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MASTERS FINAL WORK
DISSERTATION

DO LABOUR MARKET REFORMS PAY OFF? UNEMPLOYMENT AND CAPITAL ACCUMULATION IN PORTUGAL

DIOGO MIGUEL GOMES MARTINS

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Abstract

The aim of this dissertation is to study the long-run relationship between unemployment, capital accumulation and labour market variables in Portugal for the 1985Q1-2013Q4 period. We use an ARDL-bounds test model to perform the econometric estimation. We find evidence that capital accumulation has been the main driver of long-run unemployment (NAIRU), whilst labour market variables have played either a negligible or an existent explicative role. It suggests that Portuguese NAIRU is endogenous relative to capital accumulation. Consequently, we conclude that the labour market reforms proposed by *Troika* were inadequate to the Portuguese case as they were based upon a theoretical framework (exogenous NAIRU model) that was not representative of the Portuguese labour market.

Keywords: NAIRU, Unemployment, Capital Accumulation, Labour Market Institutions, ARDL, Bounds Test, Post Keynesian Economics

JEL codes: E11, E12, E15, E22, E24

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1   Introduction

In 2011 Portugal signed a memorandum with *Troika*, an association of the IMF and European in-
stitutions, that committed the Portuguese government to follow a set of political, institutional and
economic policies in exchange for the financing provided by those international institutions to the
Portuguese state (IMF, 2011).

The *Troika* memorandum was based upon two policy blocks that were implemented simultaneously:
a first one, designed to correct the macroeconomic imbalances of the Portuguese economy, namely the
trade imbalance and the high public and private debt to GDP ratios; and a second block, designed to
enhance the long-run output growth, based upon the so called structural reforms.

The structural reforms were mainly devoted to the labour market and to the welfare state. They
included the freezing of nominal minimum wages, the decrease in the value of dismissal compensations
and cuts in the scope and in the amount of unemployment benefits and of other social subsidies[1].
This set of policy prescriptions, dear to almost all IMF interventions, was inspired in the NAIRU
literature whose appearence is historically situated at the beginning of 1990's. That literature empha-
sises the need for more flexible labour markets has a necessary condition to achieve a lower long-run
unemployment rate.

Despite the growing consensus around the failure of the programme in relation to the correction
of the macroeconomic imbalances, since the public and private debt to GDP continued to increase
during the memorandum period, there are still supporters of the economic virtues of the programme
who argue that the structural reforms implemented have created a new institutional framework that
will guarantee lower levels of unemployment in the future.

Given the extensive critical literature that has emerged in the past twenty years , such considerations
are far from being obvious. That critical literature found evidence that labour market institutions play
a minor role in explaining long-run unemployment, whilst aggregate demand, in general, and capital
accumulation, in particular, were its crucial determinants.

Inspired by that line of research, we will study the long-run relationship between unemployment,
labour market institutions and capital accumulation, using an ARDL-bounds test model. It has the
advantage of assessing the existence of cointegration between variables with different integration orders.
The application of this econometric model is an innovation compared to the existing with the existent
literature since it has never been used before in this area of research. The period of time under
investigation ranges from 1985 to 2013.

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[1]For an extensive analysis of the measures proposed by *Troika* and their social and economic implications see ILO
(2013)

My main research question consists of understanding how important the labour market reforms and capital capital accumulation have been in explaining the evolution of unemployment in Portugal over the last three decades. If the labour market reforms proved to be crucial to explain unemployment during that period, the structural reforms contained in the memorandum are correctly designed given the historical experience of the Portuguese labour market; if the labour market reforms proved to be irrelevant while capital accumulation proved to be crucial, it is reasonable to conclude that the memorandum measures were not well designed. Actually, they may have even been harmful to the long-run unemployment rate, given the negative impact the internal devaluation had on the investment growth rate.

The thesis is organized as follows: the first section briefly describes the NAIRU model; section two presents a critical appraisal of the conventional NAIRU model and sets the foundations for an endogenous NAIRU theory; section 3 briefly revises the existing literature about this topic; finally, section 4 reports the empirical assessment, including the variable definition, the econometric model and the discussion of the results.

2   The NAIRU model

The presentation of the NAIRU model will rely on the exposition made in Layard and Nickell (1991, ch 1), a reference book for the NAIRU literature.

The model has an imperfect competition structure in wich capitalists and workers hold some degree of market power. Payment of the production factors is not technologically determined; it depends on the bargaining power of each side of the market.

The bargaining behaviour of each part is formalized by the following set of equations:

Price-setting equation:

$$p\text{--}w^e = \beta_0 - \beta_1 u \tag{1}$$

Wage- setting equation:

$$w\text{--}p^e = \alpha_0 - \alpha_1 u \tag{2}$$

where u represent the unemployment rate, p and w the actual price and wage level and p^e and w^e the expected price and wage level. For a graphic representation, see Figure 4 in the Appendix.

Capitalists set the price through a mark-up on the expected nominal wage, a mark-up that is negatively influenced by the unemployment level. The mark-up sensibility to unemployment (β_1) is assumed to be weak or even nonexistent. This reflects the assumption of a slightly pro-cyclical market power. Ultimately, when mark-up is insensitive to economic activity, the price setting curve is flat and illustrates a situation of normal cost pricing.

On the other hand, workers set their nominal wages through a mark-up on the expected price level. Workers market power is inversely dependent on the unemployment level. Expansionary periods are associated with low unemployment levels and, consequently, with workers' higher bargaining power and thus higher expected real wages. By contrast, recessions are associated with high unemployment levels and, consequently, with a weaker bargaining power and lower expected real wages.

The inflation rate is constant only if the expectations of the agents were fulfilled. There is just one level of unemployment that is able to ensure this condition – designated as the non-accelarating rate of unemployment (NAIRU) – determined exogenously by the structural conditions of the economy.

Demand shocks move unemployment away from its equilibrium level, giving rise to inconsistent claims on output. A positive shock makes the sum of the expected shares of capitalists and workers bigger than the output value. As adjustment mechanism, the inflation rate will change such that unemployment increases, causing a decrease in the workers' bargaining power[2]. A negative shock

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[2]The relation between inflation, output and unemployment will be explained in detaile in the subsection 2.3

creates the opposite process. The adjustment will continue until NAIRU has been restored. Hence, NAIRU works as a gravitational centre to the effective level of unemployment and is not influenced in the long run by demand shocks. Supply side shocks alone, such as a change in the price of raw materials or in the institutional structure of the labour market, are able to modify its value.

Under this paradigm, involuntary unemployment is accepted and is attributed to the labour market's inability to clear due to supply side frictions, such as the setting of efficiency wages (Shapiro and Stiglitz, 1984), the bargaining power of unions and the mismatch between firms and workers at the educational and geographical level. This characteristic marks a contrast to the New Classical framework, where the labour market tends to a market clearing position and all unemployment is voluntary due to the unwillingness of some agents to work at the current real wage (Lucas, 1972).

The NAIRU model was developed under the broader paradigm of New Keynesian Economics. Generally, this school of economic thought advocates that demand shocks only affect the economy in the short-run, while price and wage rigidities are in place and there is a trade-off between inflation and unemployment, illustrated by a negatively sloped Phillips curve. However, in the long run the Walrasian features are restored and the economy shows a self-adusting tendency to the NAIRU. The Phillips curve becomes vertical, meaning the absence of a tradeoff between inflation and unemployment. Demand-led policies are thus useless in the long run, generating only increases in inflation and no impact on output (Mankiw, 1992).

Therefore, the economic policy advice usually focuses on the correction of frictions in the supply side of the market, deemed to be an essential step towards a lower NAIRU. Two main types of policies are suggested to reach this goal; those aimed at decreasing the mismatch between workers and firms and those related to the weakening of the wage-push variables.

The first types of policies are widely accepted. They include the creation of new educational and professional programmes provided to workers, which seek to adapt their qualifications to the needs of firms. They also contemplate pin-point targeting procedures, designed to take into account the heterogeneous characteristics of different regions. A better match between the labour supply and the vacancies provided by firms ensures a lower NAIRU in the long-run (Layard and Nickell, 1991, ch 6).

Wage-push variables are those which influence the bargaining power of workers. Examples include union coverage, unemployment benefits, minimum wages and dismissal compensations. New Keynesians argue in favour of decreasing wage-push variables in order to achieve a lower long-run NAIRU, since weaker bargaining power increases workers' willingness to work at lower expected real wages. Furthermore, they claim that it increases the speed of adjustment towards the equilibrium after a shock. Cuts in unemployment benefits and in minimum wages or new institutions that limit the power

of unions are hence the most common policy recommendations (Layard and Nickell, 1991, ch 10).

Several authors have criticized the New Keynesian conclusions extracted from the NAIRU model. Most of its critics came from Post-Keysenianism, a school of thought which emphasizes the role of aggregate demand in the determination of output, both in the short and in the long run (King, 2013). They argue that New Keynesians misrepresent the main theoretical contributions of Keynes, by pointing out the lack of adjustment of prices and nominal wages as the leading justification behind involuntary unemployment. They state that the New Keynesian explanations are much closer to the ones proposesed by opponents of Keynes, like the classical economist A. C. Pigou (Davidson, 2011).

Stockhammer (2008) argues that the acceptance of the NAIRU concept, that is, the existence of an unemployment rate below which the conflicting claims on output lead to an increase in the inflation, does not imply the adherence to a theory or to a single set of economic policy prescriptions. In fact, NAIRU is compatible with New Keynesian, Post Keynesian or Marxist schools of economic thought, depending on the assumptions made about its determination and dynamics. New Keynesian interpretation is seen just as an implausible special case in which it is assumed that NAIRU is exogenously determined and it is able to impose a self-adjusting trend to current unemployment. If these premises were not verified, then aggregate demand and capital accumulation, in particular, can play a determinant role in setting the long-run unemployment rate.

3   Endogenous NAIRU

A critical appraisal of the NAIRU model must challenge its three main assumptions: uniqueness, automatic tendency to equilibrium and invariance to demand shocks. In the following sections, arguments will be presented against these assumptions and the foundations set for an endogenous NAIRU theory.

3.1   Must NAIRU be unique?

NAIRU uniqueness is implicitly related to the assumed Phillips curve shape. The Phillips curve relates the change in inflation rate - which in turn depends on the real target wage of workers - with the unemployment rate. If the Phillips curve is negatively sloped in the whole domain, as is usually assumed in the short-run, each level of unemployment corresponds to a different real target wage, so that there is only one level of unemployment compatible with a constant level of inflation. Moreover, if the Phillips Curve is vertical, as is often assumed in the long-run, the tradeoff between inflation and unemployment does not exist at all. Therefore, any attempt of exploring that trade-off by the government will be unfruitful.

However, there is profuse empirical evidence contrary to those Phillips curve shapes. Studies conducted in different countries have estimated that the Phillips curve has a horizontal shape for low and average values of unemployment (Eisner, 1996; Filardo, 1998; Barnes and Olivei, 2003). That means that NAIRU is not a single point but a range within which unemployment can decrease without increasing the actual target wage of the workers. Inside that horizontal segment it is possible for governments to delineate their economic policy to reduce unemployment without the fear of accelerating inflation. Theoretically, the assumption of a Phillips curve with a horizontal segment has already been adopted by Keynesian and Post-Keynesian authors (e.g. Tobin, 1995; Kriesler and Lavoie, 2007).

3.2   NAIRU long-run variance to demand shocks

3.2.1   Short-run deviations

Mainstream authors concede the existence of NAIRU deviations from its long-term value. This theoretical concession is designated by unemployment hysteresis. Hysteresis is a concept taken from the lexicon of physics, which refers to the persistence of past shocks in future periods. Thus, the concept of unemployment hysteresis states that the present unemployment can be partly explained by its own past dynamics.

Hysteresis is mainly justified by the limited power of the outsiders in the bargaining process, preventing the adjustment of the real wage to its initial value after the shock. Their limited power is related to the loss of abilities and skills during the period of unemployment, which make them less desirable for employers, or with labour market characteristics favourable to the bargaining power of insiders, like the existence of turnover costs (Lindbeck and Snower, 1988).

To illustrate this idea, suppose a negative demand shock associated with a higher level of unemployment in two distinct situations: a first where hysteresis is absent and a second where hysteresis is present.

In the first case, the negative demand shock has no impact on the workers' bargaining power for each level of unemployment, which graphically means that the wage-setting curve remains unchanged. Then, it is possible to conclude that the new unemployment level is unstable, since it does not correspond to the intersection between the price and the wage-setting curves. Its unstable nature is related to the inconsistent claims over output that are created at that new point where workers are demanding an income share lower than the equilibrium point because of their weaker bargaining power. That inconsistency will trigger a downward trajectory in the inflation rate which, assuming a conventional adjustment mechanism in the goods market, will make output increase and unemployment decrease

until NAIRU has been restored - see Figure 5 in the Appendix.

In the second case, hysteresis is present due to the weaker bargaining power of the outsiders. Within this context, the negative demand shock has an impact on the workers' bargaining power for each level of unemployment since the proportion of the long-term unemployed possessing weaker bargaining power will tend to increase sometime after the shock. The insiders will take the chance to strengthen their bargaining power, causing an increase in the real wage target. Graphically, this change is given by an upward rotation of the wage-setting curve, reflecting an inferior sensibility of the wage setters to the overall level of unemployment. The magnitude of that rotation depends on the proportion of long-term unemployed in each period of time. Unlike the first situation, where the adjustment in the goods market guarantees the return to the pre-shock unemployment level, in this case the adjustment will stop at the interception between the new wage-setting curve and the original price-setting curve, which corresponds to the new short-run NAIRU (Blanchard and Summers, 1986) - see Figure 6 in the Appendix.

Despite this short-run concession to the endogeneity hypothesis, the long-run NAIRU is still assumed to be exogenous. The argument is the following: as long as the long-term unemployed exert some influence over the determination of wage claims - which is assumed to be a reasonable assumption for its proponents - it is just a matter of time until they can make wage claims return to the initial level, which is graphically given by a downward rotation of the wage-setting curve until presenting its original slope again. When this happens, the short-run NAIRU ends its convergence path towards long run NAIRU. The latter is totally exogenous and only changeable by supply side factors (Nickell, 1998).

3.2.2 Long-run path dependence

In contrast, Post-Keynesian economics argues that the potential GDP, and so NAIRU, are determined by the past and present behaviour of aggregate demand (AD). That is, the potential GDP is path dependent in relation to AD. As examples, we will mention the impact of aggregate demand on three supply side elements: long run capital to output ratio, labour force growth rate and technological progress. The following arguments are summarized in Fontana and Palacio-Vera (2007).

Long-run Capital to output ratio: In the short-run, an increase in aggregate demand increases the utilization of the capital stock. If the capital utilization is high, it may create an incentive to increase investment, since companies want to increase their production capacity to match growth in demand. In the long term, this process leads to a higher capital to output ratio, increasing potential output. Instead, if the aggregate demand is low, there is greater spare capacity. Judging that the

installed capacity is sufficient to meet the future demand rises, companies may reduce their investment causing a decrease in the capital to output ratio and in the potential output (e.g. Cornwall, 1972). Additionally, an increase in AD can stimulate investment via increased retained profits because it raises the internal financing capacity of companies. Using Kalecki's words: "(. . .) investment decisions are closely related to internal accumulation of capital, i.e. to the gross savings of firms." (Kalecki, 1971).

Labour force rate of growth: When demand shocks are long and severe, causing high levels of unemployment during several years, they can lead to significant migration of workers who leave their home countries in search of work abroad. As most of these workers are adults of childbearing age, the birth rate tends to lower in the countries of origin, causing a decrease in the potential labour force growth rate and, consequently, in the potential output.

Techonological progress: AD can positively interfere in technological progress for at least two reasons. First, the expansion of demand can intensify the effects of learning by doing associated with the need to meet a higher level of production. Secondly, a high AD creates the need for companies to seek technological innovations that make them more efficient to meet the increasing production volume despite their limited level of resources. Moreover, higher efficiency and innovation may cause further expansion of new markets, in a process called dynamic increasing returns to scale. As classically stated by Joan Robinson, "(...) technical progress is being speeded up to keep up with accumulation. The rate of technical progress is not a natural phenomenon that falls like the gentle rain from heaven. When there is an economic motive for raising output per man the entrepreneurs seek out inventions and improvements. Even more important than speeding up discoveries is the speeding up of the rate at which innovations are diffused. When entrepreneurs find themselves in a situation where potential markets are expanding but labour hard to find, they have every motive to increase productivity" (Robinson, 1956, p. 96).

The above arguments have been received with scepticism for many years by mainstream economists. That should not be surprising since the long-run output invariance to demand shocks had been consensually assumed as one of the mainstream cornerstones of economics (Solow, 1997).

However, upon the appearance of the Great Recession, economists have recently become more open to accepting the path dependence hypothesis. Assessing the impact of the global financial crisis in a sample of 23 countries, Ball (2014) concluded that "(. . .) shortfalls of actual output from pre-recession trends have reduced potential output almost one-for one"; and, in the same sense, Ceretti and Summers (2015) found evidence from a sample of over 120 recessions that about two-thirds of them have led to a permanent gap between the previously estimated potential output and the after-recession estimate. They present this evidence under the concept of "super hysteresis" which, in practice, corresponds to

the acceptance of long-run effects of AD on potential output.

At the end, we should make clear the importance of these arguments to the NAIRU theory: if we take as valid the assumption of the long-run path dependence of potential output in relation to AD, that means that there is no such thing as a single and exogenous NAIRU. Given that NAIRU is derived from the potential output and this output is determined by past behaviour of AD, NAIRU is fully endogenous and its values heavily depend on the way AD was managed made in the past.

Capital accumulation: a particular case   After presenting a set of arguments in favour of the AD impact on long-term growth and therefore on NAIRU, the exposition will now focus on a particular component of AD, investment, and on capital stock.

According to Keynesian thinking, investment volatility is the main determinant of unemployment dynamics in the short and long-run (Keynes, 1936). In opposition, NAIRU literature argues that long-run unemployment is invariant in relation to capital accumulation (Layard and Nickell, 1991). We now argue that capital accumulation introduces demand and supply side transformations that make NAIRU endogenous to investment, favouring the Keynesian thesis.

First, as Robert Rowthorn convincingly argues, the invariance of NAIRU to capital accumulation is merely a consequence of a particular kind of production function specification (Rowthorn, 1999). Layard and Nickell (1991) utilizes a Cobb-Douglas production function, whose value of the elasticity of substitution between capital and labour (ε) is, by definition, equal to 1, meaning that capital and labour are perfect substitutes. Furthermore, they assume that any increase in labour productivity will be fully reflected in real wages. Under these assumptions, suppose that there is an increase in capital stock which, in turn, increases the marginal productivity of labour. If everything else stayed constant, it should lead to an increase in the demand for labour and, consequently, to a corresponding increase in employment. However, because we are assuming $\varepsilon=1$ and that any increase in productivity will be fully reflected in real wages, the increase in productivity will be exactly offset by the increasing wage costs. It creates a change in employment symmetric to the one caused by the increase in capital stock. It turns out that the employment level seems not to be sensitive to changes in capital stock.

Although ingenious, this narrative is not backed up by the facts. Empirically, the values of ε are significantly far from one. Out of a total of 33 econometric studies, in only 7 cases does the summary value exceeds 0.8, and the overall median of the summary values is equal to 0.58 (Rowthorn, 1995). Complementarily, Manning et al. (1992) and Elmeskov (1993) found evidence that labour productivity is, in fact, a weak explanatory variable for the evolution of real wages.

So, taking into account the empirical evidence, we can tell a quite different story. If the adjustment

of real wages to productivity is only partial and the substitutability between capital and labour is inferior to 1, it means that the net creation of employment caused by capital accumulation is positive, making NAIRU endogenous.

Furthermore, capital accumulation decreases the pressure on inflation for two reasons. The first is related to the process described above: if the real wages do not fully adjust to productivity changes, then the proportion of wage claims over total output becomes smaller. Second, a similar process occurs on the capitalists side. The increasing capital stock increases spare capacity, which is assumed to have an inverse relationship with the mark-up set by firms. A smaller mark-up means a minor proportion of profit claims over total output. Both effects increase the level of real wages compatible with constant inflation which, consequently, is consubstantiated in a lower NAIRU (Rowthorn, 1995).

3.3   NAIRU as a weak attractor

As was stated above, New Keynesians see NAIRU as a strong attractor to actual unemployment. The root for this result rests in the adjustment mechanism in the goods market which, in turn, is related to the AD shape.

AD is usually displayed in two distinct spaces: Price-output and Inflation-output spaces. The former has little expression in contemporary research, but remains the representation presented in most introductory and intermediate textbooks which justifies our explanation and critical appraisal. The latter is the contemporary dominant view and it is a crucial assumption of the New Consensus Macroeconomics (NCM) (Romer, 2000).[3].

3.3.1   AD in Price-Output space

The three main factors behind a negatively sloped AD in the price output space are broadly known and can be found in any introductory textbook (e.g. Bernanke et al., 2015 and Mankiw, 2014). The first is related to the effect of inflation on money demand. Higher inflation is associated with an increasing money demand for transactions. Given an exogenous stock of money, it raises the interest rate and consequently depresses investment and AD. This mechanism is usually called the Keynes effect. The second is associated with the relation between inflation and the real money ballances. Higher inflation will decrease real money balances detained by agents, which decreases the purchasing power of the current money stock. It is assumed that this decrease in real wealth will negatively influence consumption and investment (Pigou effect). The last, and probably least controversial factor, justifies

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[3]New Consensus Macroeconomics, sometimes also called Modern Macroeconimcs, is the result of a synthesis between the New Classical and the New Keynesian schools.

the reduction of AD through the appreciation of the real exchange rate, worsening the competitiveness of the economy and decreasing external demand.

Upon accepting the negative slope of the AD, the NAIRU gravitational position appears as a logical result. If unemployment falls below the NAIRU, inflation will have to go up in order to adjust the wage claims compatible with that level of unemployment. This increase will be accompanied by a decrease in AD until the new value of the NAIRU is reached. A symmetric process occurs when unemployment is above the NAIRU. Thus, as long as we assume a downward sloped AD, NAIRU will always be a a strong attractor to actual unemployment.

But these assumptions have been subjected to stern criticism. The existence of an exogenous stock of money is a simplifying assumption which has no correspondence in reality. In fact, there is empirical evidence suggesting that the money supply is endogenous, being influenced by the dynamics of aggregate demand, particularly through its impact on the demand for credit, while the interest rate is exogenous. This hypothesis has long been advocated by post-Keynesian authors (e.g. Kaldor, 1985, Moore, 1988, Chick, 1973) and more recently by authors coming from NCM (Blinder, 1997). Without an exogenous money supply, there is no reason either for an increase in AD to cause a rise in the interest rate or for an inverse relationship between the price level and real money balances, refuting both effects.

Moreover, the preponderant role of debt in modern economies gives us another reason why the aggregate demand does not depend negatively on the price level. Known as debtdeflation, this effect emphasizes the negative role that falling prices have on aggregate demand by increasing the real value of debts and so having a negative impact on consumption and investment intentions of agents (Fisher, 1933). In the context of the Great Recession we are going through, where many countries detain high private and/or public debts, this effect has to be considered.

3.3.2   AD in the Inflation-Output Space

The representation of AD on the inflation-output space was initiated by New Keynesian authors and was later embraced by the NCM. Inside the NCM framework, the Central Bank (CB) adjusts its interest rate depending on the inflation target. Whenever expectations of a growing aggregate demand threaten the inflation goal set by the central bank, it should raise the short-run interest rate in order to depress the evolution of demand and inflation expectations. Therefore, it is the CB reaction function that imposes a downward slope to AD.

However, we must be aware of two profound differences between this mechanism and the previously presented one. Whilst processes illustrated by Pigou and Keynes effects are supposed to be automatic,

that is, determined by the spontaneous action of the market, the CB's response depends on a deliberate action of the monetary authority, the absence of which determines the inexistence of the process. Besides, and even more relevant, the CB's action is not always effective. In the current context of the Great Recession, central banks face the so-called zero lower bond problem (Eggertsson and Krugman, 2012) and despite seeking to use alternative instruments of monetary policy (e.g. quantitative easing), their power to influence aggregate demand has been shown to be limited. In a scenario of the central bank's difficulty/inability to influence aggregate demand (as is happening now in the Eurozone) there is no plausible mechanism that makes the AD have a negative slope.

In short, it is not possible to give a conclusive answer regarding the shape of AD curve. During normal times, with a CB able to influence output and a low level of public/private debt, it is probable that AD shows a negative slope. However, during times such as what we are living in, characterised by high indebtedness and a powerless CB, there is no reason for the AD curve to present that shape (Stockhammer, 2011), undermining the macroeconomic foundation for a NAIRU that works as a gravitational centre to economic activity.

3.4   Summary

The previous sections carried a critical appraisal of the conventional NAIRU theory. Furthermore, arguments were presented for the adoption of an alternative theoretical framework, which can be labelled as endogenous NAIRU theory or, in the terminology of Arestis and Sawyer (2005), structuralist view of inflation. It has the following stylized characteristics: 1) NAIRU is not unique – there are a range of unemployment rates in which the inflation rate may stay constant; 2) the major supply side factors that influence the inflation frontier are the conflict over income shares and productive capacity – labour market institutions play a minor role; 3) supply side factors are not independent of the aggregate demand behaviour. Capital accumulation can influence the income shares conflict and productive capacity, meaning that aggregate demand can influence NAIRU in the long-run (Arestis and Sawyer, 2005).

In conclusion, inside this new framework governments no longer need to accept high levels of unemployment to prevent rising inflation. Alternatively, they may choose appropriate demand policies to stimulate investment and underpin full employment.

4   Literature Review

4.1   The NAIRU model

To explore the differences in unemployment between countries, Layard and Nickell (1991) estimate a cross-sectional equation including 20 countries during the 1983-1988 period. The group of independent variables included benefit duration, replacement ratio, active labour market spending, coverage of collective bargaining and the change in inflation and all variables proved to be statistically significant. Benefit duration, replacement ratio and coverage of collective bargaining had a positive impact on unemployment while active labour market spending had a negative one. Furthermore, it was claimed that this kind of regression structure is able to explain over 90 per cent of the cross-country differences in unemployment. As policy recommendations, they suggest measures such as decreasing the duration of unconditional unemployment benefits, diminishing of employment protection legislation, reforming the bargaining systems and the design of training programmes to overcome the mismatch between workers and firms.

In the same vein, Siebert (1997) argues that global competition and technological progress create the need for a flexible labour market taht can adapt to the successive shocks hitting the economy. The labour protection measures such as barriers to dismissal or the existence of a dismissal compensation are presented as detrimental for employment, since firms decrease their labour demand because they fear not being able to lay off workers after a future shock. Social protection measures such as unemployment benefits increase workers' reservation wage, also contributing to a higher equilibrium unemployment level. Finally, the author makes a brief analysis on the evolution in unemployment in several European countries, concluding that the faster decrease of unemployment in United Kingdom and Netherlands was due to their adherence to flexible labour market measures.

Nickell (1998) conducted an econometric study covering all the OECD countries between 1964 and 1992. He sought to explain the behaviour of unemployment through seven explanatory variables: Industrial turbulence, replacement ratio, terms of trade, skills mismatch, union mark-up, tax wedge and real interest rate. He found a strong long run relationship between unemployment and skills mismatch, union density and tax wedge. These results are consistent with the NAIRU model predictions.

The conclusions of this research agenda were quickly absorbed by international organizations with a significant influence over policy making. The policy recommendations of the OECD Job Study, published in 1994, were entirely in agreement with the NAIRU literature published in the preceding years (OECD, 1994). This study was an important legitimacy source for the labour market deregulatory reforms implemented by most countries during that decade. The same sort of policy recommendations

regarding labour market reforms can be found in subsequent institutional reports, like IMF (2003) or EC (2003).

4.2   Critical response

Although the NAIRU model has become the dominant script for the interpretation of unemployment in developed economies, its theoretical and empirical foundations have been repeatedly challenged. The theoretical counterpoint was widely explored in section 2, so will not be discussed again.

On the empirical level, the refutation attempt follows, roughly, two main lines of research. There is a first set of authors who investigates the robustness of the institutional variables used by advocates of the NAIRU model, assessing whether slight modifications in the specification of equations or new choices in the period of analysis have an impact on the significance of the explanatory variables. They also seek to assess whether monetary policy generates long-term effects on unemployment, opposing the conventional notion that their effect would be limited to the short-term. The other line of research introduces capital accumulation in the econometric specifications in an attempt to assess whether the lack of capital and/or the lack of investment are the main causes of unemployment in the long term.

4.2.1   Do time and specification matter?

Ball et al. (1999) analysed a sample of two groups of countries: a smaller group, consisting on six of the seven G-7 countries and a larger sample consisting on 17 OECD countries. Both groups have in common the fact they went through recessions in the early 80's. They noted that the monetary policy strategy after the recession was decisive for the degree of hysteresis, that is, the degree to which short-term unemployment affects long-term unemployment (NAIRU). Countries conducting an easier monetary policy, such as US and Canada, had fast and sustained decreases in their rate of unemployment without the occurrence of large increases in their inflation rates. In contrast, most European countries chose to maintain a tight monetary policy, a decision that caused higher and more persistent levels of unemployment. Thus, they concluded: "(...) demand expansions helped reduce the NAIRU, but the permanent reduction in the NAIRU does not require a permanent rise in inflation". They also report that "the role of labour market reforms in the success stories is exaggerated." Opposing the conclusions of Siebert (1997), they suggest that the case of Netherlands and UK are just particular cases unable to validate the success of labour market reforms. In fact, there are a large number of other countries that have also made these reforms without achieving the same success. In support of their argument, they allude to Blanchard and Jimeno (1995), where it is claimed that the evolution

of unemployment in Portugal and Spain is very different, even though the type and timing of labour market reforms are similar.

Ball et al. (1999) set themselves apart from other mainstream analysis on the impact of monetary policy on the unemployment rate by suggesting that monetary policy has long-term effects. Blanchard and Wolfers (2000), for instance, concede that the influence of labour market reforms has been overemphasized and that monetary policy may influence the short-term unemployment but retain the assumption that long-term unemployment remains invariant to the effect of monetary policy on aggregate demand.

Howell et al. (2007) criticize the institutional variables construction criteria for being too subjective and for hiding the lack of homogeneity among the various countries analysed. The gross replacement rate (GRR), for example, often used as an indicator of the generosity of unemployment compensations, fails to capture the existing asymmetries in the unemployment benefit eligibility criteria in each country. It is possible that countries with a high GRR have low coverage rates and vice versa. The same criticism can be directed at the Union Density (UD), since this indicator does not capture the collective bargaining coverage, that is, the share of employees whose wages and employment conditions are set through collective bargaining. There are several examples of countries with low UD and very high levels of collective bargaining coverage, whereby the interpretation of the indicator can be misleading.

They also dispute the causal relationship usually presented. By applying Granger-causality tests, they found that in 4 countries it is the change in unemployment that causes the variation of the GRR and not the opposite way round, as usually assumed. This causal relationship is probably explained by the increase in unemployment benefits during times of recession, representing an attempt to diminish the associated social costs.

In addition, empirical studies performed by OECD and IMF seem to be extremely sensitive to small changes in the equations specification. Baker et al. (2004) perform minor changes in the three main specifications of IMF (2003), including new variables and interactions between variables generally used in previous researches on the subject. Statistical evidence changes dramatically: from all previously significant institutional variables, only the tax wedge remains significant at 10% level.

Baccaro and Rei (2005) summarize a set of arguments supporting an alternative view with regard to the impact of the labour market institutional variables. In particular, they argue that a longer and generous GRR can increase the likelihood of matching workers and job offers and that employment protection legislation necessarily has an ambiguous effect, since it reduces both flows from unemployment into employment and flows from employment into unemployment. Additionally, they test the robustness of the methods used in Nickell and Nunziata (2001) and in IMF (2003). They apply a wide

range of alternative specifications, using static and dynamic models, annual and average data as well as a long list of estimation techniques. Like Baker et al. (2004), they find that the results largely depend on the model specification and on the estimator used. They conclude that this evidence suggests that most of these studies are skewed to confirm the starting assumptions of the theory defended by their authors.

4.2.2   Capital stock and capital accumulation

Capital stock

Inspired by Rowthorn (1995), another vein of investigation tried to empirically refute the interpretation of the NAIRU story by including capital stock in the econometric studies with the purpose of testing the hypothesis according to which unemployment in developed economies is mainly due to the lack of sufficient capital to employ the entire workforce.

Arestis and Biefang-Frisancho Mariscal (2000) test this hypothesis for UK and for Germany. They make a regression of unemployment on expected real wages, union militancy, tax and import costs, long term unemployment, nominal price inertia and capital stock. They find that the impact of capital stock on unemployment prevails above any other factor. Arestis et al. (2007) apply the same regression to a panel of 9 EMU countries, reaching similar conclusions.

Using the Fully Modified Ordinary Least Squares (FMOLS) estimator, Palacio-Vera et al. (2011) performed a similar study, trying to relate unemployment to the generosity of unemployment benefits, the interest rate, the mark-up and the capital-output ratio. All variables, except for the mark-up, were statistically significant.

Capital accumulation

In an attempt to test the Keynesian assumption according to which the dynamic of investment is the main determinant of the unemployment rate, a set of studies have been conducted which include the growth rate of investment as a regressor, in addition to the usual variables representing the labour market and the welfare state structures. Unlike the ones presented in the previous section, these studies focus on the impact of the growth rate of capital accumulation rather than on the capital stock.

Stockhammer (2004) uses the Seemingly unrelated regressions (SUR) method to study the evolution of the labour market in the United States and four European countries. He chooses to perform two estimations with different dependent variables: the unemployment rate and the growth rate of employment. Capital accumulation is consistently significant in all countries in both specifications.

On the contrary, out of all the labour market variables, only the replacement rate is consistently significant with the signal predicted by the NAIRU hypothesis.

Studying the evolution of unemployment in a panel of 20 OECD countries, Stockhammer and Klär (2010) use as explanatory variables the capital stock growth rate and a set of institutional variables, such as employment protection legislation (EPL), replacement ratio, benefit duration, union density and tax wedge. They also use controls for several macroeconomic shocks, namely the real interest rate, terms of trade and the deviation of the total productivity from its trend factor. The data is structured in 5-year averages to eliminate business cycle fluctuations. Out of all the institutional variables, only UD coefficient is statistically significant with the expected signal. EPL coefficient is statistically significant but has a sign contrary to what one would expect - increasing EPL has a negative impact on unemployment. The capital stock growth rate is again statistically significant at 1% level.

In a more recent paper, Stockhammer et al. (2014) analyse the evolution of unemployment during the period of the Great Recession (2007-2011). Econometric specifications are similar to the ones used in Stockhammer and Klär (2010) but include a new variable, Housebub, defined as the deviation of the employment ratio in the construction sector from the global rate of employment, to assess the impact of the housing bubble in the evolution of unemployment. Again, the only statistically significant institutional variable is UD. Capital accumulation and Housebub are consistently significant in all specifications.

5   Empirical assessment

5.1   Data description

The data consists of quarterly time-series ranging from the first quarter of 1985 (1985Q1) to the fourth quarter of 2013 (2013Q4)[4]. The model will include six variables: Unemployment rate (U), capital accumulation (GK), government led employment protection legislation ($GEPL$), gross replacement rate (GRR), Union Density (UD) and an external macroeconomic shock (EMS).

The unemployment rate was directly taken from the Bank of Portugal Economic Bulletin (2015). Following Stochkammer (2004), GK is defined as the logarithm of gross fixed capital formation. The series was also taken from the Bank of Portugal Economic Bulletin (2015).

$GEPL$ is a composite variable computed as the logarithm of the product of the real minimum wage

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[4]Some series are not published on a quarterly basis. In these situations, we use the interpolation methods calculated by Eviews software. For each case, the chosen interpolation method was the one that better preserved the original series behavior.

(RMW) with the weighted average of the employment protection legislation indicators published by OECD (EPL) - $GEPL = LOG(RMW * EPL)$. To construct RMW data was extracted from the nominal minimum wage and divided by the quarterly Consumer Price Index (CPI). Both variables were taken from INE - Statistics of Portugal. EPL was built from two variables published by the OECD, strict employment protection legislation of regular workers ($SEPR$) and strict employment protection legislation of temporary workers ($SEPT$). The weights utilized were taken from PORDATA. They are respectively the proportion of regular workers in the employed population ($REGPROP$) and the proportion of temporary workers in the employed population ($TEMPROP$) - $EPL = SEPR * REGPROP + SEPT * TEMPROP$. We decided to build a variable that would aggregate the impact of employment protection legislation and the minimum wage, since these are the two institutional variables under the direct influence of government action.

GRR represents the gross unemployment benefit level as a percentage of previous gross earnings. It is an indicator that intends to measure the generosity of the unemployment benefits in each country. UD corresponds to the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. It represents a proxy for the bargaining power of the workers. Both variables are computed by the OECD.

EMS is calculated as the logarithm of the product of trade openness (TO) with terms of trade (TOT) - $EMS = LOG(TO * TOT)$. This specification of the external macroeconomic shock follows the past literature on the subject, in line with Baccaro and Rei (2005) . TO is defined as the ratio between the sum of exports (EX) with imports (IM) divided by the gross domestic product (GDP) - $TO = (EX + IM)/GDP$. The values of EX, IM and GDP are taken from the Bank of Portugal Economic Bulletin (2015). TOT is defined as the ratio between the index of export prices and the index of import prices and it can be interpreted as the amount of import goods an economy can purchase per unit of export goods. The variable was taken from the OECD.

GK is a measure of capital accumulation and is included to test for the Keynesian hypothesis. $GEPL$, GRR and UD are institutional variables and are included to test for the exogenous NAIRU hypothesis. EMS is a control variable.

According to the NAIRU hypothesis $GEPL$, GRR and UD are expected to have a positive long-run impact on the unemployment rate; GK can influence unemployment negatively but only in the short-run. In contrast, the Keynesian hypothesis postulates that GK is the main determinant of unemployment, having a negative influence both in the short and in the long-run; it also predicts that $GEPL$, GRR and UD should not play a major role in explaining long-run unemployment.

5.2   Methodology and Results

5.2.1   ARDL approach to cointegration

To assess the long run relationship between unemployment, capital accumulation and the institutional variables, we will employ the Auto Regressive Distributed Lag (ARDL) – bounds test approach to cointegration analysis developed by Pesaran and Shin (1998) and Pesaran et al. (2001).

The notion of cointegration arose out of the concern about spurious or nonsense regressions in time series. When a set of variables are integrated of some order, the traditional estimation techniques applied to stationary data are commonly not valid. They generate misleading results as highly significant coefficients, low values of Durbin-Watson statistic and R squared values that behave like random variables (Granger and Newbold, 1974). However, it is possible to extract valid conclusions out of models with non-stationary variables as long as there is cointegration between them. Two sets of non-stationary $I(d)$ and $I(p)$ variables are cointegrated when exists at least one linear combination between them which is integrated of order $I(d-p)$, with $d > p$. When that is the case, it is possible to conclude the existence of a long-run relationship between the cointegrated variables.

The traditional cointegration approaches such as Engle and Granger (1987) and Johansen and Juselius (1990) had the disadvantage of requiring that all the variables employed had the same order of integration. The approach of Pesaran and Shin (1998) overcomes that methodological limitation by allowing for the use of a mixture of $I(1)$ and $I(0)$ variables in the regression. The model just imposes that the dependent variable must be $I(1)$ and that none of variables may have an order of integration higher than one.

Consequently, the first step is to determine the order of integration of the variables using the Augmented Dickey-Fuller test proposed by Said and Dickey (1984). The results are summarized in the following table:

Table 1: Unit Root Test - ADF Test

Variables	Level		1st differences		Conclusion
	intercept	intercept and trend	intercept	intercept and trend	
U	-0.9595	-2.1486	-3.7075^{***}	-3.8300^{**}	I(1)
GK	-2.2000	-1.1369	-3.2702^{**}	-3.8416^{**}	I(1)
$GEPL$	-3.4264^{**}	-3.3068^{*}	-	-	I(0)
GRR	-2.5315	-2.5105	-3.8240^{***}	-3.7638^{**}	I(1)
UD	-3.40185^{**}	-3.4666^{***}	-	-	I(0)
EMS	-1.8689	-1.3067	-12.0915^{***}	-12.2216^{***}	I(1)

*, ** and *** denote significance at ten, five and one percent significance level. Number of lags chosen by Akaike Information Criteria (AIC)

As we can observe, there is supportive evidence for the dependent variable (U) being integrated of

order 1, as well as GK, GRR and CEPL. In contrast, GEPL and UD appear to be stationary. The order of integration of the dependent variable and the mixture of I(1) and I(0) regressors are supportive findings for the use of the ARDL approach.

The ARDL model has the following general form:

$$y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \beta_i L^i y_t + \sum_{j=0}^{q} \gamma_j L^j x_t + \varepsilon_t \tag{3}$$

where α_0 is a constant, t is a time trend, y_t is a dependent variable, x_t is a vector of independent variables, L represents the lag operator and ε_t is a white noise error term.

5.2.2   Model selection

To determine the optimal lag length of the model, the Akaike informaton criteria (AIC) will be employed as proposed by Akaike (1974). It can be formally expressed as:

$$AIC = 2K - 2ln(L) \tag{4}$$

where K represents the number of parameters of the model and L is the maximised log-likelihood. The chosen model is the one that minimizes this expression. The criteria simultaneously ponders the goodness of the fit towards the inclusion of L and seeks to avoid the overfitting of the model by introducing a penalty for each additional parameter (K).

We choose to use AIC instead of other information criteria, like Bayesian information criterion (BIC) or Hannan–Quinn information criterion (HQC), because AIC is the only one that is asymptotically efficient. For a proof, see Burnham and Anderson (2002).

The next figure synthesizes the values assigned by AIC criteria to the top 20 models of the selection:

Figure 1: Model Selection

AIC Criteria (top 20 models)
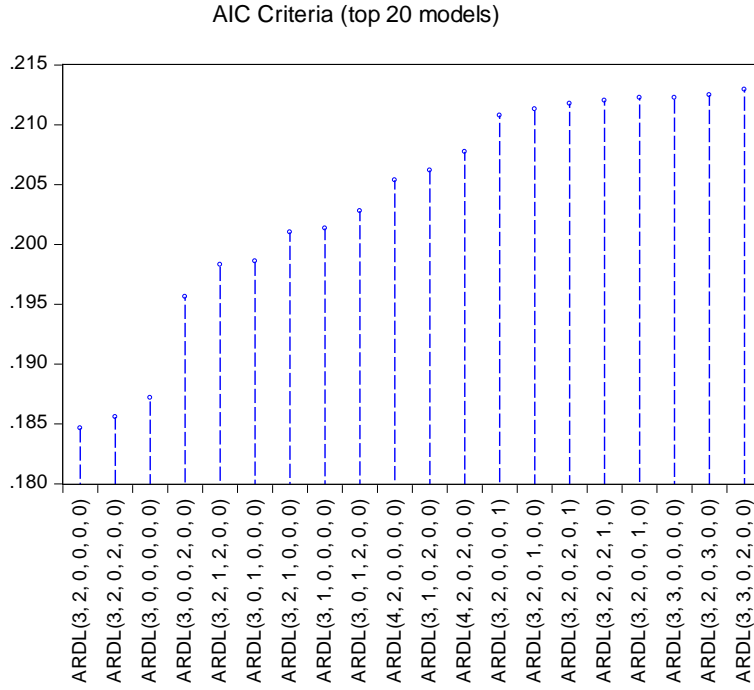
Therefore, the ARDL model selected according to AIC criterion is presented as follows:

$$U_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p}\sum_{p=1}^{3}\beta_i U_{t-p} + \sum_{j=1}^{q1}\sum_{q1=0}^{2}\gamma_j GK_{t-q1} +$$

$$+ \delta_k GEPL_t + \theta_l GRR_t + \varphi_m UD_t + \sigma_n EMS_t + \varepsilon_t \quad (5)$$

where α_0 is a constant, t is a time trend, and ε_t is a white noise error term.

5.2.3   Residual and stability diagnosis

Subsequently, we have to look for the presence of serial correlation in the disturbance term. If the model shows evidence of serial correlation, that inference is no longer valid since the serial independence of the error term is a condition for its applicability. A Breusch-Godfrey Serial Correlation LM Test was conducted providing evidence of no serial correlation at 5% level. The summary of the test results can be checked in the following table:

Table 2: Breusch-Godfrey Serial Correlation LM Test

Statistic	
$F - Stat \sim F_{(20,84)}$	1.5016 (0.1024)
$nR_u^2 \xrightarrow{d} \chi^2_{(20)}$	30.5495 (0.0614)

$F - Statistic$ and $\chi^2 - Statistic$ are reported. $p - values$ between parentheses.

Moreover, a Breusch-Pagan-Godfrey test was also conducted to assess the existence of heteroskedasticity. As can be verified in the following table, we may also conclude that there is no evidence of heteroskedasticity at 5% significance level.

Table 3: Heteroskedasticity Test: Breusch-Pagan-Godfrey

Statistic	
$F - Stat \sim F_{(11,104)}$	1.5737 (0.1174)
$nR_u^2 \xrightarrow{d} \chi^2_{(11)}$	16.5525 (0.1218)

$F - Statistic$ and $\chi^2 - Statistic$ are reported. $p - values$ between parentheses.

To search for the existence of functional misspecification, the RESET test was carried out as suggested by Ramsey (1969). The test opposes $H_0 : \varepsilon \sim N(0, \sigma^2 I)$ to $H_1 : \varepsilon \sim N(\mu, \sigma^2 I)$, $\mu \neq 0$. The test is based on the general augmented regression $y = X\beta + Z\gamma + \varepsilon$, where Z includes powers of the predicted values of the dependent variable. We chose to include two fitted terms in the model, such that $Z = [\widehat{y}^2, \widehat{y}^3]$. A summary of the results is presented in the following table:

Table 4: RESET Test

Statistic	
$F - Stat \sim F_{(2,102)}$	0.2177 (0.8047)

Omitted variables: Powers of fitted values from 2 to 3

F-statistic is reported; $p - values$ between parentheses

From the F-statistic critical value, we infer that is not possible to reject the null hypothesis which suggests no evidence of misspecification from the RESET test.

Finally, we concentrated on the stability of the model. A specification that lacks stability could be a source of concern. This would mean that the values of parameters would be unstable during the sample period, which would compromise the explanatory and forecasting power of the model. To assess it we used a CUSUM test based on the cumulative sum of the recursive residuals (Brown et al., 1975). For a model that remains stable the cumulative sum will vary randomly around a mean of zero. Otherwise, if the mean shifts upwards/downwards to some value, then an upward/downward trend will quickly develop in the cumulative sum. The test plots the sum of the recursive residuals together with a superior and an inferior frontier that represents the 5% significance level of the test.

Figure 2: CUSUM Test
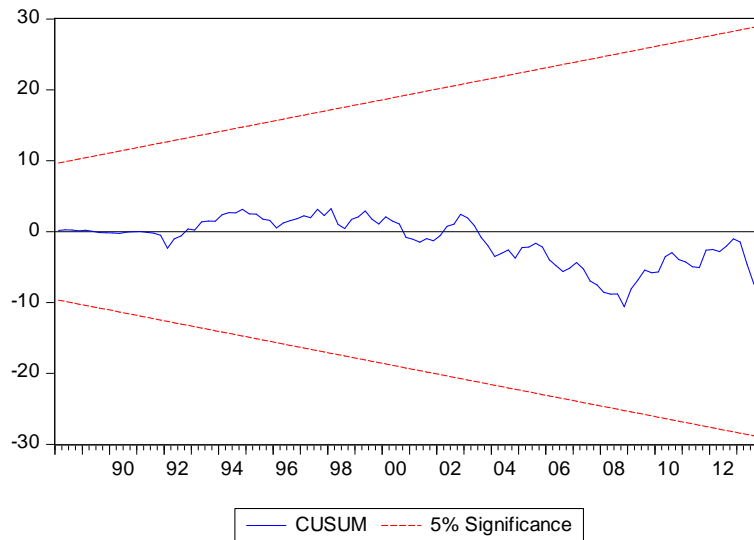
As we can notice, the cumulative sum of the recursive residuals remains inside the boundaries during the whole sample period, providing favourable evidence for the stability of the model.

After the model successfully passed the necessary tests to assess its validity, we are now prepared to evaluate the long-run relationship between the variables through the bounds test approach to cointegration.

5.2.4 Bounds test

According to Pesaran et al (2001), the first step to apply the bounds test approach to cointegration is to estimate a conditional error correction mechanism (ECM). The conditional ECM is obtained from equation (5) by subtracting U_{t-1} on both sides of the equation and by adding up and subtracting $\sum_{j=0}^{q} \gamma_j x_{t-1}$ on the right side of the equation, where x_t is a vector of the dependent variables. At the end, we get:

$$\Delta U_t = \alpha_0 + \alpha_1 t + \pi_1 U_{t-1} + \pi_2 GK_{t-1} + \pi_3 GEPL_{t-1} + \pi_4 GRR_{t-1} + \pi_5 UD_{t-1} + \pi_6 EMS_{t-1}$$

$$+ \sum_{i=1}^{2} \phi_i \Delta U_{t-i} + \sum_{i=0}^{1} \nu_i \Delta GK_{t-i} + \varepsilon_t \quad (6)$$

where α_0 is a constant, t is a time trend, and ε_t is a white noise error term.

To assess cointegration between variables, the hyphotesis $H_0 : \pi_1 = ... = \pi_6 = 0$ needs to be opposed against the hyphotesis $H_1 : \pi_1 \neq ... \neq \pi_6 \neq 0$, where H_0 stands for the absence of a long-run relationship and H_1 stands for the presence of a long-run relationship.

The standard procedure to test for the joint significance of the coefficients involves computing the

F-statistic and comparing its value with the critical value taken from the F-distribution. However, this methodology is not valid for the ECM model as the endogeneity of regressors makes OLS biased.

To overcome this difficulty, Pesaran et al. (2001) supply bounds on the critical values for the asymptotic distribution of the F-statistic. They provide lower and upper bounds on the critical values. The lower bound is based on the assumption that all of the variables are I(0), and the upper bound is based on the assumption that all of the variables are I(1). Actually, the truth may be somewhere in between these two polar extremes.

If the computed F-statistic falls below the lower bound, we conclude that no cointegration exists. If the F-statistic surpasses the upper bound, we conclude that we have cointegration. Lastly, if the F-statistic falls between the bounds, the test is inconclusive.

Table 5: Bounds Test

| H_0: No LR relationship exists	
Statistic	
$F - Stat \sim F_{(5,115)}$	4.004
Critical values	
I(0)	I(1)
2.81	3.76
Critical values for a 5% level of significance	

The value of the test statistic allows us to reject the null hypothesis of no cointegration with 5% of significance. That provides a strong evidence for a long-run relationship between the variables contained in the ECM.

A complementary strategy to confirm the result of cointegration consists of looking at the behaviour of the estimated residuals taken from the static model. If estimated residuals appear to be stationary, this situation favours the conclusion of cointegration. We can obtain the estimated residuals ($\widehat{v_t}$) by estimating the following equation:

$$\widehat{v_t} \;\; = \;\; U_t \; - \; \widehat{\Theta}_0 \; - \; \widehat{\Theta}_1 t \; - \; \widehat{\Theta}_2 GK_t \; - \; \widehat{\Theta}_3 GEPL_t \; - \; \widehat{\Theta}_4 GRR_t \; - \; \widehat{\Theta}_5 UD_t \; - \; \widehat{\Theta}_6 EMS_t \quad (7)$$

After obtaining the estimated residuals series, we may perform the ADF unit root test. The test results clearly show evidence of stationarity, by rejecting the null hypothesis of non-stationarity at 1% significance level – see test results in table 12 in the Appendix. For an additional confirmation, we can look at the cronogram of the estimated residuals:

Figure 3: Estimated Residuals
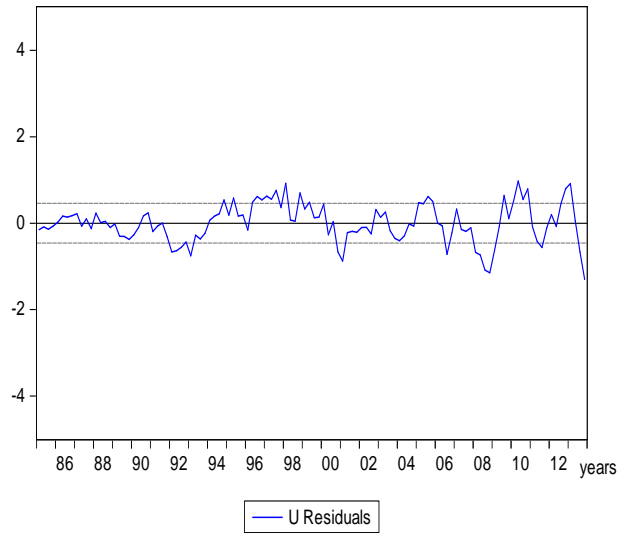
As we can notice, the cronogram also suggests that estimated residuals are stationary, since their mean and the variance appear to be constant. This evidence confirms the result of cointegration achieved by bounds test.

5.2.5   Long-run coefficients

The long-run model can be derived from the conditional ECM presented above in equation (6). It is presented as a static model with the following specification:

$$U_t \;=\; \Theta_0 \,+\, \Theta_1 t \,+\, \Theta_2 GK_t \,+\, \Theta_3 GEPL_t \,+\, \Theta_4 GRR_t \,+\, \Theta_5 UD_t \,+\, \Theta_6 EMS_t \,+\, v_t \quad (8)$$

where Θ_n are the long-run coefficients computed as follows: $\Theta_0 = \alpha_0/\pi_1$, $\Theta_1 = \alpha_1/\pi_1$, $\Theta_n = \pi_n/\pi_1$, $n = 2, ..., 6$ and ε_t is a white noise error term.

The following table summarizes the results of the model:

Table 6: Long-Run Coefficients

	Variables	Coefficients
Θ_1	t	0.1262
Θ_2	GK	-1.2121
Θ_3	$GEPL$	4.1187
Θ_4	GRR	-1.0212
Θ_5	UD	0.0487
Θ_6	EMS	2.4183

However, long-run coefficients *per se* do not provide any conclusive answer to my research proposal. To know whether NAIRU is exogenous or endogenous relative to capital accumulation I need to determine their individual significance. Unfortunately, we are unable to perform such statistical tests due to the biasedness of the OLS estimator in the context of conditional ECM model.

To surpass this obstacle, we will follow the recommendation made by Pesaran and Shin (1998) and build an ECM according to the transformation proposed by Bewley (1979).

5.2.6 Bewley transformation

Bewley (1979) recommended an ECM transformation which has the advantage of explicitly estimating the long-run coefficients. Taking the general form of the ARDL model dispalyed in equation (3) as a starting point,

$$y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \beta_i L^i y_t + \sum_{j=0}^{q} \gamma_j L^j x_t + \epsilon_t \tag{9}$$

we simply need to subtract $\sum_{i=1}^{p} \beta_i y_t$ on both sides of the equation and sum and subtract $\sum_{j=0}^{q} \gamma_j x_t$ on the right side of the equation to perform the Bewley's transformation. At the end, we may express it as follows:

$$y_t = \alpha_0 + \alpha_1 t + \sum_{j=0}^{q} \chi_j x_t + \sum_{i=0}^{p-1} \varsigma_i L^i y_{t-i} + \sum_{j=0}^{q-1} \varrho_j L^j x_{t-j} + \varepsilon_t \tag{10}$$

Applying that transformation to our ARDL model, we achieve the following regression structure:

$$U_t = \lambda_0 + \lambda_1 t + \lambda_2 GK_t + \lambda_3 GEPL_t + \lambda_4 GRR_t + \lambda_5 UD_t + \lambda_6 EMS_t$$

$$+ \sum_{i=0}^{2} \varpi_i \Delta U_{t-i} + \sum_{i=0}^{1} \psi_{t-i} \Delta GK_{t-i} + \varepsilon_t \quad (11)$$

This ECM specification, however, cannot be directly estimated by OLS. The inclusion of the contemporaneous first difference on the right-hand side of the equation (ΔU_t) creates endogeneity, a situation in which one of the regressors is correlated with the error term, making the OLS estimator biased[5].

To overcome this obstacle, we need to estimate the equation through Instrumental Variables (IV). This estimation method consists of replacing the endogenous variable (ΔU_t) with an instrumental variable (Z) which has to satisfy two conditions: 1) Be correlated with the endogenous variable $[COV(Z, \Delta U_t) \neq 0]$ and 2) Be uncorrelated with the error term $[COV(Z, \varepsilon_t) = 0]$. Bewley (1979) proposes using the lagged value of the dependent variable as instrumental variable ($Z = U_{t-1}$). He also shows that, under these conditions, the estimated long-run coefficients are equivalent to the ones computed from the conditional ECM.

To sum up, we are going to estimate Bewley's ECM through Instrumental variables for two main reasons: first, it provides explicit values of the coefficients and of its standard-errors and second it allows for directly testing the individual significance of the regressors, an essential procedure to assess my research question. The IV estimator chosen was the two-stage least squares (2SLS).

The estimation results are displayed in the following table:

---

[5] Another possible source of concern would be the presence of serial correlation in the error term. However, we have already ruled out that possibility.

Table 7: IV Estimation

	Variable	Coefficients
λ_0	$intercept$	-32.3453^* (17.7116)
λ_1	t	0.1262^{***} (0.0055)
λ_2	GK	-1.2121^{***} (0.1164)
λ_3	$GEPL$	4.1187^* (2.4150)
λ_4	GRR	-1.0212 (2.1314)
λ_5	UD	0.0487 (0.0678)
λ_6	EMS	2.4183 (2.6175)
ϖ_0	ΔU_t	-2.9675 (0.4622)
ϖ_1	ΔU_{t-1}	1.0048^{**} (0.4052)
ϖ_2	ΔU_{t-2}	0.9857^{**} (0.4052)
ψ_0	ΔGK_t	-0.0525 (0.4734)
ψ_1	ΔGK_{t-1}	-1.0069^* (0.5631)

Instrument list: $\alpha_0, t, U_{t-1}, \Delta U_{t-1}, \Delta U_{t-2}, GK_t,$
$\Delta GK_t, \Delta GK_{t-1}, GEPL_t, GRR_t, UD_t, EMS_t$
standard-errors between parentheses;
*, ** and *** denote significance at ten, five and one percent level

5.2.7 Discussion of Results

In a first look at the results, we can easily verify that the long-run coefficients estimated through 2SLS are equal to the ones computed from the conditional ECM estimated by OLS ($\lambda_i = \Theta_i$). For a proof, see Wickens and Breusch (1988).

All variables coefficients display the expected signs with the exception of GRR. In fact, results suggest that an increase in GRR generates a decrease in the unemployment rate. A possible explanation for this surprising result may be related to the automatic stabilizer effect of unemployment benefits,

which smooths the economic cycle fluctuations by providing income to unemployed workers during recessions. Nevertheless, we must not pay too much attention to this relationship since the variable is not statistically significant.

GK is highly significant. At one percent significance level, we estimate that an 1% increase in capital accumulation causes a long-run decrease of 1,2121 percentage points in the unemployment rate.

On the other hand, none of the institutional variables are significant even at a five percent level. Only $GEPL$ shows to be significant if we extend the level of significance to ten percent. Moreover, the wald test shows that the institutional variables $GEPL$, GRR and UD are not jointly significative at 5% - see table 12 in the Appendix.

In short, the results clearly support the Keynesian hyphotesys showing a highly significant long-run relationship between capital accumulation and unemployment. Moreover, the results are broadly unsupportive of the exogenous NAIRU hypothesis, since it has been shown that the institutional variables are jointly not significative.

6   Conclusion

The aim of this thesis was to assess the impact of labour market variables and capital accumulation on the long-run unemployment of the Portuguese economy during the 1985-2013 period. By studying this relationship, we wanted to verify the consistency between the labour market reforms included in the *Troika* memorandum and the past behaviour of the Portuguese labour market. Results favourable to the importance of the labour market institutional variables would be supportive of the approach taken by Troika, as well of the exogenous NAIRU that theoretically underlies it. On the other hand, results sustaining the importance of capital accumulation and the lack of relevance of the labour market variables would be supportive of the endogenous NAIRU theory, revealing the absence of empirical support for the structural reforms that have been implemented.

We are aware of the limitations of this retrospective research exercise: the study can be assertive in stressing the inconsistency between the reforms proposed by Troika and the historical behaviour of the Portuguese labour market but cannot present any conclusive answer regarding the effective impact of those measures in the future long-run unemployment. That answer can only be addressed by future research considering the developments of the labour market in subsequent years. Even so, we argue that our approach remains meaningful, since it is not reasonable to apply a policy strategy which fails to be coherent with the past behaviour of the economic field that it intends to reform.

The results of the econometric estimation do not support the exogenous NAIRU theory. Out of

the three institutional variables tested, just one of them proved to be individually significant at 10% level. Moreover, the institutional variables are jointly not significant at 5% level. In contrast, the estimation showed a strong inverse long-run relationship between unemployment and capital accumulation, statistically significant at 1% level. Thus, the results are supportive of the endogenous NAIRU theory, by suggesting that aggregate demand is the main determinant of the long-run unemployment, contradicting the usual assumption that potential output is invariant to demand shocks.
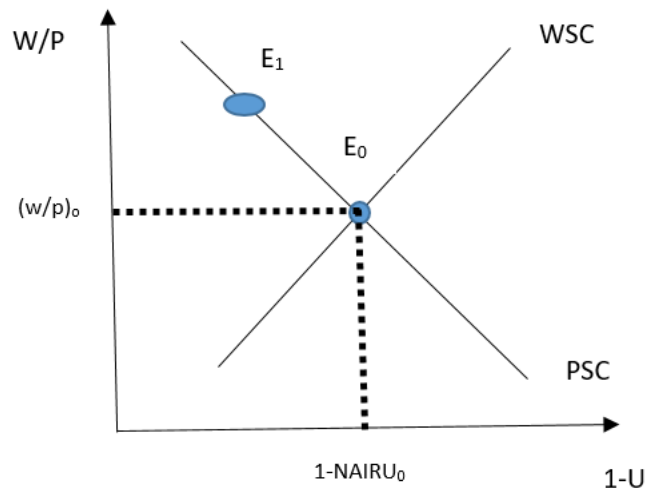
To sum up, this thesis conclude that the labour market structural reforms proposed by the *Troika* were inadequate because they were based upon a theoretical framework (exogenous NAIRU model) that was not representative of the Portuguese labour market.
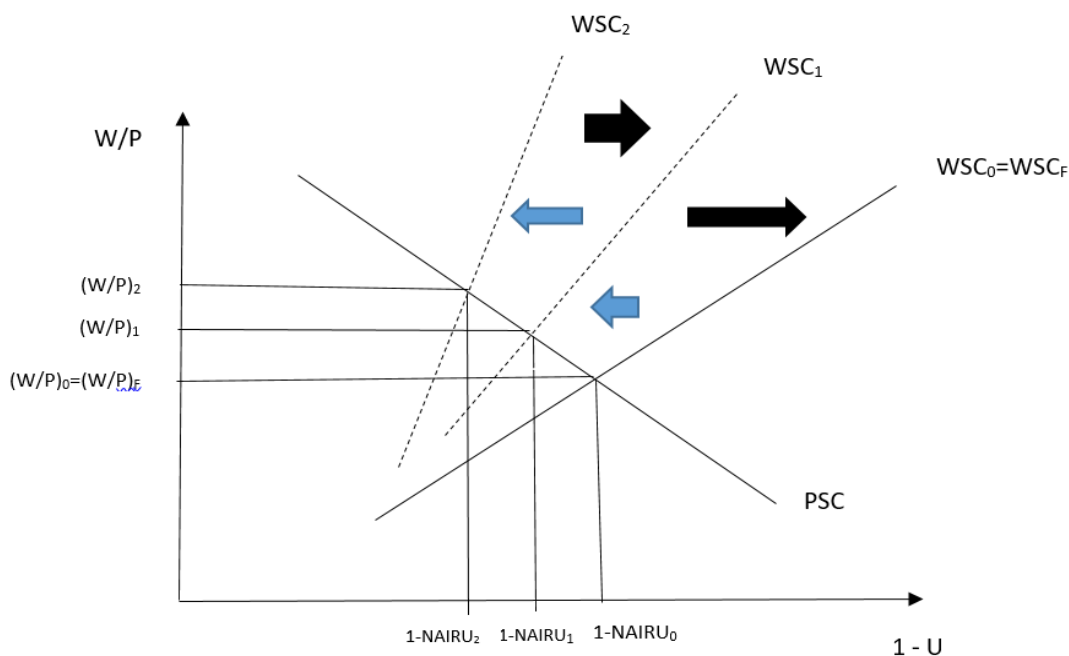
A   Appendix

Figure 4: Labour Market Equilibrium
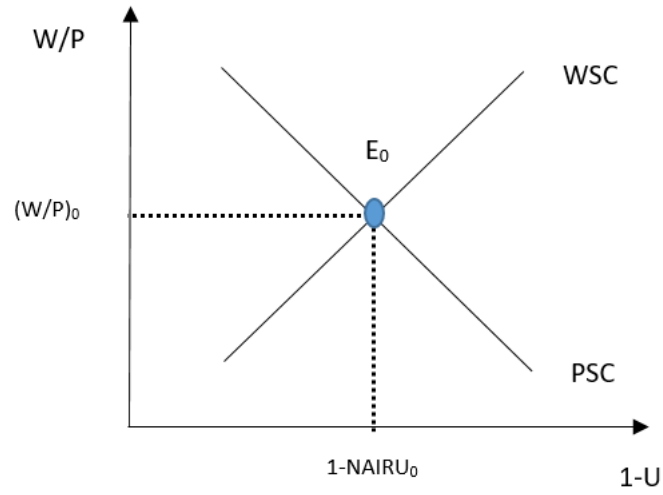
Figure 5: Negative Demand Shock without Hysteresis

Graph adapted from Stockhammer (2011)

Figure 6: Negative Demand Shock with Hysteresis


Graph adapted from Stockhammer (2011)

Table 8: Data Sources

	Original Time Series	Data Source
U	Unemployment rate	Bank of Portugal
GFC	Gross Fixed Capital Formation	Bank of Portugal
NMW	Nominal Minimum wage	INE (Statistics Portugal)
CPI	Consumer Price Index	INE (Statistics Portugal)
$SEPR$	Strict Employment Protection Legislation of Regular Workers	OECD
$SEPT$	Strict Employment Protection Legislation of Temporary Workers	OECD
$REGPROP$	Proportion of regular workers in the employed population	Pordata
$TEMPROP$	Proportion of temporary workers in the employed population	Pordata
TOT	Terms of Trade	OECD
GDP	Gross Domestic Product	Bank of Portugal
EX	Exports	Bank of Portugal
IM	Imports	Bank of Portugal
UD	Union Density	OECD
GRR	Gross Replacement Rate	OECD

Table 9: Composite Variables

GK	$log(GFC)$
RMW	NMW/CPI
EPL	$SEPR*REGPROP + SEPT*TEMPROP$
GEPL	$log(RMW*EPL)$
TO	$(EX+IM)/GDP$
EMS	$log(TO*TOT)$

Figure 7: Plots
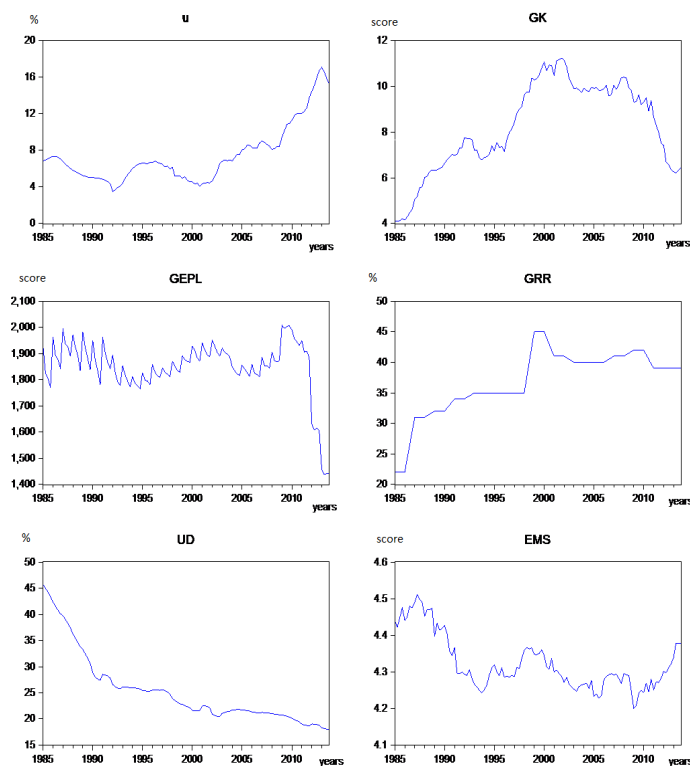
Table 10: Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
U	7.39	6.59	17.08	3.50	3.14	116
GK	8.21	8.22	11.23	4.09	1.95	116
$GEPL$	1848.97	1862.50	2008.72	1437.27	107.09	116
GRR	36.87	39.00	45.00	22.00	5.23	116
UD	25.39	22.52	45.71	17.96	6.73	116
EMS	4.32	4.29	4.51	4.19	0.07	116

Table 11: ARDL Estimation

	Variable	Coefficients
α_0		-8.1525 (5.1735)
α_1	t	0.0318 (0.0086)
β_1	U_{t-1}	1.001 (0.0938)
β_2	U_{t-2}	-0.0048 (0.1328)
β_3	U_{t-3}	-0.2485 (0.0893)
γ_0	GK_t	-0.3187 (0.0934)
γ_1	GK_{t-1}	-0.2406 (0.1237)
γ_2	GK_{t-2}	0.2538 (0.1151)
δ_0	$GEPL_t$	1.0381 (0.5506)
θ_0	GRR_t	-0.2574 (0.5364)
φ_0	UD_t	0.0123 (0.0161)
σ_0	EMS_t	0.6095 (0.8026)

standart-errors between parentheses ()

Table 12: Wald Test

H_0: $\lambda_3 = \lambda_4 = \lambda_5 = 0$	
Statistic	
$F - Stat \sim F_{(2,104)}$	8.0134 (0.2334)

F-statistic is reported; $p-values$ between parentheses

Table 13: Unit Root Test - ADF Test

H_0: *There is a Unit Root*	
Statistic	
$ADF - Stat$	-3.8737
	(0.0031)
ADF-statistic is reported; $p - values$ *between parentheses*	
Lag Length: 4	

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