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NATURAL-RATE THEORY AND OECD UNEMPLOYMENT

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Our mission is to examine from the perspective of the intertemporal-equilibrium models of endogenous natural-rate theory the huge swings in unemployment among the OECD countries in recent times. We first look at the huge rise in jobless rates between the early 1970s and the early 1990s throughout the OECD: in the United States a rise from about $5\frac{1}{2}$ per cent to 7 per cent, Canada from about 6 to $10\frac{1}{2}$, Japan from $1\frac{1}{4}$ to $2\frac{1}{4}$, Italy from $3\frac{1}{2}$ to about $7\frac{1}{4}$, the United Kingdom from about $3\frac{3}{4}$ to about 9, France from about $2\frac{3}{4}$ to about 10, and West Germany from $\frac{3}{4}$ to $5\frac{3}{4}$.[1] We then look at the developing recovery of the general unemployment rate, most notably in the United Kingdom and the United States, amid a generally continued elevation of jobless rates among the less educated. We see the mid-1990s surge of unemployment in Germany, France and Italy as another story.

There are other, older perspectives, of course. Keynesians interpreted events in the 1970s and in the 1980s as signs of effective-demand and effective-supply shocks (Feldstein, 1986; Fitoussi and Phelps, 1986; Malinvaud, 1985; Pissarides, 1990). But if the natural rate was unchanged they had to explain why the subsequent disinflation was short-lived (why inflation even turned up in the late 1980s or early 1990s) despite high unemployment. Lacking an endogenous natural rate, Keynesians could explain the durability of the slump only by positing either a permanent expectational disequilibrium or hysteresis, i.e. non-ergodicity (as in Phelps, 1972) or a degree of persistence so great as to be empirically indistinguishable from hysteresis. As the slump ran on, the expectational possibility wore thin. So they were down to hysteresis.

Hicks (1974) launched a break with the Keynesian-monetarist perspective in the 1980s with his appeal to real frictions or rigidities. If wage-setting mechanisms make the real wage, v, sticky (in the sense of Lerner), hence predetermined in the short run, the unemployment rate, u, will rise in the short run in response to a shock contracting the 'demand wage,' i.e., a downward shift of the labour-demand schedule in the $1 - u$, v plane (Bruno and Sachs, 1985). Another landmark was a bargaining model with the property that its natural unemployment rate rose in response to several much-discussed shocks such as higher taxes and an energy shock reducing labour productivity (Layard and

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[1] These are averages of 1971–3 and 1991–3 except Canada and W. Germany for which the average of 1991 and 1994 is used, and France and Italy the average of 1991 and 1992. These series are all from the U.S. Department of Labor, Bureau of Labor Statistics, as reported by the U.S. Council of Economic Advisers (1997).

Nickell, 1986). These models lacked state variables such as wealth, capital stock, or customer stock whose adjustment might retard recovery or reinforce the disturbance.

Efforts then began to append to these otherwise static models a persistence mechanism or a hysteresis mechanism that would slow or block full recovery from temporary shocks and shocks that otherwise would ultimately have been neutral for unemployment. Insider-outsider models showed that when a temporary downward shock receded, the surviving insiders, seeing their marginal productivity as increased, could force up wage scales without pushing up the probability of job loss above what it had been originally; this blocks the fast lane to full recovery (Blanchard and Summers, 1986; Lindbeck and Snower, 1988; Oswald, 1987.) Other theorists, expanding on the hypo-thesis that morale and skill decay with joblessness, argued that a protracted period without appreciable hiring generates a pool of long-term unemployed who no longer find it rational to search and apply for job openings, thus becoming permanent supernumeraries who add to measured unemployment but not to functioning unemployed; also, unemployment insurance benefits with a high replacement ratio and a lifetime duration saps the will to search (Layard and Nickell, 1987). But what if valuable 'insiders' hit by layoffs or downsizing stay in touch with their former employer to be ready for a rebound, and those that do not leave the labour force? What if the great majority of the long-term unemployed do not search any more because they have already applied and interviewed widely, and they are jobless because they have not received an offer yet? What if those in the welfare trap soon leave the pool of measured unemployed? Persistence/hysteresis became conventional wisdom before alternatives to it appeared.

Our perspective is in the tradition of intertemporal expectational equilibrium. In this view, the equilibrium path of unemployment (and labour force) from the current time forward is shaped by the structure of the economy rather than its recent history: its technology, individual preferences, social values and institutions. The intertemporal models with incentive-wage setting are of this type. They suggest that several real shocks and the ensuing adjustments to them (a rise in overseas real interest rates, a rise in welfare entitlements, etc.) shift up or tilt up the path of the moving natural rate (Phelps, 1994).[2] (The model of wage setting to dampen quitting is particularly powerful, the no-shirking model more often more convenient.) A strength of the intertemporal-equilibrium approach is its showing that unemployment may remain elevated because some (or all) of the driving forces are persisting and non-neutral for the natural rate in the long run, not mainly because the volume of unemployment has some

[2] There are other classes of equilibrium models. The neoclassical view, which sees wage rates as market-clearing, suggested to some that the minimum wage and the dole cut employment (Rueff, 1931). Models of search unemployment could lay some of it to mismatch (Mortensen and Pissarides, 1997) and disparate losses of human capital among the laid-off (Ljungquist and Sargent, 1995). Credit-market theories point to the role of balance sheets (Greenwald and Stiglitz, 1993). A neo-monetarist perspective suggests that the social upheavals of 1968, the collapse of Bretton Woods, the globalisation of capital and trade and now the EMU question, in adding to uncertainty, dampened job creation and economic growth too.

inherent persistence in the sense of sluggishness. (Of course, if we add rising marginal hiring costs to our model we create a friction causing some persistence in employment time series (Phelps, 1968), but there is a big difference between a model in which a degree of persistence serving to dampen jumps is an optional feature and a model dependent on persistence to make those shocks generate longish slumps.)

The difference matters for policy implications. Those laying high unemployment to hysteresis or to high-level persistence hold that inserting the unemployed into work through a shock to effective demand (Blanchard, 1996) or hiring subsidies (Snower, 1994) or workfare inducements would make a permanent dent in unemployment, as the wage ratchets to a lower level, even if these programmes are later terminated. In the contrasting view of structuralists, permanent and substantial fiscal measures to revive the reward to work relative to present wealth and welfare entitlements are needed if all or most of the rise of unemployment since the early 1970s is to be quickly reversed (Phelps, 1997).

We welcome this opportunity to make the case for our theoretical perspective and the thesis growing out of it against the hysteresis and persistence views.

1. Theory and Thesis

We can give some feeling for the theory advocated here with an example. A distinctive causal variable in our theory is the real interest rate as a factor behind the demand for labour (as in Fitoussi-Phelps, 1988). In forcing higher mark-ups at any given unemployment rate, an increase of the real interest rate shifts down the schedule of the product wage (pay in terms of domestic consumer-good output) that employers can afford to pay if they are to maintain their present workforce. A firm has to invest in customers (Phelps and Winter, 1970) or in employee training (Phelps, 1968; Salop, 1979) or in labour-intensive capital goods when it hires new workers. So if it is to hire it must expect to cover the interest and depreciation. A rise of real interest rates raises this hurdle.

How is unemployment affected? The theory contains (in its now-standard exposition) a generalised notion of product-wage *rigidity* in the form of the *wage curve* giving the required incentive wage as a function of the unemployment rate. In general, though, shocks impact on the wage curve as well as on the labour-demand curve.

This consideration brings in the variables lying behind the wage curve: wealth or the income from wealth (pecuniary and imputed) and, in some models, productivity (which in the turnover model gives the opportunity cost to firms of diverting employees from producing to training). We argue that the real-interest shock's impact on these variables is nil or at any rate insufficient to shift down the wage curve by as much as it lowers the labour-demand curve; so the wage does not fall enough to avert a drop of the equilibrium employment path over the near term at least (Hoon and Phelps, 1992). Subsequently,

the reduced wage and reduced employment provide a motive to decumulate wealth, which would promote recovery; but the increased interest rate operates in the opposite direction; so any recovery must be incomplete. *Our thesis at present.* The theory is a device for generating hypotheses about the causes of the long rise of unemployment. At present we are entertaining nine or ten causal forces. Of course we would expect that two or three of these would provide more than half the explanation in most countries. But which ones those are is still not settled.[3]

The first set of shocks are external shocks that an individual country (unless very large) is exposed to as a result of its openness to the global economy (thus 'global' shocks as opposed to local, or internal, shocks).

(1) The world real interest rate is the longest-standing element of our present thesis. The largely external developments elevating world real interest rates since the early 1980s are a major cause of the elevation of natural unemployment rates in Europe.

(2) The high-tech production methods of the 'information age,' while increasing the productivity of employees trained in the new methods, presumably increase the training that firms must optimally provide new employees, especially the less educated. Such an effect, *ceteris paribus*, reduces the prospective *net* productivity of workers p.a., *i.e.*, the gross productivity *less* the interest and depreciation on the investment in employees' training, thus reducing the demand wage; at the same time, since the firm's employees are now a more expensive investment, it would raise the optimum incentive pay given by the wage curve. The end-results are a fall of the wage if the demand wage is decisive; second, an unambiguous rise of unemployment in any case (even after wealth has adjusted to any fall of the wage and regardless of how much gross productivity is increased).

(3) The two 1970s oil-price shocks may very well have disturbed the natural rate. By the late 1980s the real price of oil had receded to its pre-shock level, however. On the other hand, the skyrocketing of energy prices decades ago may have had lingering effects on the labour as well as the energy intensiveness embodied in capital.

The remaining shocks are domestic and vary from country to country.

(4) Another factor behind the demand-wage schedule is the expected rate of growth of employee productivity, which appears as a subtractor from the expected real interest rate in the demand-wage equation (Pissarides, 1990). In France and Germany, the glorious years from the early 1950s to the early 1970s were followed by a sharp productivity slowdown, the slower pace continuing to this day; after catching up with the technological leaders, France and Germany could not engineer productivity growth much faster than that of the leader, the United States, which also showed a somewhat slower pace.

(5) A related factor, one that is behind the wage curve, is the cumulative ex-

[3] These important forces may have to overexplain the unemployment rise since one or more other forces, such as the evolution in the educational composition of the labour force was tending to reduce unemployment in many countries.

post growth of productivity in relation to private wealth. After growth slowed in France and Germany, wealth did not slow down so much and tended to catch up with productivity and wages, thus pushing up the wage curve (Hoon and Phelps, 1997).

(6) A domestic shock in most OECD countries has been the expansion in the level and range of benefits offered by the welfare state (the set of entitlement programmes for social insurance and social assistance) typically in the decade between the mid '60s and the mid '70s. Layard *et al.* (1991) focused on unemployment insurance benefits but the indictment can be broadened to subsidised public housing, health insurance, income support to aged parents, aid to dependent children and free public housing, all of which can be shared with workers, thus creating a kind of social wealth that workers can fall back on; it could also include a variety of medical and educational expenditures (Zoega, 1997). In incentive-wage models, increases in these entitlements would at once aggravate quitting, shirking, absenteeism etc. which would at once spur firms to raise wages and to slow hiring. In reality, unemployment may have responded even more slowly as it might have taken some time for employee propensities to adapt and for employers to react in turn. (In some countries firing restrictions and public-sector hiring may also have damped adjustment.)

(7) There have been statist intrusions into the management of business enterprises in many countries on the Continent. The imposition of penalties and indemnities for dismissal, which raise the cost of firing, appear to have pushed up unemployment. The main channel here is that having to pay for firing employees operates like a hiring cost: it lowers the demand wage while not lowering the wage curve at given wealth, welfare and productivity levels.[4] This consideration must have been especially important where an acute productivity slowdown increased the likelihood of having to lay off employees in the future.

(8) The mix of taxes with which welfare outlays and the non-welfare purchases are financed also matters. Given the period's starting stock of wealth, a decrease of the proportional value-added tax rate (think of it as initially passed on in higher money prices) has no impact on the hourly money wage read from the demand curve nor on the optimal money incentive wage given by the wage curve; it is neutral for employment even in the near term. But the increase of the payroll tax rate needed to fill in the lost revenue would lower the demand curve while not lowering the wage curve (in terms of the take-home wage). So the path of the natural rate is raised at least over the near term. But wealth then begins decumulating in keeping with the reduced wage and the elevation of unemployment, so the wage curve begins declining. The adjustment process stops once wealth is restored to its original ratio to the take-home wage, at which point the natural rate is also restored. (Hoon and Phelps, 1996). This neat story is altered if low-wage workers have considerable social wealth (public housing, etc.) and those entitlements are not geared to the after-tax wage.

(9) In some countries the fall or slowdown of the demand wage relative to

[4] When the firing rate is reduced, the hiring rate must also be lower in the new steady state, so the average duration of spells in the unemployment pool is lengthened, which dampens quitting and shirking, thus reducing the natural rate; but the duration of unemployment is worsened.

the real value of the minimum wage, either the statutory minimum or the bottom of the scale set by labour unions, has meant an increased number of workers whose wage opportunities fall below the minimum; these workers may nevertheless search for legal work at or above the minimum and therefore be counted as unemployed. This increase in submarginal workers may tend to be larger the closer the modal wage was to the minimum wage (before the former fell relative to the latter), hence the higher was the minimum wage.

(10) In a few countries there have been significant changes in two domestic macro forces both operating through the real exchange rate: public expenditure on goods and services (other than purchases under government health insurance programmes counted in entitlement outlays) and the domestic capital stock. An increase of the former causes a real exchange-rate appreciation, an increase in the latter a real depreciation. The appreciation, unless it is expected to quickly wear off (and so raise interest rates markedly), could have a net expansionary effect, reducing the natural rate, by inducing domestic firms to shave mark-ups to remain competitive for overseas buyers; a depreciation on this logic would be contractionary (Phelps, 1994).[5]

The vicissitudes of these same factors help to explain the spreading recovery on the periphery of the European continent and in the United Kingdom and the United States between the early 1990s and the present. But we doubt that a full account of this recovery is possible without bringing in a new factor that could not have played a role in driving up unemployment in the previous period (between the early 1970s and the early 1990s) – the democratisation of educational opportunities.

2. Some Evidence for our Thesis from Cross-Section Data

In chapter 17 of Phelps (1994) we estimated a system of reduced-form unemployment equations, one for each of seventeen OECD countries. While such an estimation cannot provide definitive evidence for a theory, since more than one theory may be consistent with the data, we thought of this work as a first step in testing a moving-natural-rate theory of unemployment.

Those results suggested that two global forces – the world price of energy in the 1970s and the world real interest rate in the 1980s and early 1990s – were primary factors in the increases of the unemployment rate in those two periods. While monetary factors were undoubtedly also at work, we took these results as supporting our thesis that changes in the fundamentals behind the natural rate had caused a rise in the natural rate to occur in most or all OECD countries. The simultaneity of the rise of unemployment rates in so many countries is itself strong evidence for their link to global developments.

The close fit of the unemployment rate to the world real rate of interest is

[5] There is no question, though, that public-sector hiring to offset the private sector's firing or failing to hire can, as long as it continues, delay unemployment from rising to its new equilibrium path (whatever the effect of the public sector's enlargement and the private sector's shrinkage on the equilibrium path itself.)

illustrated by the U.K. data from 1966 to 1996 in Fig. 1. It shows how a rise in the real rate of interest (measured as the weighted average of the real rates in the G7 countries) coincides with the huge rise of unemployment beginning in the early 1980s and even with the sharp rise of unemployment in 1975. Of course, the two increases in the real price of oil also played a role in these two increases of unemployment.

There were important differences in the unemployment experience of individual OECD countries and this variety is a resource for studying the effects of domestic shocks. While unemployment moved to a higher plateau in EC Europe, the exact magnitude of the rise varied considerably. Our explanations here fall into two categories. First, the effect of a fall in labour demand falls more heavily on employment (less heavily on real wages) the flatter is the wage curve, and its slope may vary from country to country. The second type of explanation here is that some country-specific shocks and evolutions offset, at least partially, the global shocks.

In our 1994 work the rates of payroll tax and personal income tax were found to be potent country-specific variables. On the Continent these tax rates generally rose steeply while in the United States and the United Kingdom they rose comparatively little. But our latest examination of the tax effects suggests that once wealth has fully adjusted to circumstances there is little effect left on the unemployment rate, as is confirmed in Fig. 2 which shows the relationship (or rather the absence of any relationship) between the growth in unemployment and the rise in the share of (total) public spending of GDP.[6]

Our recent work has focused on three further country-specific developments

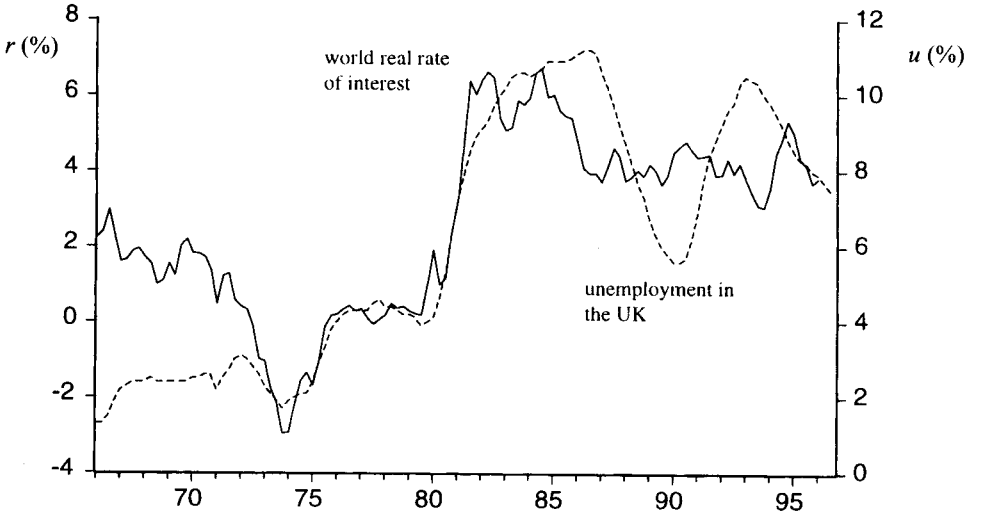

Fig. 1. *Unemployment in the UK and the World Real Interest Rate*

[6] The change in the share of GDP is weighted by its initial value. The same applies to changes in social spending in Fig. 4. The rationale for this is simply that the further one is from a welfare optimum, the bigger the effects of an increase in the distortion.

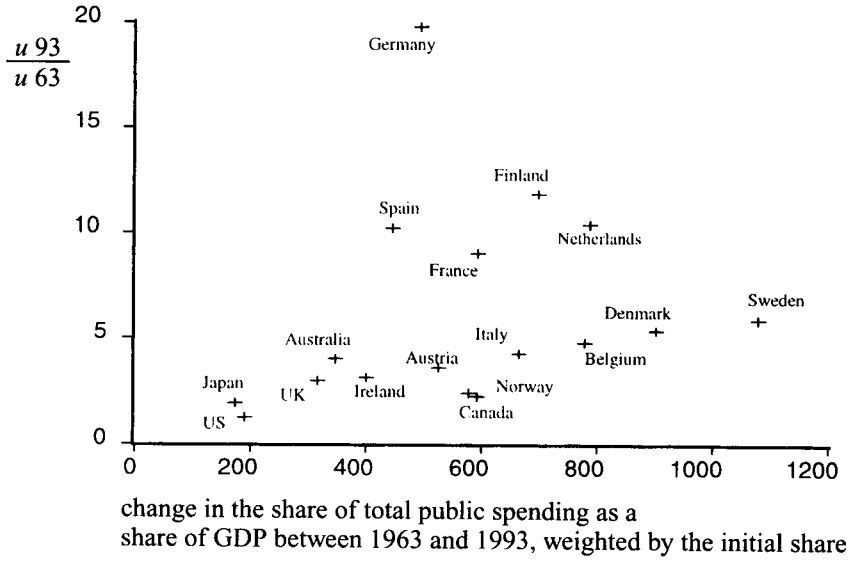

Fig. 2. *Growth in Unemployment and the Rise in Total Public Spending*

of importance. One is the slowdown of productivity, which was generally much greater on the Continent than in the United States, the United Kingdom and Scandinavia. Fig. 3 draws the relationship between the size of the slowdown and the rise of the unemployment rate. A general though far from perfect relationship can be spotted. The main outlier is Portugal which suffered a serious productivity growth slowdown but has mostly escaped the unemployment problem.

Another of these latter country-specific factors is welfare-state spending.

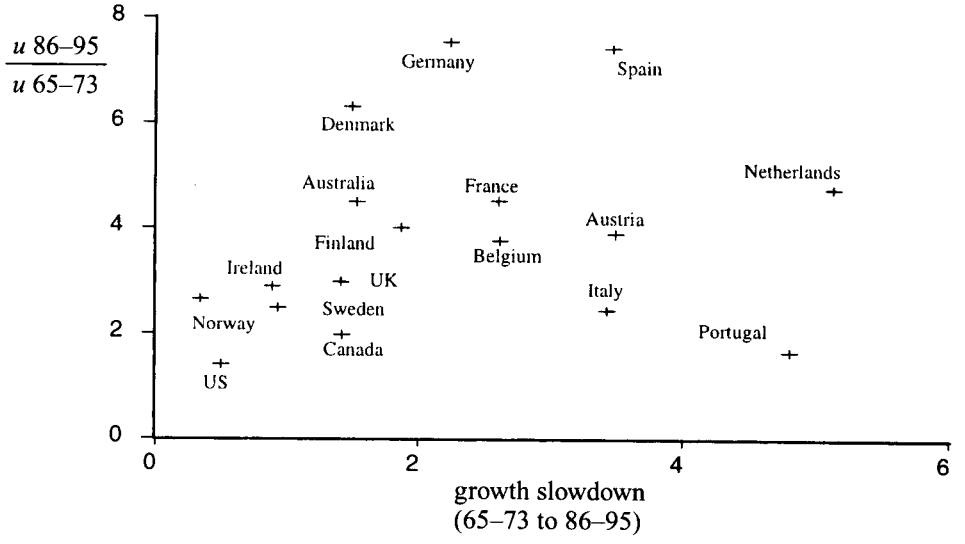

Fig. 3. *Unemployment Growth and the Slowdown of Labour Productivity Growth*

Fig. 4 shows the relationship between the change in the share of social expenditures (excluding health care) in GDP, weighted by its initial level, and the growth in unemployment. We measure social spending in a period preceding the one used to calculate average unemployment as a rise in unemployment creates increased spending on unemployment benefits. A positive relationship is visible although here too there are outliers. The ratio of social spending to GDP rose almost threefold in Sweden over this period but unemployment did not grow correspondingly. Also, the growth of unemployment in Germany is very large due to the exceedingly low rates of unemployment experienced in the early 1960s.

Yet another development varying from country to country is the improved educational composition of the labour force. (Phelps and Zoega, 1996, 1997.) Looking at the unemployment rate of different education groups in the United States we found that the movement over time of unemployment among the low education groups resembles the corresponding plots for the continent and the United Kingdom. However, this does not show up in the aggregate series because of the fall in the relative size of these groups.

The educational upgrading also had an impact in the United Kingdom. Fig. 5 shows the actual unemployment rate in the United Kingdom and the hypothetical rate that would have prevailed had there not been a general upgrading of the educational qualifications of the labour force. We see that in 1992 unemployment would have been 140 basis points higher had it not been

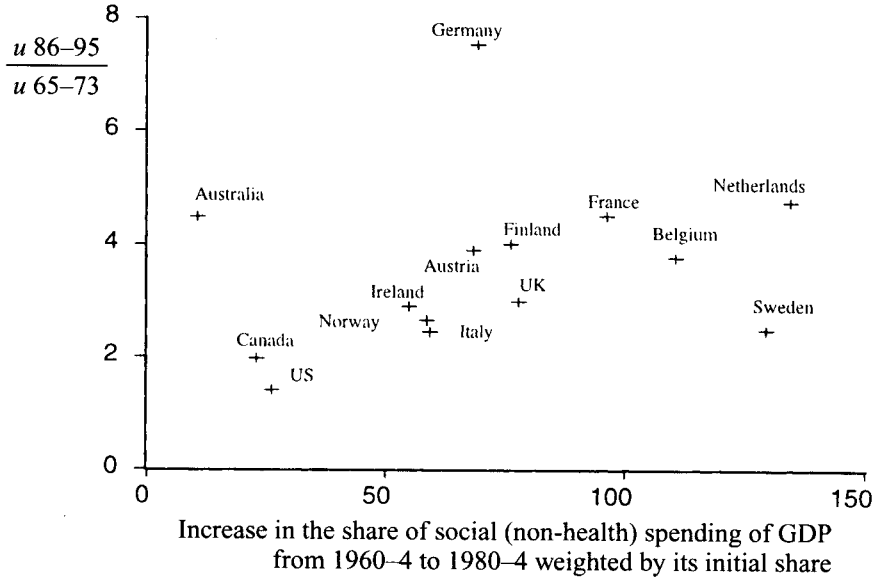

Fig. 4. *Growth in unemployment and changes in Public Spending on Social Programmes (excluding health care)*

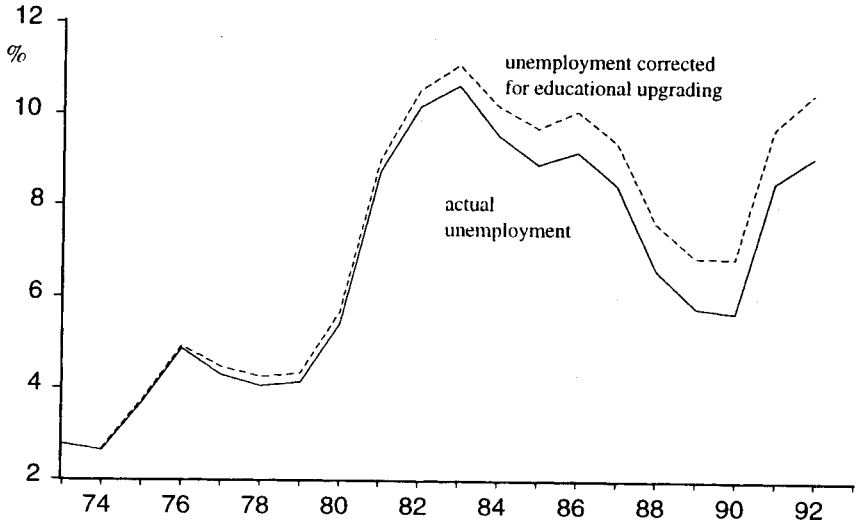

Fig. 5. *Unemployment in the UK Corrected for Educational Upgrading*

for the upgrading since 1974. The proportion of the labour force having no qualifications went from around 60% in 1974 to around 30% in 1992.[7]

We know that there has been increasing democratisation of educational opportunity on the European continent as well. But that development has not produced as strong a downward trend in the average unemployment rate on the continent since there are not generally the huge gaps between high-education and low-education unemployment rates in those countries that we find in the United States and the United Kingdom (In fact, in Italy the widening of higher education has raised the general unemployment rate.)

As noted earlier, inter-country differences in the slope of the wage curve matter, so the determinants of this slope constitute a distinct set of country-specific factors. Theory suggests that the slope of the wage curve is a function of unemployment benefits and public expenditures that substitute for private consumption, among other things. (Layard *et al.*, 1991; Zoega, 1997.) Fig. 6 shows the relationship between the growth in unemployment between the period 1965-73 and the period 1986-95, on the one hand, and the average level of social expenditures as a ratio to GDP in the period 1965-73.[8] A clear upward-sloping relationship is visible.

In Section 1 we mentioned that expected firing costs should reduce the hire rate in the quitting model. If the global downturns of the 1970s and the 1980s reduced labour demand proportionately more in those countries with the highest firing costs, employment would have fallen more in those countries on that account. As shown by Koedijk and Kremers (1996), it is clear that while some of the countries with the biggest rise in unemployment

[7] We would like to thank Brian Bell for providing us with these data.

[8] We do not use any later data for social expenditures as these are affected by changes in the unemployment rate.

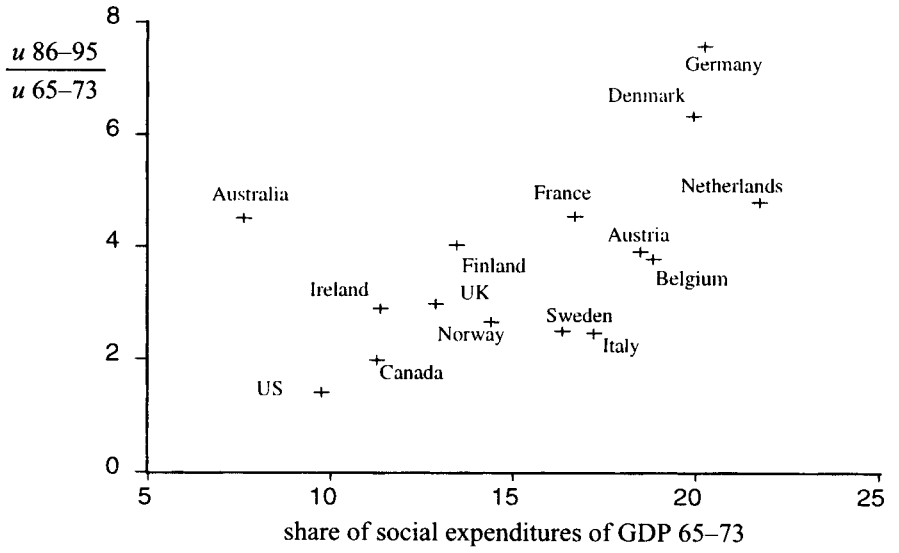

Fig. 6. *Growth in Unemployment and the Level of Social Expenditures*

also have severe protection, there are exceptions. Thus Italy and Portugal rank high on the protection scale but perform relatively well in terms of growth in unemployment, while Denmark has little protection but serious unemployment growth. It is not surprising that such institutional factors appear to be important.

Since the early 1990s a recovery has begun in the United States, the United Kingdom, and Scandinavia, and the recovery emerging earlier in the Netherlands has continued. Our theoretical perspective leads us to attribute an important part of this recovery to the notable decline of world real interest rates between, say, 1992 and the present writing (autumn 1997). Two other factors have been imparting a downward trend to the natural rate in some of the recovering economies, at least the United States and the United Kingdom. Private wealth shows evidence of adjusting to the reduced levels of wage rates and the lower employment levels that prevailed earlier, and this development has brought moderation to the wage curve. The other trend factor is the scramble up the education ladder which, while having no estimated effect of statistical significance on within-group unemployment rates, has operated to pull down strongly the average unemployment rate, notably in the United States and to a lesser extent in the United Kingdom too.

We recognise that there is another element in the recovery amidst deepening recession in Europe since the early 1990s: The periphery, consisting of Scandinavia, the Netherlands and the United Kingdom, were recipients of a real depreciation early in the 1990s, while the core of the continent, particularly Germany and France, have been at the other end of the see-saw, experiencing a steep real appreciation. Conceivably this phenomenon is to some degree further grist for our non-monetary mill – though just how that

interpretation could be elaborated is unclear to us now. However, it is plausible that part of the latter exchange appreciation is the result of tight-money policies in Germany and France, which have acted to dampen employment there while boosting employment in the periphery. (A sort of 'peso problem' may have operated to block the price-wage adjustments that would have restored interest rates or else a sequence of tightenings may have reinstituted higher interest rates whenever price-wage adjustments threatened to erase them.) But we do think we see signs of at least a partial recovery of employment in a great many OECD countries. And such a partial recovery would conform well with our endogenous natural-rate theory.

3. A Look at U.K. Data

As an illustrative single-country exercise we estimate with U.K. data the following equation, which can be derived from a price-setting curve (such as equation (A3) of the appendix,) and an equilibrium wage curve (such as equation (A5).) The equation shows changes in the rate of wage inflation as a function of the log of the unemployment rate, the proportional change in employment and shifts of the two curves:

$$\Delta^2 w_t = \alpha_0 + \alpha_1 \log(u_t) + \alpha_2 \Delta \log(100 - u_t) + \alpha_3(\Delta^2 w_t - \Delta^2 p_t) + \boldsymbol{\alpha}_4 \mathbf{X}_t + \varepsilon_t \quad (1)$$

The operator Δ denotes the difference between the current quarter and the same quarter next year, w is the log of the nominal wage, p the log of prices, and $\mathbf{X}$ is a vector of variables affecting the position of the price-wage curve and of the (equilibrium) wage curve.

Equation (1) is essentially an augmented-Phillips curve which is allowed to shift over time in response to changes in the fundamentals of the natural rate, contained in vector $\mathbf{X}$. The real-wage change term is a proxy for the ratio of the expected real wage to the actual real wage. The lower the money wage is relative to the expected money wage, the farther below the wage curve is the current wage-employment point and so the more the money wage must be increased to achieve the optimal incentive wage; and the higher the price level relative to the expected price level, the farther above the firms' supply-price schedule is the current price-output point and so the more must prices be cut to achieve the desired attraction of customers. So the size of the increase in the ratio of wages to prices is an increasing function of the ratio of the 'expected real wage' (meaning here the ratio of the expected wage to expected prices) to the actual real wage.

In the vector $\mathbf{X}$ we include the world real rate of interest, r^*, and also the real price of oil, p^{oil}. In addition we have two measures of the extent of the welfare state. One is y^{wel}, which is the ratio of public spending on welfare programs to GDP, and the other is y^{ni}, which is the sum of workers' and firms' contribution to the national insurance fund as a proportion of total disposable income. We then include a measure of personal wealth (excluding stocks and bonds) as a ratio to GDP, a, which includes housing wealth, occupational and

personal pension schemes and consumer durable assets.[9] Finally, we include the rate of growth of the labour force as this has been shown to affect the natural rate in Phelps (1968); in steady state a higher rate of labour force growth requires a higher hire rate which can only come about at lower wages (higher unemployment.)

The estimation results from quarterly data 1966.1-1995.3 are shown in Table 1. We first estimate the equation with all elements of vector **X** omitted. This is the first line of the table. As expected, the unemployment rate has a significantly negative coefficient, implying that wage inflation is less likely to accelerate at higher unemployment rates. Also, the proportional change in the employment rate has a positive sign implying that the more rapid is a recovery, the more likely it is that inflation will pick up.

We then add the world real interest rate to the equation.[10] The real rate of interest has a positive and statistically significant coefficient. The same applies to the real price of oil which is added in line 3. These results are unsurprising in light of Fig. 1.

The social spending variable, y^{wel}, rises from around 11% in 1966 to around 24% in 1990. It has a positive and significant coefficient. The tax variable, y^{ni}, rose in the 1960s and 1970s to reach a plateau in the 1980s and has come down somewhat since the mid-1980s. This variable also has a positive and significant coefficient. However, while we are confident of the robustness of the estimates of the coefficient of real interest rates and oil prices, the last two coefficients are probably not as robust as they may only capture the general upward drift of the unemployment rate since the mid-1960s.

We now add our wealth measure, a, to the equation. This variable appears to be collinear with social spending and makes the latter insignificant while having a significantly positive coefficient itself.

Finally, we add the rate of growth of the labour force from the current quarter to the same quarter next year on the theory that if there are rising marginal hiring costs the general level of employment can continue to match that of a faster growing labour force only if the level of the unemployment rate is increased. If the unemployment rate were not increased, firms pass along the increased hiring costs in the form of lower wages which moves the economy down its wage curve hence generating unemployment. This variable turns out to have an insignificant coefficient. Another variable which turned out to be insignificant, and is omitted from Table 1 due to space limitations, was the rate of income taxes (defined as the ratio of direct taxes to total household income). This comes as no surprise as personal income taxes fell in the early 1980s when unemployment was rising. We were also not able to find any sign of the effect of a productivity growth slowdown by testing for a change in the constant term of the equation between the quarters preceding 1974 and the period after.

[9] We did not include the stock of financial assets as the more unemployment prone workers are not likely to hold much wealth in that form.

[10] The most significant lag of the variables in vector **X** is included in the final results – assuming all lags have the same sign. The most significant lag of the real rate of interest was the variable lagged eight quarters. Similarly, social security contributions are lagged seven quarters. None of the remaining variables was lagged.

Table 1

Least-squares estimation results for equation (1).

log (u)	$\Delta \log (1-u)$	$(\Delta^2 w - \Delta^2 p)$	r^*	p^{oil}	y^{wel}	y^{ni}	a	$\Delta \log N$	R^2	DW	F	log.lik
−0.02	1.18	0.47							0.27	0.38	14.23	217.8
(−3.48)	(3.97)	(5.00)										
−0.04	0.74	0.44	0.81						0.33	0.46	12.95	209.8
(−5.49)	(2.49)	(4.51)	(3.90)									
−0.06	1.18	0.42	1.01	0.02					0.36	0.46	11.63	212.2
(−5.79)	(3.35)	(4.46)	(4.53)	(2.21)								
−0.14	2.14	0.45	0.92	0.04	0.99				0.41	0.49	10.22	181.1
(−4.68)	(4.19)	(4.48)	(3.54)	(2.85)	(2.53)							
−0.08	1.22	0.45	1.02	0.02		2.01			0.40	0.48	11.54	216.1
(−6.63)	(3.60)	(4.93)	(4.74)	(2.27)		(2.98)						
−0.11	2.02	0.46	1.08	0.07	−0.04		0.04		0.44	0.52	9.89	183.8
(−3.53)	(4.05)	(4.72)	(4.13)	(3.76)	(−0.06)		(2.36)					
−0.10	1.72	0.47	0.99	0.05		1.30	0.03		0.44	0.50	11.25	212.6
(−7.06)	(4.45)	(5.20)	(4.62)	(3.52)		(1.74)	(2.44)					
−0.10	1.78	0.47	1.01	0.05		1.37	0.03	−0.15	0.44	0.49	9.87	212.9
(−6.84)	(4.03)	(5.21)	(4.50)	(3.33)		(1.74)	(2.37)	(−0.28)				

4. Tests for Hysteresis or High-level Persistence

While it is relatively easy to come up with empirical results supportive of a moving natural-rate view, this is also the case for the hysteresis, or persistence, approach. If one omits all or most of the permanent non-monetary shocks to the natural rate, the slowness of the adjustment to the original steady state can only be attributed to persistence. This is the approach of Layard *et al.* (1991) and Henry and Snower (1996). The question arises how one can discriminate between these two basic views, how one can test one against the other.

Equation (2) below represents both approaches. We write unemployment as a function of its natural rate, u^*, and a lagged value of itself, in addition to a random error which measures transitory shocks. Moreover, we allow the natural rate to change over time. In particular, we imagine there to be distinct states of the world, S_j, which differ in respect to the value taken by the natural rate; $u^*(S_j)$.

$$u_t = u_t{}^*(S_j) + \beta[u_{t-1} - u^*{}_t(S_j)] + \eta_t, \beta \geq 0, \eta_t \sim \text{iid}(0, \sigma_j{}^2). \qquad (2)$$

The medium term movements in unemployment are caused by changes – possibly infrequent – in the mean unemployment rate (the natural rate of unemployment.)[11] While adjustment is certainly not considered to be instantaneous (β can be strictly positive) it is not slow adjustment that explains persistently high unemployment, but a high value of u^*. In contrast, according to the hysteresis/persistence approach, it is the slow adjustment, to a (approximately) constant natural rate, which is the problem. Here the focus is on the value taken by the coefficient β and on its determinants. Social institutions, such as the unemployment benefit system, the structure of labour market bargaining, labour market regulations etc, play a key role in this regard.

An econometric model such as that described in (2) has by now been estimated for different countries and time periods (see Bianchi and Zoega, 1997*a,b*; Ghiblawi and Pappel, 1997). The Markov switching model (MSR) is used to detect the timing of the mean shifts, and a bootstrap test can be used to test how much persistence is left once the mean shifts have been removed from the series, as measured by the coefficient estimate β. A basic finding of these papers is that for most OECD countries, the data seem consistent with infrequent shifts in mean unemployment, and estimates of β which sum to a number considerably less than 1.[12] This implies that unemployment is stationary around a shifting mean. When this model is tested against the alternative of a unit root process with a constant mean, the unit-root hypothesis is resoundingly rejected.

As a representative result, we have estimated the model for the United Kingdom using annual data for the period 1921-96. Visual inspection of the

[11] This abstracts from any small vibrations and any drift of the shock variables, and from the slow adjustment of the state variables.

[12] The exceptions are France, Italy and Spain. In these countries unemployment has drifted upwards over time in a manner which makes our shifting-mean-value model inappropriate.

series implies the existence of two states; a state of high unemployment and a state of low unemployment. In Table 2 below, we report the estimated means in the two states and the variance of unemployment in each state, in addition to the results of a Chow F-test for equality of the means across states.

We have found that in the high unemployment state, unemployment averaged 8.90%, while in the low unemployment state the average was 1.57%. We also see that the estimated variance was much higher in the high unemployment state. Finally, the hypothesis of equality of means across the two states is rejected.

The dating of regime changes is reported in Table 3, and also the sum of significant coefficients in an autoregressive process (our measure of persistence) estimated from the raw data, B, and from the series when the shifting means have been removed, B'. Columns 2 and 3 have the confidence interval for the estimate B', which we can compare with the value of B.[13] The last column has the results of a Chow test for state independent autoregressive parameters.

The 1920s and 1930s were a period of high unemployment but between 1939 and 1940 we moved to a state of low unemployment which lasted until 1975, when unemployment rose to its current high equilibrium.

The question arises how much of the observed persistence of unemployment can be explained by these two shifts in mean unemployment. The raw series gives $B = 0.90$, while the series with the mean shifts removed gives $B' = 0.65$,

Table 2

Parameter estimates in the MSR model

m^*	n^*	$\hat{u}^*(S_t)$		$\hat{\sigma}^2(S_t)$		log.-lik.	p-value
2	2	1.57	8.90	0.48	9.03	−77.95	0.00
		(0.12)	(0.48)	(0.12)	(2.06)		

The last column reports the p-value from a Chow-test for the mean parameter of an autoregressive model. Standard errors in parentheses. m is the number of states in unemployment and n is the number of mean shifts in the unemployment series.

Table 3

Dating of Mean Shifts in U.K. Unemployment and Measures of Persistence

Dates	persistence and bootstrap confidence intervals				p-value
	Lower	Upper	B'	B	
1939–1975+	0.35	0.79	0.65 (2)	0.90 (2)	0.86

A plus/minus-sign following the date of a mean shift implies the direction of the shift. The number in parentheses following the value of B (B') shows the number of lagged terms included. The last column reports the p-value from a Chow-test for the equality of the coefficients of lagged unemployment (from the residual series) in the two states.

[13] The confidence intervals were obtained by bootstrapping the errors of an AR(2) model fitted to the residual (i.e. actual minus local means) unemployment series. Number of bootstrap replications, B = 10000.

with a 95% confidence interval of 0.35 and 0.79. We can thus say that persistence is reduced 95 times in an experiment which is conducted 100 times. Moreover, the value of B' implies fairly rapid mean reversion. Thus if unemployment is 100 basis points, or 1%, above its steady state, it would take just over 3 years for it to be less than 30 basis points, or 0.1%, above steady state.

Finally, the last column tests for the equality of coefficients of lagged unemployment (from the residual series) in the two states. We cannot reject equality but the high-unemployment state does have a higher point estimate.

These results suggest that the unemployment problem may often be described as a shift in mean unemployment rather than high persistence. It is striking that the 1920s and 1930s were a period of high unemployment, the 1950s and 1960s a period of low unemployment, and the 1970s and 1980s again a period of high unemployment.

5. Conclusions

The question we have examined is what can explain the move from one epoch to another. In section 1 we suggested that changes in energy prices and world real interest rates were both admissible causes because the timing of the shifts in these two series coincided with or preceded the move to a higher unemployment epoch in so many of the OECD countries. We also pointed out several other possibilities – a productivity growth slowdown in the mid 1970s, which remains in effect especially on the Continent, and increased technological bias against less educated workers in the 1980s. The escalation of tax rates on labour in the 1960s and 1970s appear to have had an important but a transitory effect.

In contrast, we are not sympathetic to high persistence as a general explanation of high-unemployment epochs. This is simply because, as we saw from the estimation of (2), the lags cannot explain the shifts in mean unemployment. Another way of phrasing this is to say that certain changes in unemployment persist, others do not. In the United Kingdom, the rise in unemployment in the mid 1970s, and then the rise in the early 1980s, did persist for a long time, but the fall in the late 1980s did not. Moreover, the current recovery from the recession of the early 1990s seems to be feasible without rising inflation – persistence does not appear to be a problem.

For hysteresis/high persistence to be a credible alternative, its proponents have to explain under what conditions it is likely to arise. At a minimum, they have to explain how nonlinear path dependence arises (how deep recessions cause longer departures from the natural rate than the more shallow ones) and show evidence that such a mechanism is strong enough in some countries to send up unemployment rates into double digit territory while not in other countries and in other times.

Columbia University

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Appendix 1

Definition of Variables and Sources of the Data

u The rate of unemployment in the United Kingdom (%), measured by the United Kingdom Department of Employment's consistent series. Source: Datastream.
Historical unemployment data was taken from: C. H. Feinstein, *Statistical Tables of National Income, Expenditure and Output of the U.K. 1855-1965*, Cambridge: Cambridge University Press.
In combining series from different sources, preference was given to the data reported in the more recent source, and the two series then spliced together by using the earliest possible common data point.

r^* The world real rate of interest (decimals). Measured as the weighted average of real interest rates in the G7. The nominal rates are the yield on long-term government bonds and the inflation expectations are measured as the average of (GDP-deflator) inflation in the previous and following four quarters. The weights used are Summers and Heston GDP figures. Source: IMF-IFS.

W Nominal weekly average earnings (production industries) in United Kingdom. Source: Datastream. Wage inflation is measured in decimals.

P GDP deflator in United Kingdom. Source: IMF-IFS. Price inflation is measured in decimals.

P^{oil} The real price of oil. This is the ratio of the dollar price of crude oil and the GDP deflator for the U.S.(base year is 1990). Source: Datastream.

y^{ni} U.K. national insurance, health and redundancy pay fund contributions as a proportion of total (pre-tax) personal income (decimals). This includes both employers' and employees' contributions. Source: Datastream.

y^{wel} Total spending on social programmes in United Kingdom as a ratio to GDP (decimals). Source: OECD.

a The sum of housing wealth, consumer durable assets, occupational pension wealth and personal pension wealth as a proportion to GDP (decimals). Source: Blake and Orszag (1996).

N Total workforce. Source: Datastream. Labour force growth is written in decimals.

Appendix 2

A stylised version of one of intertemporal-equilibrium models may aid understanding. We choose the quitting model and the case of constant hiring costs. All goods are costlessly tradeable in perfect markets so the real exchange rate is a constant, say 1, and the domestic interest rate is given by the world real interest rate r^*. The key asset of the firm is its stock of functional employees – those readied by the firm-specific familiarisation and orientation called 'training'.[14]

The rate at which the employees depreciate is the sum of the exponential mortality rate, θ, plus the quit rate, ζ, which is given by a function $\zeta\,[v^e(1-u)/v,\ y^w/v]$ involving the unemployment rate, u, the actual wage, v, relative to the expected wage, v^e, and relative to income from wealth, y^W. The current discount rate is $r^* - \lambda + \zeta + \theta$, where λ is the rate of productivity growth. (Firms investing in additional trained employees have to expect to cover the interest *minus* the steady appreciation in the value of

[14] Yet the firms may lease and airlift equipment, the amount denoted K, from home or overseas so as to equate its marginal product to the world real interest rate, that is, $F_K\ (K, \Lambda N) = r^*$, where N is the number employed out of a fixed labour force N and Λ the current level of labour augmentation. An employee's product after interest and depreciation on 'his' equipment is $\Lambda\ [F(K/\Lambda N, 1) - (r^* + \delta)K/(\Lambda N)]$, which is given by Λ and r^*.

employees arising from their growing productivity.) From the basic arbitrage relation between the price of the asset, q, its yield including expected capital gain, and the interest rate, we have

$$q = (\Lambda - v + \mathrm{d}q/\mathrm{d}t^e)/\{\zeta[v^e(1-u)/v,\ y^W/v] + \theta + r^* - \lambda\}. \tag{A1}$$

The expected capital gain term adjusts current earnings for the extent to which they are expected to be temporarily above or below future levels. Since quitting is increasing in $1-u$ and y^W, q must be decreasing in those variables. So there is a downward sloping schedule relating q to $1-u$, given y^W and v. We do not know how firms will sort out how to divide up an expansion or contraction among them. But suppose there is a tendency for aggregate expansion (contraction) to the point where $1-u$ makes q equal to the asset's reproduction cost; this is the opportunity cost of diverting the β employees from production to training, each of whom would have produced Λ. This would be the case if there is a tendency for capital-market equilibrium in the sense of $\mathrm{d}q/\mathrm{d}t = (\mathrm{d}q/\mathrm{d}t)^e$.

$$q = \beta\Lambda. \tag{A2}$$

Then $1-u$ tends to a path satisfying (A1) and (A2). For labour-market equilibrium we have $v = v^e$. So, conditional on the path of wealth and wage, the equilibrium unemployment path satisfies

$$v/\Lambda = 1 - \beta[\zeta(1-u,\ y^W/v) + \theta + r^* - \lambda]. \tag{A3}$$

Another building block is the incentive-pay level minimising cost. The cost per employee of paying a dollar more in annual wages is one. The cost saving, or benefit, per employee of doing so is the opportunity cost of replacing each defector, $\beta\Lambda$, times the number of annual quits per employee that would be saved. Equating these two yields a wage curve *indexed* by a given v^e:

$$1 = \beta\Lambda\{[v^e(1-u)/v^2]\zeta_1 + (y^W/v^2)\zeta_2\}. \tag{A4}$$

Rewriting and using $v = v^e$ yields the equilibrium wage curve,

$$v/\Lambda = \beta[(1-u)\zeta_1(1-u,\ y^W/v) + (y^W/v)\zeta_2(1-u,\ y^W/v)]. \tag{A5}$$

This wage curve slopes upward with employment and shifts up with an increase in the nonwage-income-to-wage ratio.

Finally, the open-economy model is closed with a wealth-accumulation motive that drives y^W. We have generally drawn on the Yaari-Blanchard set-up. The resulting equation with (A3) and (A5) describe the general-equilibrium path.

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UNEMPLOYMENT: QUESTIONS AND SOME ANSWERS*

Stephen Nickell

In more or less every country in the OECD, unemployment was lower in the decades following the second world war than in any other period of comparable length, either before or since. For example, in Britain unemployment has exceeded 5% in every peacetime decade from 1850 onwards except for the 1950s and 1960s. Alternatively, as we can see in Table 1 (p. 779), average unemployment in the 1980s and 90s is higher, generally much higher, than in the 1960s in every country considered. Why this is so is one of the questions which underlies this paper. A second question, which is also illustrated in the unemployment numbers presented in Table 1 (p. 779), concerns the causes of the enormous variation in unemployment rates across the OECD countries?

As we shall see, these are difficult questions. The first, in particular, is one for which we do not have a complete answer. By this, I do not mean that we do not have theories which are broadly consistent with these numbers. In fact, we have theories consistent with more or less any numbers. What we lack is a satisfactory empirical explanation of the time series pattern of OECD unemployment. In what follows, we remain focused on these two questions, first considering the theoretical background and then looking at some possible answers. We finish with some speculative conjectures on the first question.

1. Theoretical Background

Our purpose here is to present an analytical framework which is general enough to illustrate the important issues, without being too complicated. So we take a simple, closed economy log-linear model and abstract from trend growth.

1.1. *A Simple Model of Unemployment*

We start with two equations which are common to more or less all macroeconomic models, namely

aggregate demand: $$y = \sigma_1(x_n - p) + \sigma_2 x_r, \tag{1}$$

production (Okun's law): $$u = -\omega y, \tag{2}$$

where y = real GDP, x_n = exogenous nominal demand factors, x_r = exogen-

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