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VICIOUS AND VIRTUOUS CIRCLES - THE POLITICAL ECONOMY OF UNEMPLOYMENT IN INTERWAR UK AND USA

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Abstract

This paper develops a political economy model of multiple unemployment equilibria to provide a theory of an endogenous natural rate of unemployment. This model is applied to the UK and the US interwar period which is remembered as the decade of mass unemployment. The theory here sees the natural rate and the associated path of unemployment as a reaction to shocks (mainly demand in nature) 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 react to shocks by demanding more or less social protection. The reduced form results obtained confirm a pattern of unemployment behaviour in which unemployment moves between high and low equilibria in response to shocks.

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

JEL classification: E24; E27; P16

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1. Introduction

Much of postwar unemployment policy has its roots in the experience of mass unemployment in the interwar period. Unemployment in both the USA and UK reached levels that hitherto had never been experienced in either economy. In the UK, the vision of the 'army of one million unemployed ' men after world war one had powerfully etched itself into the collective memory of the electorate and the politico-economic establishment. Not until the economic reforms of Mrs Thatcher did the UK economy, and importantly the voting public, wean themselves off the postwar thinking of demand management. Between 1929 and 1933 in the USA, unemployment soared to 25 per cent of the workforce. The political economy that underscored Roosevelt's 'New Deal' remained with the economic establishment until the Reagan tax reforms of the 1980s. The puzzle for the USA is that despite the best efforts of the New Deal, unemployment remained stubbornly high and refused to fall below 15 per cent. The puzzle for the UK was that during the half century before the First World War, real income grew at a rate of 2 per cent a year but unemployment averaged less than 4 per cent; from 1920 to 1938, real income continued to grow by about the same rate, but unemployment averaged 14 per cent.

This paper argues that shocks causing sharp cyclical demand swings generate political reactions from public opinion and vested interests, which in turn produce fiscal and monetary (demand policy) responses and also changes in supply-side policy, i.e., policy affecting the equilibrium values of real variables or 'natural rates'. Specifically, bad demand shocks tend to produce supply policy that distorts the market because these shocks generate demands for protection; these distortions in turn produce an equilibrium with a higher natural rate of unemployment which in turn can reinforce the demands for yet more protection, until matters are bad enough to create a political equilibrium where the bad effects cause enough opposition to yet more distortions.

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. The dynamics of unemployment exhibit three equilibria- one stable low unemployment equilibrium, one stable high unemployment equilibrium and a non-stable intermediate unemployment equilibrium that lies between the two.

The model of political economy of supply-side policies in this paper is similar to Wright (1986). In Wright (1986), workers have different unemployment risks, and unemployment benefits play the sole role of an insurance against adverse shocks. The median voter will optimally determine unemployment benefits by weighing their benefits (in terms of better insurance) against their costs (in terms of higher taxes). Thus, the more exposed to unemployment is the median voter, the higher the political support for unemployment benefits, much as in Meltzer and Richard (1981) the median voter's support for redistributive taxation varies with the state of the economy. However as noted by St-Paul (1996), this prediction neglects other effects of unemployment benefits to the extent that higher wages lower job creation and harm the unemployed. Therefore, a higher exposure of the employed to unemployment will tend to moderate the desire of the median voter for a high benefit level. St-Paul also analyses how labour market institutions can affect the median voter's choice.

The political economy model of institutions in this paper extends the analysis of Meltzer and Richard (1981), Wright (1986) and St-Paul (1996). Long-lasting shocks to the economy lead to demand for social protection (identified with the benefit/wage -or replacement- ratio). However, we also take into account the feedback distortionary effect of benefits on unemployment which progressively raises the chances of unemployment for the median voter. We therefore address the missing channel of Wright (1986) of how labour market institutions can affect the welfare of the decisive voter, as suggested by St-Paul (1996).

This paper joins a large literature on the creation and evolution of the institutions that favour or inhibit capitalist growth (see, for example, Persson and Tabellini, 1994; Alesina and Roderick, 1993; Perotti, 1993; Stokey and Rebelo, 1993, and Krusell et al, 1994). It also joins a set of other studies explaining the rise in unemployment since the 1970s in terms of macroeconomic shocks interacting with institutional patterns (see Blanchard and Wolfers, 2000; Fitoussi et al., 2000; Bertola et al., 2001; and Nickell et al., 2005). Our contribution here (and in Minford and Naraidoo, 2004, for postwar unemployment) is to view these interactions as the product of a political economy process.

This paper is organised along the following lines. The next section sketches the theoretical framework that produces circles of a vicious or virtuous nature. Section 3 embeds the framework within the historical context of the interwar period. Section 4 estimates the reduced form dynamic unemployment function which is capable of producing a three equilibrium unemployment case consistent with the experience of the interwar period. A bootstrapping procedure is included to test the prevalence of the 3-equilibrium case. In section 5 we test the reduced form model against a general model of hysteresis by providing out-of-sample forecast accuracy tests. Section 6 concludes.

2. Vicious and Virtuous Circles

This section sketches the theoretical framework that produces vicious and virtuous circles in unemployment[1]. The basic idea is that the natural rate of unemployment is an endogenous variable that gets pushed from a low position to a high position by the interaction of demand shocks and institutional responses. These two forces are interlinked by a political economy mechanism whereby voters with limited information on the natural rate of unemployment react to negative shocks by demanding protection which creates the vicious circle.

Bad situations can generate political demands for reform which can cut into a vicious circle (one example is Margaret Thatcher's reforms in the UK during the eighties and in the USA the Carter deregulation of the 1970's and the Reagan tax reforms of the 1980's); and equally that very long periods of good fortune can also generate a complacent attitude towards distortions whereby for example it is felt that 'social justice' can be 'afforded' through higher social protection, worker rights and so on. These political developments act as an additional source of shocks, over and above demand shocks, that can start a move towards respectively a good or bad equilibrium. There are intimate linkages through 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.

A good example is the USA interwar period. In the 1920s it was a high-performing economy with full employment but in the 1930s it was in deep slump leading to heavy regulatory intervention and the protectionism that made matters worse for all. Another case is Japan from the mid-1950s to the mid-1970s, and then again from 1990 onwards. A miracle of rapid, unstoppable growth in the first and a hopeless stagnation in the second. A further case is continental Europe which appeared to do nothing wrong in the 1960s and 1970s and yet, the role was reversed in the 1980s and 1990s.

Getting out of this state requires either a big positive shock to output and employment (for the USA; the Second World War) or a determined broad-based reform programme (the UK in 1979), which revives popular faith in market economics. Once popular confidence is built up, the demands for protection evaporate and in their place, people and business demand freedom. Then, the virtuous circle operates and the economy settles at a high-employment equilibrium.

The theory consists of two components: a model of the natural rate and a model of the political economy of supply-side policy (particularly towards the central labour market). We discuss each in turn.

As outlined by Siebert (1997), starting from a simple notion of an equilibrium in a classically clearing labour market, institutional arrangements can influence the clearing function of the labour market in basically three ways: by weakening the demand for labour, making it less attractive to hire a worker by explicitly pushing up wage costs or by introducing a negative shadow price for labour; by distorting labour supply; and

[1] For a fuller exposition see Minford and Naraidoo (2004)

by impairing the equilibrating function of the market mechanism (for instance, by influencing bargaining behaviour). To these interventions may be added those of trade unions (**see** Blanchard and Katz, 1997).

Our set-up for the labour market follows that of Minford (1983). He took the classical labour supply set-up and added the idea of a permanent unemployment benefit, payable without check on work availability. The result was to tilt the labour supply curve so that the real wage offer never fell below the benefit level, as shown in Fig. 1. Should the benefit level rise relative to productivity, unemployment will increase. That is, 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'.

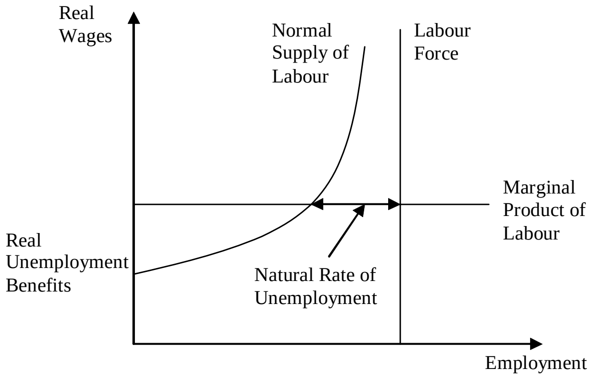


Figure 1: The Natural Rate of Unemployment

These ideas can be summarised in the following model of structural unemployment[2]. 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,

[2]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.

In more recent empirical works, 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.

$$lnU_t = u_0 + \delta ln(\frac{B_t}{\overline{W_t}}) + u_{1t} + u_t^c \tag{1}$$

where u_0 is a constant, B_t is the real benefit rate , $\overline{W_t}$ is real wages (set it is assumed by productivity), u_t^c is cyclical unemployment, and u_{1t} represents other persistent influences on unemployment, an error process assumed therefore to display high serial correlation. Examples of such influences would be demographic shifts (such as a rise in working age population), and sectoral shifts like a decline in manufacturing. These influences will have no long-run effect on unemployment but their effect is assumed to be long drawn out.

This effect provokes a political economy response. In our model, the median voter holds some non-human capital but nevertheless relies heavily on income from human capital. If this voter experiences unemployment spells, unemployment benefits yield a much needed replacement of wage income. The higher level of unemployment means that agents are more exposed to the risk of being unemployed which therefore increases their desired benefit/wage ratio. However, we also take into account the feedback distortionary effect of benefit on unemployment which increases the probability of unemployment for the median voter. Hence,.as unemployment rises, the median voter's demands for benefits rise but at a diminishing rate, as these higher benefits progressively raise the chances of unemployment.

Suppose we define an index, B_t, as the level and duration (overall 'generosity') of real unemployment benefits; for short we shall refer to it as 'benefits' (the same as in Eq. (1)). Our analysis (for details see Appendix A) implies that the log of the benefit/wage ratio is a quadratic in the rate of unemployment, U_t, or say :

$$ln(\frac{B_t}{\overline{W_t}}) = B_0 + \varphi(U_{t-1} - z) - \beta(U_{t-1} - z)^2 + \epsilon_t \tag{2}$$

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 Eq. (2), B_0 is a minimum benefit/wage ratio set in normal circumstances and φ and β are constants.

Combining Eqs. (1) and (2) leads to the following log-linear dynamic unemployment model:

$$lnU_t = (u_0 + \delta B_0 - \delta\varphi z - \delta\beta z^2) + (\delta\varphi + 2\delta\beta z)U_{t-1} - \delta\beta U_{t-1}^2 + u_{1t} + u_t^c + \delta\epsilon_t \tag{3}$$

or more compactly:

$$lnU_t = a_0 + a_1U_{t-1} + a_2U_{t-1}^2 + \xi_t \tag{4}$$

3. Interwar Unemployment

The period between the two world wars has been the source of much contemporary economic, social and policy lessons. The conventional view that aggregate demand deficiency was the principal cause of unemployment in interwar Britain was first challenged by Benjamin and Kochin (1979) who argued that part of the explanation for the high level of unemployment was due to the generosity of unemployment benefits relative to wages. While Benjamin and Kochin's explanation has been hotly contested in the academic literature[3] , a consensus view is that supply as well as demand shocks mattered to varying degrees[4]. More recently Benjamin and Matthews (1992) have challenged the perceived differences between the UK and US experiences of interwar unemployment. While demand factors mattered a great deal in the case of the USA, supply factors in the form of public relief contributed to the high level of unemployment that persisted up until the eve of the second world war[5]. This section reviews unemployment policy in both countries between the wars with the aim of demonstrating the reinforcing reaction of supply policy to negative demand shocks.

The earliest plan for a national unemployment insurance scheme in the UK (National Insurance Act 1911) was based on the assumption that unemployment was caused by temporary maladjustments in the labour market. Unemployment benefit grounded on the principles of insurance together with the savings of individual worker was to provide a short-term tide-over until re-employment. In his presidential address to the British Association in 1910, Sir Hubert Lewellyn-Smith, co-author with Sir William Beveridge of the unemployment section of the NI Bill stated:

"The scheme must avoid encouraging unemployment and for this reason the rate of unemployment benefit shall be relatively low. It would be fatal for any scheme to offer compensation for unemployment at a rate approximating to that of ordinary wages". But it was precisely on this principle that Bakke (1935) noted that the battle between insurance and maintenance was fought. It was the results of this battle that led Beveridge in his testimony to the Royal Commission on Unemployment Insurance in 1931 to describe the

[3]See for example the special issue of the Journal of Political Economy 2, 90, 1982 devoted to the critics and the reply Benjamin and Kochin (1982)

[4]For example Matthews (1986) argues that both supply and demand shocks mattered with balance in favour of supply shocks, whereas Broadberry (1986) argues the reverse.

[5]See for example Wallis and Benjamin (1981).

process as “a development from insurance by contract to relief by status” and whereas in the past he referred to “insurance popularly miscalled the dole” he went on to refer to the “dole officially miscalled insurance”[6].

The unemployment insurance system in the UK that developed after the first world war was fundamentally different from its original inception. The Unemployment Act of 1920 removed many of the former system's safeguards and increased benefits by nearly 40 per cent and extended the coverage to a further 11 million workers. In the following decade, the expansion of the insurance system was achieved by relaxation of the contributory requirement, the extension of the duration and the allowance of additional weeks of special benefits. Several forces combined to put pressure on the system to push the unemployment benefit system from insurance to maintenance. The immediate post world war one system of unemployment relief for uninsured workers was the local authority administered system of poor law relief. The financial burden of providing unemployment relief brought many a local authority close to bankruptcy. In 1923 the Minister of Labour reported that he was impressed with the plea not only from the Poor Law Guardians, and Workmans Associations but also from employers, that benefit be extended to the uninsured. The political position of both the T.U.C. and the Independent Labour Party was ‘work or maintenance’. In 1924, the Minister of Health received a deputation from the Poor Law Authorities complaining that the burden of unemployment relief could not and was never intended to be met from the local authority finances[7]. By 1931, ‘need’ had completely replaced ‘insurance’ as a criterion for transitional and unemployment benefits. The Royal Commission of 1932 stated:

“Each successive government has made changes to the scheme, which have been determined less by the need for careful balancing of income and expenditure than by a desire to attract, or do as little as possible to repel electoral support.”[8]

The relaxation of the insurance rules was also accompanied with a continuous increase in the average level of benefit. The increase in benefit was even more pronounced when the cost of living was taken into account. In its recommendation for a reduction in the level of benefits the Royal Commission on Unemployment Insurance 1931 stated:

“If a comparison be made between that rates of benefit paid in August 1924, in 1928 and now proposed by us, with adjustments corresponding to changes in the cost of living index...it will be clear that the rates which we propose are in effect higher than those in operation in the more prosperous years of 1924 and 1928”. Appendix B provides graphs of annual data on unemployment benefits and average earnings series

[6]See Bakke (1935) p.17
[7]Bakke (1935) p.147
[8]Royal Commission 1932, p.164

for the UK[9] for the period 1920-38, together with an explanation on their patterns.

Turning to the case of the USA, there was no centralised system of unemployment relief at the end of the first world war. Up until the 1930s, unemployment relief was local government based combined with private charitable organisations. The unprecedented unemployment and financial hardship that followed the 'Great Depression' brought forth a considerable expansion of relief activities. But it was not until 1932 with the establishment of the Reconstruction Finance Corporation (RFC) that the federal government began to play a role in the relief. However this system was largely ineffective as it disbursed funds to private businesses rather than directly to unemployment persons and required the condition that all locally funded relief be exhausted.

In 1933 the newly elected President Roosevelt supplanted the RFC with the Federal Emergency Relief Administration (FERA), which was to spend \$3 billion on unemployment relief. FERA represented a fundamental change in philosophy. Its principal aim was to put financial assistance directly into the hands of the unemployment through cash grants and work relief. Recipients of FERA were occasionally required to take part in public works programmes but it was far more commonplace for no work requirements be made. The FERA was phased out in 1935 which was replaced by the Works Progress Administration (WPA). This was a programme that explicitly established a 'nation-wide' system of work relief. Individual relief was based on 'needs' levels and local pay which determined the number of work hours contributed to WPA programmes[10]. However, those who were either unable to work or did not have suitable skills for WPA programmes were eligible for general relief which was an unconditional cash grant[11]. This combination of work relief and general relief remained in existence until the onset of the second world war. The conclusion of Benjamin and Matthews (1992) in their analysis of the unemployment relief in the USA was that the FERA and WPA programmes did prolong the manifestations of the Great Depression. In the relief programme is the explanation why by 1939 when per capita real income was only 4 per cent below its 1929 peak, unemployment was 17.2 per cent compared with 3.2 per cent in 1929. Table 1 summarises the minimum and maximum values of each unemployment series, together with their mean, standard deviation, skewness and kurtosis. What is remarkable about the data is its similarity in the mean and the volatility within each unemployment series. However, the higher standard deviation for the USA indicates the greater volatility in the economy during the 1930s. A look at the graphs of the two variables in Appendix C shows distinctive jumps in the

[9] The only country for which we have been able to gather some data.

[10] So for example if a person's need level was evaluated at \$60 a month and the local pay for that person's occupation was \$0.60 per hour, the recepient would work 100 hours on the WPA programme.

[11] Benjamin and Matthews (1992) estimate a demand for unemployment relief by State which depended on the size of the population, the proportion of farm population, proportion of black population, the growth of per capita state income and the level of benefits. They conclude that for every 10 people taken off the unemployment queue through WPA relief, a further 9 joined it.

unemployment series: the UK series in the beginning of the 1920s and the beginning of the 1930s, the USA in the early 1930s. In the UK, the unemployment rate was as high as it was in every year from 1921 to 1938 than from the cumulated unemployment rates from 1857 to 1920. The explanation for the jumps in the UK unemployment rate was that after the First World War, faced with wartime inflation and at the same time a commitment of the government to return the pound to its pre-war parity of $4.86/£1, there was a vigorous monetary restriction in the hope for a return to gold at pre-war parity. In a world where few prices were perfectly flexible, a temporary rise in unemployment was the price to be paid for reversal of inflation. Unemployment soon rocketed from a low of 4 per cent in 1920 to over 20 per cent in 1921. But we argue that the temporary rise in unemployment set in motion the political economy forces that drove the economy to a high unemployment equilibrium. Similarly for the USA, the growing prosperity across the nation endengered rising confidence in the future, a confidence that manifested itself in sharply rising land and stock prices in the late 1920s. In an effort to halt what it perceived to be speculative trading on the stock market, the Fed moved in 1929 to restrict bank's access to funds that were to be used for what the Fed viewed as speculative purposes. Bank found themselves unable to accommodate the credit demands of their customers and a wave of selling, culminated to the stock market crash of October 1929, produced a hike in interest rates and a crunch in aggregate demand. This soon caused the unemployment rate in the USA to climb to over 20 per cent which in turn set in train the political economy forces discussed above that sustained the economy at a high unemployment equilibrium such as that of Great Britain.

Table 1
Observed unemployment rate series(%)

	min U_t	max U_t	Mean	Std. Deviation	Skewness	Kurtosis
UK	0.3	23.4	7.5	5.7	0.90	2.95
USA	0.3	25.6	6.4	7.3	1.05	2.70

4. Econometric Results

Eq. (4) in the text is estimated using monthly unemployment series for the UK (1887.01-1939.10, 634 observations) and the USA (1906.06-1942.06, 433 observations)- data in Appendix C. The results from estimating model (4), treating $u_{1t} + u_t^c + \delta\epsilon_t$ as a composite error term are presented in Table 2. We report the ordinary least squares estimates for the model, together with their Newey-West standard errors which correct for heteroscedasticity and autocorrelation. The Breusch-Godfrey serial correlation LM test shows that we cannot reject the null hypothesis of no serial correlation.[12].

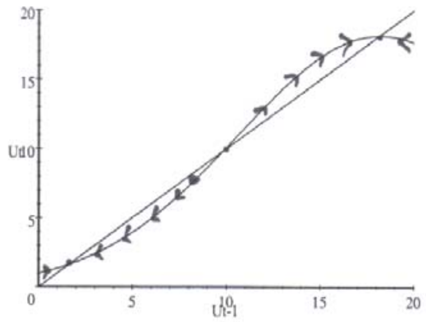
[12]On the argument that one-lag may not adequately capture the political economy process, a test of statistical difference

Table 2
Log-linear dynamic unemployment model[a]

	constant	U_{t-1}	U^2_{t-1}	ξ_{t-1}	ξ_{t-2}	ξ_{t-3}	ξ_{t-4}	se[b]	$\bar{\mathrm{R}}^2$	LM[c]
Countries										
UK	0.048	0.318**	-0.009**	0.373**	0.241**	0.185**	0.093*	0.183	0.963	2.08
	(0.030)	(0.006)	(0.000)	(0.138)	(0.046)	(0.078)	(0.051)			(0.126)
USA	-0.443**	0.368**	-0.009**	0.602**		0.175**		0.330	0.946	2.10
	(0.031)	(0.008)	(0.000)	(0.108)		(0.062)				(0.110)

Two asterisks denotes statistical significance at the 5% level and one asterisk at the 10% level.
[a]Newey-West corrected standard errors in parenthesis.
[b]Standard error of regression.
[c]Breusch-Godfrey serial correlation LM Test. p value in parenthesis.

The key parameter $\hat{a}_2$ is negative and significant in both the UK and the USA cases, implying mean reversion. Taking the exponential function of the estimated equation and setting the supply and demand shocks to zero, we can focus on the deterministic path of unemployment. The estimated function can be solved by setting $U_t - e^{a_0+a_1U_{t-1}+a_2U^2_{t-1}} = 0$ and plotting the corresponding values in Figs. 2 and 3 below. The computed unemployment equilibria (low, middle and high) is shown in Table 3 for the one-lag and 12$^{\mathrm{th}}$ lag case.



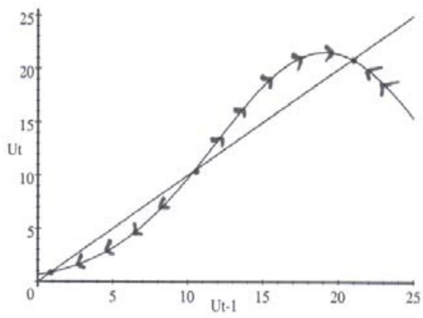


Fig. 2: UK Phase Diagram Fig. 3: USA Phase Diagram

Table 3
The estimated equilibria

	Countries			
	lag 1	*lag* 1	*lag* 12	*lag* 12
	UK	USA	UK	USA
low $\overline{u}$	1.7	0.9	2.46	1.50
middle $\overline{u}$	9.8	10.4	10.75	13.76
high $\overline{u}$	18.2	20.9	15.80	19.97

The dynamics and equilibria of unemployment can be interpreted by inspecting Figs. 2 and 3 which use the estimates from the one-lag case. The low unemployment equilibrium is a stable position and conforms

in the parameters ($\hat{a}_0$,$\hat{a}_1$ and $\hat{a}_2$) is conducted by including different lags of the variable U_t (of up to the 12$^{\mathrm{th}}$ order) in our political process for both the UK and the USA. Appendix D illustrates our procedure and provides the main results.

with the historical experience of the pre-first world war period. Once the economy experiences large demand shocks, unemployment follows more persistent dynamics but mean reverts globally, implying a high unemployment equilibrium rate. The political process discussed earlier comes into play following large shocks to the economy. The estimates suggest a plausibly high top equilibrium rate of unemployment in both countries during the 3-equilibrium period. The UK estimate of 18.2% is consistent with Matthews' (1986) finding based on a full macroeconomic model, that the natural rate of unemployment increased substantially during the 1930s. The top equilibrium rate of unemployment in the USA which amounts to nearly 11 million persons, is harder to explain. On average, nearly a quarter of the unemployed during the 1930s were in receipt of relief payments. Benjamin and Matthews (1992) estimate that nearly 1 million may have been added to the unemployed through the rise in real relief payments in the 1930s, and a further 3 million private sector jobs would have been crowded out by the end of the period through the creation of public sector relief jobs. This suggests that nearly half of the average level of unemployment during the period (1931-39) could be accounted for through the effects of Federal unemployment policy. However, Benjamin and Matthews (1992) estimates are based on a partial equilibrium analysis and the results in a full general equilibrium framework are likely to be higher.

Another econometric issue relates to the robustness of statistical inference on the parameters - $\hat{a}_0$, $\hat{a}_1$ and $\hat{a}_2$. According to our theory the error terms are autocorrelated. Hence, the standard error associated with the estimators is likely to be biased. It follows, that a 't' - or normal distribution may not approximate the actual empirical distribution of the parameters particularly well. The approach taken here is to augment our results 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 by Li and Maddala(1996).[13]

The full-sample bootstrap results based on 600 re-estimations for both countries 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.

[13] 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 600 times to generate 600 samples for each country. Then Eq. (4) in the text is reestimated for each of the 600 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 off autocorrelation at the original estimation of Eq. (4) 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 600. We therefore set the number of bootstraps to 600.

Table 4
Bootstrap estimates[a] and confidence intervals based on 600 re-estimations

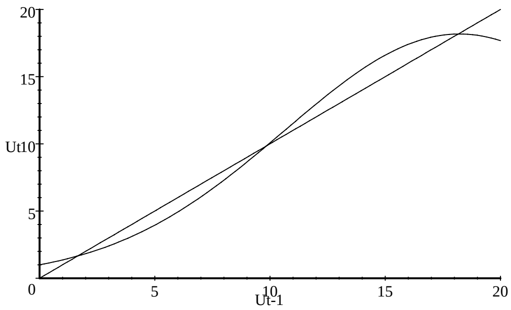
Countries	$\hat{a}_0$	95% *C.I*	$\hat{a}_1$	95% *C.I*	$\hat{a}_2$	95% *C.I*
UK	0.0474	0.016,0.078	0.3184	0.310,0.326	-0.0087	-0.009,-0.008
	(0.0158)		(0.0043)		(0.0002)	
USA	-0.4429	-0.484,-0.400	0.3680	0.352,0.384	-0.0096	-0.010,-0.009
	(0.0212)		(0.0085)		(0.0004)	

[a]Standard errors in parenthesis.

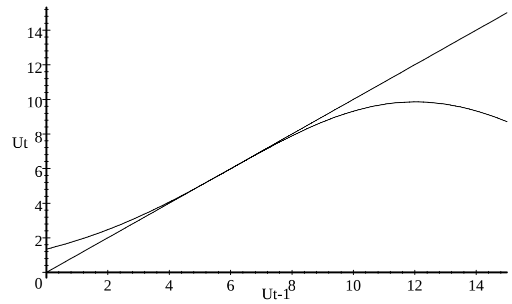
However, the key issue of this paper is whether a country is or is not subject to vicious/virtuous circles, in the sense of having three equilibria (the middle one being unstable) rather than merely one. Our central results imply that both countries have experienced 3-equilibrium situations over the sample period. Therefore we wish to develop a statistical test on the joint values of the 3 parameters $(\hat{a}_0, \hat{a}_1, \hat{a}_2)$ determining the number of equilibria. For this we turn to the bootstrapped joint parameter distribution which reveals the statistical possibilities. As it turned out, the parameter combinations for both countries generated only 3-equilibrium outcomes. This tells us that the estimated distribution of the parameters only admits of the 3-equilibrium case. Thus we cannot possibly reject the hypothesis of both countries being 3-equilibrium.

Can we however also reject the hypothesis of them being 1-equilibrium? That is, could a 1-equilibrium model generate 3-equilibrium cases like those we estimated for each country? To answer this, we bootstrap a model that lies on the borderline between the 1-equilibriumn and the 3-equilibrium cases. Such a model can be defined as one for which the slope of the phase diagram in its middle or average region (σ) is unity[14]. Fig. 4 illustrates this point. On the left is the UK's interwar phase diagram and corresponding slope. On the right is the USA's postwar equivalent from Minford and Naraidoo (2004). This is a borderline case where there is (just) one equilibrium; a slight displacement of the constant would give three. In the middle region the slope is unity, i.e., $\sigma = 1$. Plainly in the UK interwar case $\sigma \succ 1$. For an unambiguous 1-equilibrium case, σ would be less than 1. σ is thus a measure of the extent to which the combination of parameters diverges in either direction from the borderline case. We can generate its bootstrapped distribution for the two countries from the interwar errors, under the assumption that the true σ is unity and given by the postwar US parameters. Table 5 and Fig 5 show these distributions, together with the estimated $\widehat{\sigma}$ for interwar UK and US. Plainly these $\widehat{\sigma}$ convincingly reject the hypothesis that $\sigma = 1$.

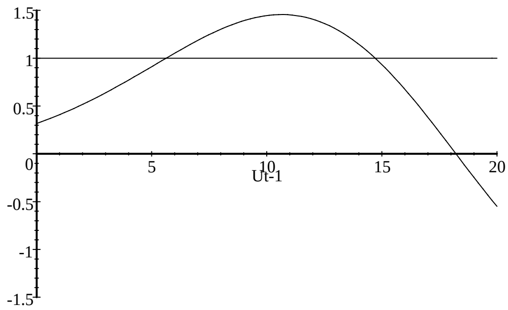
[14] $\sigma = \partial U_t / \partial U_{t-1}$ at mean unemployment, $\overline{U}$$= (a_1 + 2 * a_2 * \overline{U}) \exp(a_0 + a_1\overline{U} + a_2\overline{U})$



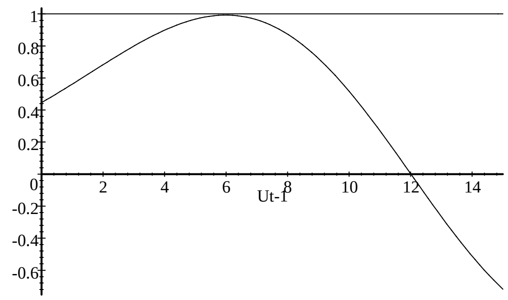
UK Phase Diagram



USA Postwar Phase Diagram



UK's Phase Diagram's Slope



USA Postwar Phase Diagram's Slope

Fig. 4. Features of 1-equilibrium and 3-equilibrium models.

Table 5
Summary Statistics for the Slope Estimate σ

Countries	UK	USA
Mean	0.993	0.993
Std Deviation	0.016	0.041
95% $C.I$	0.960,1.026	0.915,1.075
99% $C.I$	0.952,1.034	0.897,1.099
Estimated $\widehat{\sigma}$	1.25	1.12

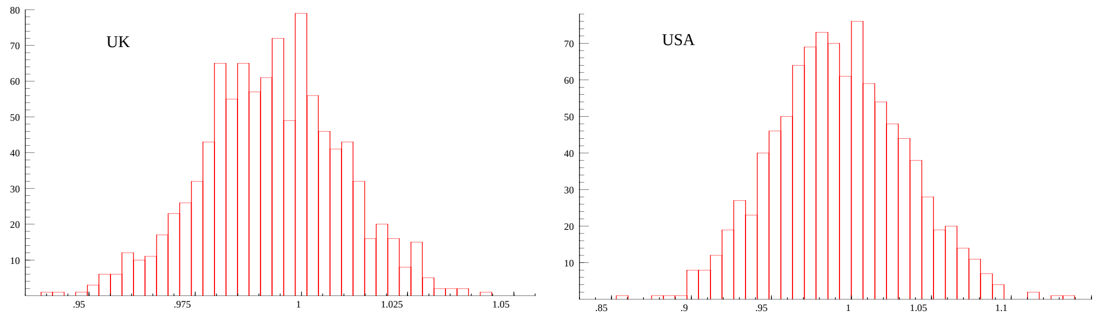


Fig. 5. Countries Distribution over σ

5. Testing the Reduced Form Equation against Rival 'General Hysteresis' Models

The reduced form equations we have estimated are derived from the theoretical model set out above. However, other models have been proposed that make unemployment dependent on its past. The term 'hysteresis' suggests that the current equilibrium unemployment rate may depend strongly on the past level of actual unemployment. Steadily increasing European unemployment rates over the past two decades have challenged the existence of a unique equilibrium rate of unemployment and nurtured the idea that the equilibrium rate of unemployment, at least to some extent, tracks the actual rate. Blanchard and Summers (1986) developed a model along these lines, focusing on Europe in the 1980s where there were large negative shocks and institutional arrangements which led to the disenfranchisement of 'outsiders' (i.e. unemployed workers who will typically not be union members), with unions bargaining only on behalf of their employed members. In the simplest case where unions simply set wages to ensure the employment of their current members but not to permit the firm to do any hiring (of outsiders), the wage-setting relation and the labour demand curve will coincide allowing for a continuum of equilibria following adverse shocks. Their model suggests a unit root in the level of unemployment. Røed (1997) has reviewed the literature on hysteresis whereby a variety of theories have been proposed for the existence of such hysteresis and has concluded that the unit root hypothesis (pure hysteresis) has rarely been rejected in the relevant theory; let us call them models of 'generalised hysteresis'.[15] These models do not in general have the same implications as ours that there may be two stable equilibria; rather they suggest that unemployment has great persistence and may be non-stationary. If non-stationary they would have potentially an infinite number of equilibria or natural rates, each shock creating a new one.

While we would argue that the model set out is to be preferred on theoretical grounds to such alternative models, nevertheless we also propose an empirical test of our reduced form against one of generalised hysteresis. We allow the alternative model to be represented by the best-fitting ARMA/ARIMA or non-linear time series process we can find. As we will see, within sample the fit of such alternatives against our particular form is barely distinguishable- not surprisingly given the high correlations between different transformations of unemployment and its lags. However, the key distinguishing feature of our model from these general time series representations lies in its forecast implications, namely that the equilibrium to which the economy returns depends on the size of the shocks; small shocks do not alter the economy's local equilibrium but at low unemployment large positive shocks drive unemployment to a high unemployment equilibrium, while

[15] Such models include models of regime-switching such as ours but with different set-ups. We impose no restrictions here on these alternatives. Further work could test particular fully-restricted models against ours *seriatim*, but that task lies well beyond our scope here.

at high unemployment large shocks, both positive and negative, drive it back to low unemployment. A general time series process will forecast unemployment either to stay roughly where it is if non-stationary; or, if stationary, to revert to some deterministic equilibrium. Thus the rival models' forecast implications are quite different; thus whichever of the models is well-specified should dominate the other in forecast performance..We use this as the basis for a repeated forecasting test of specification, where we produce both traditional and non-nested forecast tests for each date in the sample for each model.

Our purpose is to compare three alternative models; the reduced form model, the best fitting ARIMA/ARMA, and the best-fitting non-linear time series process (represented by a polynomial in the log of unemployment on its lags and powers of its lags). The best ARMA model turns out to be an AR(1) and the best polynomial model is one where all the powers are insignificant, adding nothing to the AR(1) component. Hence the chosen best rival model of hysteresis is simply one, an AR(1) with a root close to one, namely:

$$\ln U_t = \alpha + \beta \ln U_{t-1} + \epsilon_t$$

Our model is denoted by M; the rival AR(1) model by R. Table 6 shows that based on the goodness of fit measure ($\bar{R}^2$), the two models are virtually indistinguishable. The ratio $\hat{\sigma}_M/\hat{\sigma}_R$ where $\hat{\sigma}_M$, $\hat{\sigma}_R$ are the residual standard errors of the M model and the R model respectively, provides a measure of in-sample fit comparison for the alternative models. We devise a test of distinguishability based on the bootstrapped distribution of σ_M/σ_R. To this end, we perform 1000 bootstraps of the M model to give 1000 pseudo samples of the dependent variable y_t, $(= \ln u_t)$ and we perform the same procedure for the R model. Under the null hypothesis, the two processes are indistinguishable so that their predictions are the same. In this case the bootstraps from each process can be pooled, i.e., we have 2000 samples out of the two lots of 1000. The question then is, under this assumption that the two models are the same, what would be the distribution of σ_M/σ_R? We obtain this by a regression of both M and R on the 2000 bootstraps. Based on their standard errors, we compute the 95% limits of the σ_M/σ_R in Table 6. The estimated $\widehat{\sigma_M}/\widehat{\sigma_R}$ based on the actual samples for the UK and the USA are 1.18 and 0.97 respectively, both of which lie well within the 95% interval; therefore we cannot reject the null hypothesis of indistinguishability for the in-sample fit.

Table 6
AR(1) Model Statistics[a] and In-sample fit comparison

	constant	$\ln U_{t-1}$	$\bar{R}^2$	se[b]	LM[c]	$\bar{R}^2$ (M)	$\bar{R}^2$ (R)	95% C.I of σ_M/σ_R	$\hat{\sigma}_M/\hat{\sigma}_R$
UK	0.022	0.987**	0.973	0.155	1.054	0.96	0.97	0.935,1.230	1.182
	(0.020)	(0.009)			(0.349)				
USA	0.035*	0.971**	0.948	0.329	0.828	0.94	0.94	0.905,1.032	0.971
	(0.020)	(0.011)			(0.363)				

Two asterisks denotes statistical significance at the 5% level and one asterisk at the 10% level.
[a]Newey-West corrected standard errors in parenthesis.
[b]Standard error of regression.
[c]Breusch-Godfrey serial correlation LM Test. p value in parenthesis.

We now turn to comparison of the out-of-sample forecasts from the two alternative models. We retain $m = 60$ observations for out-of-sample forecasting. In particular we will use dynamic out-of-sample forecast, that is dynamic, multi-step forecasts starting from the first period in the forecast sample (1934/M11 for the UK and from 1937/M7 for the USA). In order to test the null hypothesis of equal forecasting accuracy we will employ forecast encompassing regressions, originally due to Chong and Hendry (1986), as generalised by Marquez and Ericsson (1993); further developments are suggested by Fisher and Wallis (1990) and Andrews et al. (1996). The original idea in this analysis is to regress the forecast error of one model on the other's forecasts. If the first model is correctly specified, there is no additional information contained in the other's forecasts that can help explain the forecast error of the first model. Moreover, the forecast error should have zero mean; however this is not the main focus of the test, but rather whether the second model can add information. The forecast encompassing regression is a restricted version of the pooling of forecasts formula[16].

$$y_t = \gamma_o + \gamma_1 \hat{y}_t + \gamma_2 y_t^* + \varepsilon_t;\ \varepsilon_t \sim N(0, \sigma^2)$$

where $\hat{y}_t$ is the forecast of the maintained model (here ours, M), y_t^* that of the other (here R).

The null-hypothesis is simply that $y_t - \hat{y}_t = \varepsilon_t$, that is the forecast error be an innovation. The issue is how best to test this null against the alternative that $y_t - y_t^* = \varepsilon_t$. First let γ_o be non-zero. Both Chong and Hendry (1986) and Marquez and Ericsson (1993) suggest that

$H_0 : \gamma_2 = 0 \mid \gamma_1 = 1$

is appropriate, whereas Fisher and Wallis (1990) suggest

$H_0 : \gamma_2 = 0$

A third possibility is suggested by Andrews et al. (1996)

[16]There is a large literature on pooling forecasts. See, for example, Holden and Peel (1988).

$H_0 : \gamma_2 = 0 \mid \gamma_1 + \gamma_2 = 1$

which has two advantages. Writing the regression as

$$y_t - \hat{y}_t = \gamma_o + \gamma_2(y_t^* - \hat{y}_t) + \varepsilon_t \tag{5}$$

then if y_t is integrated of order one, then all the variables in Eq. (5) are I(0) if we also make the extremely plausible assumption that any forecast is cointegrated with its outturn. The second advantage is that the model has a pooling of forecast interpretation where the weights (in our particular case $(\gamma_1 + \gamma_2)$ sum to unity). Therefore γ_o is an estimate of the average forecast error for the pooled forecast $\gamma_1 \hat{y}_t + \gamma_2 y_t^*$. We report results based on (5) following Andrews et al; however it turns out that the other methods give similar results. .

Tables 7-9 presents forecast encompassing regressions under a variety of multi-step assumptions. For Table 7 we calculate 1-step to 12-step ahead forecasts for five different episodes, each of 12 months. After each episode both models are re-estimated and the updated parameters are used to produce the forecasts for the next episode. In Table 8 we look at the forecasting period as a whole and consider the 1-60 multi-step forecasts across this whole period (thus the steps run from 1 to 60 months ahead). In Table 9 we compare fixed k-step-ahead forecasts over this whole period; we set k=12 on the grounds that a year is the forecast horizon of greatest interest to most forecasters. (For Table 8 the model is not re-estimated and for Table 9 the the model is re-estimated after each fixed k-step-ahead forecast).

What these results all show is that the (M-R) forecast helps a lot to explain the R forecast error in both the UK and the USA cases whereas the (R-M) forecast only helps to explain the M forecast error to a limited extent in the case of the UK and not at all in the USA case. Another way of putting this is that for the UK the optimal weights on M and R are roughly 0.8 and 0.2 respectively, and for the US 1 and 0 respectively. Thus the general conclusion is that the R model is heavily dominated by our M model. In sum, the out-of-sample forecasting test discriminates powerfully in favour of our specific nonlinear model against one of generalised hysteresis.

Table 7

Forecast Encompassing Regression[a]- 1-12 months ahead, five episodes

Countries		M-R					R-M			
	constant	$(\hat{y}_t - y^*_t)$	se[b]	$\bar{R}^2$	LM[c]	constant	$(y^*_t - \hat{y}_t)$	se[b]	$\bar{R}^2$	LM[c]
UK	0.037**	0.773**	0.050	0.850	2.100	0.037**	0.227**	0.050	0.316	2.100
	(0.008)	(0.052)			(0.115)	(0.008)	(0.053)			(0.132)
USA	0.024	1.107**	0.221	0.855	25.378	0.024	0.107	0.221	0.038	25.378
	(0.038)	(0.187)			(0.000)	(0.038)	(0.187)			(0.000)

Two asterisks denotes statistical significance at the 5% level and one asterisk at the 10% level.

[a]Newey-West corrected standard errors in parenthesis.

[b]Standard error of regression.

[c]Breusch-Godfrey serial correlation LM Test. p value in parenthesis.

Table 8

Forecast Encompassing Regression- 1 to 60 months ahead forecasts[a]

Countries		M-R					R-M			
	constant	$(\hat{y}_t - y^*_t)$	se[b]	$\bar{R}^2$	LM[c]	constant	$(y^*_t - \hat{y}_t)$	se[b]	$\bar{R}^2$	LM[c]
UK	0.045**	0.783**	0.051	0.849	2.249	0.045**	0.217**	0.051	0.295	2.249
	(0.008)	(0.052)			(0.115)	(0.009)	(0.052)			(0.115)
USA	-0.024	1.083**	0.222	0.894	31.271	-0.024	-0.083	0.222	0.032	31.272
	(0.133)	(0.154)			(0.000)	(0.133)	(0.154)			(0.000)

Two asterisks denotes statistical significance at the 5% level and one asterisk at the 10% level.

[a]Newey-West corrected standard errors in parenthesis.

[b]Standard error of regression.

[c]Breusch-Godfrey serial correlation LM Test. p value in parenthesis.

Table 9

Forecast Encompassing Regression- 12-month-ahead forecast[a]

Countries		M-R					R-M			
	constant	$(\hat{y}_t - y^*_t)$	se[b]	$\bar{R}^2$	LM[c]	constant	$(y^*_t - \hat{y}_t)$	se[b]	$\bar{R}^2$	LM[c]
UK	0.028**	0.808**	0.052	0.903	1.121	0.028**	0.192480	0.052	0.338	1.121
	(0.008)	(0.050)			(0.335)	(0.008)	(0.050)			(0.335)
USA	0.0174	1.033**	0.251	0.889	29.648	0.017	-0.033	0.252	0.008	29.648
	(0.045)	(0.136)			(0.000)	(0.045)	(0.136)			(0.000)

Two asterisks denotes statistical significance at the 5% level and one asterisk at the 10% level.

[a]Newey-West corrected standard errors in parenthesis.

[b]Standard error of regression.

[c]Breusch-Godfrey serial correlation LM Test. p value in parenthesis.

6. CONCLUSION

This paper argues that in both the US and the UK in the interwar period unemployment was determined by the nonlinear interaction of economic shocks and the political process. In both countries unemployment moved between a low and a high natural rate of unemployment, supporting the model's implication that if there are adverse shocks (usually brought about by a big monetary mistake - the return to gold in the

UK, and the Fed policy in the aftermath of the Great Crash), voters demand protection and unemployment benefit relief to deal with the situation. In this way, bad monetary policy breeds a worse supply-side response and the economy spirals downwards into a 'vicious circle', producing a worse equilibrium with a higher natural rate of unemployment. Movement out of the high unemployment equilibrium occurs because a large demand or supply shock triggers the 'virtuous circle'; in these cases this shock was supplied by rearmament and the second world war. This theory both fits the data in its own terms and is superior in forecasting performance out of sample to alternative models of 'generalised hysteresis' which within sample are empirically indistinguishable for familiar reasons.

The paper has a number of policy implications. One is that good macroeconomic management has a role in supporting good supply-side policy. Another is that the education of public opinion in the nature of the economy and the shocks hitting it can avoid counter-productive demands for social protection. Yet another is that reform programmes or demand shocks which overall jolt the economy away from the high unemployment equilibrium can be beneficial.

Appendix A: The model of median voter choice of B_t

In our model, the median voter holds some non-human capital but nevertheless relies heavily on income from human capital. If this voter experiences unemployment spells, unemployment benefits yield a much needed replacement of wage income. This voter's demands for benefits rise as unemployment rises, but at a diminishing rate, as these higher benefits progressively raise 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:

$$V_t^m = E_t \sum_{i=0}^{\infty} \beta^i \left(N_{t+i}^m s B_{t+i} + [1 - N_{t+i}^m s] W_{t+i} + rK - T \right) \tag{A1}$$

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 π_{t+i} which we write as:

$$\pi_{t+i} = \pi_0 + \pi U_{t+i} \qquad ; \qquad 0 \leq \pi_{t+i} \leq 1 \tag{A2}$$

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 π_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 π 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 Eq. (A3):

$$U_{t+i} = \exp(u_0 + v_{t+i}).[B_{t+i}/W_{t+i}]^{\delta} \tag{A3}$$

Eq. (A1) can be rewritten, once expectations are taken, as:

$$V_t^m = \sum_{i=0}^{\infty} \beta^i \left(\pi_{t+i} E_t B_{t+i} + [1 - \pi_{t+i}] E_t W_{t+i} + rK - T \right) \tag{A4}$$

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 $E_t W_{t+i} = W_t$. 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 (A4) as:

$$V_t^m = \frac{1}{1-\beta}(W_t + rK - T) + \left(\pi_0 + \pi\overline{U}_t\right)(B_t - W_t) \tag{A5}$$

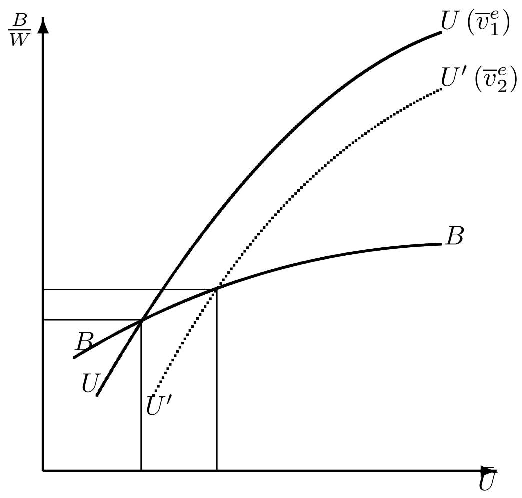
where

$$\overline{U}_t = \exp(u_0). \left(E_t \sum_{i=0}^{\infty} \beta^i \exp v_{t+i}\right) [B_t/W_t]^{\delta} \tag{A6}$$

The first order condition for benefits from maximising (A5) is then:

$$B_t = W_t \frac{\pi\delta\overline{U}_t}{\pi_0 + (1+\delta)\pi\overline{U}_t} \tag{A7}$$

Inspection of (A7) 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.



$UU =$ Equation A9 (Model of $\bar{U}$)
$BB =$ Equation A7 (Optimal $\frac{B}{W}$)
$\overline{v}_2^e > \overline{v}_1^e$ $\left(\overline{v}_t^e = \mathrm{E}_t \sum_{i=0}^{\infty} \beta^i e^{v_{t+i}}\right)$

Figure 2: Voter choice of $\frac{B}{W}$

For greater tractability we loglinearise (A7) around $\overline{U}_0$ as:[17]

$$\ln B_t = \eta(\overline{U}_0) \ln \overline{U}_t + \ln W_t + constant \tag{A8}$$

where $\eta(\overline{U}_0) = \left(\frac{\pi_0}{\pi_0 + (1+\delta)\pi\overline{U}_0}\right)$. By making $\overline{U}_0$ as close as possible to $\overline{U}_t$ the degree of approximation is minimised; thus we set $\overline{U}_0 = \overline{U}_{t-1}$, so that now we have $\eta(\overline{U}_{t-1}) = \left(\frac{\pi_0}{\pi_0 + (1+\delta)\pi\overline{U}_{t-1}}\right)$.

We also have from equation (A3):

$$\ln \overline{U}_t = u_0 + \delta(\ln B_t - \ln W_t) + \overline{v}_t^e \tag{A9}$$

[17] log first differences of (A7)

$$d \ln B_t = d \ln W_t + d \ln \left(\frac{\pi\delta\overline{U}_t}{\pi_0 + (1+\delta)\pi\overline{U}_t}\right) = d \ln W_t + d \ln \overline{U}_t - d \ln \left(\pi_0 + (1+\delta)\pi\overline{U}_t\right)$$

Using the approximation that

$$d \ln(x+z) \simeq \frac{x_0}{x_0 + z_0} d \ln x + \frac{z_0}{x_0 + z_0} d \ln z$$

the last term can be rewritten as $\left(\frac{(1+\delta)\pi\overline{U}_0}{\pi_0 + (1+\delta)\pi\overline{U}_0}\right) d \ln \overline{U}_t$. Substituting this in yields (A8). The constant of integration is found as

$$\ln \pi\delta + (1-\eta) \ln \overline{U}_0 - \ln \left(\pi_0 + (1+\delta)\pi\overline{U}_0\right)$$

Note that it does not change with $\overline{U}_0$ and that $\eta(\overline{U}_0) \ln \overline{U}_t$ has the required property that it rises with unemployment at a diminishing rate.

where $\overline{v}_t^e = \left(E_t \sum_{i=0}^{\infty} \beta^i \exp v_{t+i} \right)$. We can then compactly write the solution for the median voter's desired benefits (as illustrated in Fig. A1) in loglinear terms as:

$$(\ln B_t - \ln W_t) = \frac{\eta}{1-\delta\eta} \overline{v}_t^e + constant \tag{A10}$$

The interpretation of (A10) 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 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 during the interwar period that we observed 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 inter-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, ξ, 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 $\overline{v}_t^e = \theta E_{t-1} v_t$ where θ 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 $\frac{\eta}{1-\delta\eta}$ is a declining function of $\overline{U}_{t-1}$; under our limited information assumption this parameter becomes an estimated one, $\widehat{\frac{\eta}{1-\delta\eta}}$, 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 $E_{t-1}\overline{U}_{t-1} = \overline{v}_t^e + E_{t-1}U_t^* = [1-\xi(1-\theta)](U_{t-1}-z)$. We represent the function here linearly as:

$$\widehat{\frac{\eta}{1-\delta\eta}} = \psi_1 - \psi_2(U_{t-1}-z) \tag{A11}$$

We can now write:

$$(\ln B_t - \ln \overline{W}_t) = [\psi_1 - \psi_2(U_{t-1}-z)][\theta\xi(U_{t-1}-z)] + constant + \epsilon_t \tag{A12}$$

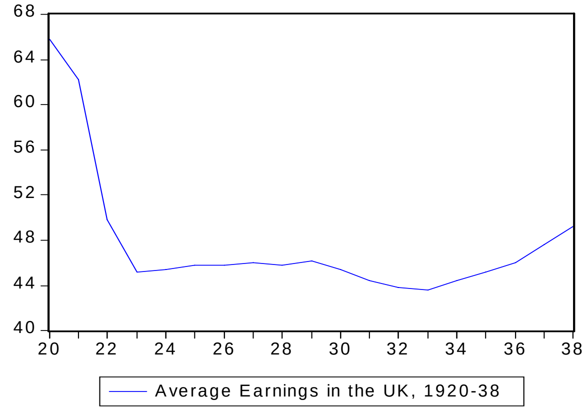
where we have added an error term, ϵ_t, to capture the influence of other factors and pieces of information on the choice of optimal benefits- because these elements may well be persistent, this error term may well too be autocorrelated.. Hence finally we obtain a reduced form equation for benefits as:

$$\ln(B_t/\overline{W_t}) = B_0 + \varphi(U_{t-1}-z) - \beta(U_{t-1}-z)^2 + \epsilon_t \tag{A13}$$

which is equation (2) in the main text.

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 (A13), B_0 is a minimum benefit/wage ratio set in normal circumstances and φ and β are constants.

Appendix B: Graphs of Average Earnings and Unemployment Benefits in the UK, 1920-38.



Data on unemployment benefits was obtained from Hatton (1980) and is a representative benefit level for male recipients with different family circumstances. The weights were based on a sample of 1927 benefit recipients. Average earnings is the average weekly manufacturing wage obtained from Chapman (1953). Both of these graphs displays shillings on the y-axis. By the end of the First World War, the Unemployment Insurance Act of 1911 and amendents in 1916 and 1919, had provided a system of centrally financed unemployment insurance in Britain to about 25 per cent of the work-force. Before 1911, unemployment insurance was either privately administered with contributions by workers and employers made payable to a fund or public assistance for unemployed persons which was locally administered and financed. After the First World War, the Unemployment Insurance Act of 1920 increased benefits by nearly 40 per cent. The act also extend coverage to more than 11 million workers. The generosity of the system progressively increased so that by 1931, weekly benefits exceeded 50 per cent of average weekly wages and also the duration of these benefits was for unlimited period to those adults who have made at least 30 weekly insurance contributions. In 1936 and again in 1938, so that on the eve of Britain's entry into the Second World War, insured workers were indefinitely eligible to receive benefits to nearly 60 per cent of average wages.

Appendix C: Data Discussion.

The systems of measuring unemployment in interwar UK and USA were markedly different. The UK method of measurement was based on the unemployment insurance system; it was a literal head count of those individuals who were covered by the insurance scheme and who were unemployed. Until late in the interwar period, America did not even have an unemployment insurance system, and even once it was founded, it covered only a small fraction of the work-force. The methodological basis for the American numbers is a survey (carried out by the U.S Bureau of Labour Statistics) of a sample of individuals which inquires into their labour force and employment status.

The data for the UK (1887.01-1939.10) is based on two variables (1887.01-1920.12; Trade Union Members Unemployed) and (1921.01-1939.10; Insured Workers Unemployed), the source being the NBER Macro History Database. These data can be regarded as a single variable as they are based on returns collected by the Board of Trade and the Ministry of Labour from various trade unions which paid unemployment benefits.

The data for the US (1906.06-1942.06) is based on two different variables (1906.06-1933.01; Unemployment of Trade Union Members $\frac{U_T}{T}$, where U_T denotes the number of trade union members unemployed and T is the number of trade union members) and (1929.01-1942.06; official unemployment rate $\frac{U}{L}$, where U is the number of unemployed and L is the size of the labour force) (note that all figures are in percentage terms); the source is from the NBER Macro History Database. To convert the first time series into the official unemployment rate $\frac{U}{L}$, we make use of the splicing factor $\frac{U}{U_T}$ which we calculated using the data where the two time series overlap, namely the period 1929.01-1933.01. First, we convert the monthly time series $\frac{U_T}{T}$ into $\frac{U_T}{L}$ by multiplying it by $\frac{T}{L}$, where only yearly data 1906-1933 is available from the US Bureau of Labour Statistics. We therefore made the assumption that total union membership T is constant over the year as well as L, the labour force. Then to obtain the splicing factor $\frac{U}{U_T}$ we take $\frac{U}{L}$ from the second time series (over the period 1929.01-1933.01) and divide it by $\frac{U_T}{L}$. Finally, to obtain $\frac{U}{L}$ we multiply $\frac{U_T}{L}$ by the splicing factor and hence convert the first time series into the second one. Figs. C1 and C2 provide plots of the two countries unemployment series.

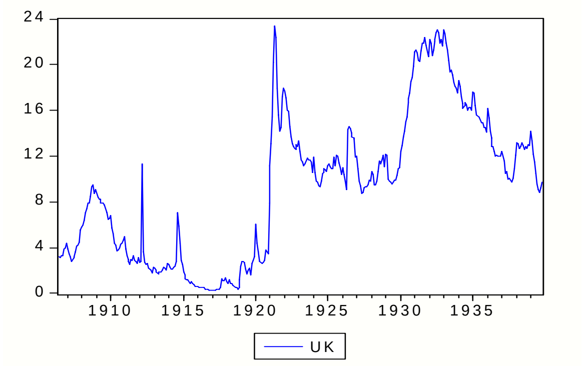


Fig. C1: UK unemployment series

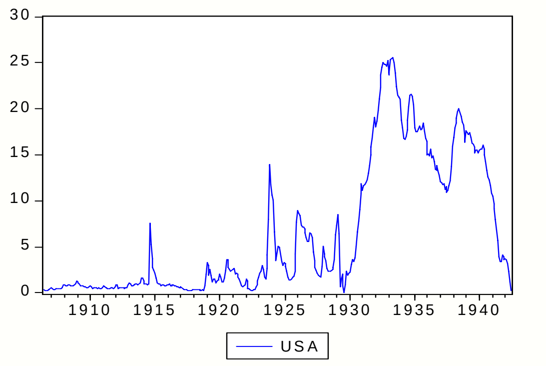


Fig. C2: USA unemployment series

Appendix D: A statistical test of mean difference in using different lags specification in the Political Process.

We can test the hypothesis of whether the one-lag outcomes are statistically different from the twelve-lag ones. The test proposed is a statistical testing which involves the sampling distribution of the difference between means of our parameters $(\hat{a}_0, \hat{a}_1, \hat{a}_2)$ given that these three parameters are the ones that generate the equilibria outcomes. This test is performed at different lags (namely the first and the twelveth one) with the mean difference given by $\hat{a}^1 - \hat{a}^{12}$ where the superscripts denote the order of the lags. The mean and standard deviation of the sampling distribution of the difference between means are given by $a^1 - a^{12}$ and $S_{\hat{a}^1 - \hat{a}^{12}}$ respectively. The latter is the standard error of the difference between means. Since the sample standard deviation is used to estimate the population value, the sampling distribution of the difference between means will also be distributed as t and the formula for the test statistic is given by: $t = \frac{(\hat{a}^1 - \hat{a}^{12}) - (a^1 - a^{12})}{S_{\hat{a}^1 - \hat{a}^{12}}}$. The null hypothesis says that $H_{0:}a^1 - a^{12}$, that is, the two means come from the same population; there is no difference between them (i.e., $a^1 - a^{12} = 0$). Thus, the formula reduces to $t = \frac{(\hat{a}^1 - \hat{a}^{12})}{S_{\hat{a}^1 - \hat{a}^{12}}}$. The formula for the standard error for dependent groups because the same variables are tested twice is given by $S_{\hat{a}^1 - \hat{a}^{12}} = \sqrt{S^2_{\hat{a}^1} + S^2_{\hat{a}^{12}} - 2 * r * S_{\hat{a}^1} * S_{\hat{a}^{12}}}$ where r is the correlation between the two sets of parameters. Given we are dealing with a two-tailed test where the alternative hypothesis is $H_{1:}a^1 \neq a^{12}$, the critical value for a 5% level of significance test is ±1.96. Table D1 summarises our analysis and results for the comparison of statistical significance difference between one-lag outcomes and both twelve-lag and two-lag outcomes. We choose to compare one-lag outcomes to both two-lag and twelve-lag outcomes in order to see whether the political economy process significantly differs at various lags. The outcomes indicate robustness of the results at shorter time lag but this robustness soon disappears as the time lag increases. However the main results of three equilibria do not change as we move from the one-lag to the twelve-lag specification as illustrated in the main text.

Table D1

Statistical Significance of difference between lag outcomes for the Political Process

1-lag v/s 12-lag	UK			USA		
H_0	$a_0^1 - a_0^{12} = 0$	$a_1^1 - a_1^{12} = 0$	$a_2^1 - a_2^{12} = 0$	$a_0^1 - a_0^{12} = 0$	$a_1^1 - a_1^{12} = 0$	$a_2^1 - a_2^{12} = 0$
H_1	$a_0^1 - a_0^{12} \neq 0$	$a_1^1 - a_1^{12} \neq 0$	$a_2^1 - a_2^{12} \neq 0$	$a_0^1 - a_0^{12} \neq 0$	$a_1^1 - a_1^{12} \neq 0$	$a_2^1 - a_2^{12} \neq 0$
$t = \frac{(\hat{a}^1 - \hat{a}^{12})}{S_{\hat{a}^1 - \hat{a}^{12}}}$	-4.05	6.57	-5.76	-8.19	10.5	-4.94
Decision Rule	Reject H_0	Reject H_0	Reject H_0	Reject H_0	Reject H_0	Reject H_0

1-lag v/s 2- lag	UK			USA		
H_0	$a_0^1 - a_0^2 = 0$	$a_1^1 - a_1^2 = 0$	$a_2^1 - a_2^2 = 0$	$a_0^1 - a_0^2 = 0$	$a_1^1 - a_1^2 = 0$	$a_2^1 - a_2^2 = 0$
H_1	$a_0^1 - a_0^2 \neq 0$	$a_1^1 - a_1^2 \neq 0$	$a_2^1 - a_2^2 \neq 0$	$a_0^1 - a_0^2 \neq 0$	$a_1^1 - a_1^2 \neq 0$	$a_2^1 - a_2^2 \neq 0$
$t = \frac{(\hat{a}^1 - \hat{a}^{12})}{S_{\hat{a}^1 - \hat{a}^{12}}}$	0.12	0.01	-0.01	-1.06	1.50	-1.86
Decision Rule	Accept H_0	Accept H_0	Accept H_0	Accept H_0	Accept H_0	Accept H_0

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