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**The Response of Wages and Labor Supply Movements  
to Employment Shocks Across Europe and the United States <sup>1/</sup>**

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Abstract

This paper assesses the responsiveness of wages and labor force movements to employment shocks across British and U.S regions and across Europe using a multivariate vector autoregression technique. The paper finds inflexible real wages in all three areas in that each area's real wage responds very little to employment shocks. However, the response of the labor force to employment shocks is much greater in the United States compared to Europe. The strong labor force response in the United States prevents any persistence in relative regional unemployment rates whereas the lack of mobility in Europe results in persistent unemployment rate differentials across British regions and European nations. Europe must therefore adopt measures to reduce barriers to immobility if it is to succeed in moderating the persistence in relative unemployment rates.

JEL Classification Numbers:

J61

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### Summary

This paper compares the degree of labor market flexibility across geographical regions in the United Kingdom and the United States and across four European countries (France, Germany, Italy, and the United Kingdom). This comparison is motivated by the prospect of European Economic and Monetary Union, within which the ability to vary bilateral exchange rates will be eliminated. This will necessitate a greater reliance on other forms of adjustment for countries within the Union.

The paper uses a multivariate VAR framework to assess the degree to which relative regional and national wages and labor forces adjust to employment shocks. The paper finds that the responsiveness of wages to employment shocks in the United States and in Europe is minimal but that there are large differences in the response of the labor forces in both areas. There is a high degree of interregional migration in the United States, so that when a region experiences a large reduction in employment, a sizable fraction of the labor force moves to surrounding regions. This movement is sufficient to prevent persistent unemployment differences across U.S. regions. In Europe, the German and French economy-wide labor forces and the British regional labor forces adjust to a limited degree to employment shocks, but the magnitude of the adjustment is insufficient to prevent the appearance of persistent unemployment rate differences. There is very little adjustment of the British and Italian economy-wide labor forces to employment shocks.

The paper concludes that Europe must promote measures to stimulate interregional and international migration to facilitate its adoption of a common currency.



## I. Introduction

The prospect of a unified currency across the European Community (EC) countries has led to a proliferation of research on the characteristics of optimal currency areas. This research has focused on the correlation of output movements across the EC economies, the expected changes in the industrial structure as a result of tariff reductions and the flexibility of alternative mechanisms of adjustment.

The first area of research attempts to gauge the need for exchange rate adjustment by evaluating the degree to which output moves together across EC countries (Cohen and Wyplosz (1989), Bayoumi and Eichengreen (1992)). Cohen and Wyplosz decompose shocks into temporary and permanent components and find that symmetric shocks dominate asymmetric shocks in France and Germany. Bayoumi and Eichengreen decompose shocks into supply and demand shocks. They find that the correlation of supply shocks across the European core countries is high but that the correlation of supply shocks between the European core countries and the Southern countries is low. This suggests that the peripheral countries may not yet be part of an optimal currency area and may therefore need the continued use of the exchange rate as a mechanism of adjustment.

The second area of research (e.g., Krugman (1991)) considers the hypothetical consequences of tariff reductions on industrial structure. It postulates that the reduction in tariff barriers embodied in the European Monetary Union (EMU) will lead to greater specialization and a decline in the symmetry of output shocks across the EC nations as firms take advantage of increasing returns. The analysis recommends a greater need for exchange rate adjustment once tariffs are reduced to moderate the increased degree of specialization resulting from the decline in tariffs. The third area of research evaluates the usefulness of alternative mechanisms of adjustment and is the focus of this paper.

Since the work of Mundell (1961), wage changes and labor force movements have been regarded as two alternative ways in which economies adjust to shocks (see Masson and Taylor (1992) for a recent overview). The purpose of this paper is to address the extent to which these alternatives have moderated macroeconomic imbalances across British regions and across the four major European nations over the past 25 years. 1/ This is an estimate of their potential future effectiveness. 2/ The appropriateness of these adjustment mechanisms is measured by considering the degree to which innovations in employment have been moderated by wage and labor force changes.

Blanchard and Katz (1992) have analyzed similar issues across the states of the United States. They find no persistence in unemployment at

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1/ The four European nations studied in this paper are the United Kingdom, France, Germany, and Italy.

2/ The Lucas critique notwithstanding.

the state level but find considerable persistence in labor demand shocks. Most of the adjustment to these shocks takes place through cross state migration rather than through wage changes so that the high rate of migration prevents these shocks from affecting the unemployment rate permanently.

Blackaby and Manning (1992) have recently considered the trade off between earnings and unemployment across the regions of the United Kingdom. They find that a rise in regional relative unemployment has a negative effect on regional earnings after a one period lag which is largely offset in the second period. They do not trace out this effect further through time however and do not address the extent to which regional labor force changes attenuate the initial shock to unemployment. These issues are addressed in this paper.

The literature on the interaction between employment, the unemployment rate and wages across European countries is vast but as yet there is no clear consensus on the reasons behind the difference in unemployment behavior between EC countries and non-EC countries and the United States. Many research papers have discovered considerable real wage rigidity across EC countries (Bruno and Sachs (1985), Grubb, Jackman and Layard (1983)) but the nature of the propagation mechanism of unemployment is disputed. Currently, the contribution of the long-term unemployed to the total unemployment pool is a popular explanation for the persistence in unemployment (Bean 1992). The explanation for this persistence is that the longer an individual spends unemployed, the quicker his job market skills deteriorate so that at a certain point he is excluded from the employable workforce by firms. This results in a shift of the effective supply of labor to the left because the long-term unemployed cease to have any influence on wage pressure. <sup>1/</sup>

This paper nests recent research on the relationship between wages changes and unemployment within the context of adjustment by evaluating the response of the real wage and unemployment to employment shocks. For this purpose Section 2 considers the extent of persistence in unemployment rates across British regions and across Europe, Section 3 develops a simple theoretical model of the labor market to motivate the choice of variable and lag structure, Section 4 presents estimates of the theoretical model and provides impulse response profiles following shocks to employment, Section 5 considers the comovement of the unemployment rate and the labor force and Section 6 concludes.

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<sup>1/</sup> This paper does not consider the origin of employment shocks across countries, (see U.S. Recent Economic Developments (SM/94/223, 8/18/94) for a discussion of the role of wage dispersion in generating employment growth).

## II. The Persistence of Unemployment Rates

### 1. Graphical analysis

In the introduction it was noted that relative state unemployment rates across the United States exhibit little persistence due to the equilibrating nature of labor force changes. This is suggested in Charts 1(a) and (b) showing unemployment rates for the nine standard regions of the United States over the period 1978 to 1991. 1/ All regional unemployment rates rose during the early eighties and the early nineties but exhibited considerable variation across regions in the speed of the rise. The unemployment rate in the Mid Atlantic increased from 7.2 percent in 1978 to 9 percent in 1982 whereas the unemployment rate in South Central rose dramatically from 5.8 percent to 11 percent over the same time period. Between 1984 and 1986 the unemployment rates in West Central and in the Rocky Mountains rose following the world oil price decline, while all other unemployment rates were declining. 2/

By contrast, Chart 2 presents a time series of unemployment rates for six British regional categories. The six categories comprise the periphery, made up of the North (N), Scotland (S) and Wales (W); the South East (SE) and East Anglia (EA); the South West (SW) and East Midlands (EM); and Yorkshire-Humberside (YH), the West Midlands (WM) and the North West (NW). Relative unemployment rates in the United Kingdom exhibit extreme persistence in that the unemployment rate in the periphery is consistently above the rate in all other regions and the unemployment rate in East Anglia and the South East is consistently below the rate in other regions. West Midlands is the only region whose relative position has changed over the period. 3/

Chart 3 presents the unemployment rate for the United Kingdom, France, Germany and Italy and shows that national unemployment differences between European countries have not shown the same degree of persistence as regional unemployment differences in the United Kingdom. During the eighties the unemployment rate in the United Kingdom and France increased above the unemployment rate in Italy but both unemployment rates had returned to a

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1/ Unemployment rate data before 1978 are not widely available.

2/ Blanchard and Katz (1992) find no visible relationship between state unemployment rates across time. They also conduct Dickey-Fuller tests for the stationarity of relative unemployment rates and although they can only reject the unit root hypothesis in a few cases, all the lagged level unemployment rate estimates are above -0.2. The difficulty in rejecting the unit root hypothesis with short data samples is widely acknowledged.

3/ Note that the comovement of unemployment rates across British regions is much more synchronized than across U.S. regions. This may indicate lower regional industry specialization in Great Britain.

historic trend level by 1991. In contrast, the unemployment rate in Germany was consistently below the level of the other three countries. 1/

## 2. Data sources and univariate variable analysis

The paper focuses on the analysis of employment, wages and the unemployment rate 2/ to determine the extent to which wage and labor supply responses (which include additions to the workforce as well as inter-regional movements) moderate employment shocks. The data used to evaluate these responses are a combination of regional and national data. The regional data are from the United Kingdom and span 1973 to 1992. The variables include regional manual wages, regional employment, the regional labor force and the regional unemployment rate and are obtained from various issues of Regional Trends. The data for the European countries span 1965 to 1991 and include the average manufacturing wage, the total number of male employees, the total male labor force and the national male unemployment rate. 3/ All of the European variables were obtained from the Organization for Economic Cooperation and Development (OECD).

In order to make statistical inference we must first consider the univariate characteristics of each variable. The null hypothesis for the regional data is that each variable relative to the national average contains a unit root. The null hypothesis for the national data is that each variable has a unit root. These hypotheses imply that the rate of change of each variable is constant in the long run. We test these hypotheses by estimating equation 1 for each variable and comparing the coefficient on the lagged level variable with Makinnon's significance tables. We find that we can accept the null hypothesis of a unit root for all variables except for the six categories mentioned in the footnote. 4/ For consistency, however, the assumption of I(1) stationarity is imposed across all regions and countries under study.

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1/ Standardized OECD unemployment rates have been used to avoid attributing persistent national unemployment differences to definitional differences.

2/ The unemployment rate is used instead of the labor supply for ease of comparison with the current economic literature:  $U = (L - E) / L$ .

3/ The manufacturing wage is used as a proxy for the aggregate wage. The male component of the labor force is used instead of the aggregate labor force because manufacturing employment is predominantly male and therefore its movements are more closely related to the manufacturing wage than movements in aggregate employment.

4/ The categories which accept the alternative hypothesis of trend stationarity are relative employment for the East Midlands, the relative wage for the South west, Wales and Scotland and United Kingdom unemployment and employment.



# U.S. Regional Unemployment Rates (in percent)

Chart 1a

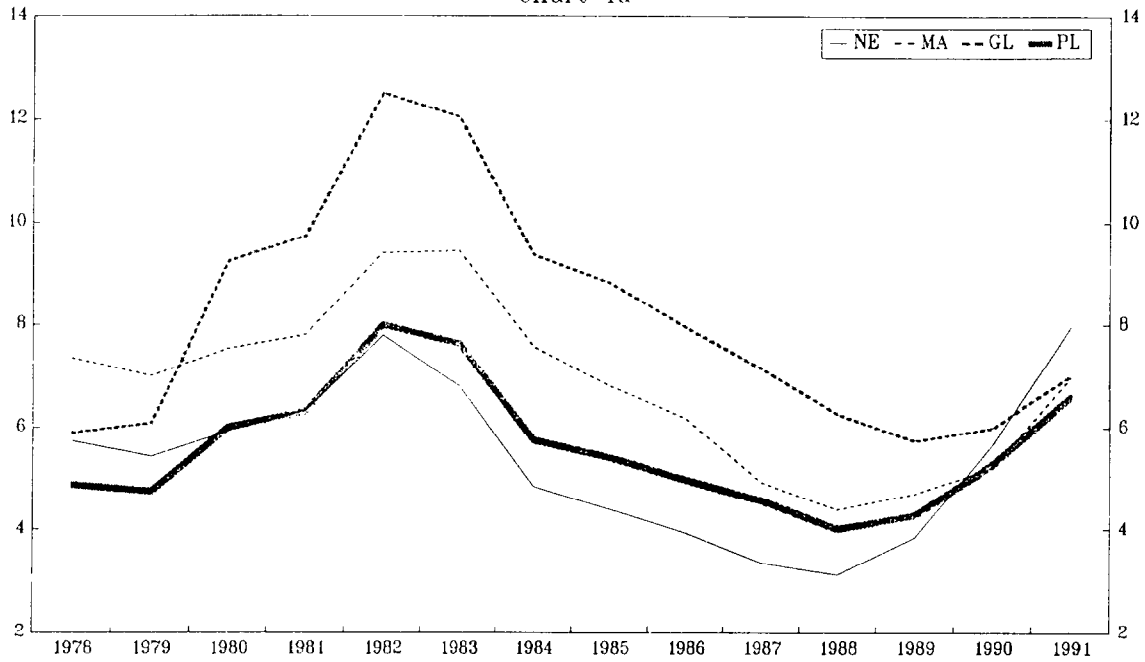
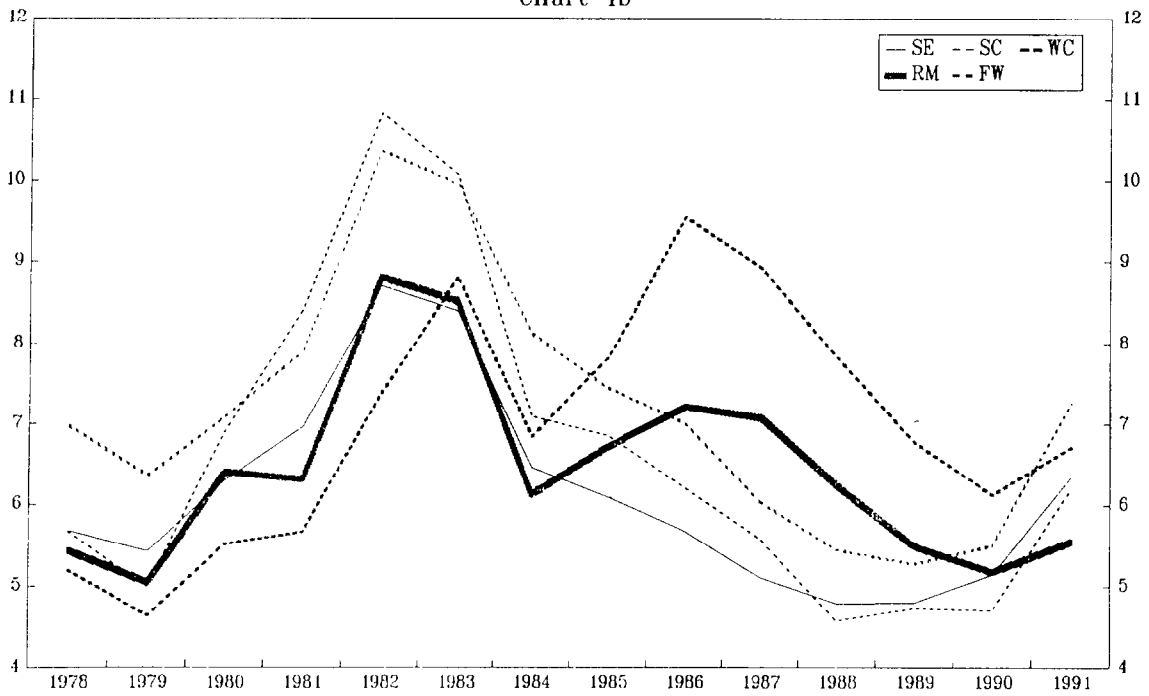
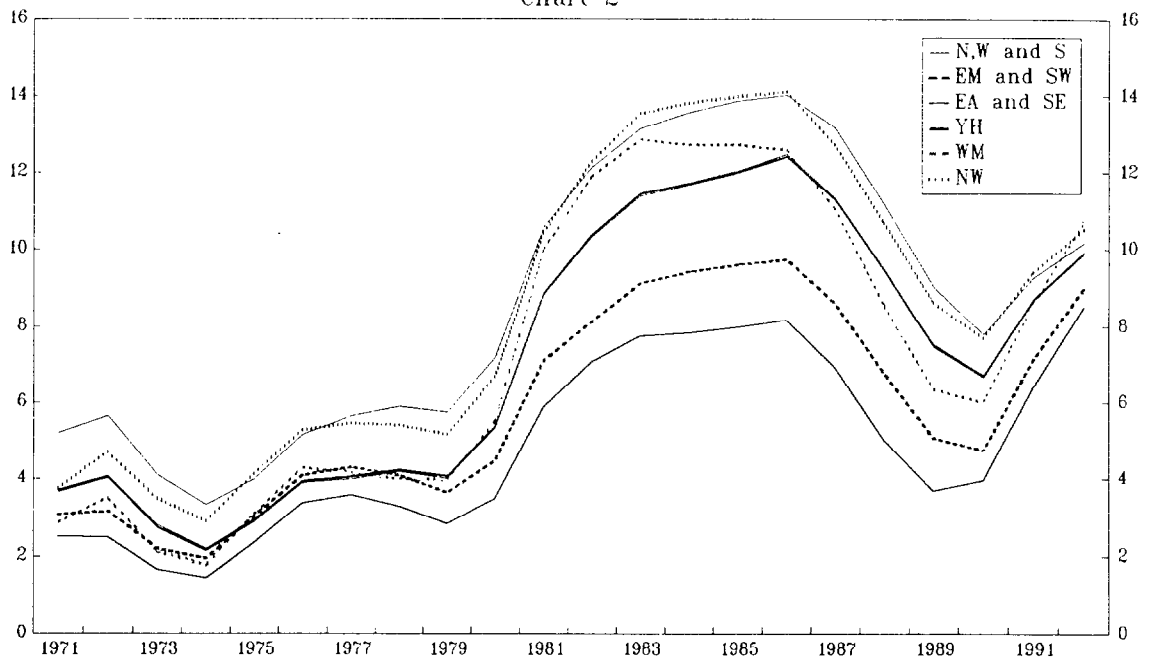


Chart 1b



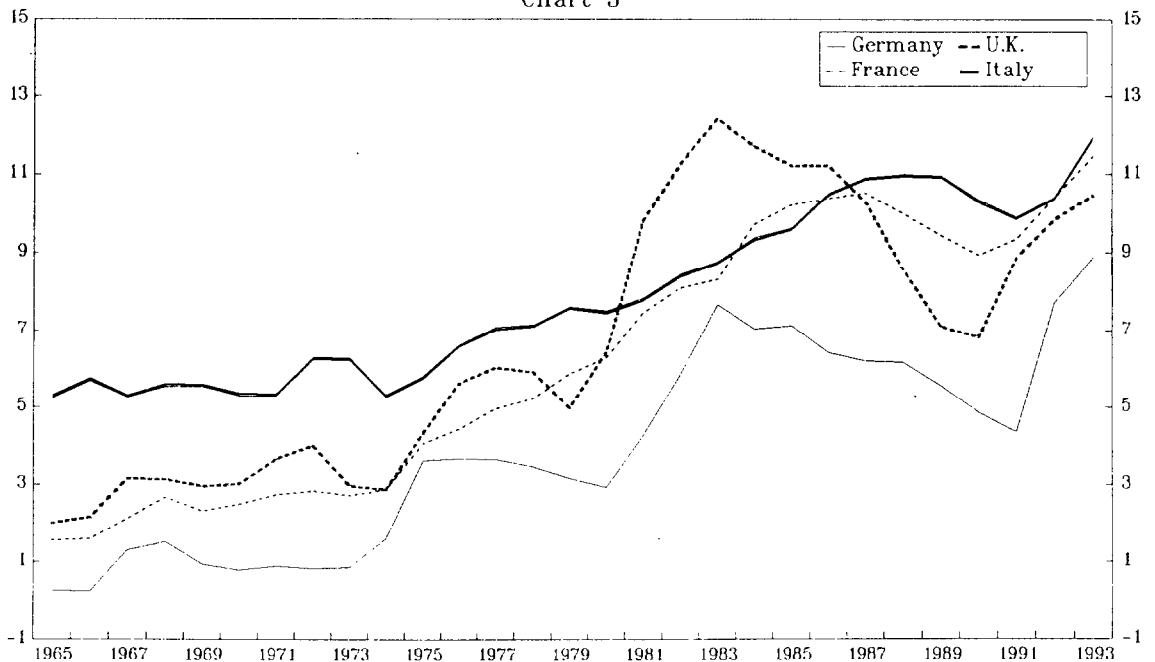
### U.K. Regional Unemployment Rates (in percent)

Chart 2



### European Unemployment Rates (in percent)

Chart 3



$$\Delta w_{it} = \alpha_0 + \alpha_1(L)\Delta w_{it-1} - \alpha_2 w_{it-1} + \mu_{it} \quad (1)$$

The univariate impulse response functions for Britain are obtained from a pooled analysis of all the regions using two lags of each variable. <sup>1/</sup> Chart 4 presents the pooled univariate responses to a unit standard deviation shock in each variable. It indicates that a unit shock to employment falls by 15 percent during the first period and remains permanently at this level thereafter. By contrast, a unit shock to the unemployment rate increases in the first period to 1.44, and then dissipates back to 1.24 over time. This time profile demonstrates that shocks to unemployment in Britain are persistent. The relative wage response follows the pattern of employment in that a unit standard deviation shock to the relative wage falls immediately to 0.66 at which point it rises to a long-run effect of 0.72 by the sixth period.

The univariate response across British regions contrasts sharply with the corresponding analysis across U.S. standard regions, presented in Chart 5. Both the relative wage and the unemployment rate variables are considered to be stationary across U.S. regions and therefore shocks to these variables are only temporary (see earlier footnote). In contrast, shocks to relative employment are persistent and cause a rise in employment in subsequent periods because of the inflow of migrants into expanding regions. In this analysis, the long-run employment response is 1.3, whereas in the analysis of Blanchard and Katz (1992), the long-run employment response is considerably higher at 1.53. <sup>2/</sup> Both these estimates are much larger than the employment response across British regions which is estimated as 0.82. An explanation for this difference is that the higher propensity to migrate in the United States enhances the initial local employment response. This national difference in the propensity to migrate is also a prominent explanation for the difference in the persistence of the unemployment rate in both countries.

The pooled univariate impulse responses for the EC countries in Chart 6 show strong similarities to the responses across Britain in that shocks to all variables have permanent effects. This again contrasts with the United States. A unit shock to the unemployment rate increases to 1.23 in the first period but then falls to leave the long run effect at 0.79. A unit shock to employment increases during the first period to 1.44 and then gradually declines to a long run value of 1.21. A unit shock to the real

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<sup>1/</sup> The observations are pooled because there are too many variables relative to the number of observations for precise estimates to be obtained across individual regions. Two lags are used to maintain consistency with the analysis of Blanchard and Katz (1992).

<sup>2/</sup> Blanchard and Katz's analysis extends back to 1952 whereas this analysis begins in 1972.

wage increases to 1.3 by the fourth period at which point it falls to a long run value of 1.2. <sup>1/</sup>

### III. Theoretical Model of Employment, Wage, and Labor Supply Interactions

The literature on the explanation of European unemployment over the past twenty years has sought to identify separate schedules for the demand for labor and for the supply of labor (see Nickell (1990) and Bean (1992) for an overview). The demand schedule is typically derived on the basis of a profit maximization exercise by firms who are assumed to take the nominal wage as given when making employment decisions. The wage setting schedule is often postulated to result from a bargain between an economy wide union and firm over wages and the likelihood of employment. This is the approach adopted below in a simple theoretical model of the labor market.

Following Blanchard and Summers (1986), insiders are assumed to determine the wage outcome through bargaining with the firm, and the number of insiders is influenced asymmetrically by those who were employed in the last period.

$$l_t^I = \alpha l_{t-1} + (1-\alpha)n_t \quad (2)$$

where  $l^I$  is the logarithm of the number of insiders,  $l$  is the logarithm of the employed,  $n$  is the total labor force and  $\alpha$  is the proportion of employees who were insiders in the last period. The real wage aspirations are assumed to be a weighted average of the previous period real wage and the trend real wage.

$$w_t = \beta(w-p)_{t-1} + (1-\beta)\omega_t \quad (3)$$

where  $w_t$  is the log of real wage aspirations and  $\omega_t$  is the trend real wage.

The wage is chosen bilaterally by firms and employees taking into account the desire of employees to achieve the real wage  $w_t$  and level of employment  $l_t^I$  and the desire of firms to hire workers at low wages. This

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<sup>1/</sup> The real wage is defined as the manufacturing wage deflated by the value-added GDP deflator. The GDP deflator is used instead of the manufacturing industry deflator because we are conducting an economy-wide analysis and assume that the manufacturing wage is a good approximation to the aggregate wage.

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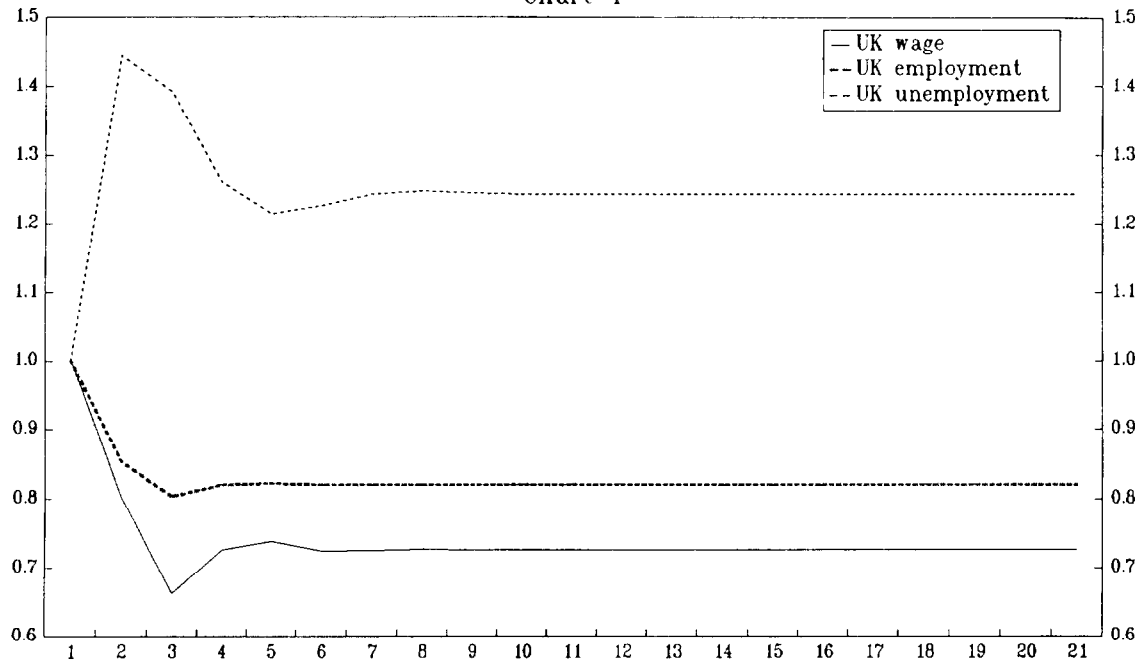
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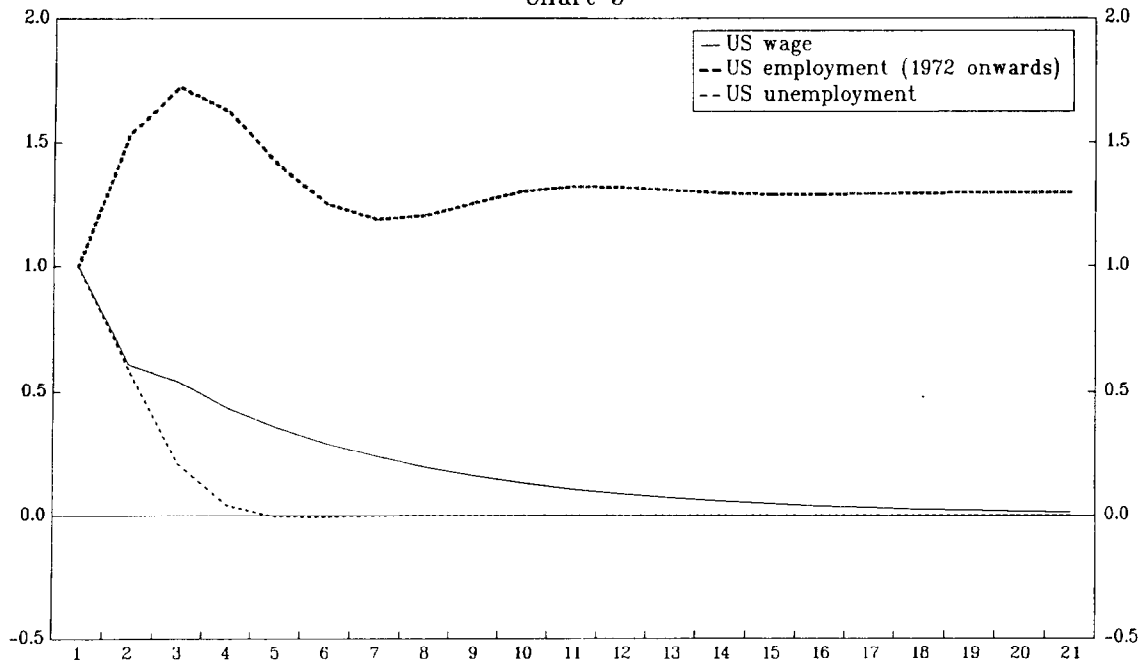
### U.K. Regional Univariate Impulse Responses

Chart 4

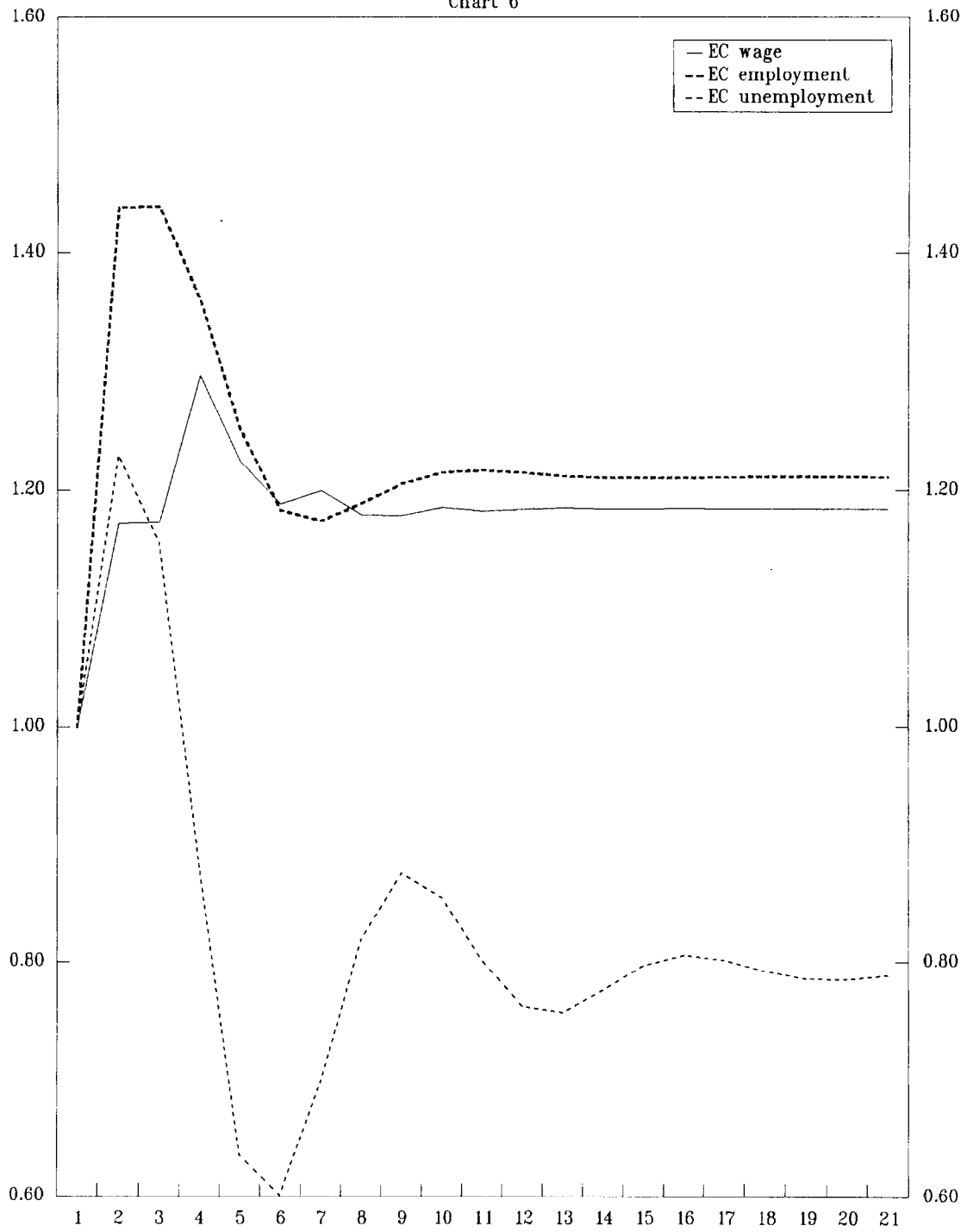


### U.S. Regional Univariate Impulse Responses

Chart 5



European Univariate Impulse Responses  
Chart 6





is achieved by employees minimizing the following loss function,  $L$ , subject to satisfying the labor demand curve and the labor force equation.

$$L = 0.5(l_t - l_t^I)^2 + \phi/2((w-p)_t - w_t)^2 \quad (4)$$

where  $\phi$  is the marginal cost of departures of the real wage from its target.

The labor demand curve is expressed as

$$l_t = \lambda l_{t-1} - \delta[(w-p)_t - \omega_t] + \epsilon_{lt} \quad (5)$$

where  $\lambda$  is the degree of persistence in labor demand and  $\epsilon_{lt}$  is an autocorrelated disturbance which is white noise when differenced.

The labor force equation is determined by the real wage and current employment. <sup>1/</sup> The real wage represents the return to labor and the current employment level represents the likelihood of obtaining a job. The inclusion of the employment level captures the motivation to migrate across regions/countries in response to region/country specific labor demand shocks and additions to the workforce as a result of new employment opportunities.

$$n_t = \mu n_{t-1} + \gamma(w-p)_t + \sigma l_t + \epsilon_{nt} \quad (6)$$

The first order condition from minimizing equation 4 subject to equations 5 and 6 gives the following dynamic expression for the real wage.

$$(w-p)_t = 1/a(\phi\beta(w-p)_{t-1} + \phi(1-\beta)\omega_t + d((\gamma-\alpha-(1-\alpha)\sigma\gamma)l_{t-1} - (1-\alpha)\mu n_{t-1})) \quad (7)$$

---

<sup>1/</sup> This formulation assumes that labor demand shocks are more prevalent than labor supply shocks which is the assumption made by Blanchard and Katz for their analysis of U.S. regions (see text).

where

$$a = \varphi + (\delta(1-\sigma) + (1-\alpha)\gamma)^2$$

$$d = \delta(1-\sigma) + (1-\alpha)\gamma$$

Taking first differences and substituting the identity between the total labor force, employment and unemployment yields

$$\Delta(w-p)_t = 1/a(\varphi\beta\Delta(w-p)_{t-1} + \varphi(1-\beta)\Delta\omega_t + d((\gamma-\alpha-(1-\alpha)(\sigma\gamma-\mu))\Delta l_{t-1} - (1-\alpha)\mu\Delta u_{t-1}) \quad (8)$$

Equation 5 expressed in first difference from yields

$$\Delta l_t = \lambda\Delta l_{t-1} - \delta[\Delta(w-p)_t - \Delta\omega_t] + \Delta\epsilon_{lt} \quad (9)$$

Expressing equation 6 in terms of unemployment and first differencing yields

$$\Delta u_t = \mu\Delta u_{t-1} + (\sigma-1)\Delta l_t + \mu\Delta l_{t-1} + \gamma\Delta(w-p)_t + \Delta\epsilon_{nt} \quad (10)$$

#### IV. Empirical Estimates of Employment, Wage, and Labor Supply Interactions

##### 1. Reduced form estimates

The reduced form of the theoretical model presented in the previous section, embodied in equations 8-10, is now estimated for the four European countries and all British regions. The real wage for the European countries is defined as the nominal manufacturing wage deflated by the value added GDP deflator. Lagged values are used as instruments for all contemporaneous endogenous variables. Table 1 presents the estimating coefficients from a SUR analysis of the European nations. 1/

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1/ The p values for tests of the equality of coefficients across countries are  $p_w = 0.015$ ,  $p_e = 0.075$ ,  $p_u = 0$ . Each value is lower than the 10 percent significance level.

Table 1. Determinants of Labor Market Variables Across Europe

a. Real Wage

<u>Variable</u>	<u>Estimate</u>	<u>T-statistic</u>
$\Delta(w-p)_{t-1}$	0.11	1.38
trend	1.75	7.63
$\Delta l_{t-1}$	0.10	0.53
$\Delta u_{t-1}$	-0.48	-1.70

b. Employment

<u>Variable</u>	<u>Estimate</u>	<u>T-statistic</u>
$\Delta l_{t-1}$	.37	3.73
$\Delta(w-p)_t$	-.01	-0.23

c. Unemployment

<u>Variable</u>	<u>Estimate</u>	<u>T-statistic</u>
$\Delta u_{t-1}$	0.26	2.56
$\Delta l_t$	-0.58	-16.00
$\Delta l_{t-1}$	0.23	2.67
$\Delta(w-p)_t$	-0.02	-1.01

Number of Observations = 96

All of the coefficient signs are comparable to the theoretical predictions presented in Section 3 with the exception of the real wage in Table 1(c). It is insignificant however.

The lack of significance of both wage coefficients in Table 1(b) and (c) suggests that the labor demand and supply curves are not identified in the analysis. Blanchard and Katz (1992) present two reasons why they believe that relative employment shocks in the United States are mostly due to labor demand shocks so that only the labor supply curve can be identified. First, if labor supply shocks predominate, border states will experience considerably higher labor supply shocks than other states because of the inflow of migrants from Mexico. However, Blanchard and Katz find that the joint behavior of employment, unemployment and wages is almost exactly identical between border and nonborder states. Secondly, if labor supply shocks are the major source of employment shocks, the response of the unemployment rate to these shocks should be positive. They find however that the response of unemployment to employment shocks is negative and conclude that employment shocks are dominated by labor demand shocks. There

is considerably less migration across European regions and nations than across the U.S. regions and therefore it is reasonable to assume that the employment pattern across Europe is also dominated by labor demand shocks. Under this assumption, the coefficient estimates of the influence of real wages on employment and unemployment trace out the labor supply curve. The insignificant wage coefficient in Table 1(c), demonstrates therefore that the labor supply curve is approximately vertical and is unresponsive to real wage changes.

The sign of the change in employment in the wage equation is positive. This is not guaranteed from the theoretical analysis because the coefficient is composed of positive and negative terms. The positive estimated value has implications for the value of  $\alpha$  (the relative strength of insiders) which can be shown as follows.

The positive coefficient on lagged employment in the wage equation implies that

$$\lambda - \alpha - (1 - \alpha)(\sigma\lambda - \mu) > 0 \quad (11)$$

$$\Leftrightarrow \alpha < (\lambda - (\sigma\lambda - \mu)) / (1 - (\sigma\lambda - \mu)) \quad (12)$$

Plugging in the coefficient estimates from Table 1(a) to (c), yields  $\alpha < 0.43$ . This figure is comparable to the results found in the work of Alogoskoufis and Manning (1988) in which they derive insider estimates for a number of OECD countries. Their average value for the United Kingdom, France, Germany and Italy is 0.48. However they conclude that their estimates of insider power do not support the insider model because the United States has the highest estimate but one of the weakest centralized bargaining structures.

Turning to the other coefficients, the low coefficient on the lagged real wage variable (0.11) and the weak effect of employment and unemployment changes both indicate that the responsiveness of the real wage to changes in employment and unemployment is low. This is consistent with the findings of Grubb, Jackman and Layard (1983) and Bruno and Sachs (1985). The trend term is significant indicating a gradual real wage increase over time.

For the analysis of British regions, each regional variable is expressed relative to the national value, and as there are no regional price indices available, the price deflator is eliminated from the comparison of relative wages across British regions. The results of the estimation of equations 8-10 across British regions are as follows.

Table 2. Determinants of Labor Market Variables Across British Regions

a. Real Wage

<u>Variable</u>	<u>Estimate</u>	<u>T-statistic</u>
$\Delta(w-p)_{t-1}$	-.23	-3.99
$\Delta l_{t-1}$	.001	0.09
$\Delta u_{t-1}$	-0.70	-5.21

b. Employment

<u>Variable</u>	<u>Estimate</u>	<u>T-statistic</u>
$\Delta l_{t-1}$	-.14	-1.75
$\Delta w_t$	0.004	0.19

c. Unemployment

<u>Variable</u>	<u>Estimate</u>	<u>T-statistic</u>
$\Delta u_{t-1}$	.47	10.11
$\Delta l_t$	-.04	-11.70
$\Delta l_{t-1}$	-.01	-2.47
$\Delta w_t$	.006	0.91

Number of Observations = 170

All the signs of the significant coefficient estimates conform to the theoretical analysis apart from the lagged employment variable in Table 2(c). The significant unemployment rate coefficient in Table 2(a), indicates that a rise in the regional unemployment rate relative to the national average leads to a reduction in the regional wage relative to the national wage level. This significant effect contrasts with the insignificant positive effect from the change in employment. In addition, contemporaneous and lagged employment changes reduce the unemployment rate demonstrating that labor demand shocks are much more prevalent than labor supply shocks. In Table 2(b) and (c), the insignificant effect of wages on employment and on the unemployment rate indicate that neither equation is well identified.

Equation 11 demonstrates how the value of  $\alpha$  is dependent on the degree of persistence of employment. Substituting the coefficients from Table 2 into equation 11 yields a value for  $\alpha = -0.29$ . This indicates that the influence of insiders across British regional labor markets is lower than across European national labor markets. This is to be expected given that there are no regional unions in United Kingdom.

The coefficient estimates from Tables 1 and 2 are captured diagrammatically in Chart 7. The labor supply curve is approximately vertical because of the weak effect of wages on the unemployment rate and the wage setting equation is fairly flat because of the weak effect of employment and unemployment changes on the real wage. The diagram illustrates that negative labor demand shocks lead to slightly lower real wages and large increases in unemployment as the demand curve shifts left. The increase in the unemployment rate is moderated over time as the labor force shrinks in response to declining wages and reduced employment opportunities. In the diagram this is reflected as a leftward shift in the labor supply locus.

## 2. Impulse response analysis

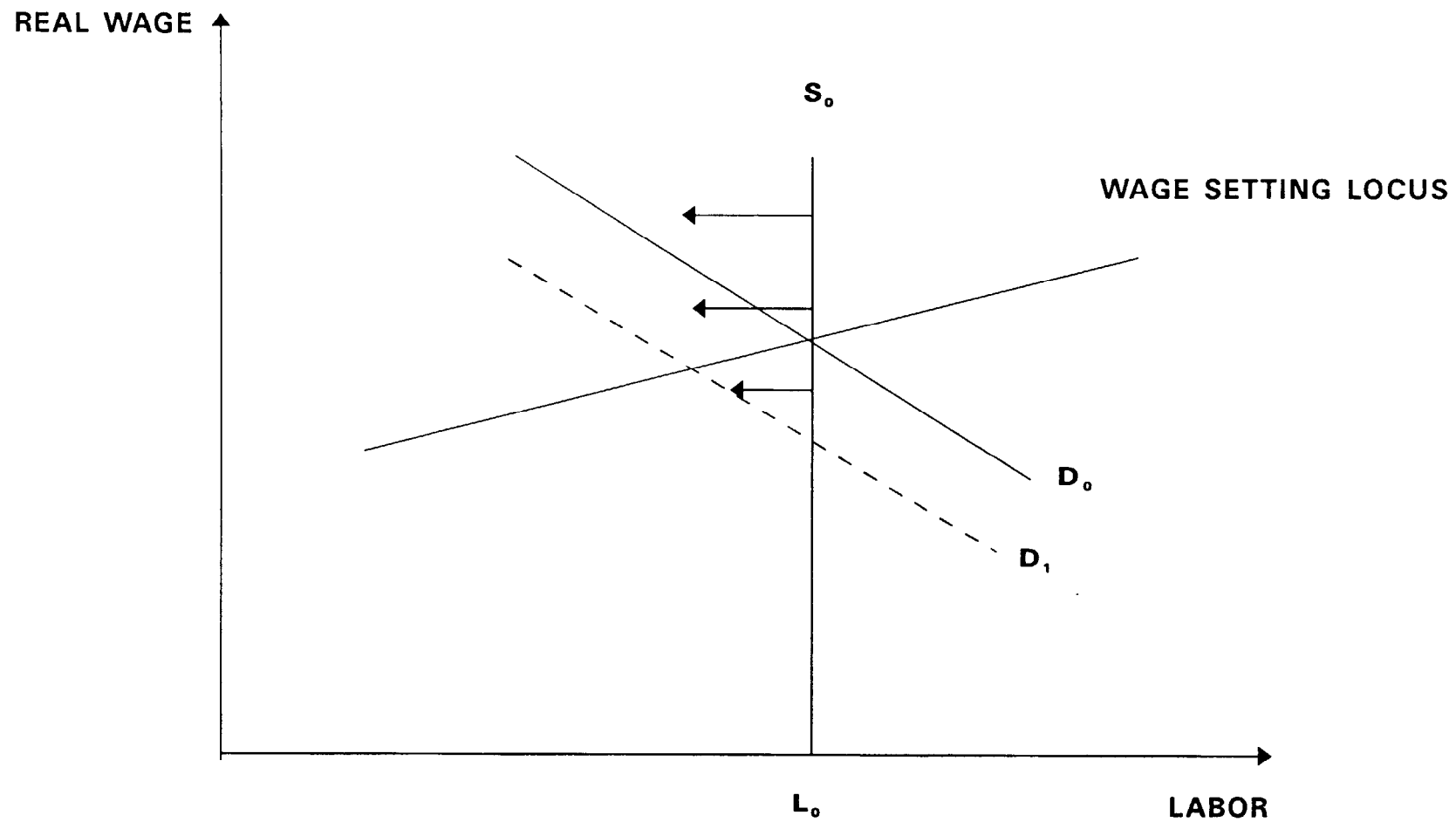
This section presents the impulse response functions of the estimates in Tables 1 and 2 to discover the extent to which labor demand shocks are moderated by wage changes and labor force changes. We assume that demand shocks to employment are the driving force of the system and we compute impulse response functions for all variables in response to these shocks. These are presented in Charts 8 and 9.

The qualitative features of Chart 8 indicate that across Europe and the British regions a unit standard deviation shock to employment leads to a long run increase in itself and to a permanent reduction in the unemployment rate. There is a slight increase in the real wage across Europe but it is insufficient to have much of an effect on the unemployment rate. There is virtually no wage response to employment shocks across the British regions. In detail, a unit shock to employment in Europe gradually increases to a long run value of 1.58. In response the real wage rises to its long run value of a third of its standard deviation by the fourth period. The consequences of this weak response are evident in the time path of the unemployment rate which falls dramatically during the first two periods to a long-run decline of over two standard deviations.

For the British regions there is virtually no relative wage response to an employment shock whereas the unemployment rate falls gradually to its long run decline of 2/3 of a standard deviation by the tenth period. The long-run effect of employment shocks on unemployment is weaker across British regions than across EC nations because the unit standard deviation employment shock falls over time across the British regions whereas it increases across Europe (see Charts 3 and 4).

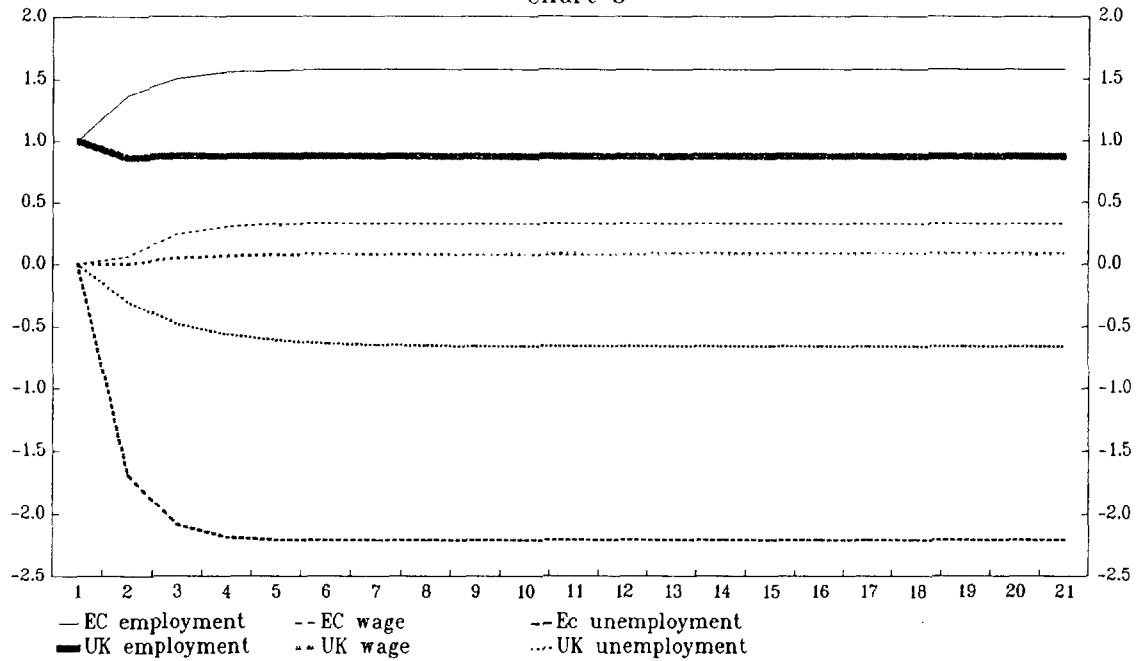
Chart 9 presents corresponding impulse responses for the United States regions. We present two sets of impulse response profiles because the unemployment rate is unavailable before 1978. The first profile relates shocks to relative employment to the response of relative unemployment and was estimated with three lags of each variable using data spanning 1978 to 1991. The profile indicates a slight initial reduction in the relative unemployment rate that is reversed by the sixth year. The other impulse response profile relates relative employment to the relative manufacturing wage and is estimated using three lags of each variable over the period 1972

# Labor Market Equilibrium Chart 7



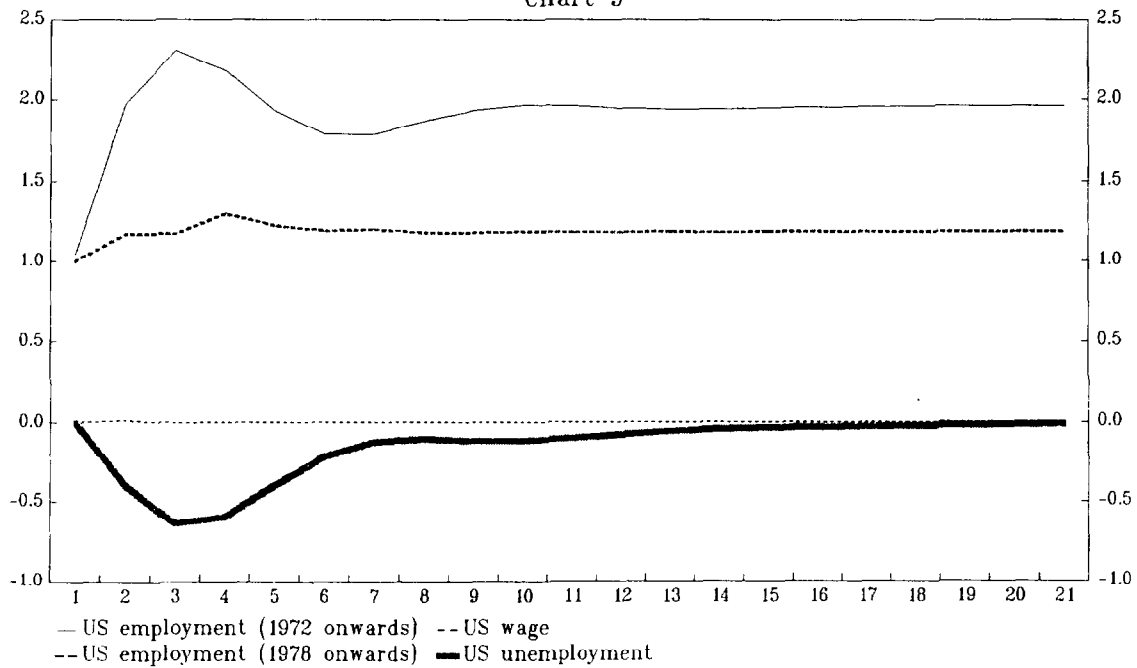
### European and U.K. Regional Multivariate Impulse Responses

Chart 8



### U.S. Regional Multivariate Impulse Responses

Chart 9





to 1990. In this case the initial shock to relative employment rises through time but has no effect on the relative wage. These results closely match those of Blanchard and Katz who estimate similar relationships using longer time spans. They find slightly greater short-run wage and unemployment responses to employment shocks but equivalent negligible long-run effects.

The major difference in behavior between Europe and the United States concerns the response of the unemployment rate to employment shocks. In the United States the relative regional unemployment rate returns to zero over time reflecting high mobility across regions whereas in Europe changes in the unemployment rate are persistent. This difference in behavior is indicated by the degree to which the labor supply curve shifts to the left in response to employment shocks. Chart 10 indicates that a negative demand shock shifts the labor demand curve to the left and if the real wage remains fairly constant this results in an immediate increase in unemployment. This increase in unemployment is only temporary in the United States because the labor supply curve gradually shifts to the left and bisects the labor demand curve at  $(w/p)_{us}$ . In Europe there is a slight reduction in the labor force but it is not sufficient to eliminate the increase in unemployment ( $L_{e1} - L_{us1}$ ).

#### V. Unemployment Rate and Labor Force Comovements

Although the European labor force response to employment shocks is insufficient to eliminate permanent unemployment effects, it may reduce the adverse initial impact. This issue is now considered. Changes in the labor force must move in the opposite direction to changes in the unemployment rate if labor force movements are to moderate the adverse effect of negative employment shocks on the unemployment rate i.e., negative employment shocks (which lead to an immediate increase in unemployment, holding the labor force constant) cause a fall in the labor force which moderates the effect of the immediate unemployment increase on the unemployment rate. We can test for this effect by regressing the rate of change in the labor force on contemporaneous and lagged values of changes in the unemployment rate. The coefficient estimates of this relationship for the European countries and the British regions are presented in Table 3 below.

Table 3 indicates that the contemporaneous effect of a change in the unemployment rate on the growth of the labor force is insignificant for all countries. This weak contemporaneous relationship may reflect the expected lag between the notification of redundancy and the resulting labor force response. <sup>1/</sup> In contrast, the lagged coefficient is significant for Germany and France but is insignificant for the United Kingdom and Italy. The coefficient estimates indicate that a 1 percent increase in the

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<sup>1/</sup> The insignificant relationship lends further support to the assumption that labor supply shocks were minor during this period. If labor supply shocks were predominant, we should see a strong positive relationship between changes in the labor force and changes in the unemployment rate.

unemployment rate leads to a 1/2 percentage point fall in the French and German labor forces. In the analysis across British regions the contemporaneous coefficient of the change in the unemployment rate is also insignificant but the lagged value is significantly negative. Its coefficient estimate indicates that a 1 percent rise in the regional unemployment rate relative to the national average leads to a 1/2 percentage point decline in its relative labor force. <sup>1/</sup>

Table 3. Labor Force Responses to Unemployment Rate Changes

	<u>United Kingdom</u>	<u>France</u>	<u>Germany</u>	<u>Italy</u>	<u>British Regions</u> <sup>2/</sup>
$\Delta u$					
Estimate	0.05	-0.05	-0.17	0.31	0.04
t-statistic	0.50	-0.35	-0.59	1.35	0.36
$\Delta u(-1)$					
Estimate	-0.06	-0.45	-0.49	-0.15	-0.54
t-statistic	-0.54	-3.30	-1.72	-0.62	-4.30
$R^2$	0.02	0.35	0.17	0.09	
DW	2.16	1.56	1.89	2.08	

## VI. Conclusion

This paper has demonstrated real wage rigidity across the U.S. regions, British regions and European nations in that the real wage is unresponsive to employment shocks in each area. In contrast, the response of the labor force to employment shocks differs considerably between the United States and Europe because inter-regional migration acts as an equilibrating mechanism across the U.S. regions whereas the amount of migration across British regions and European countries is considerably less. According to this analysis it appears that the United States is a more natural currency union than Europe. However, this does not imply that EMU should be abandoned because the persistence of the unemployment rate across European nations is comparable to its persistence across British regions and there is no discussion of introducing regional currencies in Europe. Rather there is a need for structural reform of the European labor market to stimulate inter-regional and international migration. This will allow the labor forces of the European economies to respond more fully to employment shocks.

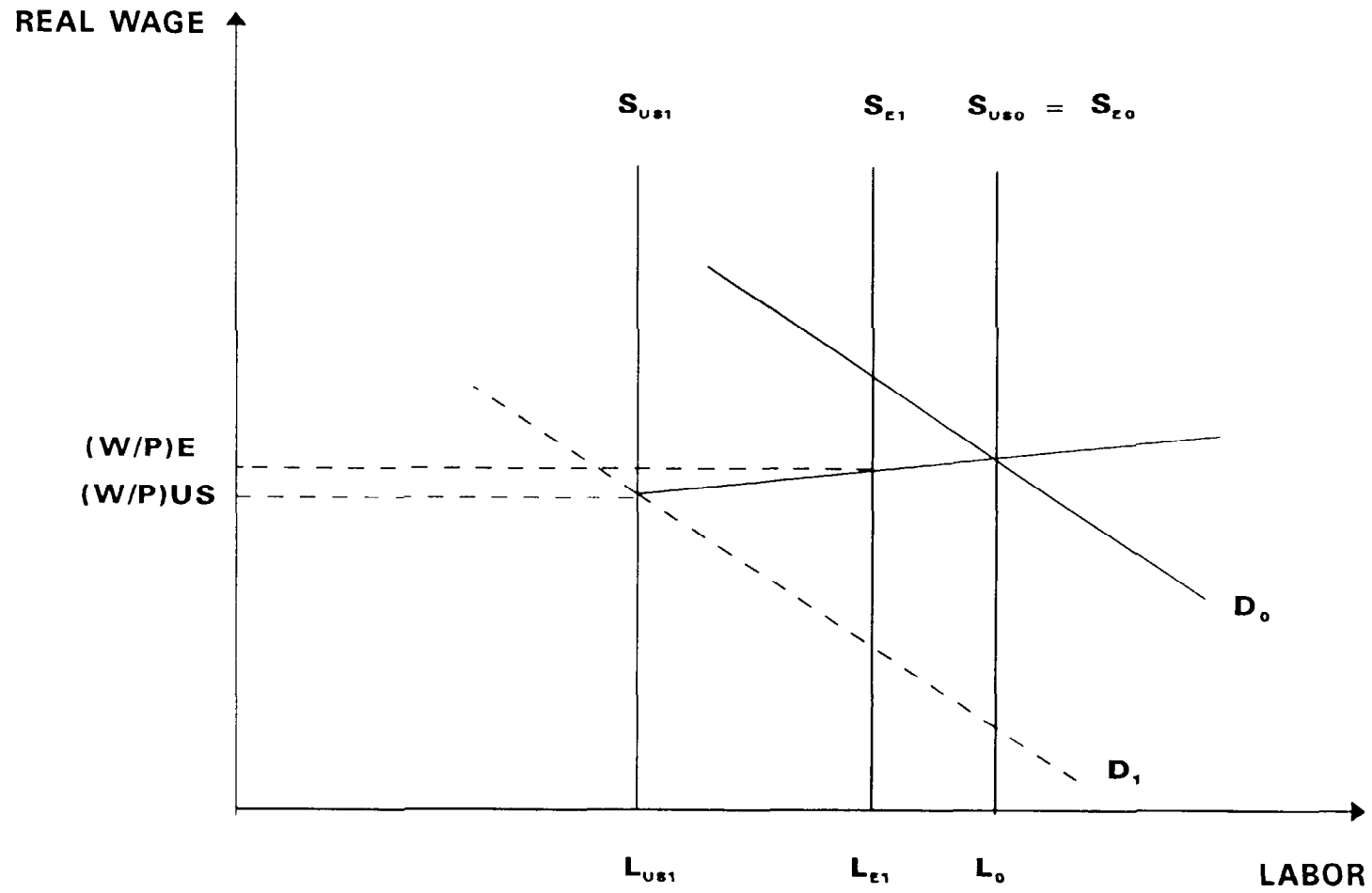
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<sup>1/</sup> The sizeable difference in the regional and economy-wide labor force response to employment shocks in the United Kingdom can be reconciled if most of the shocks to employment are economy-wide. Chart 2 suggests this because the comovement of unemployment rates across British regions is synchronous.

<sup>2/</sup> All regions were estimated as a system and therefore there are no aggregate  $R^2$  and DW values.

# Labor Market Dynamics

## Chart 10





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