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## Wage Formation and the (Non-) Existence of the NAIRU

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### **Abstract**

*The influence of NAIRU theory on economic policy is both puzzling and unfortunate, especially in a European context. This paper shows that standard rationality assumptions and objective functions may fail to generate a well-defined NAIRU in a unionized economy. It then presents two simple models with endogenous wage aspirations. One version of the model produces a unique long-run NAIRU while the other implies the presence of aspiration-induced hysteresis in the employment rate. The hysteretic version seems preferable on theoretical grounds and - at a stylized level - this version also fits the empirical evidence better than the non-hysteretic version. The argument implies that an expansionary aggregate demand policy combined with temporary incomes policies may reduce European unemployment permanently without adverse inflationary consequences.*

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### **1. Introduction**

Has high European unemployment and low growth since the breakdown of the 'golden age' in the 1970s been the result of misguided aggregate demand policy? Looking ahead, is it sensible for a future European central bank to focus exclusively on price stability or should it pay attention also to the rate of unemployment? The answer to these questions depends on the determination of

inflation and unemployment. If the economy has a 'natural rate of unemployment' - or using a different terminology, a structurally determined NAIRU - aggregate demand policy clearly cannot be used to raise the rate of employment permanently. A long-run Phillips tradeoff between unemployment and inflation on the other hand allows demand policy to play a role, and if, for some reason, inflation is linked to changes in employment rather than to the level of employment the scope for demand policy may be enhanced even further.

A few years ago there was virtually universal agreement within the profession on these issues. Keynesian demand policy might be important in the short run (although some denied this too) but had no influence on long-run employment and growth. Most of the dissenters from the mainstream view were post-Keynesian economists, but even post-Keynesians were divided on the issue. The Kalecki-inspired stagnationist literature,<sup>2</sup> for instance, claims a role for aggregate demand in both the short and the long run. Even before the start of the Keynesian 'golden age', however, Kalecki (1943) himself had expressed serious concerns about the limitations of pure demand policy. He suggested that in the long run the viability of a capitalist system required the maintenance of a reserve army of labour, a neo-Marxian position echoed in some of Joan Robinson's work, in the influential papers by Goodwin

(1967) and Rowthorn (1977) as well as in the efficiency wage literature (e.g. Bowles (1985)).

In recent years, one of the post-Keynesians who has focused most strongly on the unemployment-inflation issue is John Cornwall. In a series of writings,<sup>3</sup> some written jointly with Wendy Cornwall, he insists that institutional and evolutionary factors be given a prominent place in the analysis: the post-1945 experience must be explained in 'institutional-evolutionary' terms. The breakdown of the golden age, Cornwall argues, was caused by the increase in workers' economic and political power following a prolonged period of full employment. This argument, which seems plausible, clearly follows a Kalecki-1943 logic. Turning next to the effects of restrictive demand policy and high unemployment in the period after the breakdown, Cornwall suggests that these policies have been a failure because of duration and membership-based hysteresis effects and because low demand led to reduced productivity growth as indicated by both Okun's law and Verdoorn's law, low productivity growth in turn sharpening the distributional conflict.<sup>4</sup> Again, the argument may seem plausible, but it is Kaldorian in spirit and would seem to run counter to the Kaleckian logic underlying the analysis of the forces behind the breakdown.

This very brief outline of Cornwall's analysis fails to do it justice. But it illustrates a kind of theoretical ambivalence or even schizophrenia in post-Keynesian analysis. This characterisation, I hasten to add, includes my own work. Skott (1991), for instance, argues the case for demand policy and against the existence of a NAIRU while Skott (1992) presents what is essentially a model of Kaleckian long waves in the rate of structural unemployment.

Today, the mainstream consensus is

showing signs of strain, and it is not just post-Keynesians who are critical of NAIRU theory. The theories in one form or another have been dominant for the last 25 years but the empirical evidence remains weak, especially in the case of Europe. Either one needs a compelling explanation of shifts in the NAIRU or the NAIRU-based theories require serious reconsideration.

Shifts in the NAIRU could be explained by changes in variables like unemployment benefits, tax rates, skill-biased technological change, union structure or the degree of competition in product markets, and the theory may also be extended by including hysteresis elements - either duration or membership based. Although a large literature has focused on theories of this kind (e.g. OECD (1994), Phelps (1994), Layard et al (1991), Blanchard and Summers (1987)) the explanations have difficulty accounting for the empirical evidence. Blanchard and Jimeno (1995), for instance, point out that Spain and Portugal are very similar in terms of the structural characteristics of their labour markets but have unemployment rates that differ by 15 percentage points; Solow (1990) suggests that essentially the NAIRU comes down to a moving average of past unemployment rates; Blanchard and Katz (1997, p. 69) conclude that economists 'are a long way from having a good quantitative understanding of the determinants of the natural rate, either across time or across countries', while Hahn (1995, p. 54) suggests that 'theories of the natural rate are amongst the class of shaky and vastly incomplete theories'.

Within a broad post-Keynesian tradition the recent contributions by Arestis and Sawyer (1998) and Galbraith (1997) address some of the policy issues. The two contributions reach broadly similar conclusions. The NAIRU concept, it is argued, is unhelpful since the

NAIRU has been highly unstable. More importantly, although an overly aggressive expansion of aggregate demand may lead to inflation, we do not know the lower limits of unemployment, and both papers recommend experiments with an increase in demand. Interestingly, these policy conclusions appear to have widespread support, not just among post-Keynesians. Stiglitz (1997), for instance, who finds the NAIRU concept useful even though the precise level of the NAIRU is uncertain, emphasises the desirability of an active demand policy to test the limits of non-inflationary unemployment.

This policy conclusion may have much to recommend it, especially if - as argued by Stiglitz - the short-run Phillips curve is concave rather than convex so that inflationary consequences of an excessive demand stimulus can be undone relatively cheaply by a contractionary policy. But the theoretical issues are left open. How strong is the theoretical case in favour of the existence of a NAIRU? And if the concept is both well-defined and useful, should one expect the value of the NAIRU to shift endogenously? It is the purpose of this paper to examine some of these theoretical questions. I shall argue that traditional post-Keynesian ideas have much to offer but that there is a great need for further work, both theoretical and empirical.

The paper is in four sections. This introductory section is followed in section 2 by an analysis of NAIRU theory for a unionized economy. It is shown that even with perfectly rational agents and rational expectations the economy will not, in general, have a well-defined NAIRU: aggregate demand policy will affect both the rate of inflation and the unemployment rate. Sections 3-4 introduce fairness considerations and wage aspirations. It is shown that simple - and

psychologically well-founded - assumptions about the formation of wage aspirations can lead to hysteresis in the rate of unemployment. This source of hysteresis is distinct from traditional membership and duration based theories, and despite its simplicity the model is consistent with the stylized patterns of inflation and unemployment in both Europe and the US. Section 5 summarises the main argument and offers a few concluding remarks.

## ***2. Non-existence of a NAIRU in a unionized economy with fully rational agents***

Labour market imperfections are usually seen as the main reason for a deviation between the NAIRU and the optimal rate of unemployment ('full employment'), and the presence of strong trade unions has been an important element in the explanation of European unemployment. Precisely in the context of a unionized labour market, however, NAIRU-theories may be questionable, even if one accepts the basic premises of well-defined production possibility sets and fully rational agents with given preferences.

The absence of money illusion is at the core of the argument against a traditional downward-sloping Phillips curve. Since, by assumption, rational agents do not care about the absolute price level but about relative prices and real incomes, expected changes in nominal prices and wages should have no effects on real outcomes. But the indifference with respect to the absolute level of money wages and prices does not, in the standard analysis, extend to an indifference with respect to the rate of inflation. Agents, for some reason, dislike inflation. Without this assumption, the huge literature on the inflationary bias of discretionary monetary policy would be meaningless (why worry

about a bias that nobody cares about?).

The dislike of inflation is reflected in the government's utility function which, it is assumed, represents the preferences of the electorate. The early models of inflationary bias did not explicitly consider a unionized economy, but most models of union behaviour assume a utilitarian set-up in which unions maximise the utility of their members. Since the electorate cares about inflation, internal consistency suggests that union members - a large part of the electorate - will also care about inflation. Inflation, in other words, should enter the unions' objective function.

With these assumptions, the basis for the original Friedman argument has now collapsed. An individual worker may have no influence on aggregate inflation but a rational trade union - representing a large group of workers - cannot ignore the effects of its wage demand on aggregate inflation. Thus, in a unionized economy, inflation and unemployment will be determined as the outcome of a game between agents - unions and monetary authorities - all of whom care about both the rate of inflation and the rate of unemployment and all of whom recognize that through their choice of strategy they will affect the outcomes for both inflation and unemployment.<sup>5</sup> In a set-up like this, there can be no presumption that unemployment will be unaffected by changes in the behaviour of the monetary authorities.

Using the basic structure of the Barro-Gordon model, Skott (1997) analyses a model where both unions and governments care about inflation as well as employment, and where unions act as Stackelberg leaders vis-a-vis policy makers (that is, unions set wages before the determination of prices / aggregate nominal demand). It is shown that in this model expansionary demand policy may lead to a permanent increase in real output and employment without ever-increasing rates of

inflation.<sup>6</sup> Thus, there is no NAIRU. In fact, in the special case with a single, centralized union one gets a complete reversal of the standard policy advice: a first best outcome - zero inflation and full employment - can be achieved if the monetary authorities pursue the full employment target with a total disregard for any inflationary consequences. In other words, there should be a zero weight on inflation in the objective function of the monetary authorities. The reason for this result is simple. The union, as a Stackelberg leader, has to set nominal wages first; the inflation-indifferent central bank observes the wage and, since it cares only about employment and output, sets nominal demand so as to achieve the desired level of output; the rational union anticipates this outcome and therefore abstains from any attempt to raise real wages and reduce employment below the full employment level: it chooses nominal wages so as to achieve its preferred rate of inflation.

The strong optimality result depends on the union as Stackelberg leader. The Stackelberg assumption is plausible, I would argue, but the non-existence of a NAIRU - a weaker result - does not depend on it. It applies equally to the Nash case. Consider an economy with a centralized union and assume for concreteness - and in accordance with standard specifications in this literature - that the union has a quadratic utility function

$$U = -a \pi^2 - b (y-y^*)^2 \quad (1)$$

where  $\pi$  denotes price inflation and  $y$  the logarithm of output.<sup>7</sup> The union chooses the rate of wage inflation  $\omega$  while the central bank controls the rate of growth of nominal demand  $m$  which, by definition, can be written

$$m = \pi + (y - y_{-1}) \quad (2)$$

The level of output, finally, is determined by profit-maximising firms, giving an inverse relation between the change in output and the change in the real wage

$$y = y_{-1} + \lambda(\pi - \omega) \quad (3)$$

The union's reaction function is found by choosing the value of  $\omega$  that maximises (1) subject to (2)-(3) and a given value of  $m$ . Straightforward calculations yield<sup>8</sup>

$$\omega = A_0 (y_{-1} - y^*) + A_1 m \quad (4)$$

where  $A_0 = [b/(b+a)](1+\lambda)/\lambda$  and  $A_1 = [b/(a+b) - a/(\lambda(a+b))] < 1$ . Using the reaction function (4) in combination with (2)-(3), we get a first-order difference equation for output  $y$ ,<sup>9</sup>

$$y = B_0 y^* + B_1 m + B_2 y_{-1}$$

where  $B_0 = b/(a+b)$  and  $B_1 = B_2 = a/(a+b)$ . Since  $0 < B_2 < 1$  it follows (assuming  $m$  constant) that output will converge monotonically towards  $\bar{y}$  given by

$$\bar{y} = B_0/(1-B_2) y^* + B_1/(1-B_2) m = y^* + Cm \quad (5)$$

where  $C = a/b > 0$ . A constant level of output implies that  $m = \pi = \omega$  (use the supply function (3) and the definition of the growth in nominal income (2)), and equation (5) therefore describes a permanent trade-off between inflation and unemployment.

These results raise several issues. If there is no NAIRU, the elimination of inflation by independent, 'conservative' central bankers or the use of strict inflation targets will no longer constitute a free lunch. The analysis, in other words, casts doubt on the theory underlying policy recommendations that have become increasingly influential in recent years, for instance in connection with the

European Central Bank. But theoretical issues aside, do we not have strong empirical evidence in favour of central bank independence and in favour of price stability as the (near-) exclusive target for monetary policy? The answer, surprisingly perhaps, is no. The evidence is weak and ambiguous. It may satisfy someone with strong prior beliefs in the benefits of independent and conservative central banks, but a disinterested observer will find it anything but convincing (see Forder (1996) and Goodhart (1994) for a general discussion of methodological and data-related issues). One obvious problem concerns the use of partial analysis. The effects of different structures of policy formation (e.g. the objectives and the degree of independence of the central bank) should not be analyzed without controlling for the influence of general attitudes in the population to inflation, the structure of the labour market and the interaction between these labour market variables and the structure of policy-making.

At a theoretical level this argument has been made in a number of papers, and Cornwall and Cornwall (1997) and W. Cornwall (1999) present econometric work showing that when other variables are included, one may find a significant positive correlation between unemployment and central bank independence. Their theoretical approach and empirical specification differ somewhat from the standard literature on the effects of central bank independence, but empirical work in a standard mould also casts doubt on the traditional view. Thus, Cukierman and Lippi (1997) find evidence that, controlling for the degree of centralization in the labour market, changes in central bank independence will affect both unemployment and inflation. This study also illustrates the general weakness of the

empirical evidence: when some of the econometric results seem to contradict their theoretical expectations, they resolve the conflict by assuming that 'countries with a higher relative aversion to inflation ... have both more independent central banks as well as unions with a larger inflation aversion parameter' (p. 37). A plausible assumption, but an example of precisely the kind of complications that makes it possible to claim consistency between the data and a variety of different theories.<sup>10</sup>

The existence of long-run effects of monetary policy on employment has been derived above as an equilibrium outcome. Expectations are being met, unions correctly anticipate the policy makers' decisions and know how these decisions will affect the variables that are of interest to them. Some of the rationality and behaviour assumptions underlying the general framework are questionable (e.g. Prast (1996), Blinder (1997)). All that is required, however, for the qualitative result to go through is that unions are inflation-averse and that they recognize the existence of a link between their own wage demands and the rate of inflation. There is considerable evidence - certainly in the case of European countries with relatively centralized wage bargaining - that these conditions are met. A relaxation of the other rationality assumptions in the model will affect short-term dynamics and/or the precise form of the tradeoff, but the non-NAIRU result is quite robust.<sup>11</sup> This is in contrast to the claims of painless disinflation through credible precommitment in traditional Barro-Gordon type models, claims which rely strongly on the rational expectations of the private sector.

### **3. Fairness and endogenous changes in wage aspirations**

Norms and conventions influence many

aspects of economic activity. It is a common theme in post-Keynesian work that wage aspirations and notions of fairness play an important role in wage formation and that, furthermore, people's aspirations and ideas of fairness include a large conventional element.<sup>12</sup> Arguments of this type, however, also find support outside post-Keynesian circles. Hicks (1975), Solow (1990), Fehr et al (1993) and Akerlof and Yellen (1990), among others, all stress norms and fairness-related issues, and some of the basic ideas have a long history, going back at least to Marshall.

The influence of norms and conventions on wage formation has implications that are not always fully appreciated. In order to bring out these implications it may be useful to consider, first, a traditional account of the labour market in which the 'demand' and 'supply' sides of the labour market can be expressed in terms of relations between employment and the real wage.<sup>13</sup> To simplify the algebra I shall assume that firms always have excess capital capacity, that marginal costs are constant and proportional to unit labour cost, and that the markup on marginal cost is constant. With these assumptions, the demand side of the labour market determines the actual real wage, and the real wage grows in line with labour productivity

$$dw/dt = \omega - \pi = q$$

where  $w$  and  $q$  denote the (logarithm of) the real wage rate and the growth rate of labour productivity, respectively, and where  $-$  as in section 2 -  $\omega$  and  $\pi$  represent the rates of wage and price inflation.

Assuming that the supply of labour is proportional to the size of the labour force for any given value of the real wage, the supply side implies that

$$w^s = f(u), \quad f' < 0$$

where  $u$  is the unemployment rate. In this equilibrium framework, workers, by definition, expect to achieve the wage rate  $w^s$ . The expected growth rate of real wages is therefore given by

$$dw^s/dt = \omega^e - \pi^e = w^s - w = f(u) - w \quad (6)$$

Since wage contracts specify (the growth of) money wages, one may suppose that the expected and actual growth rates of money wages coincide, that is,  $\omega^e = \omega$ . Hence, using  $\omega - \pi = q$ , equation (6) can be rewritten as

$$\pi = \pi^e + (f(u) - w - q)$$

and we have a standard expectations-augmented Phillips curve. The real wage increases over time and the NAIRU - given by  $u^* = f^{-1}(w+q)$  - will remain constant if the supply of labour is completely inelastic (in which case  $f(u) = 0$  for  $u > u^*$  and  $f(u) = \infty$  for  $u < u^*$ ). Alternatively, a constant NAIRU obtains if the  $f(\cdot)$ -function happens to shift over time in line with the change in productivity, that is, the  $f$ -function depends on  $t$  as well as on  $u$  and can be written  $\omega^s = f(u,t) = h(u) + qt$ . This second possibility for avoiding a secular trend in the unemployment rate is unappealing, however, unless an explanation can be found for why the wage target should be increasing precisely in line with productivity. The changes in the wage target need to be endogenized.

Stiglitz (1997), among others, has described a theory of this kind. It may be worth quoting his argument in full:

Although neither the level or the rate of change of productivity has any long-run effect on the unemployment rate -

witness the fact that unemployment has been about the same over the course of a century of massive productivity growth and large shifts in the trend growth rate - changes in the productivity growth rate can have temporary effects on the natural rate of unemployment. The intuition is that workers' demands for increased real wages depend on their past rate of change, possibly because of the fact that people get accustomed to a certain rate of increase in their standard of living. Thus, after a fall in the productivity growth rate, workers will initially demand real wage growth based on their previous experience and thus faster than the increase in productivity, which puts upward pressure on the inflation rate and requires a higher level of unemployment for the economy to stay in equilibrium. But this increased NAIRU is only temporary, either because the productivity shock itself is temporary, or because workers will eventually moderate their demands in response to permanently lower productivity growth. Either way, the NAIRU can return to its preshock level. This effect, called the wage-aspiration effect, surely contributed to a rising NAIRU in the 1970s and early 1980s, in the aftermath of the productivity slowdown. However, workers have now had a lot of time to adjust their real-wage aspirations down to reflect the slower productivity growth, which should be helping the NAIRU rebound to its earlier, lower rate (Stiglitz (1997, p. 7)).

Thus, according to Stiglitz, (i) workers form aspirations with respect to the rate of growth rather than the level of the real wage, (ii) these aspirations are determined by actual

growth rates of in the past and (iii) this hypothesis about aspirations may explain not only the absence of a long-term trend in unemployment but also the US experience in the 1970s and 1980s: reduced productivity growth rates from the late 1960s caused increased unemployment until aspirations had adjusted to the new realities of low productivity growth.<sup>14</sup>

The focus on changes rather than levels of the real wage fits the observation in experimental studies that the 'main carriers of decision utility are events, not states; in particular, utility is assigned to gains or losses relative to a reference point which is often the status quo' (Kahneman (1994, p. 22)). The adjustment of aspirations to match achievements also has support in other social sciences. Psychological theories of self-perception, for instance, change 'the order of a person's assessment of his or her market worth. Instead of saying independently, "I am worth  $X$  and should receive  $X$  (or more likely,  $X + something$ )," an individual looks at the salary and decides that whatever it is, it must be the correct assessment of his or her worth: "Because I am paid  $X$ , I must be worth  $X$ ." (Lane (1991, p. 417) Thus, although the first two parts of the Stiglitz story may be unorthodox - from a mainstream economics perspective - they can be justified both theoretically and empirically.

The third element in the story also sounds plausible. It is suggested that workers expect - and demand - a certain growth rate of real wages. This growth rate is determined partly by an historically established norm, partly by the current rate of unemployment. High unemployment reduces wage demands below the norm while low unemployment causes wage demand to exceed the established norm (or putting it differently, labour supply is related not to the level of the real wage but to the (expected) growth rate of the real wage).

Algebraically, equation (6) should therefore be replaced by

$$dw^e/dt = w^s - w = g + h(u), \quad h' < 0 \quad (7)$$

where the established norm - denoted by  $g$  - is a reflection of actual wage growth in the past. It changes endogenously, increasing if actual wage growth exceeds the norm and decreasing if actual wage growth is below the norm. We thus get a dynamic equation for  $g$ ,

$$dg/dt = \mu (\omega - \pi - g) \quad (8)$$

The norm is constant and expectations fulfilled in a long-run equilibrium, that is,  $dw^e/dt = \omega - \pi = g$ . Substituting these equilibrium conditions into equation (7) it follows that we have a unique long-run equilibrium - a unique long-run NAIRU - determined by

$$h(u^{**}) = 0 \quad (9)$$

A decline in productivity growth will, however, affect the NAIRU in the short and medium term. Assume that productivity has been growing at a constant rate  $\alpha$  until, at time  $t$ , it unexpectedly drops to  $\alpha - \varepsilon$ . We may assume that the economy has settled into a long-run equilibrium when the change occurs, that is, we have a  $dw^e/dt = \omega - \pi = g = \alpha$  and  $u = u^{**} = h^{-1}(0)$ . The NAIRU, which is defined by the condition that price expectations are being fulfilled (that is,  $\pi^e = \pi$  and  $dw^e/dt = \omega - \pi$ ), temporarily rises. Substituting the expectational condition into (7) we get an expression for the short-run NAIRU after the slowdown

$$h(u^*) = \alpha - \varepsilon - g$$

At the time of the shock, the wage norm stands at  $g = \alpha$ . Thus, the NAIRU jumps to  $u^* = h^{-1}(\varepsilon) > h^{-1}(0) = u^{**}$  at the time of the

productivity shock. The gap between aspirations and achievements now leads to changes in the wage target. From (8) it is readily seen that the wage norm  $g$  declines geometrically towards the new productivity growth rate  $\alpha - \varepsilon$  and that, consequently, the NAIRU gradually converges back towards its long-run value.<sup>15</sup>

If one allows for the possibility that policy makers fail to recognize the change in productivity growth and that aggregate demand is kept too high in the period immediately after the change, the predicted pattern would seem to resemble the actual experience of the US economy quite well: rising inflation and unemployment in the period immediately after the slowdown, when unemployment was below the new NAIRU, followed by anti-inflationary policies and further increases in unemployment and, eventually, the non-inflationary return of both actual unemployment and the NAIRU to the rates that prevailed before the slowdown. The Stiglitz story, it seems, makes both theoretical and empirical sense in the case of the US.

Unfortunately, the story does not fit the European experience very well. Productivity growth slowed down in Europe too, and inflation and unemployment rose in the 1970s and 1980s. But unemployment has stayed high. Even in the US the empirical fit is far from perfect. Estimated values of the NAIRU have returned to the level of the mid 1960s, but over the same period there has been a large decline in union membership and the power of organized labour. Combine these developments with increased product market competition and changes in the demographic composition of the labour force, and one would have expected a decline in the NAIRU. In addition to these empirical questions, there is a theoretical problem: on close examination at least one of the steps in the theoretical

argument is suspect.

#### 4. An alternative specification: aspiration-induced hysteresis

Equation (8) assumes that the change in the growth norm is determined by the discrepancy between the actual wage change and the current aspirations *as measured by the value of  $g$* . This is a strange assumption. Wage aspirations are determined partly by the inertial factors captured by  $g$ , and partly by the rate of unemployment. The aspiration gap, therefore, should be measured by  $(\omega - \pi - dw^e/dt)$ , and if aspirations are being met, there is no reason for workers to revise their aspirations.<sup>16</sup> The change in  $g$ , therefore, should be specified as,

$$dg/dt = \mu(\omega - \pi - dw^e/dt) = \mu(\omega - \pi - g - h(u)) \quad (9)$$

This may look like a minor change compared to equation (8) but it has major implications.

Consider an economy in long-run equilibrium with  $\pi^e = \pi$  and  $dg/dt = 0$ , and assume that this economy suffers an unanticipated decline in the growth rate of productivity from  $\omega - \pi = q = \alpha$  to  $q = \alpha - \varepsilon$ . If inflation-averse policy makers react quickly and maintain the economy at its NAIRU at all times, then  $\pi^e = \pi$  and  $dw^e/dt = \omega - \pi$ , and the aspirational variable  $g$  will remain unchanged. Consequently, the productivity slowdown implies a permanent increase in unemployment: the NAIRU jumps to a new higher level given by

$$u_1^* = h^{-1}(q - g) = h^{-1}(\alpha - \varepsilon - g) > h^{-1}(\alpha - g) = u_0^*$$

where  $u_0^*$  is the value before the productivity slowdown.

A more plausible scenario has policy-makers reacting sluggishly to the rise in inflation rates. The productivity slowdown,

and the associated rise in  $u^*$ , leads to higher inflation; this is followed by a period in which both inflation and unemployment increase; a further tightening of demand policy then raises actual unemployment above the NAIRU, inflation is brought under control, and there is a return to demand policies that make actual unemployment equal to the prevailing value of the NAIRU. The pattern - illustrated in Figure 1 - fits the broad outline of the European experience since the late 1960s.

According to this model, a change in productivity growth *may* have permanent effects on the rate of unemployment. But it need not. Consider the case where policy-makers are completely inflation-indifferent and where they choose to maintain unemployment at the value of the old NAIRU. As a result,  $dw^e/dt > \omega - \pi = q$  and - using standard expectational assumptions - inflation will be increasing. But the failure of workers to achieve their wage aspirations also leads to declining aspirations:  $g$  is falling, and a reduction in  $g$  implies a reduction in the NAIRU. The NAIRU, in other words, depends on demand policy. If aspirations adjust quickly ( $\mu$  is large) and the adjustment of inflation expectations and nominal wages is sluggish, the inflationary costs of maintaining a low NAIRU after a slowdown may be modest; fast wage adjustments and slow changes in aspirations, on the other hand, tend to increase the inflation cost.

As a particularly simple example, consider the case where workers have static expectations with respect to the price level. This assumption - although realistic for some earlier periods in history - clearly gives a poor description of expectations for most of the postwar period in the OECD countries. Still, for illustrative purposes it is an interesting extreme case. Since  $dw/dt = \omega - \pi$ ,  $dw^e/dt = \omega - \pi^e$  and, using the expectational assumption,  $\pi^e = 0$ ,

we have

$$\begin{aligned} \pi &= \pi - \pi^e = dw^e/dt - dw/dt = g + h(u) - q \\ &= g + h(u^*) - q + h(u) - h(u^*) = h(u) - h(u^*) \end{aligned}$$

Thus, actual inflation is decreasing in actual unemployment ( $u$ ), increasing in the NAIRU ( $u^*$ ), and equal to zero when actual unemployment is equal to the NAIRU. This implies that it becomes possible to keep the rate of unemployment at the old NAIRU without any inflationary costs on the long run. The decline in productivity causes a temporary deviation between wage aspirations and actual wages (or, equivalently, between  $u$  and  $u^*$ ), and this deviation leads to inflation. But gradually wage aspirations decline,  $u^*$  converges to  $u$  and the rate of inflation goes to zero.<sup>17</sup>

This strong conclusion - the complete absence of inflation whenever  $u = u^*$  - clearly does not carry over to other specifications of the formation of expectations. The model exhibits hysteresis in the sense that  $u^*$  adjusts to  $u$  but, in general, expansionary demand policies that reduce the NAIRU will affect the rate of inflation at the end of the adjustment period. With a complete knowledge of all functional forms it may be possible to design a time pattern for aggregate demand which reduces unemployment without inflationary consequences (see Skott (1991) for a discussion of this possibility in a related model), but from the perspective of applied policy another implication of the analysis may be more relevant.<sup>18</sup>

Inflation tends to be increasing whenever actual unemployment is below the NAIRU, or equivalently - given the endogenous changes in aspirations - *whenever the NAIRU is decreasing*. It is not low unemployment as such, but the transitional process of decreasing the NAIRU that raises inflation. This distinction is essential. As pointed out by

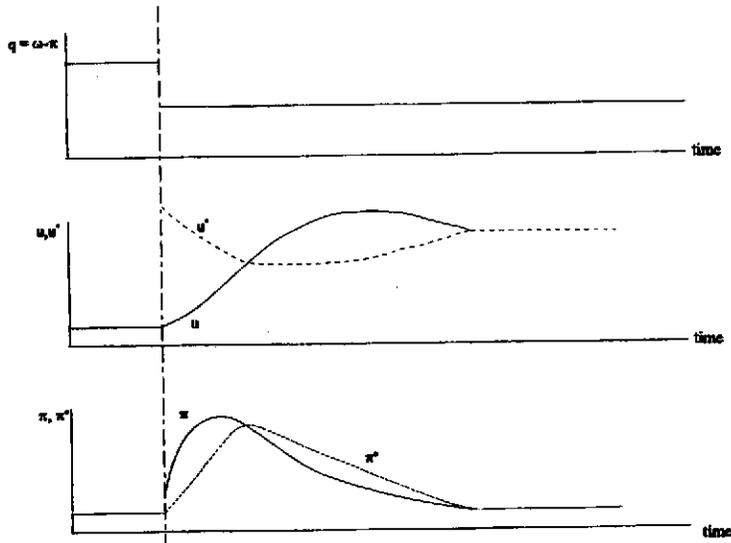


FIGURE 1: Time pattern of  $u, u^*, \pi$  and  $\pi^e$  following productivity slowdown

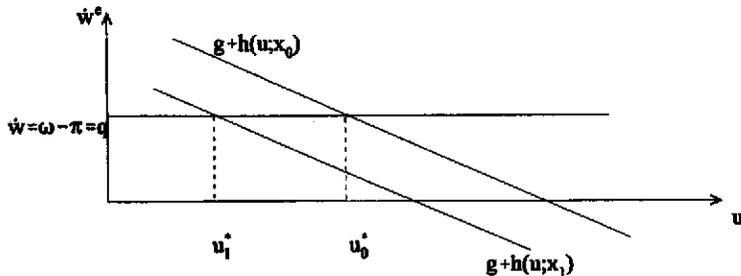


FIGURE 2: Effects on  $u^*$  of changes in the structural variables  $x$

Solow (1990, pp. 74-5) a *temporary* incomes policy, rather than a permanent policy, is sufficient to allow a permanent non-inflationary reduction in unemployment in a model of this kind.<sup>19</sup>

The effects of a productivity slowdown on

the NAIRU can also, of course, be counteracted by structural labour market policies. The advocacy of reductions in unemployment benefits and other attempts to 'increase labour market flexibility' is usually based on models without aspiration-based

changes in the value of the NAIRU, but measures of this kind will also affect the NAIRU in the present set-up: labour market policies may shift the  $h(\cdot)$  function, and since  $u^* = h^{-1}(q-g)$ , a downward shift in  $h(\cdot)$  reduces  $u^*$  (see figure 2). The case against this approach is not so much ineffectiveness with respect to the NAIRU - although clearly some policies may also be open to this criticism - but that policies which shift the  $h(\cdot)$  function downwards typically have negative social and distributional consequences. The justification for these policies therefore often relies on arguments to the effect that 'there is no alternative'.<sup>20</sup> This TINA argument breaks down if aspirational inertia cause hysteresis in the NAIRU. In this case there are alternatives: the most promising being perhaps a combination of demand and incomes policy.

### 5. Summary and conclusions

In this paper I have tried to show that, in general, models with rational agents and standard objective functions fail to generate a well-defined NAIRU in a unionized economy. The popularity of traditional NAIRU theory and its influence on policy therefore seems both puzzling and unfortunate, especially in a European context. However, post-Keynesians who want to argue the case for demand policy need to come up with a convincing explanation of the observed pattern of inflation and unemployment in the postwar period. The simple model in section 2 does not look promising in this respect (and, of course, the assumptions of the model were deliberately quite orthodox, too orthodox no doubt for most post-Keynesians). Sections 3-4 therefore considered a set-up which, in my view, embodies key elements of a convincing post-Keynesian story.

The idea is simple. Wage aspirations play a large role in wage formation and aspirations are determined endogenously. Depending on

precisely how aspirations adjust, one may get a unique NAIRU, or the NAIRU may be subject to hysteresis. A non-hysteretic version of the theory appears to have the support of, among others, Stiglitz (1997). The hysteretic version in section 4, however, seems preferable on theoretical as well as empirical grounds. It is hard to argue that European labour markets have become increasingly inflexible since the late 1960s. If anything, they have become more flexible, workers have become less militant and unions have become less powerful. According to the Stiglitz story, the NAIRU therefore should have fallen (unless the need for flexibility has increased as a result of other changes in the general economic environment facing these economies). A model with aspirational hysteresis on the other hand fits the broad European pattern: the stylized picture of productivity, inflation and unemployment in figure 1 resembles the observed pattern for Europe. Hysteretic wage aspirations may also explain why the NAIRU has not declined relative to the 1960s in the US (cf. section 3). On balance, and at this very stylized level, the hysteretic account would seem more in line with the evidence than the Stiglitz story. Whether the hypothesis can survive a more thorough empirical examination remains to be seen.

### Endnotes

1. Department of Economics, University of Aarhus, Denmark.
2. Implicitly this literature assumes a perfectly elastic labour supply and largely ignores all questions relating to the rate of unemployment. Contributions include Rowthorn (1981), Dutt (1984), Taylor (1985) and Marglin and Bhaduri (1990); Auerbach and Skott (1988) criticize some of the key assumptions of this approach.

3. E.g. Cornwall (1994) and Cornwall and Cornwall (1997).
4. The appeal to Okun and Verdoorn's law seems questionable. Okun's law relates to cyclical fluctuations, and its relevance to medium- and long-term unemployment is not obvious. Verdoorn's law does describe a long-run relation between the growth rates of output and labour productivity. A high rate of unemployment, however, does not imply that expansionary demand policy could raise the growth rate of output in the long run (unless, of course, the Verdoorn coefficient were equal to one).
5. This argument does not require a single centralized union. Individual unions, however, must be 'large' in the sense that their wage demands have perceptible effects on aggregate inflation.
6. See also Cubitt's (1992) comparison of the Nash equilibrium with games in which either the union or the monetary authorities act as Stackelberg leader: contrary to simple Barro-Gordon results, precommitment (the monetary authorities as Stackelberg leader) will not in general dominate the outcome under discretionary policy.
7. The non-NAIRU result survives in a decentralized system with multiple unions as long as the unions are large enough for the wage demands of an individual union to influence the aggregate rate of inflation.
8. Equations (2)-(3) imply that

$$\pi = (m + \lambda\omega)/(1 + \lambda)$$

$$y = y_{-1} + \lambda(\pi - \omega) = y_{-1} + \lambda(m + \lambda\omega)/(1 + \lambda) - \lambda\omega$$

$$= y_{-1} + [\lambda/(1 + \lambda)]m - [\lambda/(1 + \lambda)]\omega$$

and

$$\partial\pi/\partial\omega = \lambda/(1 + \lambda)$$

$$\partial y/\partial\omega = -\lambda/(1 + \lambda)$$

Substituting the expressions for  $\pi$  and  $y$  into the objective function (1) and differentiating yields the following first order condition

$$a(m + \lambda\omega)/(1 + \lambda) = b(y_{-1} - y^* + [\lambda/(1 + \lambda)]m - [\lambda/(1 + \lambda)]\omega)$$

Rewriting this equation, we get

$$\omega = [(1 + \lambda)/\lambda] [b/(a + b)] (y_{-1} - y^*) + [b/(a + b) - a/(\lambda(a + b))] m$$

9. Using (2)-(3) we have - see note 8 -  
 $y = y_{-1} + [\lambda/(1 + \lambda)]m - [\lambda/(1 + \lambda)]\omega$   
 Substituting the expression for  $\omega$  into this equation gives  
 $y = y_{-1} + [\lambda/(1 + \lambda)]m - [\lambda/(1 + \lambda)] \{ [(1 + \lambda)/\lambda] [b/(a + b)] (y_{-1} - y^*) + [b/(a + b) - a/(\lambda(a + b))] m \}$   
 $= y_{-1} a/(a + b) + m a/(\lambda(a + b)) + y^* b/(a + b)$
10. Bleaney (1996) also includes both labour market structure and central bank independence in his analysis, but his theoretical framework fails to allow for the possibility that unions care about inflation. He reads the evidence as consistent with a NAIRU view: the degree of central bank independence (a proxy for conservative monetary policy) does not seem to affect unemployment in his study.
11. Although inconsistent with the predilections of neoclassical economics, there is a considerable body of evidence indicating the empirical importance of money illusion. See Shafir et al (1997) for a discussion of some of the evidence on money illusion and its implications in the context of a simple efficiency wage model.

12. E.g. Kaldor (1976), Wood (1978) and Sawyer (1982) - as well as Keynes's discussion of wage relativities in the *General Theory*.

13. 'Demand' and 'supply' are in inverted commas to include models with imperfect competition, bargaining or efficiency wages. In these cases there are no demand or supply functions in a traditional sense. With imperfect competition in the product market, for instance, the 'demand function' indicates combinations of labour input and real wages that satisfy the first order conditions for profit maximisation.
14. Blanchard and Katz (1997, p. 54 and 57) present a similar argument.
15. When  $\mu=0$  the model reduces to a simple real-wage Phillips curve, and a decline in productivity growth will be associated with a rise in (equilibrium) unemployment.
16. An alternative justification of equation (8) could be constructed in terms of a time-invariant wage-share aspiration and sluggish adjustments in expectations of productivity growth.
17. Since  $u^*=h^{-1}(\omega-\pi-g)=f(\omega-\pi-g)$ , we have  $du^*/dt = f' d(\omega-\pi-g)/dt$ . If  $\omega-\pi=g$  is constant and  $h(\cdot)$  is linear, that is,  $h(u)=m_\sigma m_1 \mu$  and  $f(\omega-\pi-g)=-(\omega-\pi-g-m_0)/m_1$ , this simplifies to  $du^*/dt = \mu (\omega-\pi-g - h(u))/m_1 = \mu (h(u^*) - h(u))/m_1 = \mu (u - u^*)$ . Thus, the specification implies that the NAIRU follows a first-order autoregressive process.  
Solow (1990, chapter 3) assumes that  $u^*$  is a moving average of unemployment over the previous five years but gives no theoretical argument in support of this hypothesis. His theoretical argument in chapter 2 merely establishes the possible existence of multiple equilibria in an infinitely repeated game between workers and employers.
18. The main difference between the present model and Skott (1991) is the focus on aspirations with respect to changes in the real wage rather than the level of real wages. With this respecification the effects of the observed productivity slowdown fit the stylised pattern of European unemployment.
19. 'Wage and price guidelines' are among the instruments suggested by Galbraith (1997). His position is strengthened if wage pressure is a result of changes in unemployment rather than a permanent accompaniment of high rates of employment.
20. The TINA argument is questionable even in more orthodox models. The NAIRU for instance will typically depend on firms' markup (that is, on structural characteristics of the product market) as well as on broader institutional characteristics (e.g. profit sharing). Structural policy therefore need not focus on the 'flexibility of the labour market'.

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