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INTERNATIONAL WAGE CURVES

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ABSTRACT

The paper provides evidence for the existence of a negatively sloped locus linking the level of pay to the rate of regional (or industry) unemployment. This "wage curve" is estimated using microeconomic data for Britain, the US, Canada, Korea, Austria, Italy, Holland, Switzerland, Norway, and Germany. The average unemployment elasticity of pay is approximately -0.1. The paper sets out a multi-region efficiency wage model and argues that its predictions are consistent with the data.

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International Wage Curves

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1. Introduction

This paper is an attempt to explore the links between unemployment and the level of wages. Its principal purpose is to use international microeconomic data to document the existence of an inverse relationship between workers' pay and the local rate of unemployment. This relationship, or *wage curve*, is estimated for regions using data for Britain, the US, Canada, Austria, Italy, Holland, Switzerland and Norway[1]. Evidence of an equivalent relationship is presented for industries[2] using data for Korea and Germany (where lack of regional data prevents the same exercise as for the other nations) and for the US. The estimates suggest that, on average, the unemployment elasticity of pay is approximately -0.1, which implies that a doubling of unemployment leads to a fall in the level of the wage by ten percent[3].

The paper's secondary purpose is to write down a multi-region efficiency wage model that is consistent with, and offers a possible conceptual framework for the analysis of, the empirical patterns found in the international data. According to this model, even when workers are free to migrate between regions, the contemporaneous cross-section correlation between pay and unemployment will be negative rather than, as sometimes asserted, positive. Within this framework the paper's estimated wage curve corresponds to a no-shirking condition of the kind in, for example, Shapiro and Stiglitz(1984)[4].

Three literatures lie behind the empirical work reported in this paper. The oldest is the extensive research into Phillips Curves stemming from Phillips (1958). Although similar in its broad concern with the macroeconomic relationships between aggregate joblessness and wage-setting, the present paper does not study the rate of wage inflation, nor purport to uncover a disequilibrium adjustment mechanism. It is probably not usefully thought of as an attempt to estimate quasi-Phillips Curves. A second and related strand of research is the writings of authors such as Layard and Nickell (1986), and before them Sargan (1964), who use time-series data to estimate the effect of the aggregate unemployment rate upon the aggregate level of wages. The present paper can be seen as an attempt to employ microeconomic data to look for what might be described as a cross-section version of this relationship. The third literature upon which the paper builds is the US work initiated by Harris and Todaro (1970) and Hall (1970, 1972), and continued by Adams (1985), Browne (1978), Marston (1985) and Reza (1978). This helped to establish the current conventional wisdom that, by a compensating-differential argument, wages and unemployment are positively correlated across geographical areas. The paper tries to show that some aspects of that conventional wisdom are incorrect.

The paper begins by outlining an efficiency wage model of an economy with multiple regions. This model was developed (after examination of the data) as an attempt to find a theoretical structure that is internally theoretically consistent and fits the econometric facts. The present paper does not, and could not, claim that there exist no other models that might be consistent with the estimated wage curves. Other possibilities include the standard competitive model, contract theory, search theory, and bargaining models. However, competitive theory does not seem to offer a natural way to explain the patterns in the data, because it predicts that unemployment -- if defined as a disequilibrium surplus of labor supply over demand -- will be positively associated with the level of wages. A competitive interpretation would require that later regressions be somehow identifying a labor supply curve rather then an unemployment effect on wages. Labour contract theory and search theory also have difficulty in generating the correct predicition of a negative correlation between pay and joblessness. A bargaining framework can give the correct general kind of prediction, although the question of how a multi-region model might be constructed has hardly been considered in the literature, but it will not be pursued here. This is partly because one original intention of the paper was to analyze the economy of the United States, where unionism is relatively unimportant and where choosing a bargaining framework seems correspondingly less appropriate (although not impossible). While important, these issues are taken up more fully in a future monograph, and are not the primary focus of the paper.

2. Theory

Consider an economy consisting of two regions. The following assumptions are made about region 1, and, with small modifications, about region 2.

A.1 Assume that workers are risk-neutral, and get utility from income and disutility from effort. Define the wage as w and the level of on-the-job effort as e. Assume that utility equals the difference between income and effort, so that (pecuniary) utility is

$$u = w - e.$$

A.2 Assume that effort at work, e, is a fixed number determined by technology, but that individual employees can decide to 'shirk' and exert zero effort. If undetected by the firm, these individuals earn wage w and have $e = 0$, so that $u = w$. They are then better off than employees who provide effort.

A.3 An individual who shirks runs the risk of being detected. Designate as δ the probability of successfully shirking, that is, of escaping detection. Assume that anyone caught shirking is fired, and has then to find work elsewhere (at required effort e). Let the expected utility of a fired worker be $\overline{w}$. Define it

$$\overline{w} = (w - e)\,\alpha(U) + b\,[1 - \alpha(U)]\,.$$

This is a convex combination of w - e, the utility from working at the required effort level, and of b, which is defined as the income value of unemployment benefit plus leisure. The function $\alpha(U)$ measures the probability of finding work, and how that is affected by the level of unemployment, U, prevailing in the local labor market.

A.4 Assume that there is a constant rate of break-up, r, of firms. In steady-state equilibrium, total new hires in the local economy are $\alpha\ [1 - n]$, where l is population and n is employment, and

$$rn = \alpha [l - n].$$

Unemployment is $U \equiv 1 - n/l$, so

$$r = \frac{r}{U} - \alpha.$$

This defines a function $\alpha\ (U)$ with derivatives:

$$\alpha\ '(U) = -\frac{r}{U^2} < 0$$
$$\alpha\ ''(U) = \frac{2r}{U^3} > 0.$$

Thus the probability of finding a job, α, is a convex function of unemployment, U.

A.5 Equivalent conditions hold in the second region. The wage there is ω and the level of unemployment benefit is β. The unemployment rate in the second region is μ.

A.6 The second region differs from the first in that both workers and non-workers enjoy a non-pecuniary benefit, ϕ, from living in the region. Their utility is thus $u = \omega - e + \phi$ when working, and $u = \beta + \phi$ when unemployed.

A.7 Each region is affected by shocks to the demand for labor. The shock variable is denoted s in region 1, with a density function g(s). The shock variable in region 2 is σ, with density of $h(\sigma)$.

A.8 Workers are free, between periods, to choose to live in whichever region they prefer. They cannot migrate during a period.

The assumptions given above describe a form of efficiency-wage model. The model's key characteristic is that employers must pay a wage that is sufficently high to induce employees not to shirk. In equilibrium, workers must be behaving optimally in their effort decisions, and firms must be behaving optimally in their wage-setting. Regions differ in their non-pecuniary attractions: one of the two is a nicer place to live than the other. Excluding degenerate equilibria, however, each region must offer workers the same level of expected utility. This condition defines a zero-migration equilibrium.

A number of results can be proved.

Proposition 1.

Each region has a downward-sloping convex wage curve. If both regions have the same level of unemployment benefit (so $b = \beta$), they have a common wage curve given by the equation:

$$w = e + b + \frac{e\delta}{(1 - \delta)[1 - \alpha(U)]}.$$

Proof of Proposition 1.

For a no-shirking equilibrium, the expected utility from not shirking must equal that from shirking. Thus in region 1

$$w - e = \delta w + (1 - \delta)\{(w - e)\alpha(U) + b[1 - \alpha(U)]\}, \tag{1}$$

which simplifies, after manipulation, to

$$w = e + b + \frac{e\delta}{(1 - \delta)[1 - \alpha(U)]}. \tag{2}$$

In region 2, in which individuals receive a utility supplement ϕ, the no-shirking condition is

$$\omega - e + \phi = \delta(\omega + \phi) + (1-\delta)\{(\omega - e + \phi)\alpha(U) + (\beta + \phi)[1 - \alpha(U)]\}. \tag{3}$$

The ϕ terms cancel from both sides, leaving a wage equation

$$\omega = e + \beta + \frac{e\delta}{(1 - \delta)[1 - \alpha(U)]}. \tag{4}$$

If $b = \beta$, equation (2) is identical to equation (4), and the two regions have the same wage equation. The convexity of this wage curve follows from the convexity of the $\alpha(U)$ function and can be checked by differentiation.

More intuitively, equilibrium necessitates that wages in each region be just enough to dissuade employees from shirking. This requires that the expected utility from shirking be no greater than that from working at effort e. Because the second region's non-pecuniary attractions, ϕ, are available both to the employed and the unemployed, the condition for no-shirking is independent of ϕ. Thus, as long as there is no difference in unemployment benefit levels (or, more generally, the utility available to the jobless), each region has the same equation for its no-shirking condition. This common equation traces out a convex negatively-sloped locus linking the wage, w, to the unemployment rate, U. When unemployment is low, for example, firms pay high wages to ensure that workers value their jobs sufficiently not to shirk.

Proposition 2.

Assume that both regions have the same level of unemployment benefit. (i) Then, for a zero migration equilibrium, they must face different distributions of demand shocks, and exhibit different wage/unemployment patterns. (ii) Region 1 has a higher expected wage than region 2.

Proof of Proposition 2.

For a zero-migration equilibrium, each region must offer the same level of expected utility to workers. The expected utility of a migrant into region 1 is

$$\int \{(w - e)\,\alpha(U) + b\,[1 - \alpha(U)]\}\, g(s)\, ds, \tag{5}$$

and of a migrant into region 2 is

$$\int \{(\omega - e + \phi)\,\alpha(\mu) + (\beta + \phi)[1 - \alpha(\mu)]\}\, h(\sigma)\, d\sigma. \tag{6}$$

Given identical unemployment benefit levels $b = \beta$, and identical distributions of demand shocks $g(.) = h(.)$, these two expressions cannot be equal. The difference between them would be $\phi > 0$. In equilibrium, therefore, the regions must exhibit different wage/unemployment patterns, and this establishes the first part of the Proposition.

To demonstrate that the expected wage in region 1 is higher than the expected wage in region 2, it is necessary to prove that

$$\int wg(s)\,ds > \int \omega h(\sigma)\,d\sigma. \qquad (7)$$

Zero migration requires:

$$\int \{(w-e)\,\alpha(U) + b\,[1-\alpha(U)]\}\,g(s)\,ds$$

$$= \int \{(\omega - e + \phi)\,\alpha(\mu) + (\beta + \phi)[1-\alpha(\mu)]\}\,h(\sigma)\,d\sigma \qquad (8)$$

The two no-shirking conditions (one for each region) are

$$w - e = \delta w + (1-\delta)\{\alpha(U)(w-e) + [1-\alpha(U)]\,b\} \qquad (9)$$

$$\omega - e + \phi = \delta(\omega + \phi) + (1-\delta)\{\alpha(\mu)[\omega + \phi - e] + [1-\alpha(\mu)](\beta + \phi)\}. \qquad (10)$$

Rearranging, and integrating both sides of each of these equations,

$$\int \left(w - \frac{e}{1-\delta}\right) g(s)ds = \int \{\alpha(U)(w-e) + [1-\alpha(U)]\,b\}\,g(s)ds \qquad (11)$$

$$\int \left(\omega - \frac{e}{1-\delta} + \phi\right) h(\sigma)d\sigma = \int \{\alpha(\mu)[\omega+\phi-e] + [1-\alpha(\mu)](\beta+\phi)\}\,h(\sigma)d\sigma \qquad (12)$$

By equation (8), the left hand sides of these must be equal:

$$\int \left(w - \frac{e}{1-\delta}\right) g(s)ds = \int \left(\omega - \frac{e}{1-\delta} + \phi\right) h(\sigma)d\sigma, \qquad (13)$$

which simplifies, noting that the integral of eg/(1- δ) equals the integral of eh/(1- δ), to

$$\int w\,g(s)\,ds - \int \omega\,h(\sigma)\,d\sigma = \phi > 0. \qquad (14)$$

If Proposition 2 (i) were false, the two regions would have identical wage and unemployment outcomes. But, because region 2 is intrinsically attractive (it offers non-pecuniary benefit ϕ), all workers would attempt to migrate there. In equilibrium, therefore, region 2's attractions must be exactly counter-balanced by inferior wage and unemployment combinations.

To illustrate these ideas, Figure 1 sketches the wage curve. Curve I represents the locus along which occur the wage-unemployment combinations for regions with identical unemployment benefit levels. Repeated random shocks produce different points on the curve. To ensure a zero-migration equilibrium, the intrinsically more attractive region 2 must be characterized more often by points in the south-east portion of the wage curve, which implies worse wage and unemployment combinations. Equilibria in the less attractive region 1 must more often occur in the north-west segment of the wage curve -- so that workers are willing to live there. This is captured algebraically in Part (ii) of the proposition, which states that, because of its inherent disadvantages, the first region must on average offer higher wages than region 2. Equation 14 shows that, in this world of risk-neutral people, the size of the regional gap in expected wages will equal the value of the non-pecuniary difference between the regions.

Proposition 3.

Assume that the regions have different levels of unemployment benefit. Then the wage curve in the high-benefit region lies vertically above that in the low-benefit region.

Proof of Proposition 3.

Because the no-shirking condition is

$$w = e + b + \frac{e\delta}{(1 - \delta)[1 - \alpha(U)]}, \tag{15}$$

the level of unemployment benefit, b, is a vertical shift parameter in a graph of the wage equation in wage/unemployment space. This result follows from the fact that the level of unemployment benefit (or value of full leisure) is an intercept variable in the no-shirking-condition defining equilibrium. As would be expected intuitively, therefore, in a region with higher benefits to those who are unemployed, firms must set higher wage rates if they are to discourage shirking.

Proposition 4.

The results generalize to models with an arbitrary number of regions.

Proof of Proposition 4.

A non-shirking condition will hold for each region. Mathematically, the separability of ϕ in the wage equation ensures that, because an equivalent non-shirking condition can be written down for each area, the results generalize to an arbitrary number of regions. The heights of the different wage curves are determined by the size of the different unemployment benefit levels.

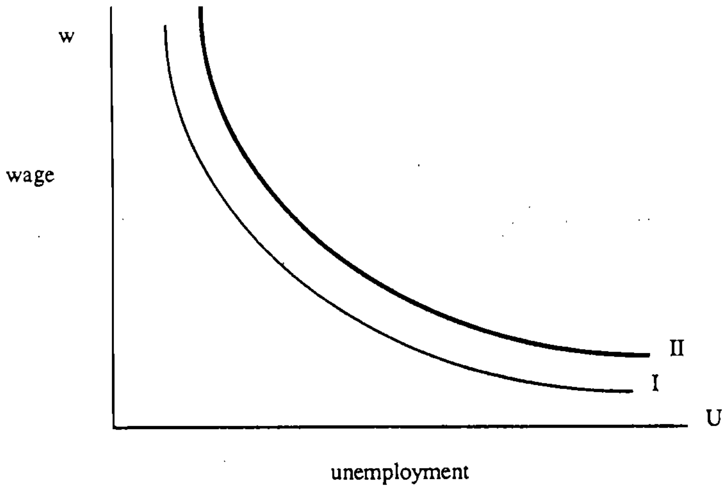
An intuitive summary of the model's structure can be given in the following way. In this efficiency wage framework a high level of regional unemployment is associated with a low level of regional wages: high unemployment makes employees keen to keep their jobs because it will be difficult to find another. Other things constant, therefore, these employees are reluctant to shirk at work, for fear they will be detected and dismissed. Knowing this, firms need pay only low wages to extract the required level of effort from workers. Fear of unemployment then disciplines workers. If unemployment is low, by contrast, employers have to offer high wages. If they do not, employees are likely, realizing that it will be easy to find another job if dismissed, to take the risk of shirking at work. When the unemployment rate is low, high wage rates are necessary to motivate workers.

Because individuals can migrate, this is not the end of the story. First, although actual wage and unemployment combinations will depend upon current demand shock variables, the average or expected wage needs to be higher in regions with low non-pecuniary attractions. This is because regions have to offer equal expected utilities: otherwise they will get no workers willing to stay. Second, a region with a relatively high level of unemployment benefit will have a relatively high wage curve (such as the bold curve, labelled II, in Figure 1). The intuitive reason for this is that, in an area where the utility from being unemployed is relatively great, to ensure that there is no shirking the employer must pay better than in areas where the utility of the jobless is comparatively low. It is more expensive to motivate workers who have good outside options. Some regions thus have wage curves that lie vertically above those in other regions.

Individuals do not all move to the regions with the highest wage curves, nor to the regions with the greatest non-pecuniary advantages, because those two kinds of regions are areas that more commonly have wage and unemployment outcomes in the south-east segments of their own wage curves. Probabilistic demand shocks are thus an essential part of a coherent model. Put loosely, intrinsically attractive regions with high unemployment benefits must be characterized, in steady state equilibrium, by harsher 'business cycles' than less favoured areas.

Acording to this multi-sector efficiency wage analysis, there exists a downward sloping convex function tying together the rate of unemployment in an area and the level of remuneration offered within that location. The intercept in this function depends on the size of unemployment benefit, so that regions have the same wage curve only if they do not differ in the generosity of income paid to (or for exogenous reasons enjoyed by) those out of work. This issue, which is akin to a fixed-effect, will play a role in the later empirical results.

Figure 1



The Wage Curve

(Region II here has a higher level of unemployment benefit than Region I)

3. Empirical Implementation

To move from the theoretical model derived in the previous section to empirical estimation, two primary issues must be considered. First, no precise assumptions have been made so far about the nature of the demand for labor. Second, it is necessary for econometric purposes to decide how the relevant wage equation could be identified.

Write the model in the following compressed way. Let f(.) be the wage curve or no-shirking equation and g(.) be an equation determining the level of unemployment. Then assume that the model is a system as follows:

Wage equation $w_i = f(U_i, i)$

Unemployment equation $U_i = g(w_i, i, s_i)$

Zero migration $Eu_i = u*$

Regions are signified by the subscript i; there can be arbitrarily many. The first equation captures the no-shirking requirement; the second writes out an equation by which pay may influence unemployment; the third, which states that expected utility Eu in region i must equal the going market level, u*, is the earlier restriction that equilibria have to have the characteristic that no-one wishes to migrate. The general form of this 3-equation system holds whatever exact assumptions are made about the nature of employment functions or about, say, the different levels of unemployment benefit across regions. One simple working assumption would be that the unemployment equation is defined by population minus a neoclassical labor demand curve (where employment depends inversely upon the wage), but this is not necessary. The first two equations simultaneously determine the wage and unemployment level, whereas the third, which is a form of integral condition, does not.

How could identification of the wage equation be achieved? At the broadest level there appear to be three possibilities. First, and most restrictive, the wage curve would be identified if all the random shocks occur on the demand side, namely, through movements in demand shift variable s. This is not a plausible condition, but might hold in an approximate way if demand shocks are quantitatively dominant. Second, the wage function would be identified if the system were appropriately recursive. If the pay equation includes lagged unemployment, for example, rather than the contemporaneous level of joblessness, it may be sufficient to treat U as a predetermined variable in the wage equation. Third, if there exist suitable variables that enter the unemployment equation but not the wage equation, then the wage curve could be estimated by conventional instrumental variable methods. If none of these is feasible, OLS estimation is likely to bias upwards the coefficient on unemployment in the wage equation, which will make it harder to obtain a significant negative unemployment coefficient in a wage equation.

This project has considered the three possibles routes to the identification of the wage equation described above. The most attractive theoretically is the third method, but a practical difficulty is that of finding suitable instruments. Instrumenting unemployment in the US case, for example, by using regional federal expenditure and weather variables makes no difference to the results found with OLS. Instrumental variable estimation has to date not changed any of the research project's conclusions. For this practical reason the approach taken throughout the paper will be to present OLS results and to defer more detailed discussion of simultaneity to a future monograph. In some cases the estimated equations here can be seen as relying on lags for identification.

The efficiency wage framework suggests that regions with different unemployment benefit levels will have no-shirking conditions (i.e. wage curves) that differ by a vertical intercept term. This implies that an important addition to wage equations will be controls for regional fixed-effects. Such controls will also capture innate differences in the regions' probability distributions of demand shocks. Without including regional fixed-effect terms an estimated wage equation will tend incorrectly to conflate the no-shirking condition and the zero-migration condition. The latter, loosely speaking, requires that in a cross-section the average unemployment rate be positively correlated with the average wage. The former, by contrast, requires that the contemporaneous levels of pay and unemployment be negatively correlated.

4. The Results

Following the model outlined above, earnings equations were estimated on pooled cross-section data for a set of ten countries. The earlier theory implicitly describes real-wage determination, but no consistent regional price data exist for the set of countries, so it is necessary to asssume that regional CPI differences are adequately captured by using year and geographical dummies. This method will go wrong only when there are important changes in the relative structure of regions' product prices, which arbitrage should go some way to prevent. Moreover, (i) Blackaby and Manning (1990) have shown that in a UK sample the inclusion of regional price deflators makes no substantitve difference to the existence of a wage curve, and (ii) the industry wage curves that are successfully estimated later in this paper can presumably be seen as immune from the criticism that omitted area price deflators are needed. For these reasons the lack of geographical prices may not be an insurmountable difficulty.

In most of the regression equations unemployment at a regional level is included as an explanatory variable within an otherwise conventional form of a Mincerian earnings equation. Where geographical codes were missing, however, industry unemployment rates are used (the theoretical model can be thought of as applying as well to industries as to regions). Wherever possible, regional and industry dummies are included in the regressions to capture the innate differences among areas. These correspond in the model to controls for the different utility levels available to those without work: regional unemployment benefit plays the role of a vertical shift variable in the wage curve (or no-shirking) equation. Because of the large number of data sets, and editorial space restrictions, no attempt is made here to explain in full the construction of different variables across nations, nor to give a full description of the means and summary statistics[5]. Details are available from the authors and in a future monograph. Efforts have been taken, however, to keep the general specifications as similar as possible across the international data sets. Moreover, the estimated unemployment elasticities are not sensitive to either the exact choice of personal control variables or to the precise form of the dependent variable (i.e. annual, monthly, weekly or hourly wages or earnings).

Results for Great Britain begin in Table 1, which uses the British Social Attitudes surveys of 1983 - 1987 and 1989 - 1991 (there was no survey in 1988). Column 1 of Table A estimates a cross-section Mincer earnings equation, with approximately 8100 observations, in which regional unemployment is entered as an explanatory variable. The wage equation explains approximately three quarters of the variance of pay. It includes sets of personal variables and of year and industry dummy variables. The log of regional unemployment (here there are 11 regions by 8 years of data) enters in Column 1 with a coefficient of -0.15. Allowing for a set of regional dummies reduces this to approximately -0.11 in Column 2. Six other regressions (Columns 3-8) are presented: these disaggregate by union and non-union status and by private sector status. The results suggest that the unemployment elasticity of wages is higher in the non-union sector and in the private sector. For example, the point elasticity in the non-union Column 4 is -0.19, whereas that in the union Column 3 regression is -0.05. Table 2 reveals similar findings, using the General Household Survey, for the UK between 1973 and 1977. Including regional dummies to control for fixed effects within regions, the unemployment elasticity of pay is estimated at approximately -0.09. It makes little difference whether hourly or weekly earnings are used as the dependent variable: compare columns 2 and 4 of Table 2.

To guard against the possibility that the standard errors in these kinds of equations are artificially small (a possibility suggested in a series of theoretical econometrics papers by Moulton 1986, 1987, 1990, Greenwald, 1983 and Kloek, 1981), the means of the dependent variable and every independent variable in each region/year cell were calculated. Table 3 reports the results of re-estimating the BSA regressions using these regional cell means as observations rather than the individual data themselves. This satisfies Moulton's condition that the level of aggregation should be the same on both sides of the regression equation. Column 2 of Table 3 shows that, controlling for regional dummies, the coefficient on the log of unemployment is -0.12, with a t-statistic of 1.8. Including a lagged dependent variable raises the t very slightly. Although the estimate of the quantitative effect of unemployment upon pay hardly changes between Tables 1 and 3, therefore, the level of statistical signifance looks considerably lower in the latter. The experiments reported in Columns 4-7 suggest that current unemployment has greater statistical power than the lagged rate of unemployment, which is generally weak in this data set.

US results are given in Table 4, using the March Current Population Surveys from 1964 to 1988, which provides a larger sample than is available for other countries[6]. The unemployment and earnings data used in the subsequent regressions relate to the respondent's labor market behaviour in the year preceding the date of interview. When estimating an earnings equation using, for example, the March 1987 CPS, regional unemployment and industry unemployment rates are mapped in for 1986. In what follows years relate to the year preceding the survey rather than to the date of the survey. In the above case, for example, estimates from the 1987 CPS would be recorded as being for 1986. The equations in Table 4 are estimated on regional cell means (derived from the full sample of approximately one and a half million observations) and, because there are 21 regions times 25 years, the equations have between 380 and 450 degrees of freedom. These 21 regions are each large areas of the US, such as New York state (see Table 4), and this choice of aggregation was necessitated by changes in data collection through the period. The included Mincer control variables, such as experience and schooling and marital status, are calculated as regional cell means. All the regressions incorporate full sets of (24) year dummies and (43) industry dummies. Unemployment and earnings are in natural logarithms. Some results for the regressions on individual data, with a total sample of approximately one and a half million observations, are discussed later.

Table 4 shows that the United States has a wage curve, and that the elasticity of the curve is not greatly different from that in Britain. Column 1 of Table 4 reveals a significant and negative effect from regional unemployment: a small coefficient of approximately -0.03 is estimated. Once regional dummies are included, however, this rises in absolute value to approximately -0.05 in Column 2 of Table 4 and, as a long run equilibrium value, to approximately -0.07 in Column 3. The significance of the lagged dependent variable in Table 4 indicates that wages are mildly autoregressive, with a coefficient on the log of wages a year ago of approximately 0.25. Column 4 incorporates unemployment variables for both the current year and the previous year, and the implied long run unemployment elasticity of pay is then equal to approximately -0.08.

Columns 6 and 7 of Table 4 show some evidence of fairly long lags, of up to two years, from the level of regional unemployment on to wages. The significance in Column 7 (Table 4) of unemployment two years ago might be taken as evidence that movements in joblessness are the cause of, and not dominantly caused by, movements in pay. This argument is based on the idea that unemployment can be treated in such an equation as predetermined, and that this helps to circumvent simultaneity problems. Lags were considerably weaker in the British regressions.

The same form of exercise, but on US state data from 1979-1987, is reported as Table 5. Estimation on cell means now provides 390 degrees of freedom. The first point to be made in this case is that -- as in Column 1 of Table 5 -- when regional fixed effects are ignored there is little or no sign of a negative effect from joblessness upon pay. This is effectively the form of inquiry undertaken by Hall (1970) and suggests one reason why his results, which were on a small sample of US cities, reveal no negative slope. To get the negative gradient, Column 2 of Table 5 includes 50 state dummies, and the coefficient on unemployment changes to -0.07 with a t-statistic of 7.3.

Columns 3-8 of Table 5 include various permutations of lagged unemployment and wage variables. The implied unemployment elasticity of pay in these equations is consistently close to approximately -0.08. The 6th and 7th columns of Table 5 reveal that the results are robust to the replacement of current unemployment by lagged unemployment.

Further CPS experiments are given in Table 6. Here the regression is estimated on the full micro sample without use of cell means, and both industry and regional unemployment rates -- again in logarithmns -- are entered together as explanatory variables. For the full sample of 1963-87 (Columns 7-9 of Table 6), when industry and regional dummies are included, the industry unemployment elasticity of pay and the regional unemployment elasticity of pay are each approximately -0.1.

Columns 1-6 of Table 6 break the time period into different samples as a way of assessing the robustness and stability of the estimates. Column 3 of Table 6 is especially interesting, because it effectively obtains, for the period 1969-1978, the Hall (1970) result that wages and unemployment are positively correlated across regions. Column 4, however, reveals that the introduction of regional dummies turns an unemployment coefficient of +0.106 into one of -0.045. Thus it is omitted regional fixed-effects that appear, in this period, to be responsible for the Hall-style finding of a positive relation between regional wage and regional unemployment. With regional dummies included in the regressions the regional unemployment elasticity of pay is estimated at: -0.08 in 1963-68, -0.05 in 1969-78, and -0.15 in 1979-87. The estimate is -0.1 overall in column 8. It is not easy to understand these variations; they will need eventually to be explained. Nevertheless, the wage curve has a persistently negative gradient and one centred at approximately -0.1. Column 9 suggests that industry and regional unemployment are orthogonal to one another.

Two other points are worth noting. First, following the spirit of the model's zero-migration condition, a series of US wage equations were estimated for the period 1979-

1987 replacing regional dummies with 'permanent' regional unemployment rates. This permanent unemployment variable was defined as average state unemployment for the period 1960-1988. As expected this variable entered positively and significant. Although its inclusion improved the performance of the regional unemployment variable, it significantly worsened the overall fit of the equation compared with the specification including regional dummies. Second, a possible objection to the efficiency wage interpretation of the estimated wage - unemployment correlation is that unemployment here could be acting as a mismeasured variable for a conventional labor supply curve. In order to test for such a possibility, regressions for the US were estimated which included the labor force participation rate and, as an alternative, the employment/population ratio. These regressions were estimated on state means for the period 1979-1987. When included with the state unemployment rate these variables were typically insignificant, whereas the coefficent on the unemployment variable remained significant and of the same size as above. Further details on these two issues are available on request from the authors.

Separate union and non-union wage curves are estimated for the US in Tables 7 and 8. Because of data restrictions it is necessary to use the March CPSs from 1983 to 1988. As was true in the UK case, the union sector of the United States appears to have a less elastic wage curve than the non-union sector. The coefficient on regional log U is, in Table 7, approximately -0.07 in union employment and -0.12 in non-union employment. The public/private sector distinction is examined in Tables 8 and 9. Columns 1 and 4 of Table 8 suggest that wages are a little more responsive to regional unemployment in the private sector than in the private sector. Once again the union sector has a less elastic wage curve. Table 9's results are more dramatic (similar findings are given by Katz and Krueger, 1991b): they show that Federal sector employees' pay is effectively independent of regional unemployment so that the wage curve there is flat.

Although it is not possible to present results in detail, wage curve estimates for Canada, South Korea, Austria, Italy, Holland, Switzerland, Norway and Germany are summarized in brief form in Table 10. These use data sets of varying sizes and types (most come from the International Social Survey Programme) but give estimates that are reasonably similar. Controlling for region or industry fixed-effects, estimates of the unemployment elasticity of wages are distributed around -0.1. They vary from a low of -0.05 for Korea's unemployment elasticity to a high of -0.12 for Austria and Holland, which might be interpreted as implying that countries do not differ markedly. The reported results are based on earnings equations of an otherwise conventional cross-section kind -- the exact specification used does not appear to affect the key findings -- into which the log of the unemployment rate has been added. Details of these specifications are available from the authors.

5. Conclusions

This paper uses a number of microeconomic data sets to study the relationship between the level of pay and the level of unemployment. It attempts to demonstrate that there is an empirical regularity in international wage and unemployment data, that the regularity appears to be consistent with one of the key predictions of efficiency wage theory, that international estimates of the unemployment elasticity of pay cluster at approximately -0.1, and that some aspects of conventional wisdom on US regional wage-unemployment patterns need to be reconsidered.

The analysis extends Shapiro and Stiglitz's (1984) efficiency wage framework in which there exists an aggregate no-shirking condition that takes the form of a downward sloping locus in wage/unemployment space. Unemployment acts in this model as a discipline device that dissuades employees from shirking on the job: a high unemployment rate allows the firm to pay less in equilibrium. The present paper shows how the Shapiro-Stiglitz approach can be incorporated into a model of inter-regional equilibrium. Its predictions are different from, and in some cases almost the opposite of, those in the tradition of Harris and Todaro (1970) and Hall (1979, 1972). The reason is that this literature has not distinguished as clearly as it might have done between, on the one hand, a positive regional correlation between expected pay and expected unemployment, and, on the other, a negative regional correlation between contemporaneous pay and unemployment.

The paper presents evidence from eight countries for the existence of an inverse relationship between employees' pay and the level of regional unemployment, and evidence from three countries for the existence of an inverse relationship between employees' pay and the level of industry unemployment. Estimates with and without controls for sectoral fixed-effects are provided. In the case of the United States it appears to be important to allow for regional fixed-effects: doing so reverses the conventional view that area wages and area unemployment rates are positively correlated. The estimated wage curves imply that, averaging across nations, a doubling of unemployment reduces the level of pay by approximately ten per cent. The size and quality of the international cross-section data sets vary, but, when taken together, the findings seem to suggest that there is a common pattern across nations.

The empirical results in the paper are consistent with a multi-region version of efficiency wage theory in which unemployment acts to discipline workers and individuals are free to migrate to their desired locations. Whether or not some preferable model can eventually be developed, it appears that a satisfactory theory of labor market behavior needs to be able to account for the fact that international wage curves exist.

Endnotes

1. Early British results are reported in Blanchflower and Oswald (1990 a,b), which appeal to a bargaining approach without any explicit regional modelling. The papers give cross-section results for various UK samples and also one small US sample (although they cannot control fully for regional fixed-effects) and attempt to summarize previous writings. One notable early paper in this literature is Blackaby and Manning (1987). Their later work on the UK is contained in Blackaby and Manning (1990). Jackman et al (1991) offers an interesting model and, using British regional data, results compatible with those presented here; Blanchflower (1991) provides recent UK estimates and finds an unemployment elasticity of approximately -0.1; Christofides and Oswald (1992) also obtain an estimate of approximately -0.08 using longitudinal Canadian contract data. A number of other authors have recently tested and found some support for wage curves: these include papers by Edin et al (1992) for Sweden, Groot et al (1992) for Holland, and Freeman (1990), Katz and Krueger (1991a, 1991b) and Blanchflower and Lynch (1992) for the United States. Topel (1986) also studies wage determination in geographical labor markets, but examines effects from variables such as the rate of change of employment rather than from the level of unemployment. Holmlund and Zetterberg (1991) find a role for unemployment in industry wage equations for various countries.

2. There is a related literature using micro data that tests for effects from the aggregate level of unemployment. This includes Bils (1985) and Nickell and Wadhwani (1990). Beaudry and DiNardo (1991), using PSID and CPS data, argue that wages depend not on current labor market conditions but on aggregate and industry unemployment rates in earlier time periods when unemployment was low.

3. The early survey by Oswald (1986) argued that an unemployment elasticity of -0.1 was emerging consistently from different kinds of aggregated and disaggregated evidence.

4. The theoretical papers by Akerlof and Yellen (1990), Bowles (1985) and Phelps (1990) also contain functions very similar to a wage curve.

5. Descriptions of some of these data sets are available in Blanchflower (1991), Blanchflower and Freeman (1992), and Blanchflower and Oswald (1989).

6. After excluding the self-employed and those working without pay, the separate files for each of the years 1964-1988 were pooled, giving a data file of over 1.5 million cases. The wage sample includes both full and part-time workers. Industry and regional unemployment rates were mapped onto the data file for the period, 1963-1987. Because of changes in the Industrial Classification over the period in question, it was only possible to uniquely distinguish 46 continuous industry groupings that could be allocated unemployment rates. Analogously, because of changes in the way regions are defined in the 1968-1975 CPS, it is possible to identify only 21 continuous regional groups over the twenty five year period. These area groupings are used to derive the regional dummies we include in our subsequent regressions. For the 1964-1967 and 1976-1988 CPSs unemployment rates are mapped in at the state level. The other years use somewhat broader area definitions. In both cases there are over 1000 separate unemployment observations.

Table 1. UK Wage Curve, 1983-1987 and 1989-1991

	All Employees				Private Sector Employees			
			Union	Non-Union			Union	Non-Union
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log unemployment (U_t)	-.1499	-.1075	-.0506	-.1897	-.2070	-.1346	-.0932	-.1817
	(7.89)	(3.53)	(1.38)	(3.55)	(8.66)	(3.47)	(1.74)	(3.27)
Regional dummies (10)	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Adjusted R^2	.7322	.7368	.7338	.7370	.7307	.7355	.7271	.7328
F	356.43	319.29	201.33	125.11	233.55	209.56	96.18	114.56
DF	8125	8116	5016	3031	5336	5948	2430	2828

Source: British Social Attitudes Survey Series.

Notes: Unless stated otherwise the following control variables were included 1) 41 industry dummies 2) 10 regional dummies 3) 3 marital status dummies 4) non-manual dummy 5) supervisor dummy 6) 2 union dummies 7) gender dummy 8) experience and its square 9) years of schooling 10) whether employment is expected to rise at the workplace dummy 11) unemployed in previous 5 years dummy 12) 7 year dummies plus a constant.

Dependent variable is the natural log of gross annual earnings. U_t is the natural log of the regional unemployment rate.

Union status determined on the basis of union recognition at the workplace.

T-statistics in parentheses.

Table 2. UK Wage Curve, 1973-1977

	Weekly Earnings		Hourly Earnings	
	(1)	(2)	(3)	(4)
U_t	-.0704	-.0895	-.0796	-.0876
	(10.47)	(4.83)	(12.72)	(5.08)
Regional dummies (10)	No	Yes	No	Yes
Constant	2.8902	2.9221	-.7634	-.7430
	(74.01)	(63.04)	(20.79)	(17.10)
Adjusted R^2	.5984	.6011	.4345	.4382
DF	60486	60476	60186	60176
F	1158.21	1038.12	594.73	535.12

Source: General Household Survey Series.

Notes: In all cases there are 60,565 observations. Unless stated otherwise the following control variables were included 1) 24 industry dummies 10 regional dummies 3) 5 marital status dummies 4) 17 qualification dummies 5) 18 occupation dummies 6) 4 year dummies 7) gender dummy experience and its square 9) part-time dummy.

Dependent variable is the natural log of gross earnings. U_t is the natural log of the regional unemployment rate.

T-statistics in parentheses.

Table 3. The U.K. Private Sector Regional Wage Curve, 1983-1991

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
U_t	-.1570	-.1215	-.1328	-.1343			-.1264
	(2.94)	(1.78)	(1.96)	(1.96)			(1.80)
U_{t-1}				-.0563	-.0091		-.0456
				(0.34)	(0.13)		(0.51)
U_{t-2}						.0182	.0430
						(0.30)	(0.44)
U_{t-3}							.0125
							(0.17)
W_{t-1}			.0985	.0973			
			(0.87)	(0.85)			
Regional dummies	No	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.8207	6.2711	6.2639	6.4289	6.0133	5.9959	6.3779
	(7.11)	(9.91)	(5.05)	(4.78)	(9.39)	(9.53)	(9.37)
Adjusted R^2	.9304	.9566	.9568	.9560	.9543	.9544	.9547
F	73.73	74.67	65.66	62.11	70.90	70.98	64.19
DF	71	61	50	49	61	61	58
N	88	88	77	77	88	88	88

Source: British Social Attitudes Surveys

Note: All equations include the same set of controls as included in Table 1. Because of a shortage of degrees of freedom we industry controls are not included. Dependent variable is log of gross annual earnings. All unemployment rates and the dependent variable (annual income) are in natural logarithms. There are 10 regional dummies.

All variables including the dependent variable are measured as the mean of all observations in a year/region cell.

T-statistics in parentheses.

Table 4. The U.S. Regional Wage Curve, 1963-1987

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
U_t	-.0274	-.0481	-.0469	-.0297			-.0258
	(2.78)	(5.56)	(5.81)	(2.87)			(2.53)
U_{t-1}				-.0281	-.0475	-.0228	-.0070
				(2.63)	(5.69)	(2.27)	(0.59)
U_{t-2}						-.0411	-.0397
						(3.86)	(3.75)
W_{t-1}			.2876	.2748	.2726	.2489	.2515
			(8.96)	(8.52)	(8.38)	(7.57)	(7.69)
Regional dummies	No	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.6722	6.6106	4.9314	5.0349	5.1093	5.4948	5.4342
	(25.10)	(29.38)	(16.38)	(16.70)	(16.86)	(17.08)	(16.97)
Adjusted R^2	.9956	.9974	.9978	.9978	.9978	.9978	.9978
F	1488.83	2045.06	2288.66	2299.44	2281.41	2173.63	2182.92
DF	445	424	403	402	403	382	381

Source: Current Population Surveys - March tapes.

Note: All equations include full sets of year dummies, region dummies (20), industry dummies (43), plus controls for 1) experience and its square 2) years of schooling 3) 4 marital status dummies 4) two race dummies 5) private sector dummy 6) part-time dummy. All unemployment rates and the dependent variable (annual income) are in natural logarithms.
All variables including the dependent variable are measured as the mean of all observations in a year/region cell.
T-statistics in parentheses.

The following 21 regional groupings had to be used:
1) Massachusetts, Maine, New Hampshire, Vermont, Rhode Island 2) Connecticut 3) New York 4) New Jersey 5) Pennsylvania 6) Ohio 7) Indiana 8) Illinois 9) Michigan, Wisconsin 10) Minnesota, Missouri, Iowa, North Dakota,South Dakota, Nebraska, Kansas 11) Delaware, Maryland, Virginia, West Virginia 12) Washington D.C. 13) North Carolina, South Carolina, Georgia 14) Florida 15) Kentucky, Tennessee 16) Alabama, Mississippi 17) Arkansas, Louisiana, Oklahoma 18) Texas 19) Montana, Arizona, Idaho, Wyoming, Colorado, New Mexico, Utah, Nevada 20) California 21) Washington, Oregon, Alaska, Hawaii.

Table 5. The U.S. State Wage Curve, 1979-1987

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
U_t	-.0100	-.0730	-.0877	-.0658	-.0511			-.0653
	(0.74)	(7.32)	(7.26)	(4.28)	(3.92)			(4.28)
U_{t-1}				-.0330	-.0337	-.0715	-.0546	-.0169
				(2.29)	(2.58)	(6.18)	(3.65)	(1.00)
U_{t-2}							-.0264	-.0255
							(1.78)	(1.77)
W_{t-1}			.0086	.0024		-.0049	-.0054	.0018
			(0.46)	(0.13)		(0.25)	(0.29)	(0.11)
State dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	6.6965	7.5761	7.8094	8.1929	7.6393	8.0009	8.2983	5.4342
	(20.56)	(26.28)	(22.11)	(22.11)	(26.63)	(21.93)	(22.03)	(16.97)
Adjusted R^2	.9375	.9829	.9797	.9800	.9831	.9788	.9789	.9801
F	110.32	232.41	171.76	172.82	234.78	164.22	164.60	173.21
DF	390	340	285	284	340	286	285	284

Source: Current Population Surveys - March tapes.

Note: All equations include full sets of year dummies, 50 state dummies (including the District of Columbia), industry dummies (43), plus controls for 1) experience and its square 2) years of schooling 3) 4 marital status dummies 4) two race dummies 5) private sector dummy 6) part-time dummy. All unemployment rates and the dependent variable (annual income) are in natural logarithms.

All variables including the dependent variable are measured as the mean of all observations in a year/state cell.

T-statistics in parentheses.

Table 6. The US Wage Curve 1963-1987

	1963-1968		1969-1978		1979-1987		1963-1987		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Industry U	-.0158	-.0191	-.0786	-.0981	-.2123	-.2122	-.0899	-.1093	
	(1.39)	(1.68)	(15.45)	(19.33)	(34.64)	(34.75)	(28.82)	(35.19)	
Regional U	.0133	-.0780	.1066	-.0454	-.0696	-.1475	-.0021	-.0987	-.1020
	(1.44)	(5.25)	(20.46)	(5.84)	(15.69)	(24.84)	(0.65)	(24.83)	(26.49)
Regional dummies	No	Yes	No	Yes	No	Yes	No	Yes	Yes
Constant	5.9851	5.3697	6.7400	6.6168	7.5579	7.6273	6.3116	5.9391	5.7159
	(195.64)	(132.39)	(333.98)	(296.55)	(368.43)	(351.22)	(462.62)	(444.36)	(485.63)
Adjusted R^2	.5398	.5440	.5649	.5650	.5326	.5363	.5748	.5757	.5753
F	5061.45	3877.01	11708.25	9096.36	12034.70	9304.54	25604.57	20606.93	20783.84
N	263133	263133	595138	595138	675822	675822	1534093	1534903	1534093

Source: Current Population Surveys - March tapes.

Note. All equations include full sets of year dummies and industry dummies (43) plus controls for 1) experience and its square 2) years of schooling 4 marital status dummies 4) two race dummies 5) private sector dummy 6) part-time dummy. All unemployment rates and the dependent varial (annual income) are in natural logarithms.

Table 7. Union & Non-Union Wage Curves: USA 1982-7

	(1) All	(2) Union	(3) Non-Union
U_t Industry	-.2090	-.0532	-.2337
	(14.58)	(1.89)	(14.27)
U_t Region	-.1142	-.0697	-.1193
	(5.05)	(1.54)	(4.67)
Union dummy	.1928	n/a	n/a
	(26.23)		
Constant	8.0838	8.5704	8.0903
	(114.87)	(60.13)	(101.63)
Adjusted R^2	.5332	.3760	.5311
F	875.19	86.41	715.02
DF	86379	15765	70502
N	86493	15878	70615

Source: Current Population Surveys -March tapes.

Note. All equations include full sets of year , state (50) and industry variables (43) plus controls for 1) experience and its square 2) years of schooling 3) 4 marital status variables 4) two race variables 5) private sector 6) part-time status. All unemployment rates and the dependent variable (annual income) are in natural logarithms.

Table 8. Union & Non-Union Wage Curves: USA 1982-7

	Private Sector			Public Sector		
	All (1)	Union (2)	Non-Union (3)	All (4)	Union (5)	Non-Union (6)
U_t Industry	-.2223	-.0702	-.2473	-.0343	+.0547	-.0654
	(14.45)	(2.18)	(14.33)	(0.59)	(0.63)	(0.86)
U_t Region	-.1216	-.0761	-.1254	-.0880	-.0592	-.0976
	(4.69)	(1.25)	(4.42)	(1.99)	(0.90)	(1.67)
Union	.1937	n/a	n/a	.1936	n/a	n/a
	(21.36)			(15.81)		
Constant	8.1717	8.7123	8.1753	7.6849	8.2095	7.5634
	(104.47)	(49.70)	(94.97)	(33.07)	(22.33)	(25.38)
Adjusted R^2	.5275	.3800	.5268	.5561	.3937	.5646
F	708.13	57.91	609.07	197.87	39.71	134.81
DF	70192	10103	59979	16085	5568	10422
N	70304	10214	60090	16189	5664	10531

Source: Current Population Surveys - March tapes.

Note. All equations include full sets of year, state (50) and industry variables (43) plus controls for 1) experience and its square 2) years of schooling 3) 4 marital status variables 4) two race variables 5) private sector 6) part-time status. All unemployment rates and the dependent variable (annual income) are in natural logarithms.

Table 9. Public Sector Wage Curves: USA 1982-7

	(1) Federal	(2) Local	(3) State
U_t Industry	+.0008	-.0743	-.2337
	(0.01)	(0.59)	(14.27)
U_t Region	+.0438	-.1428	-.1193
	(0.47)	(1.92)	(4.67)
Union	.1016	.2688	.2032
	(3.65)	(12.95)	(9.69)
Constant	7.1510	8.2609	8.4782
	(15.50)	(16.40)	(20.59)
Adjusted R^2	.5332	.3760	.5710
F	875.19	86.41	80.76
DF	3603	5706	5540
N	3703	5801	5635

Source: Current Population Surveys - March tapes.

Note. All equations include full sets of year, state (50) and industry variables (43) plus controls for 1) experience and its square 2) years of schooling 3) 4 marital status variables 4) two racevariables 5) private sector 6) part-time status. All unemployment rates and the dependent variable (annual income) are in natural logarithms.

Table 10. International Wage Curves

Country	Dependent Variable	Data Set	Coefficient on Log U	T-stat	Fixed effects	N
1. Canada	Gross annual earnings	Survey of Consumer Finances, 1986	-.14	9.3	No	31522
2. S. Korea	Gross monthly earnings	Occupational Wage Surveys 1983 & 1986	-.05*	25.0	Yes	1168142
3. Austria	Gross monthly earnings	ISSP, 1985-6	-.16	2.2	No	758
4. Austria	Gross monthly earnings	ISSP, 1985-6	-.12	1.7	Yes	758
5. Italy	Gross monthly earnings	ISSP, 1986-8	-.12	3.8	No	1532
6. Italy	Gross monthly earnings	ISSP, 1986-8	-.08	2.0	Yes	1532
7. Holland	Net monthly earnings	ISSP, 1988-9	-.23	2.6	No	1270
8. Holland	Net monthly earnings	ISSP, 1988-9	-.12	0.2	Yes	1270
9. Switz-erland	Net monthly earnings	ISSP, 1987	-.12	3.6	No	645
10. Norway	Gross yearly earnings	ISSP, 1989	-.07	2.1	No	933
11. Norway	Gross yearly earnings	ISSP, 1989	-.09	2.4	Yes	933
12. West Germany	Gross monthly earnings	ISSP, 1986-8	-.02*	0.7	No	1760
13. West Germany	Gross monthly earnings	ISSP, 1986-8	-.08*	2.1	Yes	1760

Note: Log U is defined as an area unemployment rate at various levels of disaggregation in different countries. Where indicated by a * unemployment is measured at the industry level.

Dependent variable is in natural logarithms.

In all cases Mincer variables are included as controls (i.e. gender, race, age, schooling etc.)

Data Appendix

A. British Social Attitudes Survey Series, 1983-1991

This series of surveys, core-funded by the Sainsbury Family Trusts, was designed to chart movements in a wide range of social attitudes in Britain and is similar to the General Social Survey carried out by NORC in the United States. The surveys were designed and collected by Social and Community Planning (SCPR) and derive from annual cross-sectional surveys from a representative sample of adults aged 18 or over living in private households in Great Britain whose addresses were on the electoral register. The first three surveys involved around 1800 adults; the numbers were increased to 3000 in 1986. For the first time in 1989 interviews were also conducted in Northern Ireland.

The sampling in each year involved a stratified multi-stage design with four separate stages of selection. First, in each year approximately 120 (150 in 1986) parliamentary constituencies were selected, with probability of selection proportionate to size of electorate in the constituency. Then, for each constituency a polling district was selected also with probability of selection proportionate to the size of the electorate. Then, thirty addresses were selected at a fixed interval on the electoral register. Finally, at each sampled address the interviewer selected one respondent using a random selection procedure (a Kish grid). The majority of sample errors for each survey lie in the range 1.0 to 1.5; errors for subgroups would be larger. For further details of the survey designs, non-responses etc. see, for example, Jowell, Brook and Taylor (1991).

B. The General Household Survey Series, 1973-1977

The General Household Survey is a continuous multi-purpose national sample survey based on private households selected from the Electoral Register. It originated in 1971 as a service to various government departments. Departmental interests change, and therefore although there is substantial continuity in questions over time, new areas for questioning are introduced, eg. leisure in 1973 and 1977, and drinking in 1978, and the form of questions varies between years.

The sample remained largely unchanged between 1971 and 1974 and was designed to be representative of Great Britain in each calender quarter. The 3-stage sample design involved the selection of 168 Local Authority areas as the primary sampling units (PSUs) by probability proportional to population size, after first stratifying Local Authority areas by (a) regions (b) conurbations; other urban areas; semi-rural areas; and rural areas, and (c) average rateable value. Each year 4 wards (in rural areas, groups of parishes) are selected from each PSU with probability proportional to population size. The selected Local Authority areas are rotated such that a quarter are replaced every 3 months. Within each ward, 20 or 25 addresses are selected. A maximum of 3 households are interviewed at each address (and to compensate for additional households at an address a corresponding number are deleted from the interviewer's address list). This yielded a total effective sample of 15,360 households in 1973, for example.

Since 1975, in an attempt to reduce the effects of clustering, the sample design has been based on a 2-stage sampling procedure with electoral wards as the PSUs. Geographically contiguous wards or parishes are grouped where necessary to provide a minimum electorate of 2,300 before selection. Wards are stratified by (a) regions (b) metropolitan and non-metropolitan counties, and (c) percentage in higher or intermediate non-manual socio-economic groups, to produce 168 strata. Within these strata wards are listed by (d) percentage of households in owner occupation, before being systematically selected by probability proportional to size. Four wards are used from each stratum each year, with each selected ward in use for 3 years before being replaced. Selection of addresses within wards remains the same as before 1975, but addresses where there are multiple households are treated somewhat differently. The sample is not representative in each calender quarter after 1975.

Some households respond only partially, therefore response rates can be measured in a number of different ways:-

1. The minimum response rate, defined as only completely co-operating households - 70% in 1973.

2. The maximum response rate, excludes only households where the whole household either refused or was not contacted - 84% in 1973.

3. The middle response rate, includes households where information is missing for certain questions, but excludes those where information is missing altogether for one or more household member - 81% in 1973. The middle response rate therefore includes the 6% (in 1973) of households in which information about one or more household member was obtained from someone else in the household (a 'proxy'). Certain questions are not asked by proxy, eg. questions on income, educational qualifications and opinion.

The data set is based on individuals (ie. all adults and children in the sample households); that is, the case unit is an individual, not a household. The GHS defines a household as 'a group of people living regularly at one address, who are all catered for by the same person for at least one meal a day'.

C. The International Social Survey Series, 1985-1989.

The International Social Survey Programme (ISSP) is a voluntary grouping of study teams in eleven nations (Australia, Austria, Britain, Holland, Hungary, Ireland, Israel, Italy, Norway, West Germany). In 1987 a separate Swiss survey was also included. As a condition of membership each country undertakes to run a short, annual self-completion survey containing an agreed set of questions asked of a probability-based, nation-wide sample of adults. The topics change from year to year by agreement, with a view to replication every five years or so. The major advantage of the ISSP is that it produces a common set of questions asked in identical form in the participating countries.

For a description of the technical details of the surveys see the Technical Appendix in Jowell, Witherspoon and Brook (1989)

D. The Current Population Surveys, 1964-1988.

The Current Population Survey (CPS) is the source of the official Government statistics on employment and unemployment. The CPS has been conducted montly for over 40 years. Currently, about 56,500 households are interviewed monthly, scientifically selected on the basis of area of residence to represent the Nation as a whole, individual States, and other specified areas. Each household is interviewed once a month for four consecutive months one year, and again for the corresponding time period a year later. This technique enables month-to-month and year-to-year comparisons to be obtained at a reasonable cost while minimizing the incomvenience to any one household.

Although the main purpose of the survey is to collect information on the employment situation, a very important secondary purpose is to collect information on the demographic status of the population, information such as age, sex, race, marital status, educational attainment, and family structure. From time to time additional questions are included on such important subjects as health, education, income, and previous work experience. The statistics resulting from these questions serve to update similar information collected once every 10 years through the decennial census, and are used by Government policymakers and legislators as important indicators of the US's economic situation and for planning and evaluating many Government programs.

The CPS provides current estimates of the economic status and activities of the population of the United States. Because it is not possible to develop one or two overall figures (such as the number of unemployed) that would adequately describe the whole complex of labor market phenomena, the CPS is designed to provide a large amount of detailed and supplementary data. Such data are made available to meet a wide variety of needs on the part of users of labor market information.

Thus, the CPS is the only source of monthly estimates of total employment (both farm and nonfarm); nonfarm self-employed persons, domestics, and unpaid helpers in nonfarm faily enterprises; wage and salary employees; and, finally, estimates of total unemployment. It provides the only available distribution of workers by the number of hours worked (as distinguished from aggregate or average hours for an industry), permitting separate anaylyses of part-time workers, workers on overtime, etc. The survey is also the only comprehensive current source of information on the occupation of workers and the industries in which they work. Information is available from the survey not only for persons currently in the labor force but also for those who are outside the labor force. The characteristics of such persons-whether married women with or without young children, disabled persons, students, older retired workers, etc., can be determined. Information on their current desire for work, their past work experiece, and their intentions as to job seeking are also available.

The March CPS, also known as the Annual Demographic File, contains the basic monthly demographic and labor force data described above, plus additional data on work experience, income, noncash benefits, and migration.

E. The Korean Occupational Wage Surveys, 1983 and 1986

The Occupational Wage Surveys are conducted annually by the Korean Ministry of Labor. The survey includes wage, employment and demographic information on about 5,000,000 workers. We make use of the original tapes with around 600,000 observations that are randomly sampled from the original survey. The sampling units are firms and not individuals. Firms report wage and demographic data on a random sample of their workers, but only firms with 10 or more employees are included in the survey. This omits roughly one third of the non-agricutltural workforce in a typical year.

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