnD)	Share of workers affiliated to a trade union as percentage of the labour force	OECD, 1985 – 2014
Macroeconomic shock variables		
Terms of Trade Shock (TOTS)	Yearly growth rate in the terms of trade index (i.e., import share over GDP times log of relative import-GDP prices)	OECD, 1985 – 2014
Real long term interest rates (LTI)	AMECO nominal long-term interest rate minus annual GDP deflator	AMECO, 1985 – 2014
TFP shock (TFP)	Yearly growth rate in Total Factor Productivity	AMECO, 1985 – 2014
Demand side variables		
Capital Accumulation (ACCU)	Real gross fixed capital formation/real net capital stock (*100) _{SEF}	AMECO, 1985 – 2014
Cyclically Adjusted Primary Budget Balance (CAPB)	IMF-computed structural fiscal budget net of interests (as a % of potential GDP)	IMF, 1985 – 2014