ASOCIACION ARGENTINA
DE ECONOMIA POLITICA

ANALES | ASOCIACION ARGENTINA DE ECONOMIA POLITICA

XLVII Reunión Anual

Noviembre de 2012

ISSN 1852-0022
ISBN 978-987-28590-0-8

DISTINCT CONCEPTIONS OF THE LABOUR MARKET

Salvador Pablo

Distinct conceptions of the labour market

Pablo F. Salvador[*]
CONICET
and Universidad Nacional de Cuyo

Abstract

This paper compares three major approaches that offer distinct conceptions of the labour market: (i) the natural rate of unemployment theory; (ii) the hysteresis hypothesis; and (iii) the chain reaction theory (CRT), or prolonged adjustment view, of unemployment. In line with the CRT, the interplay between the lags of the endogenous variables and spillover effects within the multi-equation labour market is what drives the time path of the actual rate of unemployment. Besides, this actual unemployment rate drifts away from its natural counterpart, even in the long-run. Overall, the CRT is a more complete approach, since it recognises how growth and dynamics interact in the labour market.

Key words: Unemployment, Labour market dynamics, Chain reaction theory, Natural rate of unemployment, Hysteresis hypothesis.

Resumen

En este trabajo se comparan tres grandes enfoques con distintas concepciones del mercado de trabajo: a) la teoría de la tasa natural de desempleo, b) la hipótesis de la histéresis y c) la teoría de la reacción en cadena (TRC) o visión de los ajustes prolongados. Según la TRC, la dinámica de la tasa actual de desempleo surge de la interacción entre los retardos de las variables endógenas y los efectos derrame dentro del merado de trabajo. Además, esta tasa actual de desempleo puede alejarse de su tasa natural, incluso en el largo plazo. En general, la TRC es un enfoque más completo al contemplar la interacción entre crecimiento y dinámica en el mercado de trabajo.

Palabras clave: Desempleo, Dinámica del mercado de trabajo, Teoría de la reacción en cadena, Tasa natural de desempleo, Hipótesis de la histéresis.

JEL Classification: *E24, J08, J21, J30*

∗ Facultad de Ciencias Económicas, Universidad Nacional de Cuyo, Centro Universitario, M5502JMA Mendoza, Argentina; +54 261 4135000 (2461); email: pfsalvador@hotmail.com; http://www.pfsalvador.com.

1. Introduction

Since the study of Layard, Nickell and Jackman (1991) much effort has been devoted to explaining the movements of the unemployment rate by focusing on the role of shocks and institutions (see also Blanchard and Wolfers, 2000), the role of institutions alone (Belot and van Ours, 2004 and Nickell, Nunziata and Ochel, 2005), and the role of the structure of the economy (Phelps, 1994 and Phelps and Zoega, 2001). Nevertheless, there is an increasing interest among macro-labour economists to examine the role of growing variables such as the capital stock or the employment productivity on the unemployment trajectory (Kapadia, 2005 and Karanassou, Sala and Salvador, 2008b).

This is the view of the chain reaction theory (CRT), or prolonged adjustment view, of unemployment, initially developed by Karanassou and Snower (1996). In line with the CRT, the interplay between the lags of the endogenous variables and spillover effects within the multi-equation labour market is what drives the time path of unemployment. In particular, spillover effects arise when shocks to a specific equation feed through system, while the label "shock" refers to changes in the exogenous variables.

As opposed to other more conventional approaches with a focus on equilibrium and the natural rate of unemployment (NRU), the CRT envisages an actual rate of unemployment that drifts away from its natural counterpart. In fact, under the CRT, the actual rate may not come close to the NRU, even in the long-run.

In this paper, we compare the CRT with the NRU theory and the hysteresis hypothesis and show their different understandings of the labour market. One of the main differences lies in how they treat the short- and long-run states. According to the CRT, cyclical unemployment variations can have prolonged after-effects, making the short, medium, and long runs to be interrelated. Another distinction stems from how they represent the labour market. The CRT offers structural representations of the labour market and conceives the changes in the unemployment rate as “chain reactions” of its responses to temporary and permanent labour market shocks. Finally, another difference has to do with the main drivers of unemployment. CRT models focus on the determinants of the actual unemployment rate (and not the NRU) and evaluate the role of both stationary and growing explanatory variables alike. The CRT argues that growing variables play a central role in the dynamics of unemployment.

Overall, the CRT is a more complete approach than the NRU theory and the hysteresis hypothesis, since it recognises how growth and dynamics interact in the labour market.

2. The natural rate of unemployment theory

According to the NRU, the labour market adjusts quickly to external shocks and spends most of the time at or near its frictionless equilibrium position. Karanassou, Sala and Snower (2007), argue that the NRU is part of what they call the frictionless equilibrium view of unemployment or the frictionless equilibrium (NRU) models. Within this view, we find those studies that focus purely on the role of institutions or “institutionalist view” (Nickell, Nunziata and Ochel, 2005), the role of shocks and institutions (Layard, Nickell and Jackman, 1991, and Blanchard and Wolfers, 2000) and the structure of the economy or “structuralist theory” (Phelps, 1994, and Phelps and Zoega, 2001).

The term “frictionless” refers to the absence of lagged adjustment processes in labour market representations. In the case of static multi-equation models, labour market adjustments are ignored and in the case of dynamic single-equation unemployment rate models, all adjustments are suppressed into the autoregressive coefficients of the unemployment equation. Therefore, it follows that unemployment evolves around “an equilibrium rate of unemployment” or NRU, which is conceived as an attractor of actual unemployment (Karanassou, Sala and Snower, 2007).

2.1. Definition of the NRU

The NRU concept dates back to the late 1960s, when Friedman (1968) and Phelps (1967, 1968) conveyed the notion of an equilibrium level of unemployment consistent with a stable inflation. This means that at any moment there is some level of unemployment consistent

with the equilibrium in the structure of real wage rates. A lower level of unemployment indicates an excess-demand for labour, and produces upward pressure on real wage rates. A higher level of unemployment indicates an excess-supply of labour, and produces downward pressure on real wage rates.[1]

The simplest representation of the NRU is:

$$u_t = u^n + \varepsilon_t, \quad (1)$$

where u_t is the unemployment rate at time t, u^n is the natural rate, and ε_t is a strict white noise stochastic process.

Since the late 1960s, the NRU has received notorious attention by macro and labour macro literature. However, while macro literature treats the NRU as an exogenous variable, labour literature considers the NRU endogenous. Macro literature has put much effort to explain inflation dynamics rather than explaining the determinants of the unemployment rate, reason for which the NRU is an exogenous variable. In other words, macro literature estimates the NRU as the unemployment rate compatible with inflation stability, which is referred to as the non-Accelerating Inflation Rate of Unemployment (NAIRU).[2]

This approach consists of two equations: (i) a downward slopping price-setting curve, which reflects the fact that imperfectly competitive firms equate marginal revenue with marginal cost, and (ii) an upward slopping wage-setting curve determined by a bargaining process between the firm and the union. Prices, p_t, are set as a mark-up on the expected wages, w_t^e, and wages, w_t, are set as a mark-up on the expected prices, p_t^e, and these mark-ups tend to rise with the level of activity, represented by the unemployment rate, u_t. A baseline representation of this approach is given by:

$$p_t = w_t^e + \alpha_0 - \alpha_1 u_t \quad (2)$$

$$w_t = p_t^e + \beta_0 - \beta_1 u_t \quad (3)$$

where α_0 represents price push factors; β_0 represents wage push factors; α_1 captures price flexibility; and β_1 captures wage flexibility. Unemployment is in equilibrium only when there is consistency between the two intended mark-ups. In the absence of nominal surprises ($p_t = p_t^e$ and $w_t = w_t^e$), the solution gives the NRU-NAIRU:

$$u^n = \frac{\beta_o + \alpha_o}{\beta_1 + \alpha_1} \quad (4)$$

Thus, any factor accounting for higher flexibility in real wages, β_1, or prices, α_1, reduces the equilibrium rate. In turn, any factor that raises the wage, β_0, or price, α_0, push factors raises the NAIRU. On the other hand, with nominal surprises and by solving price expectations assuming a random walk model, the actual unemployment rate is characterised as:

$$u_t = u^n - b(\pi_t - \pi_{t-1}) \quad (5)$$

where lower unemployment is associated with positive price surprises and higher unemployment is associated with negative price surprises.

Alternatively, we can express equation (5) as

$$\pi_t = \pi_{t-1} - b(u_t - u^n) \quad (6)$$

where the NAIRU, u^n, is the unemployment rate at which inflation is stabilised in the long-run.

---

1 This temporary trade-off between inflation and unemployment implies that the Phillips curve is vertical in the long-run.

2 The acronym NAIRU was introduced by Modigliani and Papademos (1975) and then popularised by Layard and Nickell (1986) and Layard, Nickell and Jackman (1991). For a complete analytical development of the NAIRU approach, see Layard, Nickell and Jackman (1991).

This approach made possible the distinction between a short- and a long-run NAIRU. The long-run NAIRU, consistent with stable unemployment and inflation, is the rate of unemployment to which the system tends to return, while the short-run NAIRU, apart from implying consistency with stable inflation, shows a dependence on last year's unemployment.

Some other popular extensions of this concept took place during the 1980s and 1990s. First, the "triangle model of inflation" developed by Gordon (1982, 1997 and 1998), according to which the lack of supply shocks in the relationship creates a problem of omitted variables and biases the coefficient of unemployment towards zero. The term "triangle" refers to the dependence of the inflation rate on three determinants: (i) inertia, given by the lagged rate of inflation; (ii) an index of excess demand; and (iii) supply shocks. Second, the idea of a time-varying NAIRU proposed by Gordon (1997) and Staiger, Stock and Watson (1997a and 1997b), which extends the triangle model by allowing the "nature" of the economy to change over time.

Contrary to macro literature, labour macro literature aims to identify the determinants and the size of the unemployment rate. That is, unemployment rate models endogenise the NRU and determine the economic factors that influence it. These "endogenous" NRU models explain the long-run changes in equilibrium unemployment by distinguishing two components. First, the so-called "business cycle" or conjunctural unemployment movements usually ascribed to temporary shocks. Second, the so-called "trend" or long-run equilibrium movements arising from permanent changes in the determinants of unemployment.

The first attempt to determine the size of the natural rate is found in Phelps (1968).[3] Phelps (1995, p.16) recalls that "there was a tendency among quite a few scholars, myself included, to forget that my 1968 paper on equilibrium unemployment sketched a substantive model of the determination of the size of the natural unemployment rate and the course of the equilibrium unemployment rate path which leads to it."[4] Phelps himself, however, recognised the need for a general equilibrium view of the natural rate given that the NRU has been treated as a parameter by the literature (Phelps, 1994, p. 1).

In his 1994's book, Phelps models some general-equilibrium extensions of the incentive-wage theory of the natural rate and places the focus on the structure of the economy - giving rise to the structuralist theory. The structure consists of: (i) firm's assets, which drive the labour demand; and (ii) the income from the worker's wealth that drives the wage-setting curve. The aim of the structuralist theory is to disclose "the nonmonetary mechanisms through which various nonmonetary forces are capable of propagating slumps and booms in the contemporary world economy." (Phelps, 1994, p. 1)

According to the structuralist theory, the actual unemployment rate can only temporarily deviate from its NRU. The objective of the structuralist theory is, thus, to identify the driving forces of the NRU. The set of NRU determinants in Phelps (1994) includes country-specific variables, worldwide variables and shocks. The country-specific variables are capital stock, real public debt, real government spending, tax rates and some other institutional variables, price mark-ups induced by exchange rates, and some demographic variable. The worldwide variables include the real interest rate and the real price of oil. More recent studies of the structuralist theory also include the slowdown of productivity, the share of social expenditures in GDP, the educational composition of the labour force, and asset valuation in the determination of unemployment (see, for example, Phelps and Zoega, 1998, 2001 and Fitoussi, Jestaz, Phelps and Zoega, 2000).[5]

---

[3] Phelps (1968) was the first one to model expectations in the natural rate theory by adopting the adaptive expectations hypothesis. In the 1970s, adaptive expectations were replaced by the assumption of agents forming their expectations rationally, a goal attributed to Lucas (1972a, 1972b and 1973). The adaptive and rational expectations are compatible in the sense that only a temporary trade-off between inflation and unemployment is possible.

[4] As an example, Phelps (1968) mentions that a faster growth of the labour force or a faster steady growth, if it entailed a higher average rate of layoff in the economy, would produce a higher natural rate.

[5] In these papers, asset prices are the centrepiece of the structuralist theory.

2.2 The NRU and the invariance hypothesis

This section deals with a questionable restriction always imposed to the NRU or the frictionless equilibrium view of unemployment. The restriction is that, according to this view, the long-run unemployment rate is independent of growing exogenous variables. This restriction is what Karanassou and Snower (2004) call the "unemployment invariance hypothesis." This hypothesis implies that the behaviour of the labour market, by itself, ensures that the long-run unemployment rate is independent of trended variables and contains all the equilibrating mechanisms that guarantee unemployment invariance.

There are two forms of the unemployment invariance hypothesis: (i) the "strong invariance" and (ii) the "weak invariance" hypothesis (Karanassou and Snower, 2004). The former asserts that any change in capital stock, total factor productivity (TFP) or working-age population leads to opposite shifts in the labour demand, wage setting, and labour supply curves to keep the unemployment rate at its original equilibrium level. This is in line with the institutionalist view of unemployment. An example of this type of unemployment invariance is found in the work of Layard, Nickell and Jackman (1991). The weak invariance hypothesis, on the other hand, asserts that the long-run unemployment rate can be influenced by capital stock, TFP and working-age population, but only in trendless transformations. This is in line with the structuralist view of unemployment according to which the unemployment rate may depend, for example, on the ratio of capital to labour (see Phelps, 1994 and Fitoussi, Jestaz, Phelps and Zoega, 2000).

2.3 The short, medium, and long-run

Labour macro literature usually views unemployment as two separated and independent components. These are the so-called "cyclical" (or business cycle) component and the "structural" (or trend) component of unemployment. The former refers to high-frequency movements or short-run variations usually ascribed to temporary shocks. While the latter points to low-frequency movements (or changes in the long-run equilibrium) arising from permanent changes in the determinants of unemployment. In other words, the evolution of unemployment is generally seen as short-run variations around a long-run equilibrium rate, which is the NRU or NAIRU.[6] In this way, the natural rate serves as an attractor of the actual unemployment rate (Karanassou, Sala and Snower, 2007).

This view of unemployment as two separated components conforms with the frictionless equilibrium view – institutionalist view, structuralist theory, and studies that focus on the role of shocks and institutions. According to this view, the labour market adjusts quickly to external shocks and thus this market spends most of the time at or near its frictionless equilibrium position. This means that only temporary shocks affect unemployment and these shocks have only temporary effects. This approach ignores the influence of permanent shocks. In particular, the structuralist theory cannot analyse the effects of permanent shocks on unemployment since it models unemployment dynamics through a stationary single equation that can only feature temporary labour market shocks.

3. The hysteresis hypothesis

The term "hysteresis" refers to the path dependency of unemployment.[7] In line with the hysteresis hypothesis, the equilibrium unemployment rate no longer returns to levels before the shock once a temporary shock reverses. Instead, the effects of the shock become permanent and the equilibrium unemployment rate reaches a new equilibrium.

3.1 Definition of hysteresis

The traditional definition of hysteresis postulates an extreme persistence of unemployment and focuses on the protracted effects of temporary shocks on unemployment.[8]

A formal definition of the hysteresis hypothesis is:

---

[6] See Blanchard and Fischer (1989), and Blanchard, Nordhaus and Phelps (1997).

[7] See Cross (1988), for a compilation about the hysteresis hypothesis and the natural rate theory.

[8] See Rϕed (1997), for different definitions and interpretations of hysteresis in the labour market literature.

$$u_t = u_{t-1} + \varepsilon_t, \qquad (7)$$

where u_t is the unemployment rate at time t, u_{t-1} is the unemployment rate in the previous period, and ε_t is a strict white noise stochastic process. This formulation assumes that unemployment follows a unit root process.

The initial formulation of the hysteresis hypothesis is found in the seminal works of Blanchard and Summers (1986, 1987), which focus on the mechanisms explaining the propagation of adverse supply and demand shocks over long periods of time. In particular, the mechanisms are the "insider-outsider", "human capital", and "physical capital" arguments.

Blanchard and Summers (1986) explain the insider-outsider mechanism by assuming that the unions' utility function only depends on the employed workers. Wages, therefore, are set by bargaining between employed workers - the insiders - and firms, with no role for the outsiders. Under this assumption, the insiders are concerned by maintaining their jobs, which has two implications: (i) in the absence of shocks, any level of employment of insiders is "self-sustaining" with insiders just setting the wage so as to remain employed, and (ii) in the presence of shocks, employment follows a random walk process; after an adverse shock, which reduces employment, some workers lose their insider status and the new smaller group of insiders sets the wage so as to maintain its new lower level of employment. This suggests that, if wage bargaining is a prevalent feature of the labour market, the dynamic interactions between employment and the size of the group of insiders may generate substantial employment and unemployment persistence. The key assumption is the relation between the employment status and the insider status. The possibility of persistent fluctuations in employment arises because changes in employment may change the group's membership (Blanchard and Summers, 1986, p. 16).

The human capital argument holds that unemployed workers lose the opportunity to maintain and update their skills by working. Particularly for the long-term unemployed, the atrophy of skills may combine with disaffection from the labour force associated with the inability to find a job, to reduce the effective supply of labour (Blanchard and Summers, 1986, p. 14).

Finally, the physical capital argument states that reductions in the capital stock associated with the reduced employment that accompanies adverse shocks diminish the subsequent demand for labour, and cause protracted unemployment (Blanchard and Summers, 1986, p. 13).

In short, Blanchard and Summers' main claim is that persistent high unemployment can be understood in terms of hysteresis mechanisms. In this context, membership effects - the distinction between insiders and outsiders - jointly with wage rigidity are important sources of hysteresis. According to Blanchard and Summers (1986), only unexpected nominal and real shocks have permanent effects on employment. Once employment has decreased, it remains, in the absence of other shocks, permanently at the lower level. Finally, they stress the importance of identifying the circumstances under which persistence is likely to arise. That is, if hysteresis is the result of: (i) specific labour market structures; (ii) the presence of unions; or (iii) whether it is itself the result of adverse shocks which, by increasing unemployment, trigger the insider-outsider dynamics.

In a well-known contribution, Alogoskoufis and Manning (1988) disagree with Blanchard and Summers' statement about the speed at which the unemployed workers become outsiders and the assumption of insiders just caring about their employment prospects.[9] If insiders also care about their real wages, then they should balance their employment target against their wage aspirations. In this case, there is need for an analysis of wage setting and alternative sources of unemployment persistence. These alternative sources are "membership of the group of insiders", "wage aspirations", and "demand for labour."

When unions are just concerned with the employment of their members, the evolution of union membership is then one of the determinants of the evolution of employment and

[9] See Alogoskoufis and Manning (1988, p. 464-467) for a complete analytical development.

unemployment. The union sets the wage as high as is consistent with the full employment of insiders, so the wage-setting curve is vertical at the unemployment level where all insiders are employed. When an unanticipated deflationary shock pushes unemployment up and all the newly unemployed immediately lose their insider status, the union stops being concerned about their re-employment prospects. The wage setting curve shifts to the right and then wages will be set to ensure that only those who did not lose their jobs remain employed. Therefore, the current equilibrium unemployment rate becomes a new and permanent equilibrium unemployment rate.[10] This is the extreme case of hysteresis postulated by Blanchard and Summers. On the contrary, when unions care about both employment and real wages, the wage-setting curve is downward sloping. An adverse disturbance displaces the equilibrium point, causing an upward shift in the wage-setting curve and, in the absence of further shocks; unemployment is higher than the original equilibrium, but lower than the unemployment rate immediately after the shock. Unemployment gradually converges to the equilibrium value, as the wage-setting curve gradually shifts downwards when the temporary shock disappears. Hysteresis does not occur anymore, although unemployment exhibits persistence (Alogoskoufis and Manning, 1988, pp. 432-436).

The second source of unemployment persistence is wage aspirations developed by wage setters and their unions. The sluggish real wage's effect is introduced with a short-run wage-setting curve flatter than the long-run wage-setting curve. An unanticipated adverse shock displaces the equilibrium point and in the absence of further shocks, unemployment and real wages next period will be lower than immediately after the shock. Thus, both start adjusting downwards along the labour demand curve, as the short-run wage-setting curve gradually shifts towards its long-run position. The persistence of unemployment depends on the persistence of real wage aspirations and is higher, the steeper the labour demand schedule, and the larger the weight put by insiders on wages relatively to employment (Alogoskoufis and Manning, 1988, pp. 436-437).

Finally, Alogoskoufis and Manning (1988) analyse the third source of persistence, demand for labour, with a short-run labour demand steeper than a long-run one. An unanticipated deflationary shock disturbs the initial equilibrium and increases unemployment and real wages. In the absence of further shocks, the short-run equilibrium in the following period is at the intersection of the new short-run labour demand curve with the wage-setting curve. Over time, the short-run labour demand curve shifts to the left, unemployment gradually falls, and real wages rise towards equilibrium. Persistence of unemployment depends positively on persistence in labour demand, and is higher the steeper the short-run labour demand curve, and the larger the weight assigned by unions to wages relatively to employment (Alogoskoufis and Manning, 1988, pp. 437-438).

In general, unemployment does not display hysteresis and converges to its equilibrium rate because unions wish to trade off real wages for unemployment.

According to Bianchi and Zoega, "the conventional definition of unemployment persistence fails to distinguish between the persistence of different shocks by taking into account the possibility of large shocks changing the model parameters" (1998, p. 285). For this reason, they provide a broader definition of unemployment persistence that allows the mean rate of unemployment to change abruptly over time.

A formal representation is of the following form:

$$u_t = \mu_i + u_{t-1} + \varepsilon_t \qquad (8)$$

where u_t is the unemployment rate at time t, μ_i is the mean value of unemployment in a specific subsample, u_{t-1} is the unemployment rate in the previous period, and ε_t is a strict white noise stochastic process (Bianchi and Zoega, 1998, p. 285).

Bianchi and Zoega (1998) argue that the traditional approach, which explains unemployment persistence only by the effect of lagged unemployment on equilibrium unemployment, is inconsistent with the data. The reason is that the evidence shows that the

[10] If unions also care about the newly unemployed, we return to the initial equilibrium level. The speed of adjustment depends on the weight given to the currently employed.

autoregressive parameter is less than one. Therefore, changes in the part of the natural rate that is independent of past unemployment levels, μ, are necessary. In their 1998 study, they mention two sets of models that account for these changes: (i) models with multiple equilibria, and (ii) models attempting to explain changes in the natural rate over time.[11]

When abrupt shifts occur in the model parameters, Bianchi and Zoega (1998) attribute them to structural changes, or large shocks, in the economy. They assume that a mean shift is always observed as the result of a large shock. This is the reason why they call their model the "shifting mean value" (SMV) model.

The SMV is a generalisation of the traditional definition (equation (7)) in the sense that if there is only one equilibrium in the series, the mean unemployment rate, μ, is constant over the sample period, rather than infrequently changing and the broader definition reduces to the traditional one. On the other hand, if there is more than one equilibrium in the series, there are regime shifts in unemployment.

As pointed out in Bianchi and Zoega (1998), in empirical exercises both the traditional and the broader definitions aim at obtaining an estimate of the persistence of shocks. However, whereas the original definition of hysteresis only requires the estimation of an autoregressive process, the broader approach requires first an estimation of the number of mean shifts and the dating of the mean shifts.

Finally, we refer to the study of Jaeger and Parkinson (1994), which introduces an innovative approach: they apply the Kalman-filter technique to an unobserved components (UC) model of the unemployment rate to evaluate the data in search for hysteresis effects.[12]

These authors find unnecessarily restrictive the association of the word hysteresis to the cases where the unemployment series has a unit root and take hysteresis as a phenomenon whereby changes in cyclical unemployment affect the natural rate, with which both the natural rate and cyclical unemployment do not evolve independently of each other. In this new specific framework the observed unemployment rate, u_t, is decomposed into a non-stationary natural rate component, u_t^n, and a stationary cyclical component, u_t^c:

$$u_t = u_t^n + u_t^c, \tag{9}$$

Hysteresis effects are introduced by allowing cyclical unemployment to have a lagged effect on the natural rate:

$$u_t^n = u_{t-1}^n + \varepsilon_t^n + \alpha u_{t-1}^c, \tag{10}$$

Finally, the model is completed with a third equation, which defines the cyclical component of the unemployment rate as a stationary second-order autoregressive process:

$$u_t^c = \phi_1 u_{t-1}^c + \phi_2 u_{t-2}^c + \varepsilon_t^c, \tag{11}$$

where ε_t^c and ε_t^n are mutually uncorrelated shocks.

This framework allows for hysteresis not just entering through the dependence of actual unemployment on past values, but from the influence of cyclical unemployment on the natural rate.

From the perspective of the UC model, a unit root in unemployment is a necessary but not a sufficient condition for hysteresis, because a unit root in unemployment may be induced by natural rate shocks and be entirely independent of the existence of hysteresis. By contrast, in the UC model, hysteresis in unemployment occurs if movements in the cyclical component also affect the natural rate component.

3.2 Hysteresis and the invariance hypothesis

Like the frictionless equilibrium view of unemployment, the hysteresis hypothesis is also imposed the restriction that the long-run unemployment rate is independent of growing exogenous variables.

---

[11] For a broader explanation about the workings of these two models see Bianchi and Zoega (1998, p. 301-302). See also Hughes-Hallett and Piscitelli (2002) for theoretical developments in multiple equilibria.

[12] See also Logeay and Tober (2006) for a similar analysis.

This approach also ignores the influence of trended exogenous variables such as the capital stock, TFP or working-age population on the trajectory of unemployment. Given that trended variables are overlooked in labour market representations, the hysteresis hypothesis also presupposes that the labour market, by itself, contains all the equilibrating mechanisms that guarantee unemployment invariance (Karanassou and Snower, 2004).

However, unlike the frictionless equilibrium view of unemployment where both forms of the unemployment invariance hypothesis - strong and weak - are possible, only the strong form applies to the hysteresis hypothesis.

3.3 The short, medium, and long-run

According to the frictionless equilibrium view of unemployment, the short- and long-run states of the labour market are compartmentalised. This compartmentalisation implies that the unemployment rate evolves around the NRU from which it only temporarily deviates. This compartmentalisation does not apply to the hysteresis hypothesis. Recall this approach asserts that unemployment reaches a different equilibrium path and stays permanently on it once a shock affects the unemployment trajectory. That is, temporary shocks lead to permanent changes in the unemployment rate. Given that each cyclical variation becomes permanent, the distinction between the short- and long-run states of the labour market no longer holds (Karanassou, Sala and Snower, 2007).

Like the frictionless equilibrium view, the hysteresis hypothesis only considers the influence of temporary shocks disturbing the equilibrium and ignores the influence of permanent shocks. However, while in the former approach temporary labour market shocks have only temporary unemployment repercussions, under the latter approach temporary shocks lead to permanent changes in the unemployment rate.

4. The CRT or prolonged adjustment view of unemployment

The third approach concerned with the macroeconomics of the labour market is the CRT, or prolonged adjustment view, of unemployment initially developed by Karanassou and Snower (1996).

A main feature of this approach is that the labour market adjusts only slowly to external shocks because many labour market decisions are subject to adjustment costs. Thus, current decisions may depend on past labour market outcomes.

Another striking feature is that, unlike single-unemployment rate models, CRT models can also include trended exogenous variables - imposing here that each growing endogenous variable should be balanced with its set of explanatory variables.[13] In other words, the CRT claims that the time path of unemployment is driven by the interplay between lagged adjustment processes and spillover effects within the labour market. In particular, spillover effects arise when shocks to a specific equation feed through the system, while the label “shock” refers to changes in the exogenous variables.

Another point that can be made for using the CRT lies in its disequilibrium nature. As opposed to other more conventional approaches with a focus on equilibrium and the concept of the NRU, the CRT envisages an actual rate of unemployment that drifts away from its natural counterpart. In fact, under the CRT, the actual rate may not come close to the NRU, even in the long run.

4.1 A formal representation of the CRT

We show the workings of the CRT with the following model of labour demand, real wage, and labour supply equations, which we borrowed from Karanassou, Sala and Salvador (2008a):[14]

---

[13] Empirical models have provided evidence for the importance of capital accumulation, and other trended variables, in the evolution of unemployment in the UK (Henry, Karanassou and Snower, 2000), in the EU (Karanassou, Sala and Snower, 2003), in the Nordic countries (Karanassou, Sala and Salvador, 2008a and Pehkonen, Sala and Salvador, 2011), in Japan (Agnese and Sala, 2009), in Spain (Bande and Karanassou, 2009) and in Australia (Karanassou and Sala, 2010).

[14] The model (12)-(14) is compatible with standard microeconomic foundations (as in Karanassou, Sala and Snower, 2007).

$$l_t = \alpha_2 l_{t-1} + \beta_2 z_t, \quad (12)$$

$$n_t = \alpha_1 n_{t-1} + \beta_1 k_t - \gamma w_t, \quad (13)$$

$$w_t = \beta_3 x_t - \delta u_t \quad (14)$$

where l_t, n_t, and w_t denote the endogenous labour force, employment, and real wage, respectively; z_t is working-age population, k_t is real capital stock, and x_t represents a wage push factor (e.g. benefits); the autoregressive parameters are $0 < \alpha_1, \alpha_2 < 1$, and the β's, γ, and δ are positive constants. All variables are in logs and we ignore the error terms for ease of exposition. The unemployment rate (not in logs) can be approximated by

$$u_t = l_t - n_t. \quad (15)$$

We refer to lags of the endogenous variables in the labour market model as the "lagged adjustment processes". Furthermore, the γ, and δ's generate spillover effects, since changes in an exogenous variable - say the capital stock - can also affect the real wage and labour supply equations. When either γ or δ are zero in the model (12)-(14), labour market shocks do not spillover from labour supply to labour demand and vice versa. In other words, the influence of the exogenous variables (k_t and z_t) on unemployment can be measured through individual analysis of the labour demand and supply equations. In particular, if unemployment does not influence wages $(\delta = 0)$, then labour demand and supply shocks do not spillover to wages. As a result, capital stock changes do not affect labour force, and changes in working-age population do not affect employment. If, on the other hand, $\gamma = 0$ shocks to wage setting do not affect employment and, consequently, do not spillover to unemployment. Thus, the wage elasticity of demand provides the mechanism through which changes in the wage push factor x_t feed through to unemployment. This can be seen clearly in the reduced form unemployment rate equation (21) derived below.

Let us rewrite the labour supply and demand equations (12)-(13) as

$$(1 - \alpha_2 B) l_t = \beta_2 z_t, \quad (16)$$

$$(1 - \alpha_1 B) n_t = \beta_1 k_t - \gamma w_t, \quad (17)$$

where B is the backshift operator. Substitution of (14) into (17) gives

$$(1 - \alpha_1 B) n_t = \beta_1 k_t - \gamma\beta_3 x_t + \gamma\delta u_t. \quad (18)$$

Multiplying both sides of (16) and (18) by $(1 - \alpha_1 B)$ and $(1 - \alpha_2 B)$, respectively, gives

$$(1 - \alpha_1 B)(1 - \alpha_2 B) l_t = \beta_2 (1 - \alpha_1 B) z_t, \quad (19)$$

$$(1 - \alpha_1 B)(1 - \alpha_2 B) n_t = \beta_1 (1 - \alpha_2 B) k_t + \gamma\beta_3 (1 - \alpha_2 B) x_t + \gamma\delta (1 - \alpha_2 B) u_t. \quad (20)$$

Finally, use the definition (15) and subtract (20) from (19) to obtain the *reduced form* unemployment rate equation:[15]

$$(1 + \gamma\delta - \alpha_1 B)(1 - \alpha_2 B) u_t = \beta_2 (1 - \alpha_1 B) z_t - \beta_1 (1 - \alpha_2 B) k_t + \gamma\beta_3 (1 - \alpha_2 B) x_t. \quad (21)$$

The term "reduced form" means that the parameters of the equation are not estimated directly - they are simply some nonlinear function of the parameters of the underlying labour market system.

Alternatively, the reduced form unemployment rate equation (21) can be written as

$$u_t = \phi_1 u_{t-1} - \phi_2 u_{t-2} - \theta_k k_t + \theta_z z_t + \theta_x x_t + \alpha_2\theta_k k_{t-1} - \alpha_1\theta_z z_{t-1} - \alpha_2\theta_x x_{t-1}, \quad (22)$$

[15] Note that (21) is dynamically stable since (i) products of polynomials in B which satisfy the stability conditions are stable, and (ii) linear combinations of dynamically stable polynomials in B are also stable.

where $\phi_1 = \frac{\alpha_1 + \alpha_2(1+\gamma\delta)}{1+\gamma\delta}$, $\phi_2 = \frac{\alpha_1\alpha_2}{1+\gamma\delta}$, $\theta_k = \frac{\beta_1}{1+\gamma\delta}$, $\theta_z = \frac{\beta_2}{1+\gamma\delta}$, and $\theta_x = \frac{\gamma\beta_3}{1+\gamma\delta}$.

Parameterisations (21) and (22) of the reduced form unemployment rate equation show the following. First, the autoregressive parameters ϕ_1 and ϕ_2 embody the interactions of the employment and labour force adjustment processes (α_1 and α_2, respectively). Second, the short-run elasticities (θ_k, θ_x, and θ_z) are a function of the feedback mechanisms that give rise to the spillover effects in the labour market system. Third, the interplay of the lagged adjustment processes and the spillover effects can be captured by the induced lag structure of the exogenous variables.

In applied work, the NRU is defined as the equilibrium unemployment rate at which there is no tendency for this rate to change at any time t, given the permanent component values of the exogenous variables at that time. In this sense, it represents the unemployment that would be achieved once all the lagged adjustment processes have been completed in response to the permanent components of the exogenous variables.

Therefore, the NRU is computed by setting the backshift operator B equal to unity in the unemployment rate equation (21):

$$u_t^n = \frac{\beta_2(1-\alpha_1)\tilde{z}_t - \beta_1(1-\alpha_2)\tilde{k}_t + \gamma\beta_3(1-\alpha_2)\tilde{x}_t}{(1+\gamma\delta-\alpha_1)(1-\alpha_2)}, \qquad (23)$$

where the $\sim$ above the variable denotes its permanent component. Naturally, the estimates of the NRU reflect the decision on which changes in the exogenous variables are permanent or temporary.

4.2 Long-run unemployment, NRU, and frictional growth

A salient feature of the CRT is that it envisages an actual rate of unemployment that drifts away from its natural counterpart. In fact, under the CRT, the actual rate may not come close to the NRU even in the long-run. This was first pointed out by Karanassou and Snower (1997) and lies in sharp contrast with the conventional wisdom that the NRU is the attractor of the unemployment rate.

To show this point, we use the labour market system (12)-(15) and make the plausible assumption that capital stock (k_t), the wage-push factor (x_t), and working-age population (z_t) are growing variables with growth rates that stabilise in the long-run.[16] (Note that the growth rates of log variables are proxied by their first differences, $\Delta(\cdot)$, and recall that the superscript ^{LR} denotes the long-run value of the variable.)

Equation (15) implies that unemployment stabilises in the long-run, $\Delta u^{LR} = 0$, when

$$\Delta l^{LR} = \Delta n^{LR} = \lambda. \qquad (24)$$

In other words, the restriction that the growth rate of employment is equal to the growth rate of labour force, say λ, ensures unemployment stability in the long-run.

Let us substitute the wage equation (14) into the labour demand equation (13) and rewrite the resulting equation and the labour supply equation (12) as

$$l_t = \frac{\beta_2}{1-\alpha_2} z_t - \frac{\alpha_2}{(1-\alpha_2)} \Delta l_t, \qquad (25)$$

$$n_t = \frac{\beta_1}{1-\alpha_1} k_t - \frac{\gamma\beta_3}{1-\alpha_1} x_t + \frac{\gamma\delta}{1-\alpha_1} u_t - \frac{\alpha_1}{(1-\alpha_1)} \Delta n_t \qquad (26)$$

Substitution of the above equations into (15) and some algebraic manipulation yields the following expression for the unemployment rate:

[16] This section is drawn from Karanassou, Sala and Salvador (2008b).

$$u_t = \zeta\left(\frac{\beta_2}{1-\alpha_2} z_t - \frac{\beta_1}{1-\alpha_1} k_t + \frac{\gamma\beta_3}{1-\alpha_1} x_t\right) + \zeta\left(\frac{\alpha_1}{(1-\alpha_1)} \Delta n_t - \frac{\alpha_2}{(1-\alpha_2)} \Delta l_t\right), \quad (27)$$

where $\zeta = \frac{1-\alpha_1}{1-\alpha_1+\gamma\delta}$.

The long-run unemployment rate is obtained by imposing restriction (24) on parameterisation (27) of the reduced form unemployment rate equation:

$$u^{LR} = \zeta\left[\underbrace{\left(\frac{\beta_2}{1-\alpha_2} z^{LR} - \frac{\beta_1}{1-\alpha_1} k^{LR} + \frac{\gamma\beta_3}{1-\alpha_1} x^{LR}\right)}_{\text{natural rate of unemployment}} + \underbrace{\frac{(\alpha_1-\alpha_2)\lambda}{(1-\alpha_1)(1-\alpha_2)}}_{\text{frictional growth}}\right]. \quad (28)$$

Observe that the first term of (28) gives the NRU, whereas the second term of (28) captures *frictional growth*, i.e.,

$$\text{long - run unemployment rate} = \text{NRU} + \text{frictional growth},$$

where frictional growth arises from the interplay between the lagged adjustment processes and the growing exogenous variables.

The long-run value (u^{LR}) towards which the unemployment rate converges reduces to the NRU only when frictional growth is zero. This occurs when (i) the exogenous variables have zero growth rates in the long-run (so that $\lambda = 0$), or (ii) the labour demand and supply equations have identical dynamic structures (so that $\alpha_1 = \alpha_2$).

Therefore, frictional growth implies that under quite plausible conditions (e.g. different labour demand and supply dynamics, and growing exogenous variables) the natural rate is not an attractor of the moving unemployment. In these circumstances, the relevance of the NRU in policy making is questionable.[17]

4.3 Lagged adjustment processes and their interactions

According to the CRT, actual labour market decisions depend on past labour market decisions because of adjustment costs. In other words, the presumption underlying CRT models is that current labour market activity depends on the past, and that the process of adjustment may take a long time to work itself out completely (Karanassou and Snower, 1998).

These lagged adjustment processes are well documented in the literature and refer, among others, to: (i) employment adjustments arising from labour turnover costs (hiring, training and firing costs); (ii) wage and price staggering, (iii) insider membership effects; (iv) long-term unemployment effects; and (v) labour force adjustments.[18]

By identifying the various lagged adjustment processes, the CRT can explore their interactions and quantify the potential complementarities/substitutabilities among them. For example, if the prolonged adjustments or lags are complementary with one another in propagating temporary and permanent labour market shocks, the joint influence of all the existing lags is greater than the sum of their individual influences. In this case, it will take unemployment much longer to recover in the aftermath of a recession than the period spanned by any particular lag.[19]

This dimension of the labour market is ignored by both the frictionless equilibrium view of unemployment and the hysteresis hypothesis. The former focuses attention on the long-run equilibrium unemployment rate once the adjustment processes have worked themselves out, which generally takes a few years. While in the latter approach, unemployment is

[17] See, for example, Henry, Karanassou and Snower, 2000 and Karanassou, Sala and Salvador (2008b) for two cases in which the natural rate has low power in explaining actual unemployment.

[18] See, for example, Nickell (1978), Sargent (1978), Taylor (1979), Lindbeck and Snower (1987), and Layard and Bean (1989).

[19] Karanassou and Snower (1998, p. 836-837) develop lags complementarities analytically.

assumed to have a unit root regardless of which the underlying adjustment processes are (Karanassou, Sala and Snower, 2007).

4.4 Unemployment persistence and responsiveness

According to the CRT, the labour market adjusts only slowly to labour market shocks and movements of unemployment result from the interplay between the lagged adjustment processes and the dynamic properties of the shocks. The CRT claims that unemployment responds differently through time to a temporary shock than to a permanent one and, contrary to the frictionless equilibrium view and the hysteresis hypothesis where only temporary shocks affect unemployment, the CRT analyses the after-effects of both temporary and permanent shocks.[20]

The concept that captures the after-effects of temporary shocks is "unemployment persistence", while the concept that captures the after-effects of permanent shocks is "imperfect unemployment responsiveness." These two measures provide insights into the way unemployment moves through time (Karanassou and Snower, 1996 and 1998).[21]

To define unemployment persistence suppose a one-off temporary shock in an exogenous variable occurring at period t.[22] Unemployment persistence, σ, is the sum of its responses for all periods $t+j$ in the aftermath of the shock $j \geq 1$:

$$\sigma \equiv \sum_{j=1}^{\infty} R_{t+j}, \tag{29}$$

where the series R_{t+j}, $j \geq 0$ is the impulse response function of unemployment to the shock (impulse).

In the case of static unemployment models, the shock is absorbed instantly and unemployment persistence is zero $(\sigma = 0)$. In cases of dynamically stable unemployment models, like CRT models, the effects of the shock gradually disappear and persistence is a finite quantity. Finally, in unemployment models with hysteresis, the temporary shock has a permanent effect ($\sigma = \infty$).

Given that the temporary shock represents the change in a specific exogenous variable, then: (i) the immediate response, R_t, is the short-run elasticity of the unemployment rate with respect to that explanatory variable, and (ii) the sum of the immediate response, R_t, and persistence, σ, gives the long-run elasticity of the unemployment rate with respect to that explanatory variable. Thus, the long-run elasticity of the variable is:

$$\underbrace{R_t}_{\text{short-run elasticity}} + \underbrace{\sigma}_{\text{persistence}} = \underbrace{\sum_{j=0}^{\infty} R_{t+j}}_{\text{long-run elasticity}}. \tag{30}$$

On the other hand, unemployment responsiveness measures the sum of all the unemployment effects of a permanent shock when unemployment does not adjust immediately to the new long-run equilibrium. Suppose an economy in an initial long-run equilibrium disturbed by a unit permanent shock. The unemployment responsiveness is the sum of the differences through time between the actual unemployment rate and the new (post-shock) long-run equilibrium unemployment rate:

$$\rho \equiv \sum_{j=0}^{\infty} \left[R_{t+j} - 1 \right], \tag{31}$$

If unemployment responds instantaneously to the shock and jumps to its new long-run equilibrium, unemployment is perfectly responsive ($\rho = 0$). When unemployment responds only gradually, the short-run unemployment effects of the shock are less than the long-run

---

[20] See Karanassou, Sala and Snower (2007, p. 169-178), for an illustration of the unemployment dynamics.

[21] See also Pivetta and Reis (2004) for a detailed discussion of these measures.

[22] To define unemployment persistence and imperfect unemployment responsiveness we follow the work of Bande and Karanassou (2009).

effects and unemployment is under-responsive ($\rho < 0$). Finally, if unemployment overshoots its long-run equilibrium, unemployment is over-responsive ($\rho > 0$).

4.5 The short, medium, and long-run

According to the frictionless equilibrium view of unemployment, the short- and long-run states of the labour market are compartmentalised. On the contrary, under the hysteresis hypothesis the long-run equilibrium is indistinguishable from the cyclical fluctuations. The view of the CRT is that the short- and long-run states of the labour market cannot be decomposed. On the contrary, the short- and long-run - or cyclical and structural unemployment - are imbedded in the concept of frictional growth (Karanassou, Sala and Snower, 2007).

In line with the CRT, the interplay between lagged adjustment processes and spillover effects within the labour market is what drives the time path of unemployment. Thus, cyclical unemployment variations can have prolonged after-effects, making the short, medium, and long runs to be interrelated. Therefore, it makes no sense to divide movements of unemployment into structural and cyclical. As pointed out by Karanassou and Snower (1998), the two components of unemployment are so interdependent that their interactions become more significant than their distinction.

As opposed to the frictionless equilibrium view and the hysteresis hypothesis, which are just concerned with the effects of temporary shocks on the labour market, the CRT also examines the role of permanent shocks. In CRT models, temporary and permanent shocks affect a specific equation and they then feed through the labour market system. The existence of lags, interacting with one another, prolongs the unemployment effects of the shock and, thus, unemployment responds differently, through time, to a temporary than to a permanent shock.

5. Discussion

Along this paper, we have compared three major approaches to the macroeconomics of the labour market. As discussed, these approaches provide distinct conceptions of the labour market. Perhaps, the main distinction among them comes from how they treat the short- and long-run states. The frictionless equilibrium view of unemployment decomposes unemployment into two components, “structural” and “cyclical” unemployment. In other words, cyclical variations in unemployment are independent of structural variations. On the contrary, the long-run equilibrium is indistinguishable from the cyclical variations under the hysteresis hypothesis. That is, all cyclical variations are structural in the sense that all temporary shocks have permanent unemployment effects. Finally, the CRT or prolonged adjustment view of unemployment shows how short, medium, and long runs are interrelated. According to the CRT, cyclical unemployment variations can have prolonged after-effects. Another distinction stems from how they represent the labour market. Contrary to the hysteresis hypothesis, the CRT and NRU approaches offer structural representations of the labour market. In this context of multi-equation labour market models, the CRT views changes in the unemployment rate as “chain reactions” of its responses to temporary and permanent labour market shocks. The unemployment responses work their way through a network of interacting lagged adjustment processes. Finally, another difference comes from the forces driving unemployment. While models of hysteresis focus on the path dependency of unemployment and NRU models focus on the determinants of the natural rate, CRT models focus on the determinants of the actual unemployment rate (and not the NRU); since it argues that the natural rate is not the main determinant of actual unemployment. Additionally, contrary to the frictionless equilibrium view and the hysteresis hypothesis, the CRT evaluates the role of both stationary and growing explanatory variables alike. The CRT argues that the growing variables play a central role in the dynamics of unemployment and that the unemployment contributions of these growing exogenous variables may be more important than the unemployment contributions of the “usual suspects” (for example wage-push factors). In particular, the CRT shows that in the long-run unemployment depends on

the size of capital stock. Therefore, policies related to R&D activities, policies promoting innovations and productivity growth, or policies directly fostering investment and capital accumulation, could strengthen the labour market performance.

Overall, the CRT offers a distinctive conception of the labour market. It recognises how growth and dynamics interact in the labour market and this interaction is what drives the time path of unemployment.

References

Agnese, P. and H. Sala (2009), "The Fading 1990s in Japan: Driving Forces behind the Unemployment Upsurge", *International Review of Economics & Finance*, 18 (3), 428-439.

Alogoskoufis, G. and A. Manning (1988), "On the persistence of unemployment", *Economic Policy*, 3 (2), pp. 427-469.

Bande, R. and M. Karanassou (2009), "Labour Market Flexibility and Regional Unemployment Rate Dynamics: Spain 1980-1995", *Papers in Regional Science*, 88 (1), 181-207.

Belot, M. and J. van Ours (2004), "Does the recent success of some OECD countries in lowering their unemployment rates lie in the clever design of their labour market reforms?", *Oxford Economic Papers*, 56 (4), pp. 621-642.

Bianchi, M. and G. Zoega (1998), "Unemployment persistence: does the size of the shock matter?", *Journal of Applied Econometrics*, 13 (3), pp. 283-304.

Blanchard, O. and S. Fischer (1989), *Lectures on Macroeconomics*, The MIT Press, Cambridge MA.

Blanchard, O., W. Nordhaus and E. Phelps (1997), "The medium run", *Brookings Papers on Economic Activity*, 28 (2), pp. 89-158.

Blanchard, O. and L. Summers (1986), "Hysteresis and the European unemployment problem", pp. 15-77, *NBER Macroeconomics Annual*, 1, The MIT Press, Cambridge MA.

Blanchard, O. and L. Summers (1987), "Hysteresis in unemployment", *European Economic Review*, 31, 1/2, pp. 288-295.

Blanchard, O. and J. Wolfers (2000), "The role of shocks and institutions in the rise of European unemployment: the aggregate evidence", *The Economic Journal*, 110 (462), pp. C1-C33.

Cross, R. (1988), *Unemployment, hysteresis and the natural rate hypothesis*, Basil Blackwell, Oxford.

Fitoussi, J.P., D. Jestaz, E. Phelps and G. Zoega (2000), "Roots of recent recoveries: labor reforms or private sector forces", *Brooking Papers on Economic Activity*, 1:2000, pp. 292-304.

Friedman, M. (1968), "The role of monetary policy", *The American Economic Review*, 58 (1), pp. 1-17.

Gordon, R. J. (1982), "Inflation, flexible exchange rates, and the natural rate of unemployment", *NBER Working Paper*, W0708.

Gordon, R. J. (1997), "The time-varying NAIRU and its implications for economic policy", *Journal of Economic Perspectives*, 11 (1), pp. 11-32.

Gordon, R. J. (1998), "Foundations of the goldilocks economy: supply shocks and the time-varying NAIRU", *Brookings Papers on Economic Activity*, 2, pp. 297-333.

Henry, B., M. Karanassou, and D.J. Snower (2000), "Adjustment dynamics and the natural rate: an account of UK unemployment", *Oxford Economic Papers*, 52 (1), pp. 178-203

Hughes-Hallett, A.J. and L. Piscitelli (2002), "Testing for hysteresis against nonlinear alternatives", *Journal of Economic Dynamics and Control*, 27 (2), pp. 303-327.

Jaeger, A. and M. Parkinson (1994), "Some evidence on hysteresis in unemployment rates", *European Economic Review*, 38 (2), pp. 329-342.

Kapadia, S. (2005), "The capital stock and equilibrium unemployment: a new theoretical perspective", in Discussion Paper Series 181, Department of Economics, University of Oxford.

Karanassou, M. and H. Sala (2010), "Labour Market Dynamics in Australia: What Drives Unemployment?", *Economic Record*, 86 (273), pp. 185-209.
Karanassou, M. and D.J. Snower (1996), "Explaining disparities in unemployment dynamics", in Baldassari, M., L. Paganetto and E. Phelps (eds.), *The 1990's slump: causes and cures,* Macmillan Press, London.
Karanassou, M. and D.J. Snower (1997), "Is the natural rate a reference point?", *European Economic Review*, 41 (3-5), pp. 559-569.
Karanassou, M. and D.J. Snower (1998), "How labor market flexibility affects unemployment: long-term implications of the chain reaction theory", *The Economic Journal*, 108 (448), pp. 832-849.
Karanassou, M. and D.J. Snower (2004), "Unemployment invariance", *German Economic Review*, 5 (3), pp. 297-317.
Karanassou, M., Sala, H. and Salvador, P.F. (2008a), "The (ir)relevance of the NRU for policy making: the case of Denmark", *Scottish Journal of Political Economy*, vol. 55, no. 3, 369-392.
Karanassou, M., H. Sala and P.F. Salvador (2008b), "Capital Accumulation and Unemployment: New Insights on the Nordic Experience", *Cambridge Journal of Economics*, 32 (6), 977-1001.
Karanassou, M., H. Sala and D.J. Snower (2003), "Unemployment in the European Union: a dynamic reappraisal", *Economic Modelling*, 20 (2), pp. 237-273.
Karanassou, M., H. Sala and D.J. Snower (2007), "The macroeconomics of the labor market: three fundamental views", *Portuguese Economic Journal*, 6 (3), pp. 151–180.
Layard, R. and C. Bean (1989), "Why does unemployment persist?", *The Scandinavian Journal of Economics*, 91 (2), pp. 371-396.
Layard, R. and S. Nickell (1986), "Unemployment in Britain", *Economica*, New Series, 53 (210), Supplement: unemployment, pp. S121-S169.
Layard, R., S. Nickell, and R. Jackman (1991), *Unemployment: macroeconomic performance and the labour market*, Oxford University Press, Oxford.
Lindbeck, A., and D.J. Snower (1987), "Union activity, unemployment persistence, and wage-employment ratchets", *European Economic Review*, 31 (1-2), pp. 157-167.
Logeay, C. and S. Tober (2006), "Hysteresis and the NAIRU in the Euro area", *Scottish Journal of Political Economy*, 53 (4), pp. 409-429.
Lucas, R. E. Jr. (1972a), "Expectations and the neutrality of money", *Journal of Economic Theory*, 4 (2), pp. 103-124.
Lucas, R. E. Jr. (1972b), "Econometric testing of the natural rate hypothesis", in Eckstein, O. (ed.), *The econometrics of price determination*, Washington, D.C.: Board of Governors of the Federal Reserve System.
Lucas, R. E. Jr. (1973), "Some international evidence on output-inflation tradeoffs", *The American Economic Review*, 63 (3), pp. 326-334.
Modigliani, F. and L. Papademos (1975), "Targets for monetary policy in the coming year", *Brookings Papers on Economic Activity*, 1, pp. 141-165.
Nickell, S. (1978), "Fixed costs, employment and labour demand over the cycle", *Economica*, 45 (180), pp. 329-345.
Nickell, S., L. Nunziata and W. Ochel (2005), "Unemployment in the OECD since the 1960s: what do we know?", *The Economic Journal*, 115 (500), pp. 1-27.
Pehkonen, J., H. Sala and P.F.Salvador (2011), "The Nordic Experience Revisited: Labour Market Booms and Slumps since the 1990s in Finland and Sweden", *Journal of Economic Studies*, 38 (1), 52-65.
Phelps, E. (1967), "Phillips curves, expectations of inflation and optimal employment over time", *Economica*, 34 (135), pp. 254-281.
Phelps, E. (1968), "Money-wage dynamics and labour-market equilibrium", *Journal of Political Economy*, 76 (2), pp. 678-711.
Phelps, E. (1994), *Structural slumps: the modern equilibrium theory of unemployment, interest and assets*, Harvard University Press, Cambridge MA.

Phelps, E. (1995), “The origins and further development of the natural rate of unemployment”, in Cross, R. (ed), *The natural rate of unemployment: reflections on 25 years of the hypothesis*, Cambridge University Press, Cambridge.

Phelps, E. and G. Zoega (1998), “Natural rate theory and OECD unemployment”, *The Economic Journal*, 108 (448), pp. 782-801.

Phelps, E. and G. Zoega (2001), “Structural booms: productivity expectations and asset valuations”, *Economic Policy,* 32 (16), pp. 85-126.

Pivetta, F. and R. Reis (2004), “The persistence of inflation in the United States”, *manuscript*, Harvard University.

Rϕed, K. (1997), “Hysteresis in unemployment”, *Journal of Economic Surveys*, 11 (4), pp. 389-418.

Sargent, T. (1978), “Estimation of dynamic labor demand schedules under rational expectations”, *Journal of Political Economy*, 86 (6), pp. 1009-1044.

Staiger, D., J. Stock and M. Watson (1997a), “How precise are estimates of the NRU”, pp. 195-246, in Romer, C. D. and D. H. Romer (eds.), *Reducing inflation: motivation and strategy*, Chicago University Press, Chicago.

Staiger, D., J. Stock and M. Watson (1997b), “The NAIRU, unemployment and monetary policy”, *Journal of Economic Perspectives*, 11 (1), pp. 33-49.

Talyor, J. (1979), “Staggered wage setting in a macro model”, *The American Economic Review*, 69 (2), pp. 108-113.