VICIOUS AND VIRTUOUS CIRCLES — THE POLITICAL ECONOMY OF UNEMPLOYMENT∗

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Abstract

We develop a theoretical nonlinear model of equilibrium unemployment and test its policy implications for a number of OECD countries. The theory here sees the natural rate and the associated equilibrium path of unemployment as endogenous, pushed by the interaction of shocks and the institutional structure of the economy; the channel through which these two forces feed on each other is a political economy process whereby voters with limited information on the natural rate of unemployment react to shocks by demanding more or less social protection. The reduced form results from a dozen OECD economies give support to the model and further evidence is obtained by structural estimates for the UK.

JEL: C15, C22, E24

Keywords: Equilibrium unemployment, political economy, vicious and virtuous circles, bootstrapping

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1 INTRODUCTION

Why does economic performance differ so much? Such difference applies not only across countries but also across different periods for the same country. One thinks of the US in the 1920s: a high-performing economy with full employment. But the US of the 1930s endured the Great Depression, leading to heavy regulatory intervention and protectionism that made matters worse not only for the US but also for the rest of the world. Since the second world war, we have seen both the Japanese growth from the mid-1950s to the mid-1970s, and yet stagnation from 1990 onwards. Continental Europe grew rapidly with full employment in the 1960s and 1970s and yet in the 1980s and 1990s it has been relatively stagnant, with unemployment close to 10%.

How can this be, given we all have access to the same ideas about managing the economy, the same technology, the same world capital markets, to the same sort of skills in our labour forces? In this paper we suggest that, via the processes of political economy, the structure of the economy (especially of the ‘supply side’) alters in response to shocks, often in an unhelpful way that reinforces these shocks, but also occasionally in a helpful ‘revolution’ that allows the economy finally to adapt. For example, if there is a persistent slump, voters may demand regulation, strong unions, protection and better unemployment benefits (as occurred in the US during the 1930s) or at least the abandonment of deregulation (as with Japan in the 1990s). The UK reforms starting in 1979 exemplify how the economic structure can be improved once perhaps matters have become sufficiently bad. Once popular confidence is built up, as it was in the UK during the 1980s, the demands for protection weaken and in their place, people and business demand freedom. Then the economy settles at a high-employment equilibrium.

This paper’s idea is thus that shocks causing sharp cyclical swings in unemployment generate political reactions from public opinion and vested interests, while these in turn produce not merely fiscal and monetary (demand policy) responses but also changes in supply-side policy, i.e., policy affecting the equilibrium values of real variables or ‘natural rates’. Specifically, these shocks tend to produce supply policy that distorts the market because these shocks generate demands for protection; these distortions in turn produce a worse equilibrium with a higher natural rate of unemployment which in turn can reinforce the demands for yet more protection, until matters are bad enough for a political coalition to form around reform. Vice versa, a good run of demand shocks produces more liberal supply-side policies as people are less nervous about potential misfortune. This again is self-reinforcing so that the...
economy moves in a virtuous circle to a low-unemployment high-output equilibrium. We thus posit that there are intimate linkages through the political economy between the two sorts of policies, namely, demand-management and supply side policies, and these links have the capacity to create both vicious and virtuous circles of economic performance.

Though we believe this is the first time these ideas have been integrated into a political economy theory of unemployment, in themselves they are not new. There is in particular a large literature of ‘hysteresis’ (see Layard et al. (1991)) which has noted the tendency for unemployment to react with high persistence to temporary demand and supply shocks. Blanchard and Wolfers (2000) have in this vein identified the interaction of such shocks with ‘adverse institutions’ such as unemployment benefit regimes. Indeed, Layard et al. (1991) following Burda (1988) find that long-duration unemployment is closely linked to long-duration benefits. Multiple equilibria also have a long history in the macroeconomics of unemployment (for an early example see Diamond, 1982). Our contribution here is to view these possibilities as the product of a political economy process interacting with familiar macroeconomic processes.

In section 2, we start by outlining a standard model of structural unemployment such as that of Minford (1983). We then combine this result with a model for change in the political equilibrium, such as the Meltzer and Richard (1981) model of general redistributive transfers in section 3. Section 4 derives our reduced form model and reports and discusses our main reduced form results for the twelve OECD countries under investigation. Section 5 develops a bootstrapping test procedure to determine the number and nature of equilibria. Section 6 then goes on to examine some structural estimates for the UK (the only country for which relevant data is available) for similar evidence of twin versus one stable equilibrium. Section 7 concludes that the reduced form evidence favours the widespread but not necessarily universal presence of the sorts of interactions our theory sets out; and that this conclusion is further strengthened by the only structural model evidence we have, viz for the UK.

2 A MODEL OF UNEMPLOYMENT

The crucial elements in our model determine the natural rate of unemployment, i.e., the equilibrium to which unemployment tends. Milton Friedman (1968) remarked that it was the equilibrium ‘ground
out by the Walrasian system’ of real demands and supplies. However, it never really occurred to macroeconomists to model it until much later; Friedman, Phelps (1970) and others using the natural rate concept effectively treated it like a natural constant.

It was not until the early 1980s in the UK when unemployment rose above 10% with no apparent tendency to fall that models began to be formulated of a changing natural rate. The first effort was Minford (1983); he took the classical labour supply and added the idea of a permanent unemployment benefit, payable without any check on work availability (a peculiarly European concept). The result was to tilt the labour supply curve so that the real wage offer never fell below the benefit, as shown in Figure 1. This had the effect of creating the ‘real wage rigidity’ identified for example by Bruno and Sachs (1985) in their account of the 1973-4 oil crisis.

![Diagram of the Natural Rate of Unemployment](image)

**Figure 1: The Natural Rate of Unemployment**

In the figure below, one can see how the marginal product of labour schedule (assumed here to be horizontal) can interact with this distorted labour supply schedule to generate equilibrium unemployment. Should the benefit rise relative to productivity, unemployment will result: people will voluntarily refuse to take available wage offers because benefits are preferable. They are ‘unemployed’ in the sense that they are not working but are ‘available for work’. These ideas have been later taken up by Layard and Nickell (1986) and others.
2.1 The Labour Market in outline

It is assumed that industry is competitive. Each firm enjoys constant returns to scale within an open economy facing world prices and a world capital market, allowing capital to flow as required into domestic industry. As in Heckscher-Ohlin models there is factor price determination by world traded good prices and domestic productivity; hence the horizontal demand curve for labour given by its marginal value product. Accordingly, we treat real wages, $W$, as exogenously determined by productivity.

Labour supply is ‘new classical’ in spirit, where worker has knowledge of ‘going rates’ in the sectors in which he has the necessary skills to work. He decides when to enter and when to withdraw from these sectors in a standard optimising manner; i.e., he maximises the present value of his expected welfare, given these wage rates and other relevant prices, including benefits out of work and taxes etc. in work.

The model therefore implies that the supply of labour will be dependent on the level of real wages, net of tax and expenses, relative to out of work benefits. Because of the wide differences in individual tax/benefit circumstances tight restrictions across the parameters of benefit, tax, and real wage variables are unlikely to hold and we write labour supply, $L^*$, relative to the participating working population, $POP$, as a function of benefits relative to net real wages:

$$\frac{L^*}{POP} = f\left(\frac{B}{W(1 - T_L)}\right)$$

where $B =$ real unemployment benefit, $T_L =$ tax rate (fraction of wage) paid by employee. In a time-series analysis, we may expect the elasticity of labour supply to the benefit/income ratio to be very low for a low aggregate ratio and to rise as the ratio rises, tending towards a maximum as net wage income tends to the level of benefits provision. Such a supply curve is illustrated in Figure 1.

The labour market equations are completed by the unemployment identity (shown in Figure 1) where we define $U$ as the unemployment rate:

$$U = \frac{POP - L_s}{POP}$$

The labour market model can be generalised to include the effects of union power, taxes of all sorts, employer and employee national insurance contributions (which in Europe are largely taxes in
nature) and other forms of labour market intervention\(^1\) — see for example Lazear (1990), Bentolila and Bertola (1990), OECD (1993, 1994), (Phelps(1994), Pencavel (1994), Layard et al.(1991), Forslund and Krueger (1994), Calmfors and Forslund (1991), and Siebert (1997). Nickell(1997), Nickell and Layard(1998) and OECD (1999) suggest that structural unemployment in major OECD economies is associated with the following labour market features: (a) generous unemployment benefits that are allowed to run on indefinitely, combined with little or no pressure on the unemployed to obtain work, (b) high unionisation with wages bargained collectively and no coordination between either unions or employers in wage bargaining and (c) high overall taxes impinging on labour or a combination of high minimum wages for young people associated with high payroll taxes.

We choose to enter $\ln U$ (the natural logarithm of the unemployment rate) rather than employment into the supply curve because the theory suggests as above that at high unemployment levels, a 1% change in benefits will have a larger absolute effect on unemployment levels because the slope of the supply curve will be flatter (more wage rigidity). A log formulation has this property. The labour supply curve can also have a family relationship with a ‘wage equation’ by normalising on the real wage variable and union power could enter in it to stress its role in wage-setting. It should also be noted that the use of the log of unemployment rate in a ‘wage curve’ (supply curve) has been found to be preferable in the determination of wages throughout many investigations, (Blanchflower and Oswald, 1994).

In our analysis we focus purely on benefits, because this will be the choice variable for voters under our political economy model below; such things as taxation and public expenditure, union power, and minimum wages are also potential choice variables but for simplicity we leave them out of the explicit model. Thus our operational equation becomes:

$$
\ln U_t = u_0 + \delta \ln(B_t/W_t) + u_{1t} + u_c^t
$$

where $u_0$ is a constant, $u_c^t$ is cyclical unemployment, and $u_{1t}$ represents other persistent influences

\(^1\)Later versions have proliferated; in the UK, Layard and Nickell (1986) estimated a similar model, and Bean et al. (1986) attempted to extend it to other European countries which began to experience rising unemployment UK-style during the late 1980s and 1990s. It turns out that in each country there are substantial idiosyncracies in the social support mechanisms, complicating effective modelling of the natural unemployment rate. Nevertheless a large amount of empirical work, both cross-section (Burda(1988) was the first to exploit the variation across European countries and show the importance of long-duration benefits) and time-series (Nickell, Layard and Jackman (1991) survey much of it) seemed to confirm that these mechanisms, particularly the length of time benefits were available and their ease of eligibility, were responsible for persistently high unemployment in Europe.
on unemployment. Examples of such influences would be demographic shifts (like a rise in working age population, and sectoral shifts like a decline in manufacturing). \( u_t^e \) and \( u_t \) would therefore be an error process assumed to display high serial correlation. These influences will have no long-run effect on unemployment (or if they do, it is assumed to be captured in the natural rate equation: \( \ln U^*_t = u_0 + \delta \ln(B_t/W_t) \)). However their short-run effect is assumed to be long drawn out.

3 THE POLITICAL ECONOMY OF THE SUPPLY SIDE

There is a massive literature on the creation and evolution of the institutions that favour or inhibit capitalist growth. For example, North (1981) charted the way in which protestant dissent in the low countries and the UK produced the first industrial revolutions. Lal (1998) has gone further back to show how competition in Europe between nation states under the edicts of Papal Christendom gave capitalism its secure basis. Mancur Olson (1971, 1982) set out the mechanisms by which vested interest groups could prevent the general good (in the second he argued that as nations become older they acquire more powerful vested interests as networks and clubs have longer to form and become entrenched); essentially they exercise discipline over their members who have strong interests at stake whereas the general public have too little incentive individually to understand how their own interests are prejudiced by the actions of these groups. Hence for politicians to mobilise opinion in favour of reform is costly and uncertain, whereas these groups can offer them rewards, both personal and political, for pushing their own agendas—an activity known as ‘rent-seeking’, in which existing rents are diverted instead of being augmented by productive action. This basic idea has led to a substantial applied research agenda; examples are St. Paul (1996, 2000) on the difficulties of modifying costly firing regulations in Europe.

However, there are examples of supply-side reforms being undertaken in spite of vested interest opposition. Three such are the wide-ranging reforms of the Thatcher conservatives over the 1980s and 1990s in the UK, and in the US the Carter deregulation of the 1970s and the Reagan tax reforms of the 1980s. On these occasions, it proved possible for politicians to build a sufficient coalition in public opinion to support reform.

So there is a tension between the strength of vested interests and the power of the public in asserting its general interests. A political economy of institutions should attempt to model this tension. Central
to the political economy of macroeconomic policy are models of voting behaviour. It is natural to extend these to supply side issues which we can define as microeconomic issues with macroeconomic consequences.

In our model we follow the well-known model of redistribution financed by distortionary taxation, formulated by Meltzer and Richard (1981). Policy is set as in the standard median voter model, the simplest model of electoral competition, in which the competing parties are identical in all respects and voters care only about economic policy. Therefore all parties converge to the median voter optimum. The model predicts that the size of general redistributive programmes reflects the preferences of the middle classes (the likely median voters) and is determined by their relative position on the income scale.

Our median voter however is drawn from the model of Minford and Peel (1982). There, ‘capitalists’ hold only physical capital while ‘workers’ hold only human capital; the floating or median voter, on whom we focus, lies mid-way between the two and holds both forms of capital. In what follows, we develop a model for the median voter’s choice for unemployment benefits in which this voter’s demands for benefits rise as unemployment rises, but at a diminishing rate, as the effect of extra taxes progressively raises the chances of unemployment.

We expound this model in the first place under the assumption of rational expectations with full information up to time t-1 on the relevant data and full knowledge of all model parameters. Let the (risk-neutral) median voter’s utility be given purely by a linear function of income so that the mth such voter maximises at t:

\[ V_t^m = E_t \sum_{i=0}^{\infty} \beta^i \left( N_{t+i}^m s B_{t+i} + [1 - N_{t+i}^m s] W_{t+i} + rK - T \right) \]  

where \( \beta = \) the voter’s time-preference rate, \( N_{t+i}^m \) is the number of spells the mth voter spends unemployed in year t+i, \( s = \) fraction of a year that each spell lasts; \( r \) is the rate of return on non-human capital, \( K \), and \( T = \) general per capita taxation (treated as lump sum). In addition this voter faces two constraints. First, the expected duration of unemployment in t+i (that is s times the expected number of spells) is
\[ \pi_{t+i} \] which we write as:

\[ \pi_{t+i} = \pi_0 + \pi U_{t+i} \quad ; \quad 0 \leq \pi_{t+i} \leq 1 \]  

(5)

Note that \( U \) (the rate of unemployment) = \( s(N/POP) \) where \( N/POP \) is the average number of spells per head of working population, that is the ‘turnover rate’ (fraction of jobs lost per annum). Therefore if the median voter is typical; \( \pi_{t+i} = U_{t+i} \) so that \( U = \frac{\pi_0}{1-\pi} \). We expect \( \pi_0 \) to be small and positive, on the grounds that the chances of becoming unemployed never go to zero however low unemployment may go; and \( \pi \) to be positive and less than unity, if we assume (as we do) that the median voter’s chances of unemployment are approximately the same as the population’s.

The second constraint comes from the economic model of unemployment of section 2 and is equation (6):

\[ U_{t+i} = \exp(u_0 + v_{t+i})[B_{t+i}/W_{t+i}]^6 \]  

(6)

Equation (6) can be rewritten, once expectations are taken, as:

\[ V^m_t = \sum_{i=0}^{\infty} \beta^i (\pi_{t+i}E_tB_{t+i} + [1 - \pi_{t+i}]E_tW_{t+i} + rK - T) \]  

(7)

Now we will treat \( W \) (wages, i.e. productivity) as a random walk. We expect productivity to be non-stationary (an I(1) process) because productivity growth is by its nature an innovation. If in addition to this random shock, productivity growth was related to past shocks making it an ARIMA process integrated of order 1 then future wages would be related to current wages by a linear function of the autocorrelation and moving average parameters; however for simplicity here we assume it is a simple random walk so that \( E_tW_{t+i} = W_t \). We also assume that the voters can only demand at any point of time a single, constant, benefit level (because political debate enforces simplicity), and thus they must decide on a single \( B_t \) at each date \( t \); this will not prevent them at a later date demanding a different one but at \( t \) they cannot demand a level that is planned to change. From these arguments we may further
rewrite (7) as:

$$V^m_t = \frac{1}{1 - \beta}(W_t + rK - T) + (\pi_0 + \pi\overline{U}_t)(B_t - W_t) \quad (8)$$

where

$$\overline{U}_t = \exp(u_0) \cdot \left( E_t \sum_{i=0}^{\infty} \beta^i \exp v_{t+i} \right) \left[ B_t / W_t \right]^{\delta} \quad (9)$$

The first order condition for benefits from maximising (8) is then:

$$B_t = W_t \frac{\pi b\overline{U}_t}{\pi_0 + (1 + \delta)\pi\overline{U}_t} \quad (10)$$

Inspection of (10) reveals that median voters will demand a higher benefit-wage ratio as $\overline{U}_t$ rises but at a diminishing rate. The median voter’s problem is illustrated in Figure 2. The stability condition for the model is that the slope of the $UU$ curve be greater than that of the $BB$ curve; this also implies that a rise in expected $v$ causes a rise in benefits demanded.

Figure 2: Voter choice of $\frac{B}{W}$
For greater tractability we loglinearise (10) around \( U_0 \) as:

\[
\ln B_t = \eta(U_0) \ln U_t + \ln W_t + \text{constant} \tag{11}
\]

where \( \eta(U_0) = \left( \frac{\pi_0}{\pi_0 + (1 + \delta)\pi U_0} \right) \). By making \( U_0 \) as close as possible to \( U_t \) the degree of approximation is minimised; thus we set \( U_0 = U_{t-1} \), so that now \( \eta(U_{t-1}) \).

We also have from equation (9):

\[
\ln U_t = u_0 + \delta(\ln B_t - \ln W_t) + \pi_t^* \tag{12}
\]

where \( \pi_t^* = \left( E_t \sum_{i=0}^{\infty} \beta^i \exp v_{t+i} \right) \). We can then compactly write the solution for the median voter’s desired benefits (as illustrated in Fig. 2) in loglinear terms as:

\[
(\ln B_t - \ln W_t) = \frac{\eta}{1 - \delta \eta} \pi_t^* + \text{constant} \tag{13}
\]

The interpretation of (13) is that voters are altering their benefit demands (which in turn control changes in the natural rate) in response to that part of unemployment, the persistent cyclical and other movements, that they cannot control.

At this point we introduce an important information limitation; we have assumed rational expectations conditional on their information set. However, it is clear that within this model if voters know the correct value of \( v_t \) and of the natural rate, \( U_t^* \), then their demands for benefits would be self-limiting. What would occur would be that faced with a persistent \( v \) shock to unemployment they would demand higher benefits which would raise unemployment temporarily, until the shock had disappeared. This

\cite{footnote}

\[
\begin{align*}
\text{Using the approximation that} & \\
& d \ln(x + z) \simeq \frac{x_0}{x_0 + z_0} d \ln x + \frac{z_0}{x_0 + z_0} d \ln z \\
& \text{the last term can be rewritten as} \left( \frac{(1 + \delta)\pi U_0}{\pi_0 (1 + \delta)\pi U_0} \right) d \ln U_t \\
& \text{Substituting this in yields (11). The constant of integration is found as} \\
& \ln \pi + (1 - \eta) \ln U_0 - \ln (\pi_0 + (1 + \delta)\pi U_0) \\
& \text{Note that it does not change with } U_0 \text{ and that } \eta(U_0) \ln U_t \text{ has the required property that it rises with unemployment at a diminishing rate.}
\end{align*}
\]
would produce an extended cycle in the natural rate and in the benefit-wage ratio around a single steady
state equilibrium; but it would not produce the very large and apparently self-propagating movements
in the natural rate of unemployment that we observe quite widely. However, it is worth bearing such
a model of full information in mind as it is possible that in some countries’ episodes information is
sufficiently full to avoid this phenomenon and hence produce a single unemployment equilibrium.

Instead we assume that the voters’ general situation is one of limited information about the natural
rate and hence about the other $v$ shocks disturbing unemployment. (By implication they also have
limited information about the parameters.) This limitation is motivated by the sheer difficulty and
indeed controversy that has surrounded the estimation of natural rates for different economies. Indeed
as recently as the 1970s it was commonplace among economists influential in policy to deny the existence
of a natural rate. Hence we would argue that for our post-war episodes it is quite reasonable to assume
that voters faced a signal extraction problem. They observed $U_{t-1}$ but could not decompose it into $v_{t-1}$
and the natural rate. To solve this in a standard way, we assume that they used past experience (prior
to the sample) on the ratio, $\xi$, of the variance of $v_t$ to the total variance of the unemployment rate. In
the model here they apply this ratio to the rise in unemployment since some initial rate, $z$. Thus their
estimate of $v_t$ is:

$$E_{t-1}v_t = \xi(U_{t-1} - z)$$

and of the natural rate $E_{t-1}U_t^* = (1 - \xi)(U_{t-1} - z)$. Hence the permanent
value $\overline{U} = \theta E_{t-1}v_t$ where $\theta$ is determined by the coefficients of the $v$ autocorrelation function and the
discount rate. $E_{t-1}U_t^*$ is treated as a constant, as it depends on $B_t/W_t$ which is expected to be constant
by virtue of the voter’s optimising choice. We recall that $\eta$ is a declining function of $\overline{U}_{t-1}$; under our
limited information assumption this parameter becomes an estimated one, $\hat{\eta}$, to be updated on the
basis of the latest estimates of the $v$ shock and the natural rate, in conjunction with other information
about the model. The best estimate of $\overline{U}_{t-1}$ is $E_{t-1}U_{t-1}^* = \overline{U} + E_{t-1}U_t^* = [1 - \xi(1 - \theta)](U_{t-1} - z)$. We
represent the function here linearly as:

$$\frac{\hat{\eta}}{1 - \delta \eta} = \psi_1 - \psi_2(U_{t-1} - z)$$

(14)
We can now write:

\[
(\ln B_t - \ln \overline{W}_t) = [\psi_1 - \psi_2(U_{t-1} - z)][\theta \xi(U_{t-1} - z)] + \text{constant} + \epsilon_t
\]  

(15)

where we have added an error term, \( \epsilon_t \), to capture the influence of other factors and pieces of information on the choice of optimal benefits. Hence finally we obtain a reduced form equation for benefits as:

\[
\ln(B_t/\overline{W}_t) = B_0 + \varphi(U_{t-1} - z) - \beta(U_{t-1} - z)^2 + \epsilon_t
\]  

(16)

Initially a rise in unemployment above some normal rate, \( z \), would trigger demands for higher benefits, but as unemployment rises, the rising chances of unemployment become an increasingly restraining factor. In equation \( (16) \), \( B_0 \) is a minimum benefit/wage ratio set in normal circumstances and \( \varphi \) and \( \beta \) are constants.

4 THE NONLINEAR REDUCED FORM EQUATION FOR UNEMPLOYMENT AND REDUCED FORM RESULTS:

Combining equations (3) and (16) leads to the following log-linear reduced form dynamic unemployment model:

\[
\ln U_t = (u_0 + \delta B_0 - \delta \varphi z - \delta \beta z^2) + (\delta \varphi + 2\delta \beta z)U_{t-1} - \delta \beta U_{t-1}^2 + u_1t + u_c + \delta \epsilon_t
\]  

(17)

Equation (17) can be written more compactly as:

\[
\ln U_t = a_0 + a_1 U_{t-1} + a_2 U_{t-1}^2 + \xi_t
\]  

(18)

where \( a_0 = u_0 + \delta B_0 - \delta \varphi z - \delta \beta z^2, a_1 = \delta \varphi + 2\delta \beta z, a_2 = -\delta \beta, \) and \( \xi_t = u_1t + u_c + \delta \epsilon_t \) is the error process. Then parameters \( a_0, a_1, \) and \( a_2 \) determine the dynamics of \( U_t \) – the mean reversion speed of the deterministic component of unemployment.
We begin our empirical work by estimating equation (18) for 12 OECD countries\(^3\) in the post-war period. Table 1 summarises the minimum and maximum values of each series. Table 2 reports the ordinary least squares estimates for the model, together with their Newey-West corrected standard errors. This is the standard solution to correct the standard errors for forms of autocorrelation and heteroskedasticity. Also, we include any of the first four significant lags of the error process \(\xi_t\)\(^4\) in the regression (higher lags prove to be irrelevant) on account of the theory which predicts that \(u_{ct}\) (cyclical influences) and \(u_{1t}\) (other structural influences), and hence \(\xi_t\) will be persistent. The coefficients on the lag error terms turn out to be highly significant, with the implied roots in these processes all less than unity. The parameters of interest, i.e., \(a_0\), \(a_1\) and \(a_2\) are in almost all cases statistically significant and we can observe that \(a_2\) has the correct negative sign in all models, implying mean reversion.


\(^4\)We also make an explicit estimate of \(u_{ct}\) as \(a_3u_{ct}\), where \(u_{ct}\) is the deviation of the log unemployment rate from its Hodrick-Prescott filter value and the results turn out to be pretty much the same.
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<th>Denmark</th>
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<th>Germany</th>
<th>Ireland</th>
<th>Italy</th>
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<td>min $U_t$</td>
<td>0.8</td>
<td>1</td>
<td>2.1</td>
<td>0.5</td>
<td>4.6</td>
<td>3.5</td>
<td>2</td>
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<td>max $U_t$</td>
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<td>17.9</td>
<td>12.5</td>
<td>11.7</td>
<td>18.1</td>
<td>12.2</td>
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<td>min $U_t$</td>
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<td>0.9</td>
<td>1.4</td>
<td>1.3</td>
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<tr>
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<td>6.1</td>
<td>24.6</td>
<td>8.6</td>
<td>11.2</td>
<td>10.7</td>
</tr>
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Table 1: Maximum and minimum values of the observed unemployment rate (%)
Table 2: Reduced form Parameter Estimates

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<th>Denmark</th>
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<td>$\hat{a}_0$</td>
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<td>0.005</td>
<td>0.197**</td>
<td>-0.538**</td>
<td>0.711**</td>
<td>0.452**</td>
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<td>0.080</td>
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<tr>
<td>$\xi_{t-2}$</td>
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<td>0.349**</td>
<td>0.254**</td>
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<td>0.097</td>
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<td>$\xi_{t-3}$</td>
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<td>0.134**</td>
<td>0.077</td>
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<td>-0.125**</td>
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<td>0.934</td>
<td>0.995</td>
<td>0.983</td>
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Note: Ordinary least squares results and Newey-West standard errors for model (18). Below each parameter estimate, we report its standard error.

Two asterisks denotes statistical significance at the 5% level and one asterisk at the 10% level.
Taking the natural exponential function of equation (18), we end up with equation (19) and setting $e^{\xi_t} = 1$, i.e., turning off the supply and demand shocks as represented by $\xi_t$, we focus on the deterministic path of unemployment and obtain the following non-linear relationship:

$$U_t = \exp(a_0 + a_1 U_{t-1} + a_2 U_{t-1}^2)$$

We solve $U_t - \exp(a_0 + a_1 U_{t-1} + a_2 U_{t-1}^2) = 0$ and plot the corresponding estimated functions (based on these estimated parameters), in Figures 3 and 4 and numerically calculate the unemployment equilibria (low, middle and high) which we show in Table 3.
<table>
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<tr>
<th>Countries</th>
<th>Denmark</th>
<th>Finland</th>
<th>France</th>
<th>Germany</th>
<th>Ireland</th>
<th>Italy</th>
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<td>low $\pi$</td>
<td>1.58</td>
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<td>5.00</td>
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<td>high $\pi$</td>
<td>10.75</td>
<td>15.1</td>
<td>11.4</td>
<td>10.11</td>
<td>14.92</td>
<td>11.4</td>
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<tr>
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<td>Norway</td>
<td>Spain</td>
<td>Sweden</td>
<td>UK</td>
<td>US</td>
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<tr>
<td>low $\pi$</td>
<td>1.99</td>
<td>2.01</td>
<td>1.57</td>
<td>2.10</td>
<td>2.08</td>
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<tr>
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<td>3.95</td>
<td>11.27</td>
<td>4.10</td>
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<tr>
<td>high $\pi$</td>
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<td>5.45</td>
<td>20.82</td>
<td>7.69</td>
<td>10.02</td>
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</table>

Note: Low and high equilibria are stable, the middle unstable.
An equilibrium lies on the 45° line: the actual unemployment rate \( U_t \) on the y-axis equals the last period unemployment rate \( U_{t-1} \) on the x-axis. Although the curve \( U_t = \exp(a_0 + a_1 U_{t-1} + a_2 U_{t-1}^2) \) could be below, above or move closely with the 45° line depending on the relative magnitude of \( a_0, a_1, \) and \( a_2 \), if \( a_2 < 0 \), then for the interval \((U, +\infty)\) we have \( U_t = \exp(a_0 + a_1 U_{t-1} + a_2 U_{t-1}^2) > 0 \).

**Figure 3: Phase Diagrams**

Note: The diagrams depict \( U_t = \exp(a_0 + a_1 U_{t-1} + a_2 U_{t-1}^2) \) against \( U_t = U_{t-1} \). In all diagrams we set \( U_{t-1} \in [0, \text{max 25}] \), i.e., the x-axis corresponds to the interval \([0, \text{max 25}]\).
We can interpret the dynamics and equilibria of unemployment by inspecting the phase diagrams in Figures 3 and 4.

There are basically two groups of countries here:

A. those which move between a low and a high equilibrium unemployment rate as suggested generally by our theory (Denmark, Finland, Sweden, France, Germany, Ireland, Italy, the Netherlands, Norway, Spain and the UK).
B. those which have one low equilibrium rate; the US being the only case.

A-countries behave very much in the mainstream suggested by our theory, moving between a low and high unemployment equilibrium (the middle being unstable). It is striking that all of them have a ‘mixed’ ideological history, having adopted both relatively ‘capitalist’ and ‘socialist’ policies during their post-war history. Thus for example the UK, starting from low unemployment, pursued socially interventionist policies for virtually all the post-war period, then carried out a determined reform programme in 1979. Similar swings have occurred in the Netherlands, Spain, Denmark, Sweden and Ireland. In the case of Norway, the dominant ideology favours active labour market intervention to maintain full employment: thus high benefits for the unemployed are matched by active pressure back to work. This expensive programme has been facilitated by Norway’s relatively large oil and gas revenues from the North Sea. Countries which have not (yet at least) pursued the last, reform, leg of this pattern are France, Germany, Italy and Finland.5

B-countries are the exceptions where voters’ social demands appear to be fairly insensitive to shocks. It would appear that (perhaps after its interwar experiment with the New Deal) US voter opinion is hostile to labour market intervention in line with its general espousal of free markets. What our theory suggests is that such a country’s unemployment is dominated by purely cyclical movement and that this in turn induces voters to assume that there is no movement in ‘permanent’ unemployment to be protected against. Plainly such cycle-dominance can only occur in labour markets which are either highly flexible or where active government policy substitutes for this flexibility (in the latter case, the expensive programme can only be facilitated by countries having huge reserves).

Thus there seems to be a general picture of unemployment responding to political pressures, with only one exception in which, mechanisms exist to make unemployment mean-revert quickly to its equilibrium—mechanisms that avoid the ‘circles’ we are focusing on.

5 A BOOTSTRAP APPROACH TO DISTINGUISH BETWEEN ONE-EQUILIBRIUM AND THREE-EQUILIBRIUM MODELS

Our theory suggests that the error terms are likely to be autocorrelated. Hence, the standard error associated with the estimators is likely to be biased. The standard solution has been to correct the standard errors, using the method of Newey and West (1987). Although the Newey-West standard errors correct for unknown forms of autocorrelation and heteroskedasticity, there is some evidence to suggest that the size of the t-tests based on heteroskedasticity-corrected standard errors is too large (Horowitz, 1999). It may be, therefore, that a t- or normal distribution does not approximate the actual empirical distribution of the parameters particularly well. The approach taken here is to use the Newey-West correction for the basic results but to augment these by deriving standard errors and actual confidence intervals for the distribution of the relevant coefficients by means of bootstrap procedure, originally developed by Efron (1979) and reviewed more recently by Li and Maddala (1996). The full-sample bootstrap results are presented in Table 4. The summary of the results of the bootstrap are very similar to the OLS results and the point estimates of the standard errors are similar to those obtained from the Newey-West correction.

---

6 The basic idea of the bootstrap procedure used is easily outlined. Essentially artificial data is created by resampling the error terms obtained from estimating the initial sample itself. This resampling procedure is repeated 1000 times to generate 1000 samples for each of the 12 countries. Then equation (18) in the text is reestimated for each of the 1000 artificial samples. Circularity is involved since we have to choose an estimator in the first place to obtain the sample of the error distributions. One of the problems in our bootstrap is the presence in certain residuals of autocorrelations. This implies that the errors cannot be regarded as random and are therefore unsuitable for resampling in any order. Therefore the errors used in this stage have all been purged of autocorrelation at the original estimation of equation (18) in the text, by the inclusion of appropriate autocorrelation parameters in the model itself. The latter is then used for the bootstrapping exercise. The results are little different from those with 300 bootstraps, suggesting that the distributions have well converged by 1000.
<table>
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<th>95% C.I</th>
<th>$\hat{a}_1$</th>
<th>95% C.I</th>
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Note: Below each parameter estimate, we report its standard error and Confidence Intervals, based on 1000 re-estimations.
However, the key issue of this paper is whether a country is or is not subject to vicious/virtuous circles, in the sense of having three equilibria (the middle one being unstable) rather than merely one. Our central results imply that only the US is a 1-equilibrium country and the rest 3-equilibrium. We wish to develop a statistical test on the joint values of the 3 parameters \((a_0, a_1, a_2)\) determining the number of equilibria. We carry out two sorts of test based on the bootstrapped parameter distributions.

First, we use these distributions to generate the percentage of 3-equilibrium joint-values for our single 1-equilibrium country; and the percentage of 1-equilibrium joint-values for our 3-equilibrium countries. We found the following: our 1-equilibrium country, the US, generated 50% 1-equilibrium, 50% 3-equilibrium outcomes. Our 3-equilibrium countries (Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Sweden, Spain and the UK) generated only 3-equilibrium outcomes.

These bootstrap distributions give us some information about the likelihood that 1-equilibrium countries could be 3-equilibrium ones and vice versa. For example, the US clearly could not be a 3-equilibrium country with parameters as estimated for all the other countries since their distributions do not include any 1-equilibrium cases. On the other hand, since 50% of the US parameter distribution are 3-equilibrium cases, we cannot be at all sure that our 3-equilibrium countries are not 1-equilibrium.

We would obviously like to generate more precise confidence statements. To this end we use a second test based on the slope of the \(U_t\) function at its mean. This can be understood as follows.

Figure 5 illustrates Finland and the US phase diagrams for example, together with the calculated slope \(\frac{\partial U_t}{\partial U_{t-1}} = (a_1 + 2 \times a_2 \times U_{t-1}) \exp(a_0 + a_1 U_{t-1} + a_2 U_{t-1}^2)\) of their respective functions in the lower panel. Considering a 3-equilibrium model, we can see that the slopes at the low and high stable equilibriums are necessarily less than one and a prerequisite to having a 3-equilibrium model is the presence of a middle unstable equilibrium with a slope greater than one. Thus a 3-equilibrium model requires: \(\frac{\partial U_t}{\partial U_{t-1}} > 1\) over some central range of values which we represent by the mean, whereas the slope of a 1-equilibrium model never exceeds 1. If the slope is 1 exactly over some range, then it implies a degree of ambiguity in the equilibrium state since in effect the whole of that range is in equilibrium; such a country is on the borderline of being the 1- and the 3-equilibrium type. This as we see is the case for the US.

In Figure 6 we show various countries distributions over \(\hat{\sigma}\), the (estimated) slope at that country’s mean unemployment rate. The figure enables us to make pairwise comparisons of countries. Thus, for
example, we can say that Germany’s $\hat{\sigma}$ could not belong to a US style distribution nor the US’s belong to a German-style one.

Figure 5: Features of 1-equilibrium and 3-equilibrium models
Figure 6: Countries Distribution over $\hat{\sigma}$

We can go further and test the hypothesis that $\sigma = 1$, the cross-over point between the 1- and 3-equilibrium cases. Thus for each country’s $\hat{\sigma}$ we can compute the chances of it being generated by a $\sigma = 1$ distribution and define the 95% and 99% confidence intervals for $\sigma > 1$ and $\sigma < 1$. This enables us to classify countries into three groups: 1- and 3-equilibrium with 99% confidence and ambiguous. The US estimated slope is more or less just on unity (the summary statistics is given in Table 5 above), so its bootstrapped distribution is the critical one, i.e., it is the distribution of estimated parameters that occurs if the true parameter is 1. Thus it turns out that the chances of getting an estimated parameter of 1.04 or above is 0.5% when the true value is unity. The other countries have estimated parameters of over 1.04 in all cases (some of them have values massively greater, e.g., Spain) and these countries reject the null hypothesis ($H_0: \text{slope} = 1$) at the 99% level. Hence we can be extremely confident that all countries other than the US are 3-equilibrium cases. For the US however we cannot be at all sure whether it is 1- or 3-equilibrium: indeed, as we have seen, it lies precisely on the borderline of the two, so that we could say it is equally likely to be either.
Table 5: Summary Statistics for the Slope Estimate $\hat{\sigma}$

<table>
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<tr>
<th>Countries</th>
<th>Denmark</th>
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<th>France</th>
<th>Germany</th>
<th>Ireland</th>
<th>Italy</th>
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</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.247</td>
<td>1.233</td>
<td>1.151</td>
<td>1.414</td>
<td>1.072</td>
<td>1.063</td>
</tr>
<tr>
<td>Std Deviation</td>
<td>0.021</td>
<td>0.0496</td>
<td>0.007</td>
<td>0.024</td>
<td>0.017</td>
<td>0.015</td>
</tr>
<tr>
<td>95% C.I</td>
<td>1.204,1.288</td>
<td>1.145,1.335</td>
<td>1.137,1.165</td>
<td>1.366,1.462</td>
<td>1.045,1.100</td>
<td>1.035,1.091</td>
</tr>
<tr>
<td>99% C.I</td>
<td>1.192,1.300</td>
<td>1.120,1.365</td>
<td>1.325,1.168</td>
<td>1.352,1.480</td>
<td>1.036,1.110</td>
<td>1.025,1.099</td>
</tr>
<tr>
<td>Countries</td>
<td>Netherlands</td>
<td>Norway</td>
<td>Spain</td>
<td>Sweden</td>
<td>UK</td>
<td>US</td>
</tr>
<tr>
<td>Mean</td>
<td>1.117</td>
<td>1.043</td>
<td>1.520</td>
<td>1.089</td>
<td>1.204</td>
<td>1.002</td>
</tr>
<tr>
<td>Std Deviation</td>
<td>0.016</td>
<td>0.013</td>
<td>0.029</td>
<td>0.027</td>
<td>0.012</td>
<td>0.016</td>
</tr>
<tr>
<td>95% C.I</td>
<td>1.088,1.148</td>
<td>1.017,1.068</td>
<td>1.464,1.578</td>
<td>1.033,1.147</td>
<td>1.181,1.229</td>
<td>0.970,1.034</td>
</tr>
<tr>
<td>99% C.I</td>
<td>1.076,1.160</td>
<td>1.012,1.074</td>
<td>1.446,1.592</td>
<td>1.020,1.158</td>
<td>1.170,1.236</td>
<td>0.960,1.040</td>
</tr>
</tbody>
</table>
6 Estimation of the Structural Equations for the UK

As we have seen these reduced form results generally favour the widespread existence of the 3-equilibrium case; only in the US is there ambiguity. However, reduced forms are vulnerable to identification problems. Thus in this case it could be perhaps that unemployment responds to the benefit/wage ratio but that the error in unemployment responds non-linearly to lagged unemployment for reasons other than political economy, whereas the benefit/wage ratio does not; in this case the effects of this ratio would be in the constant and error term of the unemployment reduced form. Both our political economy theory and some theory of generalised non-linear hysteresis therefore have the same reduced form and cannot be distinguished.

It is true that such generalised non-linear hysteresis requires proper theoretical underpinnings; we would suggest that, in spite of the large literature of hysteresis, such underpinnings remain elusive. Thus we would argue that our theory here represents the best candidate on purely theoretical grounds and thus identifies it by the exclusion of these alternatives.

However it is, as it happens, possible to test the paper’s hypothesis at least in a limited way, on the structural equations (3) and (16) which are relatively invulnerable to identification problems since other relationships in the economy cannot be confused with either. For the UK we have been able to assemble sufficient data to do this; we have quarterly data series of unemployment benefits, net average earnings and unemployment rates (1963Q1-2000Q3). Data on unemployment benefits were obtained from Social Trends (Central Statistics Office) for 1963Q1-1979Q4 and from the Department for Work and Pension (personal communication) for 1980Q1-2000Q3. They represent the benefit rate for a single person. Net average earnings is a weighted average of weekly net earnings.

Table 6 presents results for equation (3), based on OLS. The total effect of the average replacement ratio on unemployment, i.e., the overall long-run elasticity of unemployment with respect to the replacement ratio, is 2.21, similar to Minford (1983) where an elasticity of 2.8 was obtained. This elasticity is intended to pick up the response of long-term unemployment as unemployment benefits rise up the distribution of the working population over their productivity wage. It is therefore not comparable with the short-term search elasticities (typically of around 0.6) found by for e.g. Nickell (1979), Lancaster (1979) and Nickell and Stern (1984). More comparable is Nickell (1997) in a cross-section study for 20 OECD countries, who found that both the level and the duration of benefits, when taken together, were
the major determining factor in explaining long-run unemployment.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Single Equation (OLS)</th>
<th>FIML Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>$u_0$</td>
<td>3.365**</td>
<td>$u_0$ 24.837**</td>
</tr>
<tr>
<td>Std. Errors</td>
<td>0.098</td>
<td>Std. Errors 8.259</td>
</tr>
<tr>
<td>$\delta$</td>
<td>2.210**</td>
<td>$\delta$ 28.204**</td>
</tr>
<tr>
<td>Std. Errors</td>
<td>0.118</td>
<td>Std. Errors 10.00</td>
</tr>
<tr>
<td>$B_0 - \varphi z - \beta z^2$</td>
<td>-0.910**</td>
<td>$B_0$ -0.835**</td>
</tr>
<tr>
<td>Std. Errors</td>
<td>0.026</td>
<td>Std. Errors 0.022</td>
</tr>
<tr>
<td>$\varphi + 2\beta z$</td>
<td>0.029**</td>
<td>$\varphi$ 0.010**</td>
</tr>
<tr>
<td>Std. Errors</td>
<td>0.011</td>
<td>Std. Errors 0.006</td>
</tr>
<tr>
<td>$\beta$</td>
<td>-0.002**</td>
<td>$\beta$ -0.001**</td>
</tr>
<tr>
<td>Std. Errors</td>
<td>0.001</td>
<td>Std. Errors 0.000</td>
</tr>
</tbody>
</table>

Note: Two asterisks denotes statistical significance at the 5% level.
We then apply the political process (equation (16)) to the UK quarterly series. The OLS estimates are given in Table 6. All the signs are as expected and the parameters are significant at the 5% level.

However a more efficient way of estimation is by full information simultaneous estimators, i.e., the Full Information Maximum Likelihood (FIML) system estimation approach. FIML is an estimator for a complete system, with the number of equations equal to the number of endogenous variables. Maximum likelihood tells us that subject to correct specification these estimates are Consistent and Asymptotically Normal (CAN), and efficient in the CAN class. However, Optimisation Estimators theory can also be used to show that the CAN property of FIML holds without the Gaussianity assumption (Davidson, 2000). We would obviously favour this estimation approach to the limited information estimation above. The FIML system estimation solves the model repeatedly for the sample period for sets of parameters, choosing the likelihood maximizing set.*

*In a fully-identified model 'spurious regression' is not a concern, since the model is part of the maintained hypothesis. Error behaviour in the presence of I(1) variables in the regression could display unit roots; this behaviour would imply a lack of cointegration, which in this context has the interpretation of omitted I(1) variables. The FIML procedure then implies that the error process should be allowed for, as is done here (Minford and Webb, 2004).

The system estimates are provided in Table 6 and they vary significantly from the limited information estimation point, showing major gains from this approach. The standard errors of the FIML estimates are substantially higher for equation (3) given the parameter estimates differ markedly too. The long-run elasticity of unemployment with respect to the replacement ratio, is around 28, indeed very high but comparable to some studies in Minford (1985) where a value of 17 was obtained. What this number says is that starting from some base unemployment rate of 3%, a 1% increase in the replacement ratio will lead to an increase of approximately 30% in the base unemployment rate, i.e., the new rate will be roughly 4%. The point is that the supply curve formulation deliberately implies a rising elasticity as the natural rate of unemployment rises; the estimated elasticity is sensitive to the range of the level of the natural rate. The FIML estimate is capturing the effect over the period unemployment rate ranges from the 2.1% to 9.5%, i.e., respectively the low and high equilibrium in our model.
6.1 The implied slope coefficients of the structural models for the UK

Based on the FIML estimate of \( z \), of 3.8\%, we compute the parameters \( \hat{a}_0 = u_0 + \delta B_0 - \delta \varphi z - \delta \beta z^2 = -0.072 \), \( \hat{a}_1 = \delta \varphi + 2 \delta \beta z = 0.430 \), \( \hat{a}_2 = -\delta \beta = -0.0195 \), from the FIML structural coefficients obtained above.

We solve \( U_t - \exp(\hat{a}_0 + \hat{a}_1 U_{t-1} + \hat{a}_2 U_{t-1}^2) = 0 \) and plot the corresponding estimated function in Figure 7. The phase diagram implies a 3-equilibrium case much similar to our previous results. The numerical calculation of the unemployment equilibria is given in Table 7. (We denote this result for the UK based on the structural parameters obtained from this section as UK\(^*\)). The two sorts of tests based on the bootstrapped parameter distribution for the UK using the FIML parameters and errors generated by the maximum likelihood parameter set are applied. This 3-equilibrium joint-values case generated only 3-equilibrium cases. Table 7 provides the bootstrapped statistics for \( \hat{\sigma} \) (the estimated slope at that country’s mean unemployment rate) and Figure 6 shows the distribution over \( \hat{\sigma} \) and it can be readily seen that the hypothesis \( H_0 : \sigma > 1 \) cannot be rejected.

![Phase Diagram](image)

The diagram depict \( U_t = \exp(\hat{a}_0 + \hat{a}_1 U_{t-1} + \hat{a}_2 U_{t-1}^2) \) against \( U_t = U_{t-1} \). We set \( U_{t-1} \in [0, \text{max } 15] \), i.e., the x-axis corresponds to the interval [0, max 15].

Figure 7: Phase Diagram
Table 7: Summary Statistics for UK

<table>
<thead>
<tr>
<th>Estimated Equilibria</th>
<th>Bootstrapped Statistics for $\hat{\sigma}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>low $\pi$ 2.12</td>
<td>Mean 1.173</td>
</tr>
<tr>
<td>middle $\pi$ 5.56</td>
<td>Std. Deviation 0.012</td>
</tr>
<tr>
<td>high $\pi$ 9.50</td>
<td>95% C.I 1.146,1.199</td>
</tr>
<tr>
<td></td>
<td>99% C.I 1.148,1.206</td>
</tr>
</tbody>
</table>
What we find from the UK structural model is therefore very similar to the results for the reduced form both of the UK and of all other countries with the possible exception of the US. According to the structural model there is quite sufficient feedback from unemployment to benefits via the political process to generate the non-linearity of response in the unemployment reduced form.

7 CONCLUSION

In this paper we have developed a model in which there is feedback via the political process, combined with limited information on the natural rate, from unemployment to the social protection afforded to the unemployed and so back to unemployment. This feedback generates a non-linear response of unemployment to its own past, with a capacity for two stable equilibria, one high and one low. Reduced form estimates of such a non-linear function suggest that in the postwar period all 12 OECD economies examined exhibited two such equilibria, with the possible exception of the US which is borderline between this and exhibiting only one. When we reestimated the model in its structural form for the UK (the only case for which we had enough data) we also found support for two equilibria, suggesting that its natural rate movements were indeed the result of feedback from past unemployment movements via politics. This evidence lends further support to the theory. However further work is necessary to investigate whether for other countries too structural model evidence tallies with the reduced form evidence, consistent with what we suggest is well-founded theoretical underpinnings.
References


