WHAT WE KNOW AND DO NOT KNOW ABOUT
THE NATURAL RATE OF UNEMPLOYMENT

Olivier Blanchard
Lawrence F. Katz

WHAT WE KNOW AND DO NOT KNOW ABOUT
THE NATURAL RATE OF UNEMPLOYMENT
Olivier Blanchard and Lawrence F. Katz
NBER Working Paper 5822
November 1996
JEL Nos. E20, E30, J60
Economic Fluctuations and Growth, Labor Studies

ABSTRACT

Over the past three decades, a large amount of research has attempted to identify the determinants of the natural rate of unemployment. It is this body of work we assess in this paper. We reach two main conclusions. First, there has been considerable theoretical progress over the past 30 years. A framework has emerged. We present it, and show how it can be used to think for example about the relation between technological progress and unemployment. Second, empirical knowledge lags behind. Economists do not have a good quantitative understanding of the determinants of the natural rate, either across time or across countries. We look at two issues, the relation of wages to unemployment, and the rise of European unemployment.

Olivier Blanchard
Department of Economics, E52-252
Massachusetts Institute of Technology
Cambridge, MA 02139
and NBER
blanchar@mit.edu

Lawrence F. Katz
Department of Economics
Harvard University
Cambridge, MA 02138
and NBER
katz@nber.harvard.edu

Almost 30 years ago Friedman [1968] and Phelps [1968] developed the concept of the "natural rate of unemployment." In what must be one of the longest sentences he ever wrote, Milton Friedman explained: "The natural rate of unemployment is the level which would be ground out by the Walrasian system of general equilibrium equations, provided that there is imbedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demands and supplies, the cost of gathering information about job vacancies and labor availabilities, the costs of mobility, and so on."

Over the past three decades a large amount of research has attempted to formalize Friedman's long sentence and to identify, both theoretically and empirically, the determinants of the natural rate. It is this body of work we assess in this paper. We reach two main conclusions.

The first is that there has been considerable theoretical progress over the past 30 years. A framework has emerged, organized around two central ideas. The first is that the labor market is a market with a high level of traffic, with large flows of workers who have either lost their jobs or are looking for better ones. This, by itself implies that there must be some "frictional unemployment." The second is that the nature of relations between firms and workers leads to wage setting which often differs substantially from competitive wage setting. This in turn is likely to result in a level of unemployment which differs from the efficient frictional level. We present this framework in Section 1. We take it through its paces in Section 2, showing how it helps think about the complex relation between technological

progress and the natural rate.

The second conclusion however is that empirical knowledge sadly lags behind. Economists are a long way from having a good quantitative understanding of the determinants of the natural rate, either across time or across countries. We review in Section 3 the standard equations used in empirical macroeconomic models to characterize the natural rate. We then take up two issues. Following the work of Blanchflower and Oswald [1995], the first is known as the issue of the "wage curve" versus the "Phillips curve": it is about the form of the dynamic relation between wages and unemployment. Far from an esoteric issue, it has major implications for which variables do or do not affect the natural rate. Yet, we argue in Section 4, the empirical evidence is far from settled. The second issue is the rise in European unemployment since the 1970s. The magnitude of the increase, the diversity of labor market institutions and of policies should have helped identify culprits. Yet, we argue in Section 5, while many suspects have been identified, none has been convicted.

We believe that progress can come from a better integration of the empirical work pursued by labor economists with some of the work developed by macroeconomists, and we end up with a plea for such joint work.

1 Thinking about the Natural Rate

1.1 Flows

The labor market in advanced economies is in a constant state of flux: some firms are expanding employment, others are reducing it. Firms are constantly chang-

ing their mix of positions, laying off some workers and hiring new ones. Workers quit in search of better opportunities, forcing firms to find replacements.[1] In the United States, flows of workers to or from employment are each equal to roughly 3 percent of employment per month, with about half of these flows coming from or going to unemployment, and the other half coming from or going to "out of the labor force."[2]

Such a volume of traffic clearly implies some frictional unemployment. But there is no reason in general to expect that the natural rate will be equal to the efficient, frictional, level. Even leaving aside standard distortions such as unemployment benefits or taxes on labor income, wages are unlikely to be set in such a way as to generate the efficient level of unemployment.

1.2 Wage Setting

Three main approaches have been followed to think about wage determination.

The first has focused on the fact that, by the very nature of the labor market, both workers and firms typically have some bargaining power. The bargaining power of workers stems from the fact that they cannot be costlessly and instantaneously replaced. The bargaining power of firms arises because most workers cannot cost-lessly and instantaneously locate an equivalent job. Taking this as a starting point, the *matching approach*, following in particular Diamond [1982] and Pissarides [1990], has formalized wage determination as the result of bargaining (typically bilateral Nash bargaining) between each worker and each firm. This approach has delivered a number of important insights.[3]

In a depressed labor market, knowing that finding another job is likely to be dif-

ficult, workers will be willing to settle for a lower wage. The bargained wage will therefore be low, close to the workers' reservation wage (that is, the wage which makes a worker indifferent to being employed or unemployed). Conversely, in tight labor markets, the bargained wage will be much higher than the reservation wage. Thus, even if the reservation wage is constant, the wage will vary with labor market conditions.

The right measure of the state of the labor market is the exit rate from unemployment, defined as the number of hires divided by the number unemployed, than the unemployment rate itself. What matters to the unemployed is not how many of them there are, but how many of them there are in relation to the number of hires by firms.

Factors which affect the pace of reallocation, the matching process of workers and jobs, or the nature of bargaining will all affect wage determination. For example, at a given unemployment rate, increases in "churning"—increases in the flows of separations and hires by firms— will lead to an increase in the exit rate from unemployment and thus lead to an increase in the wage. To take another example, restrictions on firing, which partially insulate incumbent workers from wage pressure from the unemployed, will likely lead to a higher wage and decrease the role of labor market conditions in wage determination.

The second approach has focused instead on the complexity of transactions between firms and workers, and their implications for wage setting. The starting point of the *efficiency wage approach* is that wages affect productivity. It follows that firms may want to pay workers more than their reservation wage in order to get and to keep better workers, to economize on turnover costs, or to motivate

greater effort and cooperation from their work force (Katz [1986]).

Efficiency wage models imply that factors such as the organization of firms (and thus the nature of internal labor markets) and the nature of jobs (for example, the extent to which firms must trust workers to do the job right) potentially affect wage setting, and through it, affect the natural rate of unemployment.

Specific theories range from those with a strong neo-classical flavor such as Shapiro and Stiglitz [1984]) to those which emphasize fuzzier (but not necessarily less relevant) notions such as fairness (Akerlof and Yellen [1990]). At the more neoclassical end, the "shirking" model of Shapiro and Stiglitz leads to a wage relation in which the tighter the labor market —that is, the higher the exit rate from unemployment— the higher is the wage the firms have to pay to prevent shirking, an implication similar to that of matching models. At the other end, models based on fairness suggest that the reservation wage may depend on factors such as the level and the rate of growth of wages in the past, if workers have come to consider such wage increases as fair. Perhaps a better word than "reservation wage" in that context is "aspiration wage", a word which sometimes appears in the literature (e.g., Oswald [1986]).

The third approach, known as the *competitive approach* has emphasized that some unemployment is simply due to poor labor market opportunities. Especially at the bottom end of the skill distribution, workers have little or no bargaining power because they can be replaced easily. Efficiency wage considerations may also play much less of a role as many jobs are routine and differences in worker quality make less of a difference. In this case, how many unskilled workers want to work may simply depend on their reservation wages relative to their labor market

opportunities. If labor opportunities are poor, unskilled workers will simply prefer not to work, or at least not to work all the time.

This approach suggests that the right measure of labor market conditions, at least for those in the low-wage labor market, may not be the unemployment rate, but rather the non-employment rate. People facing poor opportunities relative to their reservation wages are likely to spend some of their time in and out of employment. During periods in which they are out of work, they may charac- terize themselves in household surveys as unemployed or out of the labor force, depending on the nature of the unemployment benefits system (Card and Riddell [1993]), but the distinction may be of little economic significance.

1.3 A Graphical Representation

The theories of wage determination we have just sketched differ in many ways. But they all have in common a basic implication: The tighter the labor market, the higher the real wage given the reservation wage. We write this relation as:

$$\frac{W}{P} = B\ g(u, X_s)\ ;\quad g_u < 0$$

where W is the nominal wage, P the price level, so that W/P is the real wage, B is the (real) reservation wage, u is the unemployment rate, and X_s includes all the factors which affect wage determination. This relation should be tailored to fit each theory. For example, as we saw earlier the labor market variable sug- gested by matching models is the exit rate from unemployment rather than the unemployment rate itself. Under the competitive approach, the correct variable is non-employment rather than unemployment. We shall treat the unemploy-
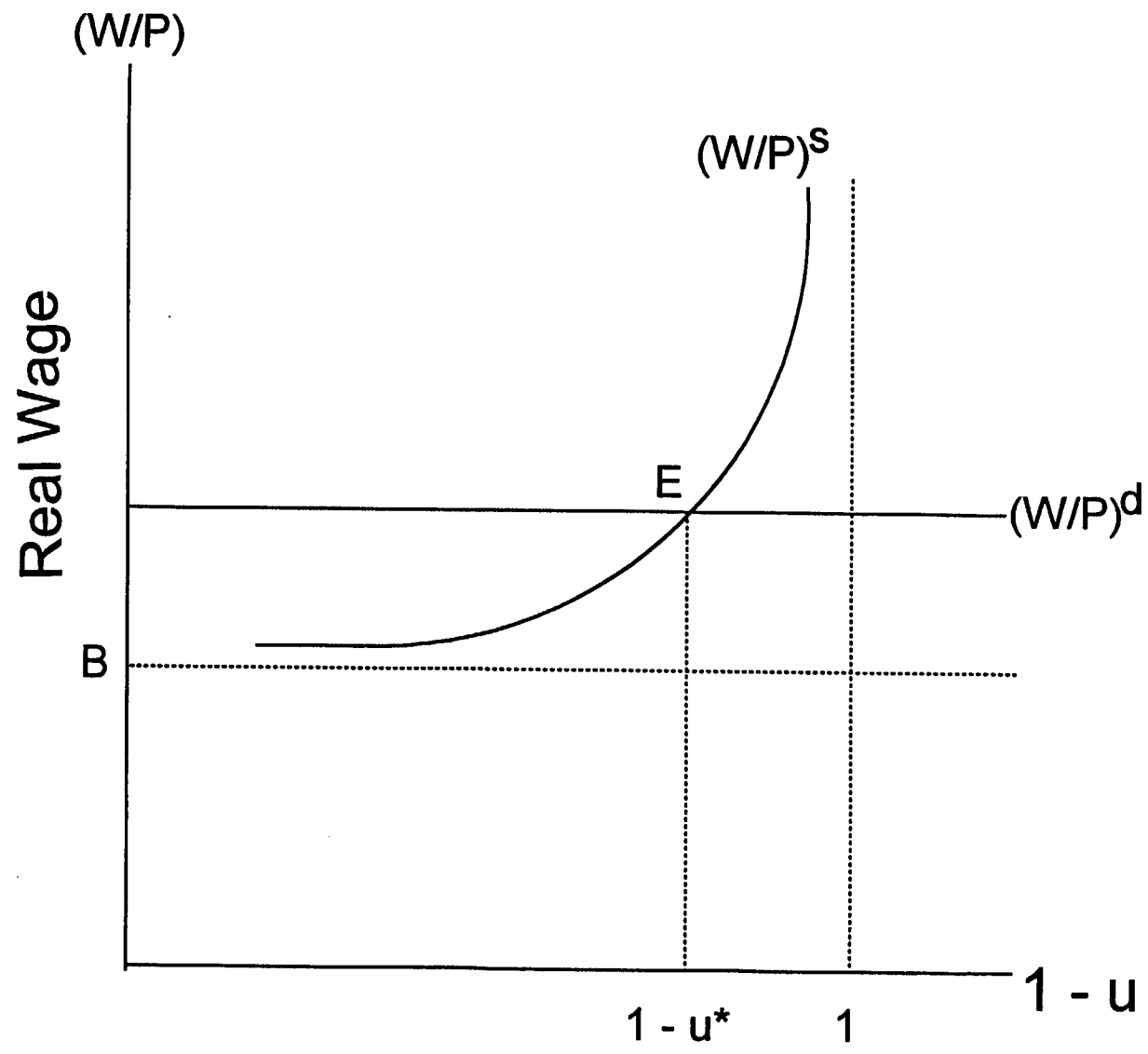
Figure 1

ment rate as a stand-in for the relevant labor market variable and ignore these differences here.

We call the wage implied by this equation the "supply wage", and this relation "the supply wage relation". We draw it as the upward sloping curve $(W/P)^s$ in Figure 1, which has the real wage on the vertical axis, and one minus the unemployment rate on the horizontal axis.

Turn now to the real wage consistent with the employment decisions of firms. If we focus for simplicity on the medium run, that is the run over which firms can adjust all factors of production including capital, we can think of the real wage paid by firms as independent of the level of employment (equivalently, the unemployment rate). We write this real wage as:

$$\frac{W}{P} = A \, f(X_d)$$

where A measures the level of total factor productivity (under the assumption of Harrod neutral technological progress) and X_d includes all the other factors which affect the real wage set by firms.

The simplest interpretation of this relation is as a long-run labor demand curve, giving the real wage consistent with other input prices and the condition that firms make zero pure profit. In this case, the function $f(.)$ reflects the character-istics of the production function. X_d includes input prices, including the interest rate, as well as any factor which reduces the wage firms can pay, such as payroll taxes. But a similar looking relation holds even when firms operate in noncom-petitive goods markets. In that case however, the function $f(.)$ reflects not only

the technology of firms, but also the behavior of markups of price over marginal cost. The higher the markup, the higher the price of goods given the wage, the lower the real wage paid by firms.

We call the real wage given by this equation the "demand wage" and the equation the "demand wage relation". The demand wage relation is represented by the horizontal line $(W/P)^d$ in Figure 1.

The natural rate of unemployment is the rate at which the supply wage and the demand wage are equal. The equilibrium is given by point E, with associated unemployment rate, u^*, in Figure 1. Or in terms of our two equations, the natural rate is such that:

$$g(u^*, X_s) = \frac{A}{B} f(X_d)$$

The natural rate of unemployment depends on the level of productivity in re- lation to the reservation wage, as well as all the factors which affect either the supply or the demand wage.[4]

2 The Natural Rate in a Changing World

Discussing all the determinants of the natural rate would take us too far. To show how the framework above can shed light on a number of current debates, we focus on one theme, the effects of technological progress on the natural rate.

2.1 "Pure" Productivity Growth and the Natural Rate

Start with a simple fact. Unemployment rates viewed over the very long run – for example, over the past century – appear be untrended in most nations (Layard et al. [1991]), despite tremendous increases in productivity. Thus, any model should satisfy the condition that there is no long run effect of the level of productivity on the natural rate of unemployment.

What restrictions does this impose on the framework we developed earlier? Return to Figure 1. An increase in productivity —an increase in A— leads to a proportional increase in the demand wage and thus an upward shift in the demand wage relation $(W/P)^d$. When will such an increase in the wage leave the natural rate unaffected? Only if the reservation wage increases in line with the real wage, leading to an upward shift in the supply wage relation $(W/P)^s$ which offsets the effect of the shift in the demand wage relation on the unemployment rate. If this is the case, an increase in the level of productivity will lead to a proportional increase in the real wage, but will not affect the natural rate.

Is this condition likely to be satisfied? The answer is yes. To see why requires a closer look at the determinants of the reservation wage.

The reservation wage depends first on what the unemployed do with their time, what we often call the utility of leisure but may also include a number of non-market activities, including working in the grey and black economy. A plausible benchmark is that increases in productivity affect market and non-market activities in roughly the same way. If this is the case, this component of the reservation wage will move in line with the real wage (a point made by Phelps [1994]).

The reservation wage depends on the various types of income support the un-

employed can expect to receive if unemployed, from unemployment benefits to other social insurance programs, to intra-family insurance. Again, a plausible benchmark is that all these increase roughly in line with wages and thus with productivity. In the United States, the ratio of average weekly unemployment benefits to average weekly wages (for workers covered by unemployment insurance) has been quite stable over the last 50 years (Advisory Council on Unemployment Compensation (ACUC) [1994]). Other social insurance components are not automatically linked to wages, but, at least for the last 50 years, they have also roughly increased in line with wages.

The reservation wage depends on non-labor income and access to credit. How desperate the unemployed are to work, and thus how low a wage they are willing to accept depends not only on the availability of income support, but also on whether they can draw on their assets, or borrow against the future. Here again, a plausible benchmark is that an increase in productivity leads to equal increases in labor and non labor income, thus again leaving the ratio of the wage to the reservation wage roughly unaffected.

We have relied so far on the narrow interpretation of the reservation wage, namely as the wage which made workers indifferent to working or not working. As we saw earlier, reservation wages may embody workers' aspirations as well as hard realities. Under that interpretation, all which is required for changes in productivity not to affect the natural rate in the long run is that aspirations eventually adjust to reality, that workers in Portugal for example do not hold out for German wages. Whatever exact content we give to the notion of aspiration wages, this appears to be a mild requirement, also likely to be satisfied.

To summarize, the conditions which deliver long-run neutrality of the natural rate to changes in productivity need not hold as a matter of logic, but they all appear plausible. The discussion makes clear that long-run neutrality does not preclude dynamic effects of changes in productivity, or—more realistically, in a world with positive productivity growth— of changes in the rate of productivity growth, such as we have seen since the mid 1970s. How long and how large these dynamic effects may be depends on the exact nature of the reservation wage. If, for example, reservation wages reflect primarily unemployment benefits, they are likely to adjust quickly to any change in the level or in the rate of growth of wages, and the effects of changes in productivity growth on the natural rate will be short-lived. But if reservation wages reflect primarily aspirations, the adjustment may be more drawn out. Suppose for example that the rate of productivity growth decreases. If, at a given unemployment rate, workers keep asking for wage increases corresponding to the previous, higher, rate of productivity growth, lower productivity growth will lead to a higher natural rate until aspirations have adjusted to the new realities.

2.2 Technological Progress, Structural Change, and the Natural Rate

We have considered so far a very rarefied form of technological progress, one which affected productivity but did not affect the organization of production in any other way. Technological progress has many more dimensions, and these are also relevant to the determination of the natural rate.

Technological progress comes with structural change. Increases in the pace of technological progress are likely to come with a higher pace of reallocation across jobs. To the extent that this leads to larger flows of workers in the labor market,

these will lead to a higher unemployment rate. These effects have been recently explored using matching models for example by Mortensen and Pissarides [1995]. Interestingly, while the empirical evidence remains largely unexplored, it does not suggest so far a strong relation between flows in the labor market and structural change. Perhaps the most striking piece of evidence is from Eastern Europe, where high structural change—measured, say, by the Lilien [1982] measure, the standard deviation of employment changes across sectors—has been associated with low flows in the labor market, and a nearly stagnant unemployment pool.[5]

Technological progress may be biased toward a particular group of workers, and this may in turn affect the natural rate. It is simplest here to think in terms of the competitive model, and to think of two groups of workers: the skilled and the unskilled. The unskilled are paid a wage very close to their reservation wage. The skilled are paid a wage much higher than their reservation wage. Shifts in the demand for unskilled workers imply movements along a very flat labor supply, shifts in the demand for skilled workers imply movements along a very steep labor supply. Thus, a change in technology that raises the demand for skilled workers but reduces it for unskilled workers will not have symmetric effects; instead, the rise in unemployment for the unskilled will be substantial, while the decline in unemployment for the skilled will be small. Overall, the natural rate of unemployment will increase. Juhn et al. [1991] have shown that this may help explain much of the rise in nonemployment for prime-age American males since the early 1970s.

2.3 Labor Market Rigidities, Sclerosis and the Natural Rate

Legal and administrative restrictions on layoffs are an example of the "labor market rigidities" that are often held responsible for high European unemployment. For example, the OECD (1994) Jobs Report argues that, in an environment in which structural change and adaptation of firms is increasingly important, countries with high labor market rigidities will do poorly and have higher unemployment.

Matching models provide a useful framework for assessing this argument. They suggest that firing restrictions have three separate effects. First, firing restrictions lead firms to keep some workers they would otherwise have laid-off. The result is less separations, and thus less hirings (the two must be equal in equilibrium), smaller flows in the labor market. Second, such restrictions force firms to keep at times workers they do not need, thus decreasing average productivity, and the demand wage. Third, raising the cost of firing strengthens the hand of the currently employed workers in bargaining, leading them to obtain a higher wage for given labor market conditions (for a given exit rate from unemployment).

The implications of these effects for the natural rate are shown in Figure 2. It will be more convenient here to think of the exit rate from unemployment—that is, the number of hires, H, divided by unemployment, U— as the relevant labor market variable for wage determination (as suggested by matching models). Thus the horizontal axis in Figure 2 plots the exit rate from unemployment rather than one minus the unemployment rate as in Figure 1. The curve corresponding to the supply wage relation is still upward sloping: an increase in the exit rate from unemployment leads to an increase in the supply wage. The locus corresponding
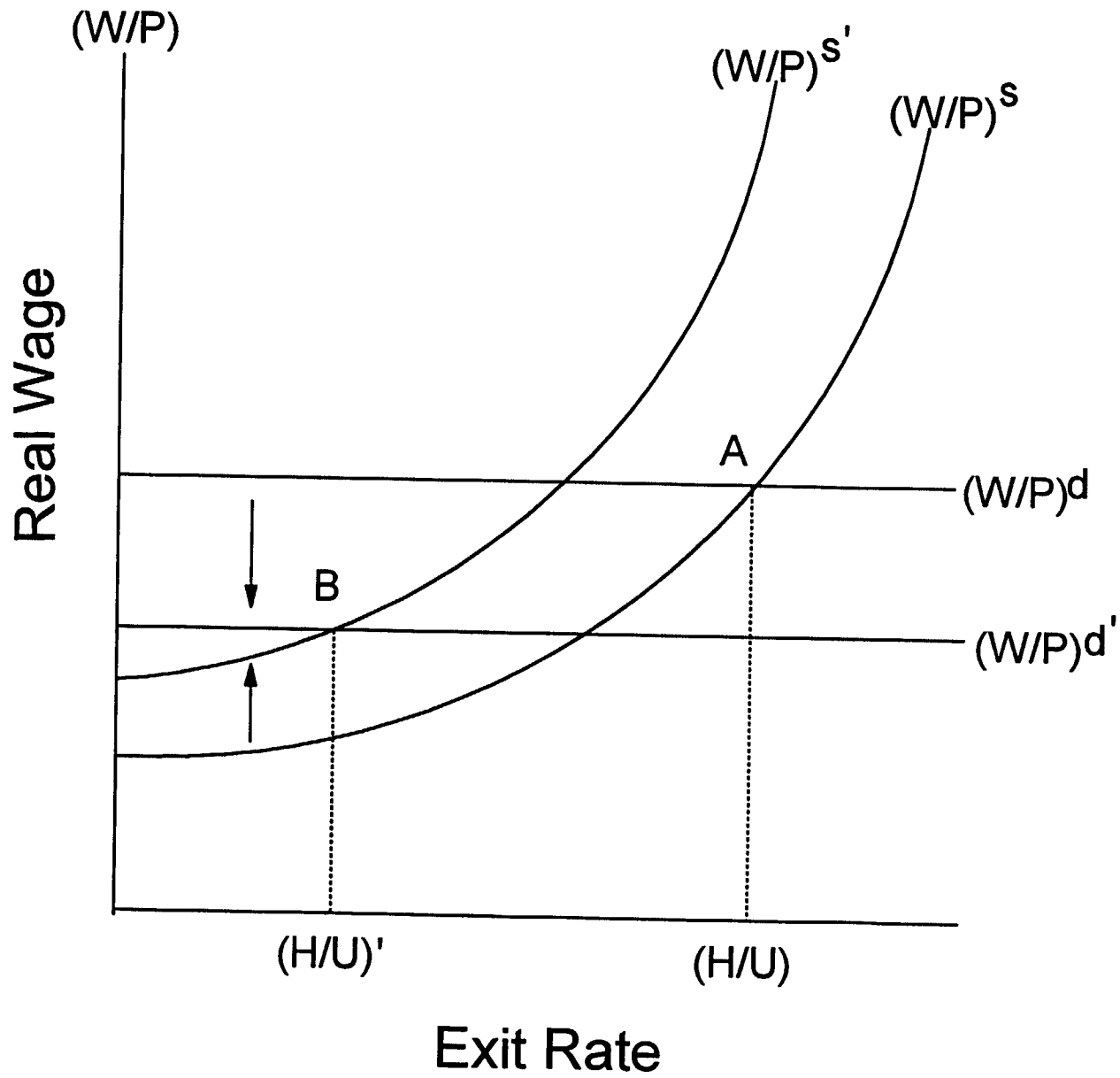
Figure 2

to the demand wage relation is still horizontal.

Because of lower average productivity, the demand wage decreases: the line $(W/P)^d$ shifts downwards to $(W/P)^{d'}$. Because workers are stronger in bargaining, the supply wage relation shifts upwards, from $(W/P)^s$ to $(W/P)^{s'}$. Thus, the equilibrium exit rate decreases from (H/U) to $(H/U)'$; equivalently unemployment duration (the inverse of the exit rate in steady state) increases. This does not however imply that the natural unemployment rate increases. This is because the flow of traffic in the labor market, and thus H, is also smaller. The declines in (H/U) and H have an ambiguous effect on U and thus on the rate of unemployment.

In words, higher firing restrictions lead to a sclerotic labor market, in which average productivity is lower, the flows of workers are lower and the duration of unemployment higher; but, contrary to the claims of the OECD report, they do not necessarily lead to a higher rate of unemployment.[6]

Putting the threads together, what does our analysis suggest about the effects of technological progress on the natural rate? In short, that they are ambiguous. Take an increase in the rate of technological progress. If reservation wages reflect in part aspirations, and aspirations lag behind, the first effect of faster technological progress will be to decrease the natural rate for some time. But if faster technological progress leads to faster churning, this will work the other way: other things equal, larger traffic in the labor market will lead to higher unemployment. And so will composition effects, if technological progress is biased against lower skilled workers, as seems to be the case at this point. These effects do not add up to an unambiguous, simple, answer. But the analysis, which builds on nearly

all aspects of the framework we presented earlier (flows and matching, the nature of bargaining, competitive factors at the lower end of the skill distribution, efficiency wages and the role of aspirations) represents, we believe, progress.

This is however the end of the good news. Suggesting a list of potential determinants of the natural rate is not the same as identifying their respective roles. And, as we now argue, empirical knowledge lags very much behind.

3   The Macroeconometric Evidence

Let us start by reviewing the standard characterization of the joint behavior of wage inflation, price inflation, and unemployment in U.S. macroeconometric models.

Macroeconometric models determine the natural rate through two equations, a "price equation" (which corresponds conceptually to what we called the demand wage relation) and a "wage equation" (which corresponds to the supply wage relation). In their simplest form, the equations can be written as:

$$\Delta p_t = a_p + \Delta w_t + \epsilon_{pt}$$
$$\Delta w_t = a_w + \Delta p_{t-1} - \beta\, u_t + \epsilon_{wt}$$

where p is the logarithm of the price index, w is the logarithm of the nominal wage, so that Δp and Δw are price and wage inflation respectively, u is the unemployment rate, a_p and a_w are constants, and ϵ_p and ϵ_w are error terms.

Eliminating wage inflation between the two, these equations yield the (expectations-augmented) "Phillips curve" reduced form relation between the

change in inflation and the unemployment rate:

$$\Delta p_t = a + \Delta p_{t-1} - \beta u_t + \epsilon_t$$

where $a \equiv a_p + a_w$, and $\epsilon_t \equiv \epsilon_{wt} + \epsilon_{pt}$.

The natural rate of unemployment is typically interpreted as the rate of unemployment consistent with constant (non-accelerating) inflation in this Phillips curve equation.

The first three columns of Table 1 report the results of estimating these relations using annual U.S. data for 1970-95, with the consumer price index as a measure of the price level, and compensation per hour in the business sector as a measure of the wage level.

Even in their simplest form, these three equations fit the data quite well. Obviously they can be improved upon. The actual wage equations of large macroeconometric models include richer lag structures, as well as other variables such as trend productivity growth and wage/price-control dummies. Actual price equations typically specify price inflation not only as a function of wage inflation, but also of productivity growth and the rate of change of other input prices. A state-of-the art specification of the reduced-form Phillips curve is given for example by Gordon [1997] in his paper for this volume. It includes longer lags of past inflation, a slowly moving natural rate, price-control dummies, and the rate of change of food and energy prices. But the basic structure of these equations remains close to those of the bare-bones specifications presented in the first three columns of Table 1, so that we can use these simpler equations as a basis for discussion.

Table 1
Price Inflation, Wage Inflation, and Unemployment
in the United States, 1970-95

	(1) Δp	(2) Δw	(3) Δp	(4) Δw
Constant	-0.77 (0.28)	7.20 (1.40)	6.64 (1.65)	6.75 (1.31)
Δp_{-1}		1.00*	1.00*	1.00*
Δw	1.00*			
$(w_{-1} - p_{-1}) - x_{-1}$				0.11 (0.05)
Unemployment rate (u)		-0.99 (0.21)	-1.02 (0.24)	-0.95 (0.19)
Durbin-Watson Statistic	1.26	1.18	1.48	1.38
$\bar{R}^2$	0.76	0.67	0.71	0.72

All regressions include 26 annual observations for 1970 to 1995. A star * indicates that the coefficient is constrained to equal 1.

p = 100 x log(Consumer Price Index), using the CPI-U; w = 100 x log(Compensation per hour in the business sector); u is the civilian unemployment rate measured in percentage points. Time is a linear time trend equal to (year minus 1970); x = log(cyclically-adjusted labor productivity) = predicted value from a regression of log(business sector output per hour) on a linear time trend and its square for the 1969 to 1994 period.

Sources: Citibase.

We take up two issues in the next two sections. The first one is that of the consistency of the standard macroeconometric wage equation linking wage inflation to the unemployment rate with the demand wage relation suggested by theory. The second is why these empirical macroeconometric relations that have worked reasonably well for the United States have failed so miserably for Europe over the last twenty years. This failure motivates us to summarize what we think has been learned (or not learned) from the search for causes of the rise of European unemployment.

4 Wages and Unemployment

If we interpret lagged inflation as a proxy for expected inflation in the wage equation above, we can think of the empirical wage equation as giving the *rate of change* of the (expected) real wage as a function of the unemployment rate. Is such a relation consistent with the supply wage relation implied in our framework and illustrated by the $(W/P)^s$ locus in Figure 1?

The answer would appear to be no. Recall that the supply wage relation implies, conditional on the reservation wage B and other wage determinants X_s, a relation between the *level* of the real wage and the unemployment rate. But the reservation wage is not observable. Thus what turns out to be crucial here is the exact nature of the reservation wage and the implied empirical relationship between wages and unemployment when one cannot explicitly condition on B.

Suppose, to take an extreme case, that the reservation wage is really an aspiration wage, and that this aspiration wage in turn is based on the real wage paid last year. This will generate exactly the relation observed in the data (ignoring the

difference between expected and actual price inflation): The rate of change of the wage (equivalently the ratio of the wage this year to the wage last year) will depend on the unemployment rate. But this is indeed an extreme case. In general, as we argued earlier, reservation wages will reflect in part factors which grow with productivity. Then the relation will be one in which the real wage is equal, or at least returns over time, to a level determined by both the level of productivity and the unemployment rate.

This suggests that the wage equation found in macroeconomic models may be misspecified, and that a more appropriate specification is:

$$\Delta w_t = a_w + \Delta p_{t-1} - \lambda(w_{t-1} - p_{t-1} - x_{t-1}) - \beta\, u_t + \epsilon_{wt}$$

where x is the log of the productivity level. If λ is positive, this equation implies that while it may take some time, the real wage eventually adjusts to a level determined by productivity and the unemployment rate.[7] The standard macroeconometric wage equation can be seen as imposing the possibly incorrect restriction that λ is equal to zero.

To see whether this is the case, we estimate this augmented empirical wage equation and report the results in the last column of Table 1. The variable x is constructed as the fitted value from a first stage regression of the logarithm of labor productivity on a quadratic time trend. The point estimate of λ is actually *negative* (-0.11 with a standard error of 0.05), suggesting the absence of any long-term level relation between the real wage and the unemployment rate.[8]

But this does not quite settle the issue. One may question whether we can trust

the estimated value of λ in column (4). Issues of specification are many and have been discussed at length in the empirical literature. They range from the treatment of expected inflation, to the measurement of the underlying productivity growth trend, to the non-inclusion of other possibly highly autocorrelated wage determinants (variables in X_s in the supply wage relation), and so on. In an important contribution, Blanchflower and Oswald [1994] have suggested one way of avoiding some if not all of these issues, by looking at the behavior of wages and unemployment rates across regions (or states) within a country over time. Their argument is a simple and compelling one. If many of these difficult-to-measure variables, such as expectations of inflation or the underlying productivity growth trend, are common across regions within a a nation, then they can be dealt with by using time effects in a panel data regression model.

Let us be more precise here. Consider the n U.S. states, indexed by i, and assume that for each one, the relation between wages and unemployment has the following form:

$$\Delta w_{it} = a_{wi} + \Delta p_{t-1} - \lambda(w_{i,t-1} - p_{t-1} - x_{t-1}) - \beta\, u_{it} + \epsilon_{wit}$$

This equation is a straightforward extension to the state level of the augmented wage equation estimated on aggregate data in column (4) of Table 1. The rate of change in the nominal wage in state i is a function of lagged inflation (assumed common to all states), the lagged log real wage adjusted for productivity (where productivity is assumed to be common to all states), and the state-specific unemployment rate.[9] This equation can be estimated on panel data by replacing all the terms which vary through time but are common to all states by time effects,

and thus running the change in the log nominal wage in each state on lagged log nominal wage, the state unemployment rate, time and state dummies. Note also that by writing $\Delta w_{it} = w_{it} - w_{it-1}$ and moving w_{it-1} to the right hand side, this equation can be rewritten in the following form (that makes the results in Table 2 below easier to interpret):

$$w_{it} = a_{wi} + (1 - \lambda)w_{i,t-1} - \beta u_{it} + d_t + \epsilon_{wit}$$

where the d_t are time fixed effects. This equation says that, other things equal, the wage w_{it} depends on the lagged wage w_{it-1} with coefficient $1 - \lambda$.

Estimating this equation using yearly data for states of the United States, and for regions in the United Kingdom, Blanchflower and Oswald [1994] estimate λ to be close to one (equivalently, $1 - \lambda$ to be close to zero). They conclude that that once region and time effects are included that there is "little sign of autoregression in wage equations" (p. 284) so that the wage adjusts to the unemployment rate rapidly with little interesting dynamics.

If Blanchflower and Oswald were right, the problem would then be to reconcile micro and macro empirical results. In the process of exploring their results for this paper, we have concluded however, as have Card and Hyslop [1996] and Bell [1996a], that their results concerning the lack of wage dynamics appear to be non-robust, at least for the United States. The details of our analysis are given in Blanchard and Katz [1996]. But the basic source of the difference between their results and ours is, we believe, their use of annual earnings from the March Current Population Survey (CPS) as their basic wage measure. This annual earnings measure deviates from a theoretically appropriate wage rate measure since

Table 2
The Relationship Between Wages and Unemployment
U.S. States, 1980-91

	Dependent variable = Log State Wage (w_{it})					
	(1) Weekly UI	(2) Hourly Manuf.	(3) Hourly ORG CPS	(4) Hourly ORG CPS	(5) Hourly March CPS	(6) Annual March CPS
Lagged log wage (w_{it-1})	0.978 (0.010)	0.953 (0.020)	0.911 (0.017)	0.920 (0.017)	0.633 (0.030)	0.258 (0.039)
Log unemployment rate (u_{it})	-0.034 (0.002)	-0.019 (0.004)	-0.041 (0.003)	-0.039 (0.003)	-0.057 (0.008)	-0.062 (0.017)
Adjusted wage[a]	No	No	Yes	Yes	Yes	No
State average worker controls[b]	No	No	No	No	No	Yes
Standard error ($\hat{\sigma}$)	0.008	0.011	0.011	0.011	0.028	0.042

All regressions except column (2) contain 612 observations (51 states x 12 years) for 1980 to 1991; column (2) contains 561 observations for 1980 to 1990. All regressions include state and year fixed effects. The estimates are obtained by weighted OLS using as weights the relative number of workers in each state in each year. Standard errors are in parentheses. i indexes state; t indexes time.

[a]The dependent variable (w_{it}) and the lagged dependent variable (w_{it-1}) are log state average wage adjusted for characteristics of workers in the state using year-specific OLS log earnings regressions (using CPS sampling weights) as a wage prediction model; w_{it} is the mean wage residual (coefficient on state dummy variable) for state s in year t from such a cross-section log hourly earnings regression. Individual-level controls include schooling dummies, a quartic in experience, a female dummy, interactions of the quartic in experience with the female dummy, marital status, marital status interacted with female, a nonwhite dummy, and a full-time dummy in column (3). The adjustment equation for (4) also includes 10 one-digit industry dummies. The adjustment equation for (5) is described in Card and Hyslop (1996).

[b]Includes average worker characteristics by state and year from the Merged Outgoing Rotation Groups of the Current Population Survey (CPS) analogous to individual controls in wage adjustment equation used for column (4).

Sources of Wage Measures: Column (1): Log(average weekly earnings in employment covered by unemployment insurance), U.S. Department of Labor (1996); (2) Log(average hourly earnings of production workers in manufacturing), BLS; (3) & (4) Adjusted log hourly earnings, Merged Outgoing Rotation Group Files of CPS; (5) Adjusted log hourly earnings from March CPS, Card and Hyslop (1996); (6) Average log annual earnings, March CPS, Card and Hyslop (1996). Annual state unemployment rates are from BLS, LABSTAT.

it mixes up actual changes in wages with changes in hours of work. The March CPS samples are also relatively small for measuring annual state average wages. Systematic measurement error from the use of an inappropriate wage measure and sampling error in the lagged wage measure both bias down the coefficient of the lagged log wage in a regression of the current log wage on lagged log wage and other covariates (equivalently, they lead to an upward biased estimate of λ.)

Both problems can be corrected by using more appropriate measures of the wage and larger data sets. A sampling of our estimates from regressions of the log wage on the lagged log wage, the (log) unemployment rate, state, and year dummies for U.S. states over the 1980-91 period is presented in Table 2.[10] The estimates in the first four columns of Table 2 use administrative data on average weekly earnings of covered workers from the U.S. unemployment insurance (UI) system, data on average hourly earnings of manufacturing production workers from a large-scale etablishment survey, and data on hourly earnings from the Merged Annual Outgoing Rotation Groups of the CPS. These regressions consistently yield estimates of the coefficient on the lagged log wage close to 1 (0.91 to 0.97) implying a value of λ close to 0 (0.03 to 0.09). As shown in column 4, such large coefficients on the lagged log wage remain even when adjusting the wage measure for detailed individual worker characteristics.[11] The last two columns show the effects of using the March CPS (column 5) and annual earnings as the measure of wages (column 6) —the sample and the earnings measure used by Blanchflower and Oswald. The use of the March CPS sample reduces the estimated coefficient on the lagged wage to 0.63. The use of annual earnings further reduces the coefficient to 0.26, an estimate close to that obtained by Blanchflower and Oswald.

To summarize, estimates from state regressions suggest that there is a long-run

relation between wages and unemployment, but that, in contrast, to the results of Blanchflower and Oswald, the adjustment to this level is slow. Why have we spent a section on the dynamics of the wage equation? Why does it mattter whether λ is close to zero or instead close to one? For two reasons.

The first is that the dynamics of the wage equation determine the dynamic effects of variables such as oil price shocks and payroll taxes (the variables captured in X_d and in X_s in the demand wage and supply wage relations) on the natural rate of unemployment.

The second is that the discussion shows the extent of our ignorance about wage behavior, and in turn about the exact nature of the reservation wage. Does this dependence of wages on lagged wages reflect the effects of an individual's own lagged wage, or of the lagged wages of others in the relevant labor market, or of (unmeasured) variables correlated with lagged wages? We do not know. The most interesting piece of evidence here is Card [1990]'s study of wage determination in Canadian union contracts. Card uses the interaction of unanticipated inflation with partial wage indexation to decompose real wage changes during the course of a contract into "intended" and "unintended" components. He finds that intended and unintended changes in real wages over the course of the previous contract have similar effects on wages in the next contract: a 10 percent intended or unintended increase in real wages in the previous contract is associated with a 4 percent higher wage in the new contract. This suggests that the actual own lagged wages, not just unobservables correlated with lagged wages, play a role in affecting current wages. Other pieces of evidence are relevant here, such as the evidence that workers who have lost high wage jobs appear to hold out for high wages, even when jobs with such high wages are unlikely to be offered to them.[12]

The issue strikes us as an important topic for research.

5   The Puzzle of European Unemployment

The evolution of the unemployment rate in OECD-Europe since 1970 is shown in Figure 3. The unemployment rate is defined as the total number of unemployed in all OECD-Europe, divided by the total labor force. Since European inflation in the last five years has been roughly constant, there is a little doubt that most of the rise in actual unemployment corresponds to a large increase in the natural rate of unemployment.

One would have thought that such an increase in the natural rate, together with the wealth of Europe's cross-sectional variation in institutions and outcomes, would allow economists to identify which variables affect or do not affect the natural rate. It is fair to say that this has not been the case.[13]

The initial line of research, started in the late 1970s, focused on the effects of the increase in the price of energy and the slowdown in total factor productivity growth (Bruno and Sachs [1985]). But while this line of argument can explain much of what happened in the late 1970s, it cannot easily explain why the natural rate kept increasing in the 1980s and has remained so high in the 1990s. The price of oil has now returned to the level of the early 1970s. And it is hard to believe that aspirations of workers have not adjusted by now to the reality of lower productivity growth.

Another popular explanation put forward in the mid-1980s was that high taxes were the source of high unemployment. The motivation was clear: tax rates had
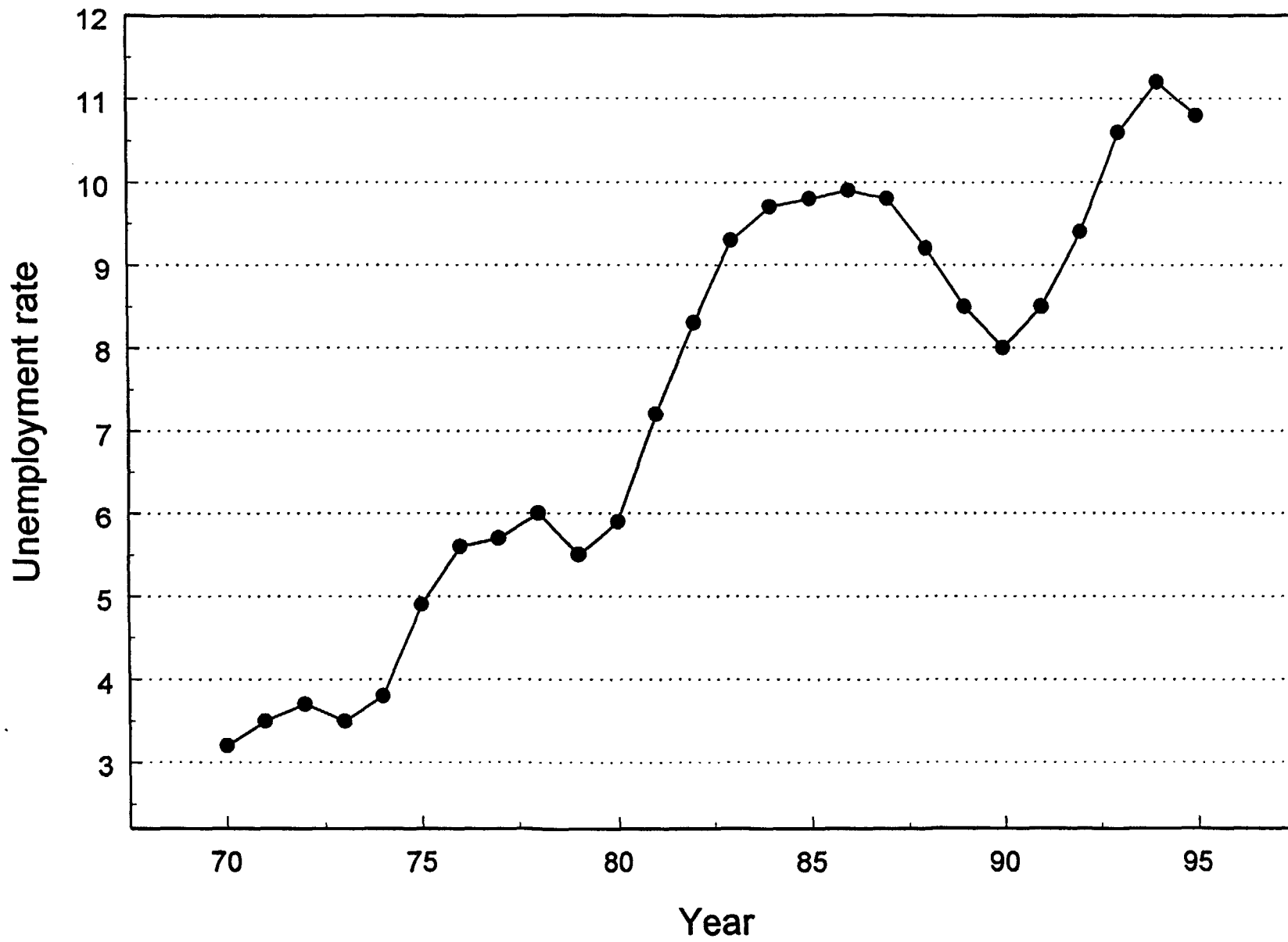
Figure 3

increased substantially since the 1960s and tax rates were much higher in Europe than in the United States. Our framework indeed suggests that some taxes can have a permanent effect on the natural rate. For example, if part of the reservation wage reflects untaxed activities, then higher payroll or income taxes will decrease the ratio of the wage to the reservation wage, leading to an increase in the natural rate of unemployment. In terms of Figure 1, an increase in payroll taxes will lead to a downward shift in the horizontal demand wage schedule but will not generate as large a downward shift in the supply wage schedule, thereby generating an increase in u^*. The role of taxes was a main focus of multi-country study organized by Richard Layard and Steve Nickell in the mid-1980s. The effort was judged only partially successful at the time (Bean et al. [1986]), and has not withstood the test of time well. The cross-sectional evidence within Europe does not reveal much correlation between tax rates and unemployment rates, nor between changes in tax rates and changes in unemployment.[14] In the recent study by Jackman et al. [1996] summarizing their interpretation of the increase in European unemployment, taxes no longer appear in the equation used to explain time series and cross country movements in unemployment.

Since the early 1990s, the focus has turned to three other explanations for high European unemployment: labor market rigidities, skill-biased technological progress and hysteresis.

As noted earlier, the major theme of the OECD (1994) Jobs Study is that labor market rigidities explain much of the rise in unemployment in Europe. The argument developed in the official report is that widening globalization has strengthened competition and increased the need for flexibility. Thus, while legal restrictions on firing and hiring have not become more stringent —indeed, they have

typically become less stringent— the actual cost that such restrictions impose on firms has substantially increased. Despite the OECD endorsement, this approach faces conceptual and empirical problems. At the theoretical level, as we saw earlier, while rigidities can indeed increase cost and lead to labor market sclerosis, it is not clear that they lead to high unemployment. At the empirical level, the evidence on job and worker turnover collected so far does not suggest (somewhat surprisingly) much increase in the pace of reallocation and in labor market turnover. And, finally, the cross country evidence on the relation of unemployment to rigidities is less than fully supportive. For example, although Spain and Portugal are classified by the OECD as having the most stringent legal restrictions on layoffs in Europe, Spain's unemployment rate is equal to nearly four times that of Portugal (Blanchard and Jimeno [1995]).

The second strand of research has examined the role of skill-biased technological progress. The argument is that for the last 20 years or so, technological progress has been associated with an acceleration in the rate at which labor demand shifts in favor of skilled relative to unskilled workers. Compared to the United States, Europe has higher relative minimum wages, higher social benefits for the nonemployed, and stronger pressures for wage compression. Thus, the argument goes, this skill-biased technological shift (typically viewed as arising from the computer revolution) has led to a larger increase in the unemployment of the unskilled, and in overall unemployment in Europe than in the United States (Krugman [1994]). Rising unemployment and slow private-sector employment growth in Europe and rising wage inequality and declining real earnings of the less-skilled in United States are viewed as flip sides of the same coin. Research here is just starting, and it is too early to tell how this approach will fare. What is clear is that the hypoth-

esis works well when looking at two observations, the United States and Europe. It is less clear that it can explain the cross-country differences within Europe.[15]

The difficulty in finding a common explanation for what appears as a largely common increase in the natural rate across European countries has led some economists, including one of the authors(Blanchard and Summers [1986]), to explore explanations based on "hysteresis," —the notion that the history of unemployment itself may have long lasting effects on the natural rate.[16] From this perspective, various shocks to the European economy, including the oil shocks of the 1970s and the tight monetary policies of the 1980s led to high actual unemployment. By the late 1980s, inflation was low, but sustained high unemployment for a decade had led in turn to an increase in the natural rate of unemployment.

There are a number of potential channels for hysteresis in unemployment. A long period of high actual unemployment leads to an increase in the proportion of long-term unemployed. If the long-term unemployed either lose skills or become less effective in their search, their effect on bargaining will decrease, leading to a higher natural rate of unemployment (Blanchard [1991]). Sociological factors may also increase the reservation wage of some of the unemployed: a long period of unemployment changes society's attitudes towards the unemployed. It becomes more socially acceptable to be unemployed and to use existing benefits to their utmost (Lindbeck [1995]). Family insurance may develop to help the unemployed, in particular the unemployed youth. Hysteresis may also come from the political response to unemployment. Higher prolonged unemployment creates pressure for government policies to offer more generous programs aimed at helping the unemployed. These changes decrease the pain, but they are also likely to increase the natural rate in the process.

The empirical case for hysteresis is far from tight however. At the macroeconomic level, a recent paper by Ball [1996] presents evidence that those OECD countries which experienced larger or longer disinflations in the 1980s, especially those with both large disinflations and generous unemployment benefits, have also experienced larger increases in the natural rate of unemployment from 1980 to 1990. The most natural explanation is one based on hysteresis. But the evidence on the relative and absolute importance of the specific channels for hysteresis is weaker. For example, whether higher unemployment leads over time to more generous unemployment benefits appears to be empirically ambiguous (Di Tella and MacCulloch [1995], Saint-Paul [1995]). While there is evidence of loss of skills, morale, and search effectiveness by the long-term unemployed, it remains to be shown that these can generate the degree of hysteresis needed to explain the evolution of European unemployment since the mid-1980s.

6 Conclusions

We have argued that while substantial conceptual progress has been made in thinking about the natural rate of unemployment, empirical knowldege lags behind. Economists are a long way from having a good quantitative understanding of the determinants of the natural rate, either across time or across countries.

Burgeoning empirical research on rich micro-data sets has improved our understanding of the importance in wage determination and the behavior of the unemployed of some of the mechanisms highlighted by alternative models of the natural rate. Research on industry and establishment wage differentials has shed some light on the relative importance of efficiency wage, bargaining, and compet-

itive factors for wage determination in different parts of the labor market (e.g., Krueger and Summers [1988]; Abowd and Lemieux [1993]). Much has been learned concerning the effects of the generosity and potential duration of unemployment benefits on the job search behavior of the unemployed and the duration of unemployment (e.g., Katz and Meyer [1990]; Meyer [1990]). New work is exploring the roles of unemployment insurance and intra-family insurance in providing support for the unemployed and potentially affecting the evolution of reservation wages (e.g., Gruber [1997]; Gruber and Berry Cullen [1996]). The research on the wage curve by Blanchflower and Oswald [1994] and our own work on regional labor market dynamics (Blanchard and Katz [1992]) highlight the possibility of using state and regional data as testing grounds for macroeconomic models of the labor market.

Nevertheless, we feel that a divide has grown between macroeconomists and labor economists, at least on this side of the Atlantic. Too much theoretical work on the natural rate of unemployment by macroeconomists is divorced from microeconomic evidence, and too much micro-econometric work seems in search of a broader theoretical framework for interpretation. This is unhealthy. We thus end with a plea for more joint efforts by macro and labor economists to better integrate theoretical and empirical work on wage determination and unemployment.

Notes

[1] Much progress has been made in the recent past in our knowledge of the distribution of changes in employment across firms over time, thanks in large part to the work of Davis and Haltiwanger [1996].

[2] Most of our knowledge of flows of workers between labor market states in the United States comes from the Current Population Survey (CPS). The numbers given in the text are the CPS numbers adjusted for measurement error, which otherwise generates spuriously high estimated flows (Blanchard and Diamond [1990]).

[3] For recent models and applications along these lines, see for example Mortensen and Pissarides [1994], or Blanchard and Diamond [1990].

[4] Two formal treatments of the determination of the natural rate—and two important references— are given in the books by Layard et al. [1991] and by Phelps [1994]. Shorter treatments can be found in the articles by Woodford [1994] and by Bean [1994].

[5] See, for example, Blanchard et al. [1995], and Boeri [1996].

[6] Models which explore various implications of firing costs for employment and unemployment include Bentolila and Bertola [1990] and Hopenhayn and Rogerson [1993].

[7] This error correction specification was first proposed and estimated in this context by Sargan [1964].

[8] This result is consistent with estimation by others. Grubb [1986] estimates a similar specification for each OECD country. He also finds an estimated negative value of λ for the United States, but a positive value for most other countries. Recent estimates by Turner et al. [1996] report a small but positive value of λ for the United States (0.08).

[9]As noted by Bell [1996a], the assumption that productivity trends are common to all states appears empirically questionable. So is the assumption of common inflation rates. In other words, estimation with regional data still has to confront the issue of state specific unobservables. We leave this issue aside here.

[10]We use the log rather than the level of the unemployment rate to be consistent with Blanchflower and Oswald's specifications.

[11]Bell [1996b] finds similar results using weekly wage measures for Canada, Germany, and the United Kingdom.

[12]See, for example, Kruse [1988] and Summers [1986].

[13]For detailed and careful assessments of progress to date, read the surveys by Bean [1994] and by Elmeskov [1993]. The technical parts of the OECD Jobs Study (OECD 1994, Parts I and II) also review theories and facts in great detail.

[14]A dissenting view however is presented by Phelps [1994], who argues that there are both good theoretical reasons as well as substantial empirical evidence for the proposition that higher payroll taxes increase the natural rate.

[15]See Card et al. [1996], Freeman and Katz, L. (eds) [1995], and Nickell and Bell [1996].

[16]Formally, the word "hysteresis" should be used only for the case where the natural rate is truly history dependent so that the time series process for the unemployment rate contains a unit root. Using hysteresis to refer to long lasting rather than permanent effects of the history of actual unemployment rates on the natural rate is a minor abuse of language.

References

Abowd, J. and Lemieux, T., 1993, The effects of product market competition on collective bargaining agreements: The case of foreign competition in Canada, *Quarterly Journal of Economics* 108, 983–1014.

Advisory Council on Unemployment Compensation (ACUC), 1994, *Report and recommendations*, ACUC, Washington, DC.

Akerlof, G. and Yellen, J., 1990, The fair wage-effort hypothesis and unemployment, *Quarterly Journal of Economics* 105(2), 255–284.

Ball, L., 1996, Disinflation and the NAIRU, *NBER working paper 5520*.

Bean, C., 1994, European unemployment; a survey, *Journal of Economic Literature* 32, 573–619.

Bean, C., Layard, R., and Nickell, S. (eds.), 1986, *Unemployment*, Economica, Supplement.

Bell, B., 1996a, Wage curve or Phillips curve?, mimeo, Nuffield College, Oxford.

Bell, B., 1996b, Wither the wage curve?, mimeo, Nuffield College, Oxford.

Bentolila, S. and Bertola, G., 1990, Firing costs and labour demand : how bad is Eurosclerosis ?, *Review of Economic Studies* 57, 381–402.

Blanchard, O., 1991, Wage bargaining and unemployment persistence, *Journal of Money, Credit and Banking* pp. 277–292.

Blanchard, O., Commander, S., and Coricelli, F., 1995, Unemployment and re-

structuring in Eastern Europe, pp. 289–330, *Unemployment, restructuring, and the labor market in Eastern Europe and Russia*, S. Commander and F. Coricelli eds, World Bank.

Blanchard, O. and Diamond, P., 1990, The cyclical behavior of the gross flows of US workers, *Brookings Papers on Economic Activity* pp. 85–155.

Blanchard, O. and Jimeno, J., 1995, Structural unemployment: Spain versus Portugal, *American Economic Review* 85, 212–218.

Blanchard, O. and Katz, L., 1992, Regional evolutions, *Brookings Papers on Economic Activity* 1, 1-76.

Blanchard, O. and Katz, L., 1996, Wages and unemployment. a reassessment of the wage curve, mimeo.

Blanchard, O. and Summers, L., 1986, Hysteresis and the European unemployment problem, *NBER Macroeconomics Annual* 1, 15–78, Stanley Fischer (editor) , MIT Press.

Blanchflower, D. and Oswald, A., 1994, *The wage curve*, MIT Press, Cambridge, MA and London.

Blanchflower, D. G. and Oswald, A. J., 1995, An introduction to the wage curve, *Journal of Economic Perspectives* (9-3), 153–167.

Boeri, T., 1996, Labor market flows in the midst of structural change, mimeo, OECD.

Bruno, M. and Sachs, J., 1985, *The Economics of Worldwide Stagflation*, Basil

Blackwell, Oxford.

Card, D., 1990, Unexpected inflation, real wages, and employment determination in union contracts, *American Economic Review* 80, 669–688.

Card, D. and Hyslop, D., 1996, Does inflation "grease the wheels" of the labor market?, NBER working paper 5538.

Card, D., Kramarz, F., and Lemieux, T., 1996, Changes in the relative structure of wages and employment: a comparison of the United States, Canada, and France, NBER working paper 5487.

Card, D. and Riddell, W., 1993, A comparative analysis of unemployment in Canada and the United States, pp. 149–189, in David Card and Richard Freeman (eds), *Small Differences That Matter*, University of Chicago Press, Chicago.

Davis, S. and Haltiwanger, J., 1996, *Job Creation and Job Destruction*, MIT Press; Cambridge, Mass.

Di Tella, R. and MacCulloch, R., 1995, The determination of unemployment benefits, mimeo, Oxford University.

Diamond, P., 1982, Wage determination and efficiency in search equilibrium, *Review of Economic Studies* 49, 217–227.

Elmeskov, J., 1993, High and persistent unemployment: assessment of the problem and its causes, Working paper 132, OECD, Paris.

Freeman, R. and Katz, L. (eds), 1995, *Differences and changes in wage structures*,

University of Chicago Press; Chicago.

Friedman, M., 1968, The role of monetary policy, *American Economic Review* 58, 1–21.

Gordon, R., 1997, The time-varying NAIRU and its implications for economic policy, *Journal of Economic Perspectives*, forthcoming.

Grubb, D., 1986, Topics in the OECD Phillips curve, *Economic Journal* 96, 55–79.

Gruber, J., 1997, The consumption smoothing benefits of unemployment insurance, *American Economic Review*, forthcoming.

Gruber, J. and Berry Cullen, J., 1996, Spousal labor supply as insurance: Does unemployment insurance crowd out the added worker effect?, NBER WP 5608.

Hall, R., 1979, A theory of the natural rate of unemployment and the duration of unemployment, *Journal of Monetary Economics* 5, 153–169.

Hopenhayn, H. and Rogerson, R., 1993, Job turnover and policy evaluation: a general equilibrium analysis, *Journal of Political Economy* 101(5), 915–938.

Jackman, R., Layard, R., and Nickell, S., 1996, Combatting unemployment: Is flexibility enough?, *mimeo* LSE, presented at the OECD Conference on *Interactions between Structural Reform, Macroeconomic Policies and Economic Performance*, March 1996.

Juhn, C., Murphy, K. M., and Topel, R., 1991, Why has the natural rate increased

over time?, *Brookings Papers on Economic Activity* 2, 75–142.

Katz, L., 1986, Efficiency wage theories: a partial evaluation, *NBER Macroeconomics Annual* 1, 235-276.

Katz, L. F. and Meyer, B. D., 1990, The impact of the potential duration of unemployment insurance benefits on the duration of unemployment, *Journal of Public Economics* 41, 45–72.

Krueger, A. and Summers, L., 1988, Efficiency wages and the inter-industry wage structure, *Econometrica* 56, 259–293.

Krugman, P., 1994, Past and prospective causes of high unemployment, *Reducing Unemployment: Current Issues and Policy Options* pp. 49–80, Proceedings of a symposium in Jackson Hole, Wyoming. Federal Reserve Bank of Kansas City; Kansas City, MO.

Kruse, D., 1988, International trade and the labor market experience of displaced workers: Evidence from the displaced workers survey, *Industrial and Labor Relations Review* 41.

Layard, R., Nickell, S., and Jackman, R., 1991, *Unemployment; Macroeconomic performance and the labour market*, Oxford University Press.

Lilien, D., 1982, Sectoral shifts and cyclical unemployment, *Journal of Political Economy* 90, 777–792.

Lindbeck, A., 1995, Hazardous welfare-state dynamics, *American Economic Review* 85(2), 9–15.

Meyer, B., 1990, Unemployment insurance and unemployment spells, *Econometrica* 58, 757–782.

Mortensen, D. and Pissarides, C., 1994, Job creation and job destruction in the theory of unemployment, *Review of Economic Studies* 61-3(208), 397–416.

Mortensen, D. and Pissarides, C., 1995, Technological progress, job creation and job destruction, mimeo.

Nickell, S. and Bell, B., 1996, Changes in the distribution of wages and unemployment in OECD countries, *American Economic Review* 86, 302–308.

Oswald, A., 1986, Is wage rigidity caused by "layoffs by seniority"?, pp. 77–95, in *Wage Rigidity and Unemployment*, Wilfred Beckerman, ed., Baltimore: Johns Hopkins University Press.

Phelps, E., 1968, Money-wage dynamics and labor market equilibrium, *Journal of Political Economy* 76, Part 2, 678–711.

Phelps, E., 1994, *Structural Slumps. The modern equilibrium theory of unemployment, interest, and assets*, Harvard University Press; Cambridge MA.

Pissarides, C., 1990, *Equilibrium Unemployment Theory*, Basil Blackwell; Oxford.

Saint-Paul, G., 1995, Some political aspects of unemployment, *European Economic Review* 39, 575–592.

Sargan, J., 1964, Wages and prices in the U.K., *Econometric analysis for National Economic Planning*.

Shapiro, C. and Stiglitz, J., 1984, Equilibrium unemployment as a discipline device, *American Economic Review* 74, 433–444.

Summers, L., 1986, Why is unemployment so very high near full employment ?, *Brookings Papers on Economic Activity* 2.

Turner, D., Richardson, P., and Rauffet, S., 1996, Modelling the supply side of the seven major OECD economies, OECD Economics Department working paper 167; Paris.

U.S. Department of Labor, 1995, *UI Financial Data Handbook. ET Handbook 394*, Washington D.C., Prepared by the Employment and Training Administration, Unemployment Insurance Service.

Woodford, M., 1994, Structural slumps, *Journal of Economic Literature* 32(4), 1784–1815.